

Table 1. Level designations and energies (in cm⁻¹) relative to the ground state and lifetimes (τ in s) for the 321 levels arising from the $1snl$ ($n \leq 6, l \leq (n-1)$) and $2lnl'$ ($n \leq 6, l \leq (n-1)$) configurations of helium-like ions with $Z = 10 - 36$.

| Z | Key | jj -coupling | LS -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|----------------|-------------------|-------------------|--------------------|----------------------|-----------------------|-----------------------|
| 10 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2S_0$ | 0 | 0 | 0 | | | 100. (1) |
| 10 | 2 | $1s_{1/2} 2s_{1/2}(J=1)$ | $1s2s^3S_1$ | 7299940 | 7299610 | 7299372 | 9.240E-05 | 9.461E-05 | 100. (2) |
| 10 | 3 | $1s_{1/2} 2p_{1/2}(J=0)$ | $1s2p^3P_0$ | 7378200 | 7377936 | 7377654 | 9.775E-09 | 9.770E-09 | 100. (3) |
| 10 | 4 | $1s_{1/2} 2p_{1/2}(J=1)$ | $1s2p^3P_1$ | 7378500 | 7378235 | 7377956 | 1.821E-10 | 1.830E-10 | 100. (4) |
| 10 | 5 | $1s_{1/2} 2p_{3/2}(J=2)$ | $1s2p^3P_2$ | 7380050 | 7379794 | 7379514 | 8.912E-09 | 8.908E-09 | 100. (5) |
| 10 | 6 | $1s_{1/2} 2s_{1/2}(J=0)$ | $1s2s^1S_0$ | 7382680 | 7382472 | 7382183 | 3.498E-02 | 3.537E-02 | 100. (6) |
| 10 | 7 | $1s_{1/2} 2p_{3/2}(J=1)$ | $1s2p^1P_1$ | 7436560 | 7436136 | 7436031 | 1.131E-13 | 1.130E-13 | 100. (7) |
| 10 | 8 | $1s_{1/2} 3s_{1/2}(J=1)$ | $1s3s^3S_1$ | 8623000 | 8622596 | 8622444 | 1.735E-11 | 1.741E-11 | 100. (8) |
| 10 | 9 | $1s_{1/2} 3p_{1/2}(J=0)$ | $1s3p^3P_0$ | 8644400 | 8643930 | 8643848 | 6.824E-12 | 6.825E-12 | 100. (9) |
| 10 | 10 | $1s_{1/2} 3p_{1/2}(J=1)$ | $1s3p^3P_1$ | 8644500 | 8644029 | 8643948 | 6.751E-12 | 6.753E-12 | 100. (10) |
| 10 | 11 | $1s_{1/2} 3s_{1/2}(J=0)$ | $1s3s^1S_0$ | 8644880 | 8644202 | 8644338 | 1.909E-11 | 1.913E-11 | 100. (11) |
| 10 | 12 | $1s_{1/2} 3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 8644960 | 8644489 | 8644408 | 6.848E-12 | 6.849E-12 | 100. (12) |
| 10 | 13 | $1s_{1/2} 3d_{3/2}(J=1)$ | $1s3d^3D_1$ | 8657000 | 8655981 | 8655938 | 2.285E-12 | 2.282E-12 | 100. (13) |
| 10 | 14 | $1s_{1/2} 3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 8657120 | 8656002 | 8655961 | 2.290E-12 | 2.286E-12 | 95.1 (14) |
| 10 | 15 | $1s_{1/2} 3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 8657190 | 8656157 | 8656115 | 2.288E-12 | 2.285E-12 | 100. (15) |
| 10 | 16 | $1s_{1/2} 3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 8662400 | 8656657 | 8656654 | 2.393E-12 | 2.389E-12 | 95.1 (16) |
| 10 | 17 | $1s_{1/2} 3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 8660530 | 8659932 | 8659981 | 3.835E-13 | 3.821E-13 | 100. (17) |
| 10 | 18 | $1s_{1/2} 4s_{1/2}(J=1)$ | $1s4s^3S_1$ | 9075200 | 9074693 | 9074662 | 2.561E-11 | 2.584E-11 | 100. (18) |
| 10 | 19 | $1s_{1/2} 4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 9084000 | 9083466 | 9083441 | 1.150E-11 | 1.154E-11 | 100. (19) |
| 10 | 20 | $1s_{1/2} 4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 9084060 | 9083485 | 9083530 | 2.785E-11 | 2.801E-11 | 100. (20) |
| 10 | 21 | $1s_{1/2} 4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 9084040 | 9083509 | 9083485 | 1.141E-11 | 1.145E-11 | 100. (21) |
| 10 | 22 | $1s_{1/2} 4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 9084230 | 9083703 | 9083678 | 1.154E-11 | 1.157E-11 | 100. (22) |
| 10 | 23 | $1s_{1/2} 4d_{3/2}(J=1)$ | $1s4d^3D_1$ | 9090300 | 9088429 | 9088418 | 5.285E-12 | 5.282E-12 | 100. (23) |
| 10 | 24 | $1s_{1/2} 4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 9090340 | 9088441 | 9088430 | 5.294E-12 | 5.292E-12 | 97.0 (24) |
| 10 | 25 | $1s_{1/2} 4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 9090390 | 9088503 | 9088492 | 5.290E-12 | 5.290E-12 | 100. (25) |
| 10 | 26 | $1s_{1/2} 4f_{5/2}(J=3)$ | $1s4f^3F_3$ | 9089800 | 9088764 | 9088767 | 1.105E-11 | 1.104E-11 | 53.3 (26) 46.7 (30) |
| 10 | 27 | $1s_{1/2} 4f_{5/2}(J=2)$ | $1s4f^3F_2$ | | 9088778 | 9088778 | 1.105E-11 | 1.103E-11 | 100. (27) |
| 10 | 28 | $1s_{1/2} 4d_{5/2}(J=2)$ | $1s4d^1D_2$ | | 9088791 | 9088788 | 5.624E-12 | 5.611E-12 | 97.0 (28) |
| 10 | 29 | $1s_{1/2} 4f_{7/2}(J=4)$ | $1s4f^3F_4$ | 9089800 | 9088817 | 9088817 | 1.105E-11 | 1.104E-11 | 100. (29) |
| 10 | 30 | $1s_{1/2} 4f_{7/2}(J=3)$ | $1s4f^1F_3$ | 9094400 | 9088824 | 9088828 | 1.106E-11 | 1.104E-11 | 53.3 (30) 46.7 (26) |
| 10 | 31 | $1s_{1/2} 4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 9090630 | 9090054 | 9090078 | 9.076E-13 | 9.031E-13 | 100. (31) |
| 10 | 32 | $1s_{1/2} 5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 9282200 | 9281662 | 9281655 | 4.025E-11 | 4.100E-11 | 100. (32) |
| 10 | 33 | $1s_{1/2} 5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 9286650 | 9286081 | 9286113 | 4.392E-11 | 4.421E-11 | 100. (33) |
| 10 | 34 | $1s_{1/2} 5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 9286640 | 9286096 | 9286088 | 1.941E-11 | 1.960E-11 | 100. (34) |
| 10 | 35 | $1s_{1/2} 5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 9286660 | 9286119 | 9286111 | 1.928E-11 | 1.947E-11 | 100. (35) |
| 10 | 36 | $1s_{1/2} 5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 9286760 | 9286218 | 9286210 | 1.946E-11 | 1.965E-11 | 100. (36) |
| 10 | 37 | $1s_{1/2} 5d_{3/2}(J=1)$ | $1s5d^3D_1$ | 9288500 | 9288609 | 9288606 | 1.012E-11 | 1.014E-11 | 100. (37) |
| 10 | 38 | $1s_{1/2} 5d_{3/2}(J=2)$ | $1s5d^3D_2$ | 9288500 | 9288616 | 9288613 | 1.014E-11 | 1.016E-11 | 97.4 (38) |
| 10 | 39 | $1s_{1/2} 5d_{5/2}(J=3)$ | $1s5d^3D_3$ | 9288500 | 9288648 | 9288644 | 1.013E-11 | 1.015E-11 | 100. (39) |
| 10 | 40 | $1s_{1/2} 5f_{5/2}(J=3)$ | $1s5f^3F_3$ | 9289800 | 9288794 | 9288797 | 2.138E-11 | 2.134E-11 | 54.8 (40) 45.2 (45) |
| 10 | 41 | $1s_{1/2} 5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 9288801 | 9288802 | 2.135E-11 | 2.133E-11 | 100. (41) |
| 10 | 42 | $1s_{1/2} 5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 9288810 | 9288811 | 1.087E-11 | 1.084E-11 | 97.4 (42) |
| 10 | 43 | $1s_{1/2} 5f_{7/2}(J=4)$ | $1s5f^3F_4$ | 9289800 | 9288820 | 9288822 | 2.136E-11 | 2.134E-11 | 100. (43) |
| 10 | 44 | $1s_{1/2} 5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 9288824 | 9288829 | 3.584E-11 | 3.579E-11 | 53.7 (44) 46.3 (48) |
| 10 | 45 | $1s_{1/2} 5f_{7/2}(J=3)$ | $1s5f^1F_3$ | 9294400 | 9288825 | 9288828 | 2.140E-11 | 2.136E-11 | 54.8 (45) 45.2 (40) |
| 10 | 46 | $1s_{1/2} 5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 9288828 | 9288833 | 3.585E-11 | 3.579E-11 | 100. (46) |
| 10 | 47 | $1s_{1/2} 5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 9288840 | 9288845 | 3.585E-11 | 3.580E-11 | 100. (47) |
| 10 | 48 | $1s_{1/2} 5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 9288843 | 9288848 | 3.585E-11 | 3.580E-11 | 53.7 (48) 46.3 (44) |
| 10 | 49 | $1s_{1/2} 5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 9290000 | 9289428 | 9289451 | 1.769E-12 | 1.749E-12 | 100. (49) |
| 10 | 50 | $1s_{1/2} 6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 9393367 | 9393352 | 6.149E-11 | 6.313E-11 | 100. (50) |
| 10 | 51 | $1s_{1/2} 6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 9395898 | 9395926 | 6.601E-11 | 6.740E-11 | 100. (51) |
| 10 | 52 | $1s_{1/2} 6p_{1/2}(J=0)$ | $1s6p^3P_0$ | 9395000 | 9395913 | 9395897 | 3.099E-11 | 3.148E-11 | 100. (52) |
| 10 | 53 | $1s_{1/2} 6p_{1/2}(J=1)$ | $1s6p^3P_1$ | 9395000 | 9395927 | 9395910 | 3.081E-11 | 3.129E-11 | 100. (53) |
| 10 | 54 | $1s_{1/2} 6p_{3/2}(J=2)$ | $1s6p^3P_2$ | 9395000 | 9395984 | 9395968 | 3.107E-11 | 3.158E-11 | 100. (54) |
| 10 | 55 | $1s_{1/2} 6d_{3/2}(J=1)$ | $1s6d^3D_1$ | 9400000 | 9397354 | 9397343 | 1.727E-11 | 1.727E-11 | 100. (55) |
| 10 | 56 | $1s_{1/2} 6d_{3/2}(J=2)$ | $1s6d^3D_2$ | 9400000 | 9397358 | 9397347 | 1.732E-11 | 1.731E-11 | 97.6 (56) |
| 10 | 57 | $1s_{1/2} 6d_{5/2}(J=3)$ | $1s6d^3D_3$ | 9400000 | 9397377 | 9397365 | 1.730E-11 | 1.730E-11 | 100. (57) |
| 10 | 58 | $1s_{1/2} 6f_{5/2}(J=3)$ | $1s6f^3F_3$ | 9398400 | 9397459 | 9397457 | 3.656E-11 | 3.649E-11 | 56.0 (58) 44.0 (64) |
| 10 | 59 | $1s_{1/2} 6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 9397463 | 9397460 | 3.649E-11 | 3.647E-11 | 100. (59) |
| 10 | 60 | $1s_{1/2} 6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 9397473 | 9397476 | 6.151E-11 | 6.143E-11 | 53.2 (60) 46.8 (68) |
| 10 | 61 | $1s_{1/2} 6f_{7/2}(J=4)$ | $1s6f^3F_4$ | 9398400 | 9397474 | 9397471 | 3.651E-11 | 3.650E-11 | 100. (61) |
| 10 | 62 | $1s_{1/2} 6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 9397475 | 9397466 | 1.853E-11 | 1.863E-11 | 97.6 (62) |
| 10 | 63 | $1s_{1/2} 6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 9397476 | 9397478 | 6.152E-11 | 6.143E-11 | 100. (63) |
| 10 | 64 | $1s_{1/2} 6f_{7/2}(J=3)$ | $1s6f^1F_3$ | 9403000 | 9397477 | 9397475 | 3.660E-11 | 3.652E-11 | 56.0 (64) 44.0 (58) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 10 | 65 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 9397481 | 9397486 | 9.272E-11 | 9.259E-11 | 53.7 (65) 46.3 (70) |
| 10 | 66 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 9397482 | 9397485 | 6.154E-11 | 6.144E-11 | 100. (66) |
| 10 | 67 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 9397483 | 9397487 | 9.272E-11 | 9.259E-11 | 100. (67) |
| 10 | 68 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 9397484 | 9397487 | 6.153E-11 | 6.144E-11 | 53.2 (68) 46.8 (60) |
| 10 | 69 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 9397487 | 9397492 | 9.273E-11 | 9.260E-11 | 100. (69) |
| 10 | 70 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 9397489 | 9397493 | 9.273E-11 | 9.260E-11 | 53.7 (70) 46.3 (65) |
| 10 | 71 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | 9396200 | 9397829 | 9397844 | 3.057E-12 | 2.952E-12 | 100. (71) |
| 10 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | | 15401023 | | 4.271E-13 | | 76.8 (72) |
| 10 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 15423400 | 15422137 | | 1.756E-13 | | 100. (73) |
| 10 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 15421100 | 15423176 | | 1.756E-13 | | 100. (74) |
| 10 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 15428000 | 15425420 | | 1.757E-13 | | 100. (75) |
| 10 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 15494000 | 15490535 | | 8.600E-14 | | 100. (76) |
| 10 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 15494300 | 15491698 | | 8.599E-14 | | 100. (77) |
| 10 | 78 | $2p_{3/2}^2(J=2)$ | $2p^2^3P_2$ | 15494300 | 15493709 | | 8.604E-14 | | 100. (78) |
| 10 | 79 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^1D_2$ | 15530500 | 15529203 | | 8.503E-14 | | 100. (79) |
| 10 | 80 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 15539300 | 15539493 | | 1.614E-13 | | 100. (80) |
| 10 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | 15652180 | 15650563 | | 1.124E-13 | | 76.4 (81) |
| 10 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 16804306 | | 4.155E-13 | | 69.1 (82) 30.9 (106) |
| 10 | 83 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p^1P_1$ | | 16813747 | | 2.391E-13 | | 47.7 (83) 47.6 (110) 4.78 (116) |
| 10 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 16829126 | | 6.009E-13 | | 73.2 (84) |
| 10 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 16835872 | | 2.526E-13 | | 53.9 (85) 44.2 (92) 1.93 (113) |
| 10 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 16836525 | | 1.458E-13 | | 73.1 (86) |
| 10 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 16836577 | | 2.775E-13 | | 51.4 (87) 45.4 (93) 3.14 (112) |
| 10 | 88 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 16837799 | | 3.331E-13 | | 64.3 (88) 29.3 (94) 6.30 (111) |
| 10 | 89 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 16838171 | | 1.513E-13 | | 80.1 (89) |
| 10 | 90 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 16840048 | | 1.547E-13 | | 78.1 (90) |
| 10 | 91 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 16840565 | | 1.286E-13 | | 89.4 (91) |
| 10 | 92 | $2p_{1/2}3s_{1/2}(J=0)$ | $2s3p^3P_0$ | | 16841489 | | 2.120E-13 | | 40.5 (85) 40.1 (92) 19.4 (113) |
| 10 | 93 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 16842096 | | 1.970E-13 | | 48.4 (93) 32.7 (87) 18.9 (112) |
| 10 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 16843439 | | 1.747E-13 | | 63.9 (94) 19.0 (88) 17.1 (111) |
| 10 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 16862997 | | 1.600E-13 | | 87.5 (95) |
| 10 | 96 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 16864654 | | 1.610E-13 | | 100. (96) |
| 10 | 97 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d^3F_4$ | | 16866424 | | 1.612E-13 | | 100. (97) |
| 10 | 98 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^1D_2$ | | 16866615 | | 1.549E-13 | | 87.8 (98) |
| 10 | 99 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 16868034 | | 1.260E-13 | | 100. (99) |
| 10 | 100 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^3P_1$ | | 16868749 | | 1.264E-13 | | 100. (100) |
| 10 | 101 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3P_2$ | | 16869383 | | 1.527E-13 | | 51.9 (101) 30.9 (102) 17.2 (114) |
| 10 | 102 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^1D_2$ | | 16871130 | | 1.575E-13 | | 48.0 (101) 31.6 (102) 20.4 (114) |
| 10 | 103 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 16875264 | | 5.510E-13 | | 81.2 (103) |
| 10 | 104 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 16875653 | | 5.207E-13 | | 80.0 (104) |
| 10 | 105 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 16876172 | | 4.969E-13 | | 78.3 (105) |
| 10 | 106 | $2s_{1/2}3s_{1/2}(J=1)$ | $2p3p^3S_1$ | | 16879749 | | 1.797E-13 | | 68.3 (106) 31.7 (82) |
| 10 | 107 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 16885283 | | 1.412E-13 | | 100. (107) |
| 10 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d^3D_2$ | | 16885885 | | 1.411E-13 | | 100. (108) |
| 10 | 109 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d^3D_3$ | | 16886651 | | 1.409E-13 | | 100. (109) |
| 10 | 110 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 16889448 | | 2.125E-13 | | 51.8 (110) 39.5 (83) 7.62 (116) |
| 10 | 111 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^3P_2$ | | 16902736 | | 1.720E-13 | | 77.3 (111) |
| 10 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d^3P_1$ | | 16903314 | | 1.711E-13 | | 78.3 (112) |
| 10 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d^3P_0$ | | 16903674 | | 1.707E-13 | | 78.9 (113) |
| 10 | 114 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 16905783 | | 2.777E-13 | | 61.9 (114) 38.1 (102) |
| 10 | 115 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d^1F_3$ | | 16913579 | | 1.358E-13 | | 100. (115) |
| 10 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d^1P_1$ | | 16924199 | | 1.539E-13 | | 88.3 (116) |
| 10 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p^1S_0$ | | 16932534 | | 1.563E-13 | | 73.7 (117) |
| 10 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s^3S_1$ | | 17290448 | | 5.255E-13 | | 68.6 (118) 31.4 (144) |
| 10 | 119 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p^1P_1$ | | 17295198 | | 2.903E-13 | | 47.9 (119) 45.0 (147) 5.97 (168) |
| 10 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s^1S_0$ | | 17298987 | | 6.421E-13 | | 71.6 (120) 28.4 (169) |
| 10 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s^3P_0$ | | 17301795 | | 2.887E-13 | | 51.4 (121) 45.4 (127) 3.14 (162) |
| 10 | 122 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p^3P_1$ | | 17302403 | | 3.331E-13 | | 53.0 (122) 42.2 (129) 4.79 (161) |
| 10 | 123 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p^3P_2$ | | 17303309 | | 4.216E-13 | | 64.2 (123) 27.4 (130) 8.46 (159) |
| 10 | 124 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p^3D_1$ | | 17304891 | | 1.768E-13 | | 71.4 (124) 20.1 (139) 8.51 (128) |
| 10 | 125 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p^3D_2$ | | 17306097 | | 1.899E-13 | | 74.2 (125) |
| 10 | 126 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p^3D_3$ | | 17307668 | | 2.081E-13 | | 67.0 (126) 31.7 (141) 1.24 (163) |
| 10 | 127 | $2p_{1/2}4s_{1/2}(J=0)$ | $2s4p^3P_0$ | | 17308452 | | 2.212E-13 | | 45.1 (121) 35.6 (127) 19.3 (162) |
| 10 | 128 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p^1P_1$ | | 17308568 | | 1.458E-13 | | 90.5 (128) |
| 10 | 129 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s^3P_1$ | | 17309012 | | 2.022E-13 | | 52.9 (129) 27.8 (122) 19.2 (161) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 10 | 130 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s^3P_2$ | | 17310263 | | 1.739E-13 | | 66.9 (130) 18.9 (159) 14.2 (123) |
| 10 | 131 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d^3F_2$ | | 17314857 | | 1.705E-13 | | 82.3 (131) |
| 10 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2p4p^1D_2$ | | 17316046 | | 2.549E-13 | | 49.8 (132) 39.8 (160) 6.67 (138) |
| 10 | 133 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d^3F_3$ | | 17316190 | | 1.766E-13 | | 87.6 (133) |
| 10 | 134 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p^3P_0$ | | 17316603 | | 1.422E-13 | | 100. (134) |
| 10 | 135 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p^3P_1$ | | 17317267 | | 1.448E-13 | | 98.2 (135) |
| 10 | 136 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d^3F_4$ | | 17317844 | | 1.857E-13 | | 85.1 (136) |
| 10 | 137 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d^1D_2$ | | 17318511 | | 1.569E-13 | | 89.5 (137) |
| 10 | 138 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p^3P_2$ | | 17318766 | | 1.531E-13 | | 89.4 (138) |
| 10 | 139 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d^3D_1$ | | 17320601 | | 4.419E-13 | | 71.0 (139) 23.8 (124) 3.91 (165) |
| 10 | 140 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d^3D_2$ | | 17320974 | | 3.777E-13 | | 65.1 (140) 26.9 (125) 4.38 (164) |
| 10 | 141 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d^3D_3$ | | 17321395 | | 3.453E-13 | | 61.8 (141) 32.5 (126) 5.72 (163) |
| 10 | 142 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d^3D_1$ | | 17323983 | | 1.531E-13 | | 89.7 (142) |
| 10 | 143 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d^3D_2$ | | 17324760 | | 1.532E-13 | | 97.0 (143) |
| 10 | 144 | $2s_{1/2}4s_{1/2}(J=1)$ | $2p4p^3S_1$ | | 17325373 | | 1.928E-13 | | 66.5 (144) 31.9 (118) 1.52 (135) |
| 10 | 145 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^3D_3$ | | 17325439 | | 1.556E-13 | | 95.9 (145) |
| 10 | 146 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f^1F_3$ | | 17325622 | | 1.538E-13 | | 58.6 (146) 35.3 (155) 6.03 (149) |
| 10 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s^1P_1$ | | 17325743 | | 2.138E-13 | | 48.8 (147) 33.6 (119) 10.1 (142) |
| 10 | 148 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f^3F_4$ | | 17325936 | | 1.535E-13 | | 62.4 (148) 23.8 (156) 13.8 (158) |
| 10 | 149 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f^3F_3$ | | 17325962 | | 1.557E-13 | | 71.9 (149) 17.1 (146) 5.17 (155) |
| 10 | 150 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f^3F_2$ | | 17325966 | | 1.545E-13 | | 94.4 (150) |
| 10 | 151 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f^3F_2$ | | 17327803 | | 1.029E-12 | | 88.8 (151) |
| 10 | 152 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f^3F_3$ | | 17327951 | | 8.174E-13 | | 84.9 (152) |
| 10 | 153 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f^1F_3$ | | 17328064 | | 3.613E-12 | | 97.3 (153) |
| 10 | 154 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f^3F_4$ | | 17328151 | | 8.168E-13 | | 84.9 (154) |
| 10 | 155 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f^3G_3$ | | 17328944 | | 1.537E-13 | | 60.9 (155) 21.0 (146) 18.2 (149) |
| 10 | 156 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^3G_4$ | | 17329207 | | 1.537E-13 | | 50.3 (156) 36.0 (148) 13.7 (158) |
| 10 | 157 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | | 17330455 | | 1.536E-13 | | 100. (157) |
| 10 | 158 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^1G_4$ | | 17330940 | | 1.534E-13 | | 73.8 (158) |
| 10 | 159 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d^3P_2$ | | 17331995 | | 1.771E-13 | | 71.9 (159) 20.2 (123) 5.27 (130) |
| 10 | 160 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d^1D_2$ | | 17332071 | | 2.665E-13 | | 53.3 (160) 40.8 (132) 5.86 (166) |
| 10 | 161 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d^3P_1$ | | 17332537 | | 1.758E-13 | | 75.2 (161) |
| 10 | 162 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d^3P_0$ | | 17332855 | | 1.749E-13 | | 77.5 (162) |
| 10 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^3D_3$ | | 17333273 | | 1.581E-13 | | 88.6 (163) |
| 10 | 164 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | | 17333484 | | 1.574E-13 | | 50.3 (164) 35.7 (166) 5.53 (150) |
| 10 | 165 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | | 17334716 | | 1.570E-13 | | 95.5 (165) |
| 10 | 166 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | | 17335007 | | 1.545E-13 | | 53.8 (166) 42.0 (164) 2.21 (132) |
| 10 | 167 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d^1F_3$ | | 17335274 | | 1.496E-13 | | 98.8 (167) |
| 10 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | | 17340332 | | 1.657E-13 | | 85.4 (168) |
| 10 | 169 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | | 17343906 | | 1.763E-13 | | 73.2 (169) |
| 10 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | | 17508891 | | 6.940E-13 | | 69.4 (170) 30.6 (207) |
| 10 | 171 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p^1P_1$ | | 17511845 | | 3.250E-13 | | 47.3 (171) 41.8 (203) 6.26 (236) |
| 10 | 172 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | | 17512865 | | 7.371E-13 | | 69.8 (172) 30.2 (237) |
| 10 | 173 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | | 17514522 | | 3.019E-13 | | 53.7 (173) 43.5 (178) 2.82 (228) |
| 10 | 174 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | | 17515134 | | 4.096E-13 | | 55.1 (174) 36.5 (180) 5.55 (225) |
| 10 | 175 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | | 17515769 | | 5.910E-13 | | 70.0 (175) 18.8 (182) 11.2 (222) |
| 10 | 176 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | | 17516641 | | 1.940E-13 | | 69.6 (176) 21.0 (191) 9.42 (181) |
| 10 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | | 17517584 | | 2.178E-13 | | 66.0 (177) 28.0 (192) 2.97 (217) |
| 10 | 178 | $2p_{1/2}5s_{1/2}(J=0)$ | $2s5p^3P_0$ | | 17518962 | | 2.381E-13 | | 44.1 (173) 39.0 (178) 16.9 (228) |
| 10 | 179 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | | 17519037 | | 2.906E-13 | | 52.6 (179) 44.8 (193) 2.55 (229) |
| 10 | 180 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s^3P_1$ | | 17519513 | | 2.067E-13 | | 54.7 (180) 26.0 (174) 16.8 (225) |
| 10 | 181 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p^1P_1$ | | 17519642 | | 1.571E-13 | | 83.9 (181) |
| 10 | 182 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | | 17520827 | | 1.633E-13 | | 71.7 (182) 18.5 (222) 6.63 (175) |
| 10 | 183 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | | 17521545 | | 1.766E-13 | | 76.9 (183) |
| 10 | 184 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^1D_2$ | | 17522191 | | 3.369E-13 | | 42.6 (184) 41.2 (217) 9.49 (192) |
| 10 | 185 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | | 17522668 | | 1.901E-13 | | 77.7 (185) |
| 10 | 186 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | | 17522670 | | 1.503E-13 | | 100. (186) |
| 10 | 187 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | | 17523343 | | 1.702E-13 | | 80.0 (187) |
| 10 | 188 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | | 17524281 | | 2.413E-13 | | 67.5 (188) 32.5 (213) |
| 10 | 189 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^3P_2$ | | 17524509 | | 2.176E-13 | | 57.5 (189) 21.7 (192) 11.0 (184) |
| 10 | 190 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^1D_2$ | | 17524580 | | 1.636E-13 | | 77.9 (190) |
| 10 | 191 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | | 17524967 | | 3.321E-13 | | 59.0 (191) 26.3 (176) 8.61 (187) |
| 10 | 192 | $2p_{3/2}5p_{1/2}(J=2)$ | $2s5d^3D_2$ | | 17525505 | | 2.218E-13 | | 35.6 (192) 34.6 (189) 26.5 (177) |
| 10 | 193 | $2p_{3/2}5p_{3/2}(J=3)$ | $2s5d^3D_3$ | | 17525719 | | 2.480E-13 | | 43.5 (179) 42.8 (193) 8.85 (229) |
| 10 | 194 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | | 17526337 | | 1.585E-13 | | 76.5 (194) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 10 | 195 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 17526753 | | 1.550E-13 | | 62.1 (195) 24.7 (215) 12.1 (199) |
| 10 | 196 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 17526951 | | 1.550E-13 | | 38.2 (196) 37.8 (216) 24.0 (221) |
| 10 | 197 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^3D_2$ | | 17527266 | | 2.023E-13 | | 67.5 (197) 23.9 (208) 4.27 (190) |
| 10 | 198 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 17527438 | | 1.572E-13 | | 81.8 (198) |
| 10 | 199 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 17527468 | | 1.646E-13 | | 46.7 (199) 30.9 (215) 11.8 (229) |
| 10 | 200 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3D_3$ | | 17527601 | | 2.752E-13 | | 49.1 (200) 46.2 (214) 3.48 (233) |
| 10 | 201 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 17527655 | | 1.534E-13 | | 64.7 (201) 19.9 (219) 15.4 (205) |
| 10 | 202 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 17527669 | | 1.534E-13 | | 35.3 (202) 35.2 (220) 29.5 (223) |
| 10 | 203 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 17527805 | | 2.097E-13 | | 46.7 (203) 30.7 (171) 16.9 (194) |
| 10 | 204 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 17527979 | | 1.597E-13 | | 63.0 (204) 19.8 (226) 14.3 (231) |
| 10 | 205 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | | 17528004 | | 1.539E-13 | | 36.6 (205) 34.7 (227) 28.8 (219) |
| 10 | 206 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^1F_3$ | | 17528300 | | 2.440E-12 | | 98.3 (206) |
| 10 | 207 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^3S_1$ | | 17528304 | | 1.958E-13 | | 65.1 (207) 30.6 (170) 4.30 (187) |
| 10 | 208 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 17528357 | | 3.691E-13 | | 63.1 (208) 17.2 (183) 15.6 (197) |
| 10 | 209 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 17528382 | | 1.073E-11 | | 59.0 (209) 41.0 (212) |
| 10 | 210 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 17528387 | | 1.185E-11 | | 100. (210) |
| 10 | 211 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 17528401 | | 4.676E-12 | | 100. (211) |
| 10 | 212 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | | 17528420 | | 5.675E-12 | | 62.2 (212) 36.5 (209) 1.29 (196) |
| 10 | 213 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 17528753 | | 3.996E-13 | | 67.3 (213) 32.7 (188) |
| 10 | 214 | $2p_{3/2}5d_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | | 17528780 | | 2.305E-13 | | 44.1 (200) 36.9 (214) 19.0 (185) |
| 10 | 215 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 17530113 | | 1.545E-13 | | 39.2 (195) 33.6 (215) 27.2 (199) |
| 10 | 216 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 17530254 | | 1.543E-13 | | 58.4 (196) 33.6 (216) 7.98 (221) |
| 10 | 217 | $2s_{1/2}5d_{5/2}(J=2)$ | $2p5p\ ^1D_2$ | | 17530753 | | 2.412E-13 | | 51.2 (217) 46.6 (184) 2.21 (235) |
| 10 | 218 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 17530867 | | 1.534E-13 | | 100. (218) |
| 10 | 219 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^1G_4$ | | 17531062 | | 1.544E-13 | | 35.6 (201) 35.6 (219) 28.8 (205) |
| 10 | 220 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 17531076 | | 1.544E-13 | | 64.4 (220) 19.6 (202) 16.0 (223) |
| 10 | 221 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 17531138 | | 1.527E-13 | | 69.4 (221) 29.3 (216) 1.29 (196) |
| 10 | 222 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 17531229 | | 1.733E-13 | | 66.7 (222) 18.2 (175) 8.43 (197) |
| 10 | 223 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 17531546 | | 1.533E-13 | | 54.7 (223) 45.3 (202) |
| 10 | 224 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 17531565 | | 1.533E-13 | | 100. (224) |
| 10 | 225 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 17531664 | | 1.726E-13 | | 74.0 (225) |
| 10 | 226 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^1F_3$ | | 17531773 | | 1.536E-13 | | 37.2 (226) 35.0 (204) 27.8 (231) |
| 10 | 227 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 17531791 | | 1.536E-13 | | 65.1 (227) 19.2 (205) 15.7 (219) |
| 10 | 228 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 17531934 | | 1.716E-13 | | 79.9 (228) |
| 10 | 229 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 17531967 | | 1.569E-13 | | 77.2 (229) |
| 10 | 230 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 17532109 | | 1.550E-13 | | 44.9 (230) 33.6 (235) 16.8 (198) |
| 10 | 231 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^3F_3$ | | 17532582 | | 1.529E-13 | | 50.4 (231) 36.8 (226) 12.8 (233) |
| 10 | 232 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 17532592 | | 1.529E-13 | | 100. (232) |
| 10 | 233 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^1F_3$ | | 17532737 | | 1.527E-13 | | 81.8 (233) |
| 10 | 234 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 17533048 | | 1.557E-13 | | 95.5 (234) |
| 10 | 235 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 17533258 | | 1.537E-13 | | 52.9 (235) 43.3 (230) 2.09 (192) |
| 10 | 236 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 17535338 | | 1.646E-13 | | 82.7 (236) |
| 10 | 237 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 17537149 | | 1.763E-13 | | 74.5 (237) |
| 10 | 238 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 17618214 | | 6.698E-12 | | 68.4 (238) 31.6 (265) |
| 10 | 239 | $2s_{1/2}6s_{1/2}(J=1)$ | $2p6p\ ^3S_1$ | | 17620238 | | 4.487E-12 | | 66.4 (272) 33.6 (239) |
| 10 | 240 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 17625697 | | 6.062E-13 | | 45.8 (240) 40.5 (289) 8.69 (314) |
| 10 | 241 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 17627954 | | 5.801E-13 | | 55.6 (241) 39.1 (246) 5.32 (296) |
| 10 | 242 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 17628364 | | 9.120E-13 | | 66.1 (242) 22.4 (248) 9.03 (295) |
| 10 | 243 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 17628821 | | 1.174E-12 | | 75.1 (243) |
| 10 | 244 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 17630045 | | 2.454E-13 | | 65.7 (244) 25.6 (257) 8.77 (249) |
| 10 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 17630692 | | 3.025E-13 | | 54.8 (245) 34.9 (260) 5.41 (293) |
| 10 | 246 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 17631290 | | 1.914E-13 | | 72.2 (246) 17.6 (241) 10.2 (296) |
| 10 | 247 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 17631811 | | 6.893E-13 | | 65.0 (247) 30.2 (280) 4.87 (297) |
| 10 | 248 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 17632016 | | 1.847E-13 | | 75.9 (248) |
| 10 | 249 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^1P_1$ | | 17632427 | | 2.013E-13 | | 64.8 (249) 22.5 (266) 7.14 (239) |
| 10 | 250 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 17633047 | | 1.709E-13 | | 74.2 (250) |
| 10 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^1D_2$ | | 17633342 | | 5.532E-13 | | 38.7 (251) 32.0 (293) 22.3 (260) |
| 10 | 252 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 17633803 | | 1.559E-13 | | 67.6 (252) 18.7 (294) 6.27 (290) |
| 10 | 253 | $2s_{1/2}6s_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 17634170 | | 9.457E-13 | | 58.4 (265) 41.6 (253) |
| 10 | 254 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^1I_6$ | | 17634292 | | 4.406E-13 | | 48.2 (254) 41.3 (319) 10.5 (308) |
| 10 | 255 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 17634293 | | 4.316E-13 | | 89.5 (255) |
| 10 | 256 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 17634370 | | 3.871E-13 | | 68.7 (256) 21.4 (277) 6.90 (292) |
| 10 | 257 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 17634478 | | 2.824E-13 | | 48.8 (257) 35.5 (266) 7.28 (244) |
| 10 | 258 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 17635124 | | 1.341E-13 | | 45.8 (258) 38.5 (317) 15.7 (306) |
| 10 | 259 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 17635129 | | 1.351E-13 | | 84.2 (259) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 10 | 260 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^3D_2$ | | 17635248 | | 3.434E-13 | | 40.6 (260) 21.3 (270) 17.7 (251) |
| 10 | 261 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 17635369 | | 1.425E-13 | | 76.4 (261) |
| 10 | 262 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 17635411 | | 1.438E-13 | | 43.3 (262) 34.6 (321) 22.1 (304) |
| 10 | 263 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 17635525 | | 3.526E-13 | | 56.6 (263) 41.2 (291) 2.22 (273) |
| 10 | 264 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^1D_2$ | | 17635557 | | 1.683E-13 | | 52.8 (264) 16.7 (252) 16.7 (290) |
| 10 | 265 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 17635636 | | 3.767E-12 | | 85.5 (265) |
| 10 | 266 | $2s_{1/2}6d_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 17635863 | | 2.579E-13 | | 32.3 (257) 22.0 (266) 21.9 (244) |
| 10 | 267 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 17635981 | | 1.707E-13 | | 69.4 (267) 9.54 (314) 7.81 (289) |
| 10 | 268 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 17636243 | | 1.694E-13 | | 27.2 (268) 27.0 (297) 20.4 (280) |
| 10 | 269 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 17636436 | | 1.553E-13 | | 51.0 (269) 20.7 (270) 12.9 (315) |
| 10 | 270 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^3P_2$ | | 17636693 | | 1.880E-13 | | 37.2 (270) 21.8 (269) 20.2 (260) |
| 10 | 271 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 17636694 | | 5.055E-13 | | 70.6 (271) 20.4 (290) 3.18 (250) |
| 10 | 272 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 17636724 | | 2.235E-12 | | 79.6 (272) |
| 10 | 273 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 17636735 | | 1.534E-13 | | 43.2 (273) 30.7 (300) 24.6 (305) |
| 10 | 274 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 17636749 | | 1.717E-13 | | 47.8 (274) 21.0 (301) 15.3 (310) |
| 10 | 275 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 17636753 | | 1.529E-13 | | 47.7 (275) 29.1 (312) 23.2 (302) |
| 10 | 276 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 17636759 | | 1.528E-13 | | 52.3 (276) 26.0 (303) 21.7 (307) |
| 10 | 277 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^3F_3$ | | 17636816 | | 4.641E-13 | | 36.1 (277) 30.1 (279) 11.0 (274) |
| 10 | 278 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^1F_3$ | | 17636851 | | 1.210E-12 | | 29.6 (278) 28.3 (256) 20.4 (274) |
| 10 | 279 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^1F_3$ | | 17636851 | | 9.330E-13 | | 57.0 (279) 20.3 (277) 6.41 (292) |
| 10 | 280 | $2s_{1/2}6d_{5/2}(J=3)$ | $2p6p\ ^3D_3$ | | 17636894 | | 2.518E-13 | | 41.8 (247) 31.2 (280) 13.3 (268) |
| 10 | 281 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 17637095 | | 1.082E-11 | | 64.3 (281) 35.7 (284) |
| 10 | 282 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 17637100 | | 6.841E-12 | | 100. (282) |
| 10 | 283 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 17637100 | | 1.304E-11 | | 100. (283) |
| 10 | 284 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 17637111 | | 8.090E-12 | | 74.3 (284) |
| 10 | 285 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 17637171 | | 1.482E-11 | | 100. (285) |
| 10 | 286 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 17637171 | | 1.601E-11 | | 53.3 (286) 46.7 (287) |
| 10 | 287 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 17637176 | | 1.483E-11 | | 53.3 (287) 46.7 (286) |
| 10 | 288 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 17637177 | | 1.604E-11 | | 100. (288) |
| 10 | 289 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 17637423 | | 2.546E-13 | | 43.9 (289) 39.8 (240) 11.0 (267) |
| 10 | 290 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^3D_2$ | | 17637848 | | 1.715E-13 | | 40.0 (290) 24.6 (264) 17.8 (250) |
| 10 | 291 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 17637880 | | 1.920E-13 | | 68.0 (291) 32.0 (263) |
| 10 | 292 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^3D_3$ | | 17638391 | | 1.607E-13 | | 74.0 (292) |
| 10 | 293 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 17638855 | | 3.282E-13 | | 51.3 (293) 41.7 (251) 3.22 (245) |
| 10 | 294 | $2s_{1/2}6p_{3/2}(J=2)$ | $2p6d\ ^3P_2$ | | 17639333 | | 3.378E-13 | | 38.9 (294) 38.5 (243) 17.4 (290) |
| 10 | 295 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 17639460 | | 4.009E-13 | | 44.7 (295) 43.1 (242) 10.3 (267) |
| 10 | 296 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 17639545 | | 4.665E-13 | | 51.2 (296) 48.8 (241) |
| 10 | 297 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 17640195 | | 2.417E-13 | | 45.1 (297) 29.5 (298) 14.6 (261) |
| 10 | 298 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 17640257 | | 4.835E-13 | | 48.5 (261) 25.8 (268) 10.3 (298) |
| 10 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 17640315 | | 1.684E-13 | | 40.6 (299) 29.6 (269) 24.8 (315) |
| 10 | 300 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 17640329 | | 1.630E-13 | | 54.9 (273) 25.1 (300) 20.0 (305) |
| 10 | 301 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^1F_3$ | | 17640337 | | 1.560E-13 | | 43.6 (274) 29.1 (301) 24.7 (310) |
| 10 | 302 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 17640350 | | 1.674E-13 | | 48.7 (275) 27.3 (302) 18.0 (312) |
| 10 | 303 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 17640358 | | 1.526E-13 | | 47.7 (276) 28.7 (303) 23.7 (307) |
| 10 | 304 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 17640390 | | 4.059E-13 | | 26.8 (304) 26.4 (262) 21.8 (312) |
| 10 | 305 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 17640538 | | 2.951E-13 | | 51.2 (259) 27.4 (305) 21.4 (300) |
| 10 | 306 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 17640545 | | 2.941E-13 | | 48.8 (306) 28.0 (258) 23.2 (317) |
| 10 | 307 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 17640684 | | 2.684E-13 | | 48.6 (255) 28.2 (307) 23.2 (303) |
| 10 | 308 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 17640688 | | 2.676E-13 | | 51.4 (308) 26.1 (254) 22.4 (319) |
| 10 | 309 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 17640775 | | 2.334E-13 | | 84.7 (309) |
| 10 | 310 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 17640806 | | 1.712E-13 | | 53.9 (310) 42.0 (301) 4.02 (278) |
| 10 | 311 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 17640806 | | 1.797E-13 | | 100. (311) |
| 10 | 312 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 17640815 | | 2.970E-13 | | 41.2 (302) 30.2 (312) 13.5 (262) |
| 10 | 313 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 17640870 | | 1.932E-13 | | 89.2 (313) |
| 10 | 314 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 17640900 | | 3.049E-13 | | 64.5 (314) 18.5 (240) 6.27 (267) |
| 10 | 315 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 17641064 | | 1.739E-13 | | 56.7 (315) 38.4 (299) 4.82 (260) |
| 10 | 316 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 17643152 | | 1.360E-11 | | 100. (316) |
| 10 | 317 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 17643174 | | 1.476E-11 | | 54.9 (317) 45.1 (258) |
| 10 | 318 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 17643409 | | 6.188E-13 | | 100. (318) |
| 10 | 319 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 17643410 | | 6.206E-13 | | 53.9 (319) 46.1 (254) |
| 10 | 320 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 17643715 | | 1.816E-12 | | 100. (320) |
| 10 | 321 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 17644747 | | 2.159E-12 | | 68.7 (321) 31.3 (262) |
| 11 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 11 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 8935368 | 8934935 | | 3.424E-05 | | 100. (2) |
| 11 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 9022385 | 9022046 | | 8.736E-09 | | 100. (3) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|-----------------------|
| 11 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 9022908 | 9022568 | | 7.018E-11 | | 100. (4) |
| 11 | 5 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 9025315 | 9024977 | | 7.589E-09 | | 100. (5) |
| 11 | 6 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 9028021 | 9027697 | | 1.395E-02 | | 100. (6) |
| 11 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 9088735 | 9088251 | | 7.475E-14 | | 100. (7) |
| 11 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 10558946 | 10558510 | | 1.170E-11 | | 100. (8) |
| 11 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 10582781 | 10582291 | | 4.466E-12 | | 100. (9) |
| 11 | 10 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 10582947 | 10582459 | | 4.384E-12 | | 100. (10) |
| 11 | 11 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 10583431 | 10582757 | | 1.275E-11 | | 100. (11) |
| 11 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 10583658 | 10583171 | | 4.486E-12 | | 100. (12) |
| 11 | 13 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 10596647 | 10596094 | | 1.502E-12 | | 100. (13) |
| 11 | 14 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 10596667 | 10596123 | | 1.507E-12 | | 93.0 (14) |
| 11 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 10596925 | 10596373 | | 1.505E-12 | | 100. (15) |
| 11 | 16 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 10597475 | 10596955 | | 1.566E-12 | | 93.0 (16) |
| 11 | 17 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 10601080 | 10600470 | | 2.542E-13 | | 100. (17) |
| 11 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 11115065 | 11114545 | | 1.723E-11 | | 100. (18) |
| 11 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 11124873 | 11124326 | | 7.545E-12 | | 100. (19) |
| 11 | 20 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 11124944 | 11124399 | | 7.445E-12 | | 100. (20) |
| 11 | 21 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 11124986 | 11124405 | | 1.858E-11 | | 100. (21) |
| 11 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 11125244 | 11124698 | | 7.572E-12 | | 100. (22) |
| 11 | 23 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | 11130639 | 11130011 | | 3.478E-12 | | 100. (23) |
| 11 | 24 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | 11130639 | 11130028 | | 3.487E-12 | | 95.5 (24) |
| 11 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | 11130639 | 11130128 | | 3.483E-12 | | 100. (25) |
| 11 | 26 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | 11131051 | 11130428 | | 7.248E-12 | | 55.0 (26) 45.0 (30) |
| 11 | 27 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | 11131051 | 11130447 | | 7.246E-12 | | 100. (27) |
| 11 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | 11131017 | 11130459 | | 3.678E-12 | | 95.5 (28) |
| 11 | 29 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | 11131051 | 11130507 | | 7.247E-12 | | 100. (29) |
| 11 | 30 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | 11131056 | 11130519 | | 7.255E-12 | | 55.0 (30) 45.0 (26) |
| 11 | 31 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 11132393 | 11131806 | | 6.022E-13 | | 100. (31) |
| 11 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 11369887 | 11369337 | | 2.708E-11 | | 100. (32) |
| 11 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 11374842 | 11374281 | | 1.275E-11 | | 100. (33) |
| 11 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 11374868 | 11374292 | | 2.927E-11 | | 100. (34) |
| 11 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 11374879 | 11374319 | | 1.261E-11 | | 100. (35) |
| 11 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 11375032 | 11374472 | | 1.280E-11 | | 100. (36) |
| 11 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | 11377767 | 11377160 | | 6.665E-12 | | 100. (37) |
| 11 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | 11377767 | 11377169 | | 6.685E-12 | | 96.1 (38) |
| 11 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d\ ^3D_3$ | 11377767 | 11377220 | | 6.676E-12 | | 100. (39) |
| 11 | 40 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f\ ^3F_3$ | 11377987 | 11377388 | | 1.402E-11 | | 56.3 (40) 43.7 (45) |
| 11 | 41 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f\ ^3F_2$ | 11377987 | 11377397 | | 1.400E-11 | | 100. (41) |
| 11 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d\ ^1D_2$ | 11377984 | 11377407 | | 7.108E-12 | | 96.1 (42) |
| 11 | 43 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f\ ^3F_4$ | 11377987 | 11377428 | | 1.401E-11 | | 100. (43) |
| 11 | 44 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g\ ^3G_4$ | | 11377433 | | 2.351E-11 | | 54.1 (44) 45.9 (48) |
| 11 | 45 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f\ ^1F_3$ | 11377991 | 11377435 | | 1.404E-11 | | 56.3 (45) 43.7 (40) |
| 11 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g\ ^3G_3$ | | 11377438 | | 2.351E-11 | | 100. (46) |
| 11 | 47 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g\ ^3G_5$ | | 11377457 | | 2.351E-11 | | 100. (47) |
| 11 | 48 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g\ ^1G_4$ | | 11377461 | | 2.352E-11 | | 54.1 (48) 45.9 (44) |
| 11 | 49 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p\ ^1P_1$ | 11378646 | 11378064 | | 1.175E-12 | | 100. (49) |
| 11 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s\ ^3S_1$ | 11507469 | 11506929 | | 4.171E-11 | | 100. (50) |
| 11 | 51 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s\ ^1S_0$ | 11510320 | 11509768 | | 4.371E-11 | | 100. (51) |
| 11 | 52 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p\ ^3P_0$ | 11510387 | 11509769 | | 2.050E-11 | | 100. (52) |
| 11 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p\ ^3P_1$ | 11510387 | 11509791 | | 2.028E-11 | | 100. (53) |
| 11 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p\ ^3P_2$ | 11510387 | 11509880 | | 2.056E-11 | | 100. (54) |
| 11 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d\ ^3D_1$ | 11512003 | 11511419 | | 1.140E-11 | | 100. (55) |
| 11 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d\ ^3D_2$ | 11512003 | 11511425 | | 1.144E-11 | | 96.4 (56) |
| 11 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d\ ^3D_3$ | 11512003 | 11511454 | | 1.143E-11 | | 100. (57) |
| 11 | 58 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f\ ^3F_3$ | 11512130 | 11511548 | | 2.395E-11 | | 57.2 (58) 42.8 (64) |
| 11 | 59 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f\ ^3F_2$ | 11512130 | 11511553 | | 2.393E-11 | | 100. (59) |
| 11 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d\ ^1D_2$ | 11512137 | 11511567 | | 1.209E-11 | | 96.4 (60) |
| 11 | 61 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g\ ^3G_4$ | | 11511570 | | 4.035E-11 | | 53.9 (61) 46.1 (68) |
| 11 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f\ ^3F_4$ | 11512130 | 11511571 | | 2.395E-11 | | 100. (62) |
| 11 | 63 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g\ ^3G_3$ | | 11511573 | | 4.035E-11 | | 100. (63) |
| 11 | 64 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f\ ^1F_3$ | 11512133 | 11511575 | | 2.400E-11 | | 57.2 (64) 42.8 (58) |
| 11 | 65 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h\ ^3H_5$ | | 11511583 | | 6.081E-11 | | 53.8 (65) 46.2 (70) |
| 11 | 66 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g\ ^3G_5$ | | 11511584 | | 4.036E-11 | | 100. (66) |
| 11 | 67 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h\ ^3H_4$ | | 11511585 | | 6.081E-11 | | 100. (67) |
| 11 | 68 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g\ ^1G_4$ | | 11511586 | | 4.036E-11 | | 53.9 (68) 46.1 (61) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 11 | 69 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 11511592 | | 6.082E-11 | | 100. (69) |
| 11 | 70 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 11511594 | | 6.082E-11 | | 53.8 (70) 46.2 (65) |
| 11 | 71 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | 11512505 | 11511944 | | 2.029E-12 | | 100. (71) |
| 11 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 18757400 | 18755433 | | 2.904E-13 | | 77.1 (72) |
| 11 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 18780000 | 18777888 | | 1.189E-13 | | 100. (73) |
| 11 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 18781500 | 18779435 | | 1.189E-13 | | 100. (74) |
| 11 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 18784900 | 18782801 | | 1.191E-13 | | 100. (75) |
| 11 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 18856100 | 18854277 | | 5.841E-14 | | 100. (76) |
| 11 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 18857800 | 18855989 | | 5.839E-14 | | 100. (77) |
| 11 | 78 | $2p_{3/2}^2(J=2)$ | $2p^2^3P_2$ | 18860700 | 18858946 | | 5.844E-14 | | 100. (78) |
| 11 | 79 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^1D_2$ | 18900900 | 18898581 | | 5.776E-14 | | 100. (79) |
| 11 | 80 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 18909900 | 18909001 | | 1.097E-13 | | 100. (80) |
| 11 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | 19034800 | 19032470 | | 7.555E-14 | | 77.1 (81) |
| 11 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 20467358 | | 2.829E-13 | | 69.5 (82) 30.5 (106) |
| 11 | 83 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p^1P_1$ | | 20477617 | | 1.634E-13 | | 48.0 (83) 47.3 (110) 4.65 (116) |
| 11 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 20494587 | | 4.063E-13 | | 73.8 (84) |
| 11 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 20501623 | | 1.701E-13 | | 54.5 (85) 43.7 (92) 1.77 (113) |
| 11 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 20502375 | | 9.861E-14 | | 71.9 (86) 15.7 (103) 12.4 (91) |
| 11 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 20502654 | | 1.917E-13 | | 53.1 (87) 43.6 (93) 3.27 (112) |
| 11 | 88 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 20504361 | | 2.385E-13 | | 68.4 (88) 24.3 (94) 7.29 (111) |
| 11 | 89 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 20504842 | | 1.031E-13 | | 80.0 (89) |
| 11 | 90 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 20507608 | | 1.062E-13 | | 77.3 (90) |
| 11 | 91 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 20507907 | | 8.823E-14 | | 87.5 (91) |
| 11 | 92 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 20508063 | | 1.473E-13 | | 41.2 (92) 40.1 (85) 18.7 (113) |
| 11 | 93 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 20508983 | | 1.340E-13 | | 50.4 (93) 31.6 (87) 18.0 (112) |
| 11 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 20511041 | | 1.163E-13 | | 69.4 (94) 15.7 (111) 15.0 (88) |
| 11 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 20531934 | | 1.093E-13 | | 85.6 (95) |
| 11 | 96 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 20534424 | | 1.101E-13 | | 100. (96) |
| 11 | 97 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^1D_2$ | | 20536915 | | 1.061E-13 | | 85.7 (97) |
| 11 | 98 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d^3F_4$ | | 20537105 | | 1.103E-13 | | 100. (98) |
| 11 | 99 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 20537855 | | 8.619E-14 | | 100. (99) |
| 11 | 100 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^3P_1$ | | 20538901 | | 8.671E-14 | | 100. (100) |
| 11 | 101 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3P_2$ | | 20539565 | | 1.110E-13 | | 40.5 (101) 36.5 (102) 21.1 (114) |
| 11 | 102 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^1D_2$ | | 20542161 | | 1.035E-13 | | 58.6 (101) 24.2 (102) 17.1 (114) |
| 11 | 103 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 20545470 | | 3.778E-13 | | 81.3 (103) |
| 11 | 104 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 20546067 | | 3.475E-13 | | 79.6 (104) |
| 11 | 105 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 20546834 | | 3.312E-13 | | 77.4 (105) |
| 11 | 106 | $2s_{1/2}3s_{1/2}(J=1)$ | $2p3p^3S_1$ | | 20550891 | | 1.206E-13 | | 68.8 (106) 30.1 (82) 1.07 (100) |
| 11 | 107 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 20557326 | | 9.673E-14 | | 100. (107) |
| 11 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d^3D_2$ | | 20558265 | | 9.653E-14 | | 100. (108) |
| 11 | 109 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d^3D_3$ | | 20559418 | | 9.635E-14 | | 100. (109) |
| 11 | 110 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 20562227 | | 1.449E-13 | | 51.8 (110) 39.2 (83) 7.26 (116) |
| 11 | 111 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^3P_2$ | | 20576676 | | 1.173E-13 | | 77.8 (111) |
| 11 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d^3P_1$ | | 20577478 | | 1.166E-13 | | 79.1 (112) |
| 11 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d^3P_0$ | | 20577989 | | 1.163E-13 | | 79.8 (113) |
| 11 | 114 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 20580708 | | 1.858E-13 | | 60.9 (114) 39.1 (102) |
| 11 | 115 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d^1F_3$ | | 20590137 | | 9.273E-14 | | 100. (115) |
| 11 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d^1P_1$ | | 20601478 | | 1.055E-13 | | 88.5 (116) |
| 11 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p^1S_0$ | | 20610664 | | 1.076E-13 | | 74.1 (117) |
| 11 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s^3S_1$ | | 21061125 | | 3.533E-13 | | 69.5 (118) 30.5 (145) |
| 11 | 119 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p^1P_1$ | | 21066073 | | 1.968E-13 | | 48.2 (119) 44.0 (150) 5.70 (168) |
| 11 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s^1S_0$ | | 21070306 | | 4.359E-13 | | 72.9 (120) |
| 11 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s^3P_0$ | | 21072914 | | 1.923E-13 | | 52.5 (121) 44.8 (127) 2.72 (162) |
| 11 | 122 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p^3P_1$ | | 21073818 | | 2.318E-13 | | 54.2 (122) 39.9 (129) 4.70 (161) |
| 11 | 123 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p^3P_2$ | | 21075040 | | 3.060E-13 | | 67.8 (123) 23.1 (130) 9.17 (160) |
| 11 | 124 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p^3D_1$ | | 21076429 | | 1.197E-13 | | 70.7 (124) 19.6 (139) 9.72 (128) |
| 11 | 125 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p^3D_2$ | | 21078172 | | 1.303E-13 | | 72.5 (125) |
| 11 | 126 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p^3D_3$ | | 21080477 | | 1.487E-13 | | 63.4 (126) 35.2 (141) 1.34 (163) |
| 11 | 127 | $2p_{1/2}4s_{1/2}(J=0)$ | $2s4p^3P_0$ | | 21080601 | | 1.568E-13 | | 44.1 (121) 37.9 (127) 17.9 (162) |
| 11 | 128 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p^1P_1$ | | 21081407 | | 1.010E-13 | | 88.3 (128) |
| 11 | 129 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s^3P_1$ | | 21081446 | | 1.397E-13 | | 53.6 (129) 27.5 (122) 17.7 (161) |
| 11 | 130 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s^3P_2$ | | 21083347 | | 1.160E-13 | | 71.1 (130) 17.8 (160) 11.1 (123) |
| 11 | 131 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d^3F_2$ | | 21087613 | | 1.165E-13 | | 80.9 (131) |
| 11 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2p4p^1D_2$ | | 21089206 | | 1.804E-13 | | 47.3 (132) 40.5 (159) 7.26 (138) |
| 11 | 133 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d^3F_3$ | | 21089531 | | 1.216E-13 | | 85.9 (133) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 11 | 134 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 21089765 | | 9.782E-14 | | 99.0 (134) |
| 11 | 135 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 21090742 | | 1.017E-13 | | 92.3 (135) |
| 11 | 136 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 21092024 | | 1.326E-13 | | 81.7 (136) |
| 11 | 137 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^1D_2$ | | 21092518 | | 1.087E-13 | | 85.9 (137) |
| 11 | 138 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^3P_2$ | | 21092887 | | 1.133E-13 | | 80.7 (138) |
| 11 | 139 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 21094072 | | 2.873E-13 | | 69.3 (139) 24.4 (124) 3.27 (165) |
| 11 | 140 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^3D_2$ | | 21094708 | | 2.180E-13 | | 57.6 (140) 27.4 (125) 11.5 (138) |
| 11 | 141 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 21095282 | | 2.181E-13 | | 58.0 (141) 36.4 (126) 5.54 (163) |
| 11 | 142 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 21098051 | | 1.056E-13 | | 85.2 (142) |
| 11 | 143 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^3D_2$ | | 21099293 | | 1.085E-13 | | 90.2 (143) |
| 11 | 144 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 21099771 | | 1.054E-13 | | 45.9 (144) 44.7 (155) 9.39 (149) |
| 11 | 145 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | | 21099943 | | 1.288E-13 | | 68.1 (145) 29.3 (118) 2.55 (135) |
| 11 | 146 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 21100200 | | 1.052E-13 | | 55.4 (146) 28.5 (156) 16.1 (158) |
| 11 | 147 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^3D_3$ | | 21100231 | | 1.166E-13 | | 86.2 (147) |
| 11 | 148 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 21100335 | | 1.063E-13 | | 91.0 (148) |
| 11 | 149 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | | 21100336 | | 1.077E-13 | | 62.8 (149) 24.3 (144) 7.38 (163) |
| 11 | 150 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 21100378 | | 1.452E-13 | | 48.6 (150) 32.9 (119) 12.5 (142) |
| 11 | 151 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 21102136 | | 5.905E-13 | | 85.9 (151) |
| 11 | 152 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^1F_3$ | | 21102410 | | 1.415E-12 | | 78.1 (152) |
| 11 | 153 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^3F_3$ | | 21102434 | | 4.482E-13 | | 58.8 (153) 21.0 (152) 10.6 (133) |
| 11 | 154 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 21102665 | | 4.828E-13 | | 81.5 (154) |
| 11 | 155 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 21104460 | | 1.054E-13 | | 52.5 (155) 25.7 (144) 21.8 (149) |
| 11 | 156 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 21104802 | | 1.054E-13 | | 45.7 (156) 43.8 (146) 10.5 (158) |
| 11 | 157 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 21106328 | | 1.053E-13 | | 100. (157) |
| 11 | 158 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | | 21107026 | | 1.052E-13 | | 74.0 (158) |
| 11 | 159 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 21107358 | | 1.771E-13 | | 51.2 (159) 43.7 (132) 5.10 (166) |
| 11 | 160 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 21107390 | | 1.207E-13 | | 71.7 (160) 18.7 (123) 5.23 (130) |
| 11 | 161 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 21108119 | | 1.198E-13 | | 76.0 (161) |
| 11 | 162 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 21108565 | | 1.191E-13 | | 79.5 (162) |
| 11 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 21109004 | | 1.083E-13 | | 85.7 (163) |
| 11 | 164 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 21109289 | | 1.076E-13 | | 49.9 (164) 34.0 (166) 8.76 (148) |
| 11 | 165 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | | 21110938 | | 1.076E-13 | | 96.1 (165) |
| 11 | 166 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 21111358 | | 1.060E-13 | | 54.5 (166) 41.7 (164) 2.09 (132) |
| 11 | 167 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^1F_3$ | | 21111473 | | 1.020E-13 | | 98.6 (167) |
| 11 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | | 21116871 | | 1.135E-13 | | 85.3 (168) |
| 11 | 169 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | | 21120543 | | 1.219E-13 | | 73.7 (169) |
| 11 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | | 21328898 | | 4.318E-13 | | 71.1 (170) 28.9 (212) |
| 11 | 171 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | | 21331531 | | 2.135E-13 | | 46.8 (171) 39.8 (210) 7.73 (180) |
| 11 | 172 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | | 21333066 | | 4.780E-13 | | 71.9 (172) 26.5 (237) 1.64 (186) |
| 11 | 173 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | | 21334131 | | 1.961E-13 | | 55.6 (173) 42.2 (178) 2.21 (226) |
| 11 | 174 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | | 21335055 | | 2.946E-13 | | 57.1 (174) 32.5 (180) 5.42 (223) |
| 11 | 175 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | | 21335826 | | 4.302E-13 | | 73.8 (175) |
| 11 | 176 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | | 21336487 | | 1.305E-13 | | 69.3 (176) 20.5 (191) 10.2 (181) |
| 11 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | | 21337777 | | 1.479E-13 | | 63.3 (177) 28.3 (188) 4.60 (216) |
| 11 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | | 21339302 | | 1.754E-13 | | 43.4 (178) 41.8 (173) 14.8 (226) |
| 11 | 179 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 21339859 | | 2.271E-13 | | 52.5 (179) 44.6 (192) 2.92 (229) |
| 11 | 180 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | | 21340116 | | 1.466E-13 | | 54.6 (180) 26.2 (174) 14.5 (223) |
| 11 | 181 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^1P_1$ | | 21340468 | | 1.106E-13 | | 74.7 (181) |
| 11 | 182 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | | 21341896 | | 1.158E-13 | | 53.0 (182) 19.4 (183) 15.2 (190) |
| 11 | 183 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 21342197 | | 1.135E-13 | | 53.4 (183) 23.6 (182) 12.6 (219) |
| 11 | 184 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^1D_2$ | | 21342973 | | 2.546E-13 | | 41.7 (184) 35.1 (216) 15.5 (188) |
| 11 | 185 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 21343501 | | 1.310E-13 | | 73.1 (185) |
| 11 | 186 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 21343508 | | 1.044E-13 | | 96.8 (186) |
| 11 | 187 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | | 21344405 | | 1.434E-13 | | 58.9 (187) 28.7 (191) 5.41 (181) |
| 11 | 188 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^3D_2$ | | 21345756 | | 2.074E-13 | | 34.9 (188) 27.7 (193) 17.8 (184) |
| 11 | 189 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 21345814 | | 2.070E-13 | | 54.3 (189) 45.7 (213) |
| 11 | 190 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^1D_2$ | | 21346040 | | 1.159E-13 | | 67.2 (190) 11.3 (211) 6.17 (183) |
| 11 | 191 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 21346189 | | 1.696E-13 | | 42.8 (191) 25.8 (176) 21.4 (187) |
| 11 | 192 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 21347205 | | 1.454E-13 | | 49.5 (192) 31.6 (179) 10.1 (229) |
| 11 | 193 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^3P_2$ | | 21347266 | | 1.176E-13 | | 62.8 (193) 19.2 (177) 14.7 (188) |
| 11 | 194 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 21347539 | | 1.083E-13 | | 74.0 (194) |
| 11 | 195 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 21347854 | | 1.069E-13 | | 64.4 (195) 22.1 (215) 12.3 (199) |
| 11 | 196 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 21348137 | | 1.068E-13 | | 39.4 (196) 36.1 (217) 24.4 (222) |
| 11 | 197 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 21348721 | | 2.294E-13 | | 55.0 (197) 37.0 (211) 3.01 (190) |
| 11 | 198 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 21348732 | | 1.090E-13 | | 75.3 (198) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 11 | 199 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 21348813 | | 1.175E-13 | | 40.0 (199) 27.2 (215) 15.2 (229) |
| 11 | 200 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 21348857 | | 1.055E-13 | | 66.2 (200) 19.1 (220) 14.7 (228) |
| 11 | 201 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 21348883 | | 1.055E-13 | | 36.1 (201) 33.8 (221) 30.1 (224) |
| 11 | 202 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^3F_3$ | | 21348930 | | 2.792E-13 | | 65.2 (202) 24.9 (214) 4.18 (185) |
| 11 | 203 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 21349215 | | 1.118E-13 | | 56.6 (203) 22.0 (227) 15.9 (233) |
| 11 | 204 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 21349248 | | 1.058E-13 | | 39.9 (204) 33.8 (228) 26.4 (220) |
| 11 | 205 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^1F_3$ | | 21349534 | | 2.040E-12 | | 98.3 (205) |
| 11 | 206 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 21349609 | | 7.890E-12 | | 66.4 (206) 33.6 (209) |
| 11 | 207 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 21349616 | | 1.121E-11 | | 100. (207) |
| 11 | 208 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 21349624 | | 4.063E-12 | | 100. (208) |
| 11 | 209 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | | 21349655 | | 5.498E-12 | | 71.4 (209) 28.6 (206) |
| 11 | 210 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 21349681 | | 1.437E-13 | | 49.2 (210) 30.4 (171) 15.1 (194) |
| 11 | 211 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^3D_2$ | | 21350155 | | 1.484E-13 | | 35.1 (211) 30.7 (197) 18.3 (182) |
| 11 | 212 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^3S_1$ | | 21350348 | | 1.263E-13 | | 67.7 (212) 25.4 (170) 6.86 (187) |
| 11 | 213 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 21350538 | | 2.099E-13 | | 54.1 (213) 45.9 (189) |
| 11 | 214 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^3D_3$ | | 21350994 | | 1.219E-13 | | 64.6 (214) 19.7 (185) 15.7 (202) |
| 11 | 215 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 21352765 | | 1.056E-13 | | 36.6 (215) 35.0 (195) 28.4 (199) |
| 11 | 216 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | | 21352906 | | 1.540E-13 | | 55.2 (216) 39.7 (184) 1.86 (235) |
| 11 | 217 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 21352948 | | 1.056E-13 | | 61.8 (217) 32.5 (196) 5.70 (222) |
| 11 | 218 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 21353648 | | 1.048E-13 | | 100. (218) |
| 11 | 219 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 21353678 | | 1.171E-13 | | 64.8 (219) 15.0 (175) 13.1 (211) |
| 11 | 220 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^1G_4$ | | 21353882 | | 1.060E-13 | | 36.5 (220) 33.7 (200) 29.7 (228) |
| 11 | 221 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 21353905 | | 1.060E-13 | | 66.3 (221) 19.0 (201) 14.7 (224) |
| 11 | 222 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 21354060 | | 1.047E-13 | | 69.8 (222) 28.4 (196) 1.79 (217) |
| 11 | 223 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 21354217 | | 1.169E-13 | | 74.4 (223) |
| 11 | 224 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 21354488 | | 1.054E-13 | | 55.2 (224) 44.8 (201) |
| 11 | 225 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 21354509 | | 1.054E-13 | | 100. (225) |
| 11 | 226 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 21354575 | | 1.165E-13 | | 82.9 (226) |
| 11 | 227 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^1F_3$ | | 21354618 | | 1.057E-13 | | 40.3 (203) 33.8 (227) 25.9 (233) |
| 11 | 228 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | | 21354640 | | 1.057E-13 | | 59.8 (204) 22.0 (228) 18.2 (220) |
| 11 | 229 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 21354674 | | 1.074E-13 | | 72.0 (229) 14.8 (199) 9.63 (215) |
| 11 | 230 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 21354864 | | 1.063E-13 | | 43.9 (230) 29.7 (235) 22.7 (198) |
| 11 | 231 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5d\ ^3F_3$ | | 21355530 | | 1.045E-13 | | 56.0 (231) 22.8 (233) 16.8 (227) |
| 11 | 232 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 21355582 | | 1.052E-13 | | 100. (232) |
| 11 | 233 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^3F_3$ | | 21355648 | | 1.047E-13 | | 36.0 (233) 33.3 (231) 27.9 (227) |
| 11 | 234 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 21356019 | | 1.069E-13 | | 96.4 (234) |
| 11 | 235 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 21356317 | | 1.057E-13 | | 53.9 (235) 42.8 (230) 1.64 (188) |
| 11 | 236 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 21358303 | | 1.127E-13 | | 82.4 (236) |
| 11 | 237 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 21359728 | | 1.244E-13 | | 73.8 (237) |
| 11 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 21471507 | | 5.077E-13 | | 71.0 (238) 26.6 (287) 1.25 (268) |
| 11 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2s6p\ ^1P_1$ | | 21473035 | | 2.344E-13 | | 43.1 (239) 35.6 (286) 13.5 (248) |
| 11 | 240 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 21473663 | | 4.657E-13 | | 66.8 (240) 29.5 (318) 3.78 (253) |
| 11 | 241 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 21474539 | | 2.074E-13 | | 55.7 (241) 42.4 (246) 1.95 (304) |
| 11 | 242 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 21475378 | | 4.149E-13 | | 61.2 (242) 21.9 (248) 8.66 (239) |
| 11 | 243 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 21475784 | | 5.555E-13 | | 78.2 (243) |
| 11 | 244 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 21476156 | | 1.409E-13 | | 68.3 (244) 21.5 (255) 10.2 (249) |
| 11 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 21477059 | | 1.618E-13 | | 54.3 (245) 28.5 (256) 9.61 (291) |
| 11 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 21478161 | | 1.940E-13 | | 48.9 (246) 40.4 (241) 10.7 (304) |
| 11 | 247 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 21478821 | | 4.413E-13 | | 72.1 (247) 22.9 (284) 5.02 (307) |
| 11 | 248 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 21478948 | | 1.594E-13 | | 53.5 (248) 24.7 (242) 11.9 (239) |
| 11 | 249 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^1P_1$ | | 21479171 | | 1.209E-13 | | 52.2 (249) 27.6 (268) 9.47 (238) |
| 11 | 250 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 21479298 | | 1.208E-13 | | 73.2 (250) |
| 11 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^1D_2$ | | 21480144 | | 3.825E-13 | | 36.5 (251) 32.5 (256) 22.2 (291) |
| 11 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 21480446 | | 1.331E-13 | | 62.5 (252) 18.4 (273) 11.1 (290) |
| 11 | 253 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 21480646 | | 1.108E-13 | | 93.4 (253) |
| 11 | 254 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6s\ ^3P_2$ | | 21480881 | | 1.075E-13 | | 48.2 (254) 22.8 (294) 13.6 (289) |
| 11 | 255 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 21481138 | | 2.706E-13 | | 63.7 (255) 20.2 (268) 9.60 (244) |
| 11 | 256 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^3D_2$ | | 21482037 | | 2.900E-13 | | 35.2 (251) 31.9 (256) 19.7 (245) |
| 11 | 257 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 21482293 | | 5.387E-13 | | 77.4 (257) |
| 11 | 258 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 21482398 | | 1.022E-13 | | 70.8 (258) 17.8 (292) 9.98 (266) |
| 11 | 259 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 21482552 | | 1.021E-13 | | 41.6 (259) 29.2 (298) 28.2 (293) |
| 11 | 260 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 21482730 | | 1.102E-13 | | 68.6 (260) 11.4 (321) 7.96 (301) |
| 11 | 261 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6d\ ^3D_2$ | | 21482811 | | 1.338E-13 | | 35.1 (254) 33.0 (261) 11.7 (270) |
| 11 | 262 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 21482865 | | 9.563E-14 | | 72.7 (262) |
| 11 | 263 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 21482877 | | 8.890E-14 | | 74.3 (263) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 11 | 264 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 21482878 | | 9.562E-14 | | 39.7 (264) 33.0 (299) 27.3 (303) |
| 11 | 265 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 21482886 | | 8.891E-14 | | 40.0 (265) 34.3 (295) 25.7 (306) |
| 11 | 266 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 21483087 | | 1.051E-13 | | 33.6 (266) 33.4 (307) 23.3 (292) |
| 11 | 267 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 21483239 | | 1.086E-13 | | 62.2 (267) 19.7 (320) 12.8 (309) |
| 11 | 268 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^3P_1$ | | 21483322 | | 1.186E-13 | | 33.8 (268) 29.9 (249) 20.2 (244) |
| 11 | 269 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 21483356 | | 1.431E-13 | | 33.1 (269) 25.6 (273) 17.6 (308) |
| 11 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 21483411 | | 3.677E-13 | | 72.6 (270) |
| 11 | 271 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 21483435 | | 1.068E-13 | | 46.1 (271) 28.5 (310) 22.6 (302) |
| 11 | 272 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 21483448 | | 1.051E-13 | | 45.8 (272) 30.1 (311) 24.1 (315) |
| 11 | 273 | $2p_{1/2}6g_{7/2}(J=3)$ | $2s6f\ ^3F_3$ | | 21483454 | | 1.976E-13 | | 48.0 (273) 20.1 (269) 10.7 (308) |
| 11 | 274 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 21483457 | | 1.050E-13 | | 54.2 (274) 25.0 (312) 20.8 (305) |
| 11 | 275 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^1F_3$ | | 21483763 | | 3.057E-12 | | 100. (275) |
| 11 | 276 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 21483792 | | 7.396E-12 | | 62.4 (276) 37.6 (279) |
| 11 | 277 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 21483794 | | 9.547E-12 | | 100. (277) |
| 11 | 278 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 21483806 | | 3.626E-12 | | 100. (278) |
| 11 | 279 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 21483824 | | 4.862E-12 | | 73.1 (279) |
| 11 | 280 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 21483884 | | 1.479E-11 | | 54.7 (280) 45.3 (282) |
| 11 | 281 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 21483884 | | 1.224E-11 | | 100. (281) |
| 11 | 282 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 21483892 | | 1.229E-11 | | 54.9 (282) 45.1 (280) |
| 11 | 283 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 21483893 | | 1.489E-11 | | 100. (283) |
| 11 | 284 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 21484182 | | 1.413E-13 | | 63.7 (284) 30.6 (247) 3.23 (266) |
| 11 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 21484380 | | 1.116E-13 | | 73.0 (285) |
| 11 | 286 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 21484990 | | 1.575E-13 | | 51.4 (286) 34.0 (239) 7.36 (248) |
| 11 | 287 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^3S_1$ | | 21485588 | | 1.467E-13 | | 57.2 (287) 27.3 (238) 14.2 (268) |
| 11 | 288 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 21485763 | | 1.256E-13 | | 79.4 (288) |
| 11 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^3D_2$ | | 21485777 | | 1.116E-13 | | 34.8 (289) 33.9 (289) 18.9 (250) |
| 11 | 290 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^3D_3$ | | 21486471 | | 1.085E-13 | | 68.1 (290) 25.8 (252) 4.23 (273) |
| 11 | 291 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 21486857 | | 1.363E-13 | | 64.4 (291) 25.7 (251) 4.99 (245) |
| 11 | 292 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 21487555 | | 1.031E-13 | | 42.4 (292) 30.3 (266) 27.2 (258) |
| 11 | 293 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 21487647 | | 1.026E-13 | | 67.8 (293) 30.4 (259) 1.81 (298) |
| 11 | 294 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 21487709 | | 1.190E-13 | | 54.2 (294) 25.4 (289) 13.4 (243) |
| 11 | 295 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 21487740 | | 7.897E-14 | | 53.7 (295) 46.3 (265) |
| 11 | 296 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 21487749 | | 7.900E-14 | | 100. (296) |
| 11 | 297 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 21487791 | | 9.619E-14 | | 100. (297) |
| 11 | 298 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 21487946 | | 9.631E-14 | | 67.9 (298) 27.3 (259) 4.86 (293) |
| 11 | 299 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 21487969 | | 8.877E-14 | | 54.1 (299) 45.9 (264) |
| 11 | 300 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 21487985 | | 8.882E-14 | | 100. (300) |
| 11 | 301 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 21488008 | | 1.209E-13 | | 66.7 (301) 15.7 (260) 14.0 (242) |
| 11 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 21488122 | | 1.007E-13 | | 41.4 (302) 33.5 (310) 25.2 (262) |
| 11 | 303 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 21488135 | | 1.007E-13 | | 74.9 (303) |
| 11 | 304 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 21488231 | | 1.223E-13 | | 82.9 (304) |
| 11 | 305 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 21488270 | | 9.734E-14 | | 42.0 (305) 35.4 (312) 22.6 (263) |
| 11 | 306 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 21488278 | | 9.736E-14 | | 77.4 (306) |
| 11 | 307 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 21488560 | | 1.061E-13 | | 60.7 (307) 22.8 (266) 14.2 (292) |
| 11 | 308 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^1F_3$ | | 21488670 | | 1.033E-13 | | 33.7 (313) 29.2 (269) 16.9 (308) |
| 11 | 309 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 21488687 | | 1.057E-13 | | 39.4 (309) 35.0 (267) 24.3 (320) |
| 11 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 21488716 | | 1.051E-13 | | 52.1 (271) 26.4 (310) 21.5 (302) |
| 11 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^1G_4$ | | 21488736 | | 1.050E-13 | | 54.2 (272) 25.1 (311) 20.7 (315) |
| 11 | 312 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 21488744 | | 1.051E-13 | | 45.8 (274) 29.4 (312) 24.8 (305) |
| 11 | 313 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6d\ ^1F_3$ | | 21488745 | | 1.022E-13 | | 54.1 (313) 17.0 (269) 12.0 (308) |
| 11 | 314 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 21489095 | | 1.038E-13 | | 100. (314) |
| 11 | 315 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^3G_4$ | | 21489103 | | 1.037E-13 | | 55.3 (315) 44.7 (311) |
| 11 | 316 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 21489295 | | 1.040E-13 | | 100. (316) |
| 11 | 317 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 21489302 | | 1.042E-13 | | 57.5 (317) 42.5 (308) |
| 11 | 318 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 21489332 | | 1.629E-13 | | 65.7 (318) 28.0 (240) 6.29 (253) |
| 11 | 319 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 21489422 | | 1.056E-13 | | 97.0 (319) |
| 11 | 320 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 21489632 | | 1.052E-13 | | 53.9 (320) 43.6 (309) 1.44 (256) |
| 11 | 321 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 21490132 | | 1.150E-13 | | 78.0 (321) |
| 12 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 12 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 10736136 | 10735912 | | 1.385E-05 | | 100. (2) |
| 12 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 10831989 | 10831864 | | 7.883E-09 | | 100. (3) |
| 12 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 10832818 | 10832696 | | 2.937E-11 | | 100. (4) |
| 12 | 5 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 10836388 | 10836270 | | 6.405E-09 | | 100. (5) |
| 12 | 6 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 10838778 | 10838637 | | 6.553E-03 | | 100. (6) |
| 12 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 10906612 | 10906337 | | 5.139E-14 | | 100. (7) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|-----------------------|
| 12 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s^3S_1$ | 12691170 | 12690910 | | 8.168E-12 | | 100. (8) |
| 12 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p^3P_0$ | 12717465 | 12717157 | | 3.045E-12 | | 100. (9) |
| 12 | 10 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p^3P_1$ | 12717729 | 12717421 | | 2.953E-12 | | 100. (10) |
| 12 | 11 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s^1S_0$ | 12718304 | 12717809 | | 8.840E-12 | | 100. (11) |
| 12 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 12718786 | 12718478 | | 3.061E-12 | | 100. (12) |
| 12 | 13 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d^3D_1$ | 12733183 | 12732837 | | 1.028E-12 | | 100. (13) |
| 12 | 14 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 12733223 | 12732874 | | 1.031E-12 | | 90.6 (14) |
| 12 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 12733603 | 12733257 | | 1.030E-12 | | 100. (15) |
| 12 | 16 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 12734298 | 12733921 | | 1.067E-12 | | 90.6 (16) |
| 12 | 17 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 12738006 | 12737596 | | 1.751E-13 | | 100. (17) |
| 12 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s^3S_1$ | 13361991 | 13361661 | | 1.201E-11 | | 100. (18) |
| 12 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 13372822 | 13372459 | | 5.152E-12 | | 100. (19) |
| 12 | 20 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 13372934 | 13372573 | | 5.039E-12 | | 100. (20) |
| 12 | 21 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 13372977 | 13372594 | | 1.287E-11 | | 100. (21) |
| 12 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 13373378 | 13373018 | | 5.175E-12 | | 100. (22) |
| 12 | 23 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d^3D_1$ | 13379385 | 13378918 | | 2.381E-12 | | 100. (23) |
| 12 | 24 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 13379400 | 13378942 | | 2.389E-12 | | 93.6 (24) |
| 12 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 13379562 | 13379095 | | 2.386E-12 | | 100. (25) |
| 12 | 26 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | 13379893 | 13379435 | | 4.948E-12 | | 55.9 (26) 44.1 (30) |
| 12 | 27 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | 13379893 | 13379459 | | 4.947E-12 | | 100. (27) |
| 12 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | 13379830 | 13379468 | | 2.505E-12 | | 93.6 (28) |
| 12 | 29 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | 13379893 | 13379549 | | 4.949E-12 | | 100. (29) |
| 12 | 30 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | 13379898 | 13379566 | | 4.954E-12 | | 55.9 (30) 44.1 (26) |
| 12 | 31 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 13381265 | 13380865 | | 4.152E-13 | | 100. (31) |
| 12 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 13669618 | 13669257 | | 1.887E-11 | | 100. (32) |
| 12 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 13675091 | 13674716 | | 8.721E-12 | | 100. (33) |
| 12 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 13675137 | 13674750 | | 2.025E-11 | | 100. (34) |
| 12 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 13675149 | 13674775 | | 8.556E-12 | | 100. (35) |
| 12 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 13675377 | 13675003 | | 8.757E-12 | | 100. (36) |
| 12 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | 13678422 | 13677987 | | 4.566E-12 | | 100. (37) |
| 12 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | 13678430 | 13678001 | | 4.582E-12 | | 94.4 (38) |
| 12 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | 13678513 | 13678078 | | 4.576E-12 | | 100. (39) |
| 12 | 40 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | 13678692 | 13678268 | | 9.571E-12 | | 56.9 (40) 43.1 (45) |
| 12 | 41 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | 13678692 | 13678280 | | 9.561E-12 | | 100. (41) |
| 12 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | 13678680 | 13678288 | | 4.838E-12 | | 94.4 (42) |
| 12 | 43 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | 13678692 | 13678326 | | 9.569E-12 | | 100. (43) |
| 12 | 44 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | 13678742 | 13678332 | | 1.605E-11 | | 54.4 (44) 45.6 (48) |
| 12 | 45 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | 13678692 | 13678335 | | 9.584E-12 | | 56.9 (45) 43.1 (40) |
| 12 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | 13678742 | 13678339 | | 1.605E-11 | | 100. (46) |
| 12 | 47 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | 13678742 | 13678367 | | 1.606E-11 | | 100. (47) |
| 12 | 48 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | 13678742 | 13678372 | | 1.606E-11 | | 54.4 (48) 45.6 (44) |
| 12 | 49 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 13679363 | 13678967 | | 8.101E-13 | | 100. (49) |
| 12 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 13835434 | | 2.925E-11 | | 100. (50) |
| 12 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 13838571 | | 1.408E-11 | | 100. (51) |
| 12 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 13838582 | | 3.008E-11 | | 100. (52) |
| 12 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 13838605 | | 1.383E-11 | | 100. (53) |
| 12 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 13838737 | | 1.413E-11 | | 100. (54) |
| 12 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 13840447 | | 7.829E-12 | | 100. (55) |
| 12 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 13840455 | | 7.854E-12 | | 94.7 (56) |
| 12 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 13840499 | | 7.848E-12 | | 100. (57) |
| 12 | 58 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 13840607 | | 1.635E-11 | | 57.6 (58) 42.4 (64) |
| 12 | 59 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 13840614 | | 1.634E-11 | | 100. (59) |
| 12 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 13840626 | | 8.216E-12 | | 94.7 (60) |
| 12 | 61 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 13840641 | | 2.755E-11 | | 54.2 (61) 45.8 (68) |
| 12 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 13840641 | | 1.636E-11 | | 100. (62) |
| 12 | 63 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 13840645 | | 2.755E-11 | | 100. (63) |
| 12 | 64 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 13840647 | | 1.639E-11 | | 57.7 (64) 42.3 (58) |
| 12 | 65 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | 13841054 | 13840660 | | 4.152E-11 | | 53.8 (65) 46.2 (70) |
| 12 | 66 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 13840661 | | 2.756E-11 | | 100. (66) |
| 12 | 67 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | 13841054 | 13840663 | | 4.152E-11 | | 100. (67) |
| 12 | 68 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 13840664 | | 2.756E-11 | | 54.2 (68) 45.8 (61) |
| 12 | 69 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | 13841054 | 13840673 | | 4.153E-11 | | 100. (69) |
| 12 | 70 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | 13841054 | 13840675 | | 4.153E-11 | | 53.8 (70) 46.2 (65) |
| 12 | 71 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | 13841392 | 13841014 | | 1.399E-12 | | 100. (71) |
| 12 | 72 | $2s^2_{1/2}(J=0)$ | $2s^2^1S_0$ | 22440800 | 22441211 | | 2.034E-13 | | 77.4 (72) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 12 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p\ ^3P_0$ | 22465200 | 22465238 | | 8.325E-14 | | 100. (73) |
| 12 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p\ ^3P_1$ | 22467400 | 22467435 | | 8.329E-14 | | 100. (74) |
| 12 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p\ ^3P_2$ | 22472200 | 22472260 | | 8.343E-14 | | 100. (75) |
| 12 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2\ ^3P_0$ | 22549700 | 22549881 | | 4.106E-14 | | 100. (76) |
| 12 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2\ ^3P_1$ | 22552100 | 22552342 | | 4.103E-14 | | 100. (77) |
| 12 | 78 | $2p_{3/2}^2(J=2)$ | $2p^2\ ^3P_2$ | 22556300 | 22556528 | | 4.107E-14 | | 100. (78) |
| 12 | 79 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2\ ^1D_2$ | 22600500 | 22600303 | | 4.065E-14 | | 100. (79) |
| 12 | 80 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p\ ^1P_1$ | 22609200 | 22610635 | | 7.769E-14 | | 100. (80) |
| 12 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2\ ^1S_0$ | 22746800 | 22746680 | | 5.291E-14 | | 77.5 (81) |
| 12 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s\ ^3S_1$ | | 24492535 | | 2.018E-13 | | 70.2 (82) 29.8 (106) |
| 12 | 83 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p\ ^1P_1$ | | 24504049 | | 1.153E-13 | | 48.4 (83) 47.0 (110) 4.54 (116) |
| 12 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | | 24522457 | | 2.856E-13 | | 74.4 (84) |
| 12 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s\ ^3P_0$ | | 24529822 | | 1.179E-13 | | 55.7 (85) 42.8 (90) 1.54 (113) |
| 12 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p\ ^3D_1$ | | 24530666 | | 6.902E-14 | | 71.2 (86) 15.1 (103) 13.7 (92) |
| 12 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p\ ^3P_1$ | | 24531278 | | 1.369E-13 | | 54.6 (87) 42.1 (93) 3.36 (112) |
| 12 | 88 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | | 24533572 | | 1.763E-13 | | 72.0 (88) 19.7 (94) 8.23 (111) |
| 12 | 89 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | | 24534208 | | 7.266E-14 | | 79.8 (89) |
| 12 | 90 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | | 24537160 | | 1.062E-13 | | 42.7 (90) 39.4 (85) 17.9 (113) |
| 12 | 91 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 24538140 | | 7.569E-14 | | 76.2 (91) |
| 12 | 92 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^1P_1$ | | 24538167 | | 6.255E-14 | | 86.1 (92) |
| 12 | 93 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s\ ^3P_1$ | | 24538515 | | 9.431E-14 | | 52.3 (93) 30.6 (87) 17.1 (112) |
| 12 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 24541564 | | 8.028E-14 | | 74.3 (94) |
| 12 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 24563454 | | 7.717E-14 | | 84.2 (95) |
| 12 | 96 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 24567009 | | 7.774E-14 | | 100. (96) |
| 12 | 97 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^1D_2$ | | 24570223 | | 7.500E-14 | | 84.4 (97) |
| 12 | 98 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 24570304 | | 6.093E-14 | | 100. (98) |
| 12 | 99 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 24570895 | | 7.796E-14 | | 100. (99) |
| 12 | 100 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | | 24571775 | | 6.161E-14 | | 98.9 (100) |
| 12 | 101 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 24572413 | | 8.269E-14 | | 39.6 (101) 33.3 (102) 23.8 (114) |
| 12 | 102 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^3P_2$ | | 24576236 | | 7.164E-14 | | 65.1 (102) 19.5 (101) 15.4 (114) |
| 12 | 103 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 24578323 | | 2.649E-13 | | 81.4 (103) |
| 12 | 104 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^3D_2$ | | 24579212 | | 2.344E-13 | | 77.9 (104) |
| 12 | 105 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 24580288 | | 2.260E-13 | | 76.2 (105) |
| 12 | 106 | $2s_{1/2}3s_{1/2}(J=1)$ | $2p3p\ ^3S_1$ | | 24584953 | | 8.432E-14 | | 69.2 (106) 29.1 (82) 1.78 (100) |
| 12 | 107 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 24592113 | | 6.851E-14 | | 97.6 (107) |
| 12 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^3D_2$ | | 24593534 | | 6.830E-14 | | 100. (108) |
| 12 | 109 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3D_3$ | | 24595222 | | 6.807E-14 | | 100. (109) |
| 12 | 110 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 24597768 | | 1.022E-13 | | 51.7 (110) 38.9 (83) 6.74 (116) |
| 12 | 111 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 24613533 | | 8.262E-14 | | 77.1 (111) |
| 12 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 24614607 | | 8.204E-14 | | 79.9 (112) |
| 12 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 24615311 | | 8.178E-14 | | 80.8 (113) |
| 12 | 114 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 24618367 | | 1.281E-13 | | 59.7 (114) 40.3 (101) |
| 12 | 115 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^1F_3$ | | 24629823 | | 6.546E-14 | | 100. (115) |
| 12 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 24641700 | | 7.464E-14 | | 88.8 (116) |
| 12 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 24651695 | | 7.607E-14 | | 74.7 (117) |
| 12 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 25204630 | | 2.520E-13 | | 70.7 (118) 29.3 (148) |
| 12 | 119 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | | 25210194 | | 1.378E-13 | | 48.4 (119) 42.9 (150) 5.43 (168) |
| 12 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 25214643 | | 3.061E-13 | | 73.8 (120) |
| 12 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 25217247 | | 1.328E-13 | | 53.6 (121) 44.1 (126) 2.33 (162) |
| 12 | 122 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 25218534 | | 1.690E-13 | | 55.9 (122) 37.5 (128) 4.67 (161) |
| 12 | 123 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 25220109 | | 2.310E-13 | | 71.3 (123) 18.8 (130) 9.89 (159) |
| 12 | 124 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 25221181 | | 8.386E-14 | | 70.2 (124) 19.1 (139) 10.7 (129) |
| 12 | 125 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 25223589 | | 9.259E-14 | | 70.2 (125) 26.7 (140) 1.83 (132) |
| 12 | 126 | $2p_{1/2}4s_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 25226007 | | 1.148E-13 | | 43.4 (121) 40.2 (126) 16.4 (162) |
| 12 | 127 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 25226826 | | 1.122E-13 | | 58.7 (127) 39.8 (141) 1.50 (163) |
| 12 | 128 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 25227256 | | 9.955E-14 | | 54.7 (128) 27.0 (122) 16.1 (161) |
| 12 | 129 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^1P_1$ | | 25227757 | | 7.252E-14 | | 84.5 (129) |
| 12 | 130 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 25230077 | | 8.002E-14 | | 74.0 (130) |
| 12 | 131 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 25233642 | | 8.229E-14 | | 79.2 (131) |
| 12 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 25235745 | | 1.343E-13 | | 43.8 (132) 40.5 (158) 8.27 (140) |
| 12 | 133 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 25236271 | | 8.659E-14 | | 82.7 (133) |
| 12 | 134 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 25236290 | | 6.959E-14 | | 98.4 (134) |
| 12 | 135 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 25237663 | | 7.602E-14 | | 85.5 (135) |
| 12 | 136 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 25239846 | | 9.980E-14 | | 76.7 (136) |
| 12 | 137 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^1D_2$ | | 25240094 | | 7.787E-14 | | 81.3 (137) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 12 | 138 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^3P_2$ | | 25240472 | | 1.008E-13 | | 56.7 (138) 21.6 (140) 11.3 (158) |
| 12 | 139 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 25240979 | | 1.801E-13 | | 64.1 (139) 24.5 (124) 7.07 (135) |
| 12 | 140 | $2p_{3/2}4p_{1/2}(J=2)$ | $2s4d\ ^3D_2$ | | 25242141 | | 1.103E-13 | | 39.1 (140) 34.9 (138) 23.7 (125) |
| 12 | 141 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 25242729 | | 1.402E-13 | | 53.3 (141) 41.2 (127) 5.46 (163) |
| 12 | 142 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 25245475 | | 7.508E-14 | | 80.7 (142) |
| 12 | 143 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 25247176 | | 7.459E-14 | | 52.1 (143) 36.9 (155) 11.0 (147) |
| 12 | 144 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^3D_2$ | | 25247344 | | 8.400E-14 | | 79.7 (144) |
| 12 | 145 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 25247742 | | 7.450E-14 | | 49.1 (145) 32.4 (156) 18.5 (160) |
| 12 | 146 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 25248040 | | 7.552E-14 | | 85.7 (146) |
| 12 | 147 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | | 25248066 | | 7.704E-14 | | 55.9 (147) 27.5 (155) 11.2 (163) |
| 12 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^3S_1$ | | 25248137 | | 8.968E-14 | | 68.8 (148) 27.3 (118) 3.96 (135) |
| 12 | 149 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^3D_3$ | | 25248416 | | 1.106E-13 | | 62.6 (149) 35.2 (153) 2.26 (166) |
| 12 | 150 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 25248560 | | 1.025E-13 | | 48.3 (150) 32.3 (119) 13.9 (142) |
| 12 | 151 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 25249879 | | 2.885E-13 | | 77.3 (151) |
| 12 | 152 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^1F_3$ | | 25250069 | | 2.481E-12 | | 98.9 (152) |
| 12 | 153 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^3F_3$ | | 25250572 | | 1.462E-13 | | 51.4 (153) 33.0 (149) 15.6 (133) |
| 12 | 154 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 25250633 | | 2.823E-13 | | 76.5 (154) |
| 12 | 155 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 25253815 | | 7.471E-14 | | 46.4 (143) 29.4 (155) 24.2 (147) |
| 12 | 156 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 25254238 | | 7.468E-14 | | 49.8 (145) 41.5 (156) 8.72 (160) |
| 12 | 157 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 25256060 | | 7.462E-14 | | 100. (157) |
| 12 | 158 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 25256168 | | 1.203E-13 | | 48.0 (158) 47.0 (132) 3.98 (167) |
| 12 | 159 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 25256466 | | 8.462E-14 | | 70.1 (159) 16.8 (123) 6.96 (144) |
| 12 | 160 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | | 25256939 | | 7.457E-14 | | 72.7 (160) |
| 12 | 161 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 25257392 | | 8.410E-14 | | 76.5 (161) |
| 12 | 162 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 25257989 | | 8.367E-14 | | 81.4 (162) |
| 12 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 25258494 | | 7.649E-14 | | 81.9 (163) |
| 12 | 164 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 25258839 | | 7.584E-14 | | 48.9 (164) 33.0 (167) 13.0 (146) |
| 12 | 165 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | | 25260960 | | 7.611E-14 | | 96.6 (165) |
| 12 | 166 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^1F_3$ | | 25261480 | | 7.200E-14 | | 96.6 (166) |
| 12 | 167 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 25261516 | | 7.501E-14 | | 54.4 (167) 42.2 (164) 1.88 (132) |
| 12 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | | 25267104 | | 8.001E-14 | | 84.5 (168) |
| 12 | 169 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | | 25270923 | | 8.588E-14 | | 74.8 (169) |
| 12 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | | 2526419 | | 3.005E-13 | | 72.8 (170) |
| 12 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2s5p\ ^1P_1$ | | 25529321 | | 1.454E-13 | | 45.0 (171) 37.2 (210) 11.2 (180) |
| 12 | 172 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | | 25530942 | | 3.281E-13 | | 72.7 (172) |
| 12 | 173 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | | 25531901 | | 1.339E-13 | | 57.0 (173) 41.3 (178) 1.76 (224) |
| 12 | 174 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | | 25533205 | | 2.265E-13 | | 58.9 (174) 27.2 (180) 7.32 (171) |
| 12 | 175 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | | 25534092 | | 3.228E-13 | | 77.0 (175) |
| 12 | 176 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | | 25534519 | | 9.111E-14 | | 69.2 (176) 20.0 (187) 10.8 (181) |
| 12 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | | 25536199 | | 1.042E-13 | | 60.1 (177) 28.2 (188) 6.42 (215) |
| 12 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | | 25537816 | | 1.310E-13 | | 46.5 (178) 41.0 (173) 12.5 (224) |
| 12 | 179 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 25538993 | | 1.945E-13 | | 61.4 (179) 35.3 (194) 3.38 (225) |
| 12 | 180 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | | 25539004 | | 1.070E-13 | | 54.9 (180) 25.3 (174) 12.0 (220) |
| 12 | 181 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^1P_1$ | | 25539557 | | 8.049E-14 | | 65.4 (181) 18.5 (191) 6.25 (187) |
| 12 | 182 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | | 25540613 | | 8.442E-14 | | 73.0 (182) |
| 12 | 183 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 25541971 | | 7.617E-14 | | 68.7 (183) 18.3 (218) 5.28 (211) |
| 12 | 184 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^1D_2$ | | 25542016 | | 2.036E-13 | | 39.8 (184) 29.3 (215) 23.2 (188) |
| 12 | 185 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 25542612 | | 9.326E-14 | | 68.8 (185) 17.9 (201) 8.39 (214) |
| 12 | 186 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 25542644 | | 7.518E-14 | | 95.1 (186) |
| 12 | 187 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 25543643 | | 1.378E-13 | | 48.1 (187) 36.8 (191) 6.48 (176) |
| 12 | 188 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^3D_2$ | | 25545225 | | 1.765E-13 | | 35.3 (188) 25.7 (184) 20.2 (177) |
| 12 | 189 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 25545650 | | 2.059E-13 | | 61.6 (189) 38.4 (212) |
| 12 | 190 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^1D_2$ | | 25545898 | | 8.511E-14 | | 54.5 (190) 14.4 (211) 13.4 (183) |
| 12 | 191 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^3P_1$ | | 25546170 | | 9.279E-14 | | 34.3 (191) 23.7 (187) 22.9 (176) |
| 12 | 192 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 25547008 | | 7.652E-14 | | 72.6 (192) |
| 12 | 193 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 25547137 | | 7.653E-14 | | 57.7 (193) 28.1 (216) 5.18 (194) |
| 12 | 194 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 25547256 | | 8.477E-14 | | 41.8 (194) 20.0 (202) 14.1 (179) |
| 12 | 195 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 25547524 | | 7.574E-14 | | 40.0 (195) 33.6 (217) 25.2 (223) |
| 12 | 196 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^3P_2$ | | 25547806 | | 7.513E-14 | | 62.7 (196) 13.2 (199) 13.1 (177) |
| 12 | 197 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 25548268 | | 2.563E-13 | | 71.9 (197) 19.4 (211) 3.88 (182) |
| 12 | 198 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 25548278 | | 7.482E-14 | | 67.5 (198) 18.5 (221) 14.0 (229) |
| 12 | 199 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 25548303 | | 7.980E-14 | | 56.5 (199) 13.1 (235) 10.8 (196) |
| 12 | 200 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 25548317 | | 7.481E-14 | | 36.9 (200) 32.5 (222) 30.6 (226) |
| 12 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^3F_3$ | | 25548413 | | 2.311E-13 | | 69.5 (201) 15.0 (214) 5.99 (185) |
| 12 | 202 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 25548503 | | 9.047E-14 | | 28.6 (202) 20.7 (179) 19.9 (216) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 12 | 203 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | | 25548673 | | 8.018E-14 | | 52.2 (203) 23.7 (228) 17.3 (233) |
| 12 | 204 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | | 25548714 | | 7.530E-14 | | 43.8 (204) 31.7 (229) 24.5 (221) |
| 12 | 205 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^1F_3$ | | 25549021 | | 1.821E-12 | | 98.8 (205) |
| 12 | 206 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | | 25549080 | | 5.355E-12 | | 69.4 (206) 30.6 (209) |
| 12 | 207 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | | 25549092 | | 9.174E-12 | | 100. (207) |
| 12 | 208 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | | 25549094 | | 2.993E-12 | | 100. (208) |
| 12 | 209 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | | 25549138 | | 4.320E-12 | | 73.1 (209) |
| 12 | 210 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | | 25550103 | | 1.013E-13 | | 52.5 (210) 29.5 (171) 12.1 (192) |
| 12 | 211 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^3D_2$ | | 25550823 | | 8.489E-14 | | 41.2 (211) 22.9 (190) 18.2 (182) |
| 12 | 212 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | | 25551007 | | 1.149E-13 | | 61.8 (212) 38.2 (189) |
| 12 | 213 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^3S_1$ | | 25551018 | | 8.717E-14 | | 67.3 (213) 21.6 (170) 9.75 (191) |
| 12 | 214 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d^3D_3$ | | 25552031 | | 7.955E-14 | | 70.2 (214) 21.2 (185) 7.54 (201) |
| 12 | 215 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^1D_2$ | | 25553663 | | 1.005E-13 | | 59.5 (215) 32.5 (184) 2.72 (196) |
| 12 | 216 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f^1F_3$ | | 25554208 | | 7.490E-14 | | 38.4 (216) 32.9 (193) 28.7 (202) |
| 12 | 217 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f^3F_4$ | | 25554436 | | 7.488E-14 | | 63.6 (217) 31.7 (195) 4.72 (223) |
| 12 | 218 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | | 25554844 | | 8.149E-14 | | 62.3 (218) 18.4 (211) 12.1 (175) |
| 12 | 219 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f^3G_5$ | | 25555247 | | 7.445E-14 | | 100. (219) |
| 12 | 220 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d^3P_1$ | | 25555470 | | 8.167E-14 | | 73.1 (220) |
| 12 | 221 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g^3G_4$ | | 25555473 | | 7.520E-14 | | 37.1 (221) 32.4 (198) 30.5 (229) |
| 12 | 222 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g^3G_5$ | | 25555508 | | 7.519E-14 | | 67.5 (222) 18.6 (200) 13.8 (226) |
| 12 | 223 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f^1G_4$ | | 25555778 | | 7.439E-14 | | 69.7 (223) 28.1 (195) 2.19 (217) |
| 12 | 224 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d^3P_0$ | | 25555915 | | 8.158E-14 | | 85.7 (224) |
| 12 | 225 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | | 25556147 | | 7.583E-14 | | 67.1 (225) 18.5 (202) 11.9 (216) |
| 12 | 226 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g^1H_5$ | | 25556197 | | 7.483E-14 | | 55.5 (226) 44.5 (200) |
| 12 | 227 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g^3H_6$ | | 25556222 | | 7.484E-14 | | 100. (227) |
| 12 | 228 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g^1F_3$ | | 25556230 | | 7.500E-14 | | 44.2 (203) 31.3 (228) 24.5 (233) |
| 12 | 229 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g^3G_4$ | | 25556259 | | 7.501E-14 | | 55.8 (204) 24.1 (229) 20.1 (221) |
| 12 | 230 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f^3D_2$ | | 25556374 | | 7.526E-14 | | 42.4 (230) 28.1 (199) 26.6 (235) |
| 12 | 231 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | | 25557190 | | 7.371E-14 | | 78.6 (231) |
| 12 | 232 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g^3F_2$ | | 25557335 | | 7.473E-14 | | 100. (232) |
| 12 | 233 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g^3F_3$ | | 25557394 | | 7.457E-14 | | 50.5 (233) 38.9 (228) 10.7 (231) |
| 12 | 234 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f^3D_1$ | | 25557741 | | 7.565E-14 | | 97.2 (234) |
| 12 | 235 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f^1D_2$ | | 25558131 | | 7.491E-14 | | 54.3 (235) 42.9 (230) 1.52 (215) |
| 12 | 236 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d^1P_1$ | | 25559989 | | 7.920E-14 | | 81.8 (236) |
| 12 | 237 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p^1S_0$ | | 25561287 | | 8.686E-14 | | 74.8 (237) |
| 12 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s^3S_1$ | | 25698402 | | 3.281E-13 | | 72.3 (238) |
| 12 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2s6p^1P_1$ | | 25699945 | | 1.437E-13 | | 39.8 (239) 32.5 (286) 19.7 (248) |
| 12 | 240 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s^1S_0$ | | 25700774 | | 3.028E-13 | | 69.4 (240) 25.2 (319) 5.38 (253) |
| 12 | 241 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s^3P_0$ | | 25701268 | | 1.339E-13 | | 59.0 (241) 39.7 (246) 1.28 (297) |
| 12 | 242 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p^3P_1$ | | 25702486 | | 3.187E-13 | | 61.7 (242) 15.9 (248) 13.0 (239) |
| 12 | 243 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p^3P_2$ | | 25702883 | | 3.818E-13 | | 78.5 (243) |
| 12 | 244 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p^3D_1$ | | 25702991 | | 9.559E-14 | | 68.1 (244) 20.2 (254) 10.7 (250) |
| 12 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p^3D_2$ | | 25704120 | | 1.097E-13 | | 51.5 (245) 26.9 (251) 12.0 (291) |
| 12 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p^3P_0$ | | 25705362 | | 1.527E-13 | | 54.0 (246) 37.7 (241) 8.32 (297) |
| 12 | 247 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d^3D_3$ | | 25706333 | | 3.954E-13 | | 79.6 (247) |
| 12 | 248 | $2s_{1/2}6p_{3/2}(J=1)$ | $2p6s^3P_1$ | | 25706432 | | 1.242E-13 | | 50.1 (248) 24.4 (242) 18.4 (239) |
| 12 | 249 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d^3F_2$ | | 25706457 | | 8.545E-14 | | 72.7 (249) |
| 12 | 250 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p^1P_1$ | | 25706576 | | 8.870E-14 | | 42.9 (250) 32.5 (283) 13.1 (238) |
| 12 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d^3D_2$ | | 25707583 | | 3.024E-13 | | 41.2 (251) 32.8 (256) 16.9 (291) |
| 12 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d^3F_3$ | | 25707872 | | 9.473E-14 | | 58.0 (252) 19.2 (272) 12.8 (290) |
| 12 | 253 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p^3P_0$ | | 25708209 | | 8.197E-14 | | 87.3 (253) |
| 12 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d^3D_1$ | | 25708565 | | 2.319E-13 | | 71.1 (254) 13.2 (283) 11.9 (244) |
| 12 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d^3P_2$ | | 25708806 | | 7.916E-14 | | 25.6 (255) 24.9 (282) 21.6 (292) |
| 12 | 256 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d^1D_2$ | | 25709723 | | 2.395E-13 | | 46.9 (256) 25.3 (251) 19.4 (245) |
| 12 | 257 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f^3G_3$ | | 25709971 | | 7.430E-14 | | 70.7 (257) 17.8 (293) 9.99 (307) |
| 12 | 258 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f^3F_4$ | | 25710015 | | 6.144E-13 | | 86.7 (258) |
| 12 | 259 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f^3G_4$ | | 25710190 | | 7.419E-14 | | 41.5 (259) 29.0 (298) 28.3 (294) |
| 12 | 260 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d^3D_1$ | | 25710395 | | 7.818E-14 | | 66.4 (260) 13.1 (321) 9.98 (295) |
| 12 | 261 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g^3H_4$ | | 25710576 | | 7.113E-14 | | 71.5 (261) 16.1 (299) 12.4 (310) |
| 12 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g^3H_5$ | | 25710599 | | 7.113E-14 | | 39.1 (262) 32.4 (303) 28.5 (300) |
| 12 | 263 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h^3I_5$ | | 25710660 | | 6.857E-14 | | 72.1 (263) 15.3 (305) 12.6 (312) |
| 12 | 264 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h^3I_6$ | | 25710673 | | 6.858E-14 | | 38.8 (264) 33.3 (301) 27.9 (306) |
| 12 | 265 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f^3D_3$ | | 25710780 | | 7.665E-14 | | 36.9 (265) 33.6 (307) 23.0 (293) |
| 12 | 266 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f^3F_2$ | | 25710875 | | 7.803E-14 | | 58.5 (266) 22.2 (320) 14.5 (308) |
| 12 | 267 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f^3F_2$ | | 25710919 | | 3.809E-13 | | 82.7 (267) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 12 | 268 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 25710964 | | 9.794E-14 | | 33.6 (268) 23.1 (272) 19.5 (309) |
| 12 | 269 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 25711049 | | 7.668E-14 | | 47.9 (269) 27.0 (310) 21.2 (299) |
| 12 | 270 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 25711053 | | 7.450E-14 | | 44.5 (270) 30.8 (311) 24.7 (315) |
| 12 | 271 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 25711066 | | 7.451E-14 | | 55.5 (271) 24.4 (312) 20.1 (305) |
| 12 | 272 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^3F_3$ | | 25711073 | | 1.559E-13 | | 53.4 (272) 16.5 (268) 9.56 (309) |
| 12 | 273 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^1F_3$ | | 25711407 | | 2.882E-12 | | 100. (273) |
| 12 | 274 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 25711432 | | 5.135E-12 | | 71.0 (274) 29.0 (277) |
| 12 | 275 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 25711436 | | 8.514E-12 | | 100. (275) |
| 12 | 276 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 25711443 | | 2.735E-12 | | 100. (276) |
| 12 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 25711472 | | 4.168E-12 | | 77.7 (277) |
| 12 | 278 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 25711530 | | 1.063E-11 | | 100. (278) |
| 12 | 279 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 25711531 | | 1.282E-11 | | 55.9 (279) 44.1 (280) |
| 12 | 280 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 25711543 | | 1.075E-11 | | 56.1 (280) 43.9 (279) |
| 12 | 281 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 25711544 | | 1.293E-11 | | 100. (281) |
| 12 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 25711575 | | 8.602E-14 | | 60.6 (282) 12.6 (292) 10.6 (289) |
| 12 | 283 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 25712319 | | 7.810E-14 | | 39.8 (250) 32.3 (283) 18.4 (244) |
| 12 | 284 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 25713097 | | 8.777E-14 | | 81.1 (284) |
| 12 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 25713599 | | 7.675E-14 | | 74.3 (285) |
| 12 | 286 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 25713901 | | 1.009E-13 | | 57.6 (286) 27.0 (239) 11.2 (248) |
| 12 | 287 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^3S_1$ | | 25714881 | | 8.810E-14 | | 61.7 (287) 18.3 (238) 18.3 (283) |
| 12 | 288 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 25715037 | | 8.176E-14 | | 89.2 (288) |
| 12 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 25715148 | | 7.703E-14 | | 43.3 (289) 28.9 (292) 19.4 (249) |
| 12 | 290 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 25715972 | | 7.601E-14 | | 67.0 (290) 28.4 (252) 2.35 (272) |
| 12 | 291 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 25716116 | | 8.662E-14 | | 67.1 (291) 16.5 (256) 7.94 (285) |
| 12 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 25717282 | | 7.961E-14 | | 53.6 (255) 31.1 (292) 8.38 (243) |
| 12 | 293 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 25717311 | | 7.406E-14 | | 42.6 (293) 29.4 (307) 28.0 (257) |
| 12 | 294 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 25717438 | | 7.392E-14 | | 68.1 (294) 29.2 (259) 2.79 (298) |
| 12 | 295 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 25717620 | | 8.029E-14 | | 68.2 (295) 19.5 (260) 8.95 (242) |
| 12 | 296 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 25717748 | | 7.128E-14 | | 100. (296) |
| 12 | 297 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 25717885 | | 8.081E-14 | | 89.4 (297) |
| 12 | 298 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 25718012 | | 7.118E-14 | | 67.6 (298) 28.9 (259) 3.51 (294) |
| 12 | 299 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 25718012 | | 7.315E-14 | | 39.7 (299) 32.4 (310) 27.9 (261) |
| 12 | 300 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 25718033 | | 7.314E-14 | | 72.0 (300) 17.5 (262) 10.6 (303) |
| 12 | 301 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 25718127 | | 6.408E-14 | | 53.0 (301) 47.0 (264) |
| 12 | 302 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 25718140 | | 6.409E-14 | | 100. (302) |
| 12 | 303 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^3H_5$ | | 25718182 | | 6.819E-14 | | 56.8 (303) 43.2 (262) |
| 12 | 304 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 25718197 | | 6.821E-14 | | 100. (304) |
| 12 | 305 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 25718231 | | 7.183E-14 | | 39.4 (305) 33.6 (312) 27.0 (263) |
| 12 | 306 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 25718244 | | 7.183E-14 | | 72.9 (306) |
| 12 | 307 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 25718305 | | 7.503E-14 | | 57.3 (265) 25.7 (307) 15.6 (293) |
| 12 | 308 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 25718452 | | 7.487E-14 | | 39.2 (266) 39.0 (308) 21.8 (320) |
| 12 | 309 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^1F_3$ | | 25718508 | | 7.461E-14 | | 48.2 (268) 25.9 (309) 21.6 (317) |
| 12 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 25718533 | | 7.469E-14 | | 49.7 (269) 27.6 (310) 22.7 (299) |
| 12 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^1G_4$ | | 25718566 | | 7.467E-14 | | 55.5 (270) 24.3 (311) 20.1 (315) |
| 12 | 312 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 25718578 | | 7.468E-14 | | 44.5 (271) 29.9 (312) 25.7 (305) |
| 12 | 313 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 25718635 | | 7.290E-14 | | 78.5 (313) |
| 12 | 314 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 25718968 | | 7.387E-14 | | 100. (314) |
| 12 | 315 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^3G_4$ | | 25718980 | | 7.386E-14 | | 55.2 (315) 44.8 (311) |
| 12 | 316 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 25719181 | | 7.406E-14 | | 100. (316) |
| 12 | 317 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 25719203 | | 7.412E-14 | | 56.9 (317) 43.1 (309) |
| 12 | 318 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 25719287 | | 7.469E-14 | | 98.0 (318) |
| 12 | 319 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 25719522 | | 9.296E-14 | | 71.3 (319) 20.3 (240) 8.37 (253) |
| 12 | 320 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 25719554 | | 7.454E-14 | | 54.2 (320) 43.6 (308) 1.13 (291) |
| 12 | 321 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 25720038 | | 7.810E-14 | | 77.7 (321) |
| 13 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 13 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 12703061 | 12702832 | | 6.035E-06 | | 100. (2) |
| 13 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 12807847 | 12807720 | | 7.164E-09 | | 100. (3) |
| 13 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 12809088 | 12808966 | | 1.321E-11 | | 100. (4) |
| 13 | 5 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 12814213 | 12814095 | | 5.320E-09 | | 100. (5) |
| 13 | 6 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 12815760 | 12815615 | | 3.503E-03 | | 100. (6) |
| 13 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 12891081 | 12890805 | | 3.650E-14 | | 100. (7) |
| 13 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 15020463 | 15020204 | | 5.871E-12 | | 100. (8) |
| 13 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 15049244 | 15048943 | | 2.146E-12 | | 100. (9) |
| 13 | 10 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 15049634 | 15049333 | | 2.046E-12 | | 100. (10) |
| 13 | 11 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 15050257 | 15049771 | | 6.316E-12 | | 100. (11) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|-----------------------|
| 13 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 15051152 | 15050851 | | 2.160E-12 | | 100. (12) |
| 13 | 13 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d^3D_1$ | 15066988 | 15066650 | | 7.267E-13 | | 100. (13) |
| 13 | 14 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 15067034 | 15066693 | | 7.297E-13 | | 87.9 (14) |
| 13 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 15067596 | 15067258 | | 7.285E-13 | | 100. (15) |
| 13 | 16 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 15068371 | 15068005 | | 7.518E-13 | | 87.9 (16) |
| 13 | 17 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 15072141 | 15071742 | | 1.247E-13 | | 100. (17) |
| 13 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s^3S_1$ | 15816791 | 15816478 | | 8.620E-12 | | 100. (18) |
| 13 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 15828659 | 15828304 | | 3.637E-12 | | 100. (19) |
| 13 | 20 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 15828823 | 15828471 | | 3.512E-12 | | 100. (20) |
| 13 | 21 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 15828851 | 15828490 | | 9.186E-12 | | 100. (21) |
| 13 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 15829460 | 15829111 | | 3.656E-12 | | 100. (22) |
| 13 | 23 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d^3D_1$ | 15836000 | 15835600 | | 1.685E-12 | | 100. (23) |
| 13 | 24 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 15836017 | 15835630 | | 1.691E-12 | | 91.3 (24) |
| 13 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 15836256 | 15835856 | | 1.689E-12 | | 100. (25) |
| 13 | 26 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | 15836714 | 15836236 | | 3.493E-12 | | 56.3 (26) 43.7 (30) |
| 13 | 27 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | 15836714 | 15836267 | | 3.492E-12 | | 100. (27) |
| 13 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | 15836581 | 15836272 | | 1.763E-12 | | 91.3 (28) |
| 13 | 29 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | 15836714 | 15836397 | | 3.494E-12 | | 100. (29) |
| 13 | 30 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | 15836714 | 15836420 | | 3.497E-12 | | 56.3 (30) 43.7 (26) |
| 13 | 31 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 15838068 | 15837678 | | 2.957E-13 | | 100. (31) |
| 13 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 16182216 | 16181869 | | 1.355E-11 | | 100. (32) |
| 13 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 16188215 | 16187849 | | 6.163E-12 | | 100. (33) |
| 13 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 16188281 | 16187905 | | 1.445E-11 | | 100. (34) |
| 13 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 16188299 | 16187936 | | 5.978E-12 | | 100. (35) |
| 13 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 16188626 | 16188263 | | 6.193E-12 | | 100. (36) |
| 13 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | 16191946 | 16191545 | | 3.232E-12 | | 100. (37) |
| 13 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | 16191955 | 16191562 | | 3.246E-12 | | 92.3 (38) |
| 13 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | 16192077 | 16191676 | | 3.240E-12 | | 100. (39) |
| 13 | 40 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | 16192318 | 16191888 | | 6.755E-12 | | 57.2 (40) 42.8 (45) |
| 13 | 41 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | 16192318 | 16191903 | | 6.748E-12 | | 100. (41) |
| 13 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | 16192244 | 16191910 | | 3.405E-12 | | 92.3 (42) |
| 13 | 43 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | 16192318 | 16191970 | | 6.755E-12 | | 100. (43) |
| 13 | 44 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | 16192385 | 16191977 | | 1.133E-11 | | 54.6 (44) 45.4 (48) |
| 13 | 45 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | 16192318 | 16191983 | | 6.764E-12 | | 57.2 (45) 42.8 (40) |
| 13 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | 16192385 | 16191986 | | 1.133E-11 | | 100. (46) |
| 13 | 47 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | 16192385 | 16192026 | | 1.133E-11 | | 100. (47) |
| 13 | 48 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | 16192385 | 16192033 | | 1.134E-11 | | 54.6 (48) 45.4 (44) |
| 13 | 49 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 16192975 | 16192590 | | 5.770E-13 | | 100. (49) |
| 13 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 16379344 | | 2.110E-11 | | 100. (50) |
| 13 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 16382780 | | 9.988E-12 | | 100. (51) |
| 13 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 16382803 | | 2.135E-11 | | 100. (52) |
| 13 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 16382830 | | 9.705E-12 | | 100. (53) |
| 13 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 16383019 | | 1.003E-11 | | 100. (54) |
| 13 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 16384899 | | 5.551E-12 | | 100. (55) |
| 13 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 16384910 | | 5.571E-12 | | 92.8 (56) |
| 13 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 16384975 | | 5.567E-12 | | 100. (57) |
| 13 | 58 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 16385096 | | 1.154E-11 | | 57.8 (58) 42.2 (64) |
| 13 | 59 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 16385104 | | 1.153E-11 | | 100. (59) |
| 13 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 16385116 | | 5.775E-12 | | 92.8 (60) |
| 13 | 61 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 16385142 | | 1.944E-11 | | 54.5 (61) 45.5 (68) |
| 13 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 16385143 | | 1.155E-11 | | 100. (62) |
| 13 | 63 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 16385148 | | 1.944E-11 | | 100. (63) |
| 13 | 64 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 16385150 | | 1.157E-11 | | 57.8 (64) 42.2 (58) |
| 13 | 65 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | 16385557 | 16385170 | | 2.931E-11 | | 53.9 (65) 46.1 (70) |
| 13 | 66 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 16385171 | | 1.945E-11 | | 100. (66) |
| 13 | 67 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | 16385557 | 16385173 | | 2.931E-11 | | 100. (67) |
| 13 | 68 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 16385175 | | 1.945E-11 | | 54.5 (68) 45.5 (61) |
| 13 | 69 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | 16385557 | 16385189 | | 2.932E-11 | | 100. (69) |
| 13 | 70 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | 16385557 | 16385192 | | 2.932E-11 | | 53.9 (70) 46.1 (65) |
| 13 | 71 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | 16385868 | 16385505 | | 9.959E-13 | | 100. (71) |
| 13 | 72 | $2s^2_{1/2}(J=0)$ | $2s^2^1S_0$ | 26458700 | 26459310 | | 1.478E-13 | | 77.8 (72) |
| 13 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 26484800 | 26484790 | | 6.011E-14 | | 100. (73) |
| 13 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 26487600 | 26487812 | | 6.014E-14 | | 100. (74) |
| 13 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 26494500 | 26494534 | | 6.026E-14 | | 100. (75) |
| 13 | 76 | $2p^2_{1/2}(J=0)$ | $2p^2^3P_0$ | 26577700 | 26578069 | | 2.971E-14 | | 100. (76) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 13 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2\ ^3P_1$ | 26581100 | 26581515 | | 2.967E-14 | | 100. (77) |
| 13 | 78 | $2p_{3/2}^2(J=2)$ | $2p^2\ ^3P_2$ | 26586800 | 26587249 | | 2.969E-14 | | 100. (78) |
| 13 | 79 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2\ ^1D_2$ | 26635100 | 26635130 | | 2.940E-14 | | 100. (79) |
| 13 | 80 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p\ ^1P_1$ | 26643400 | 26644940 | | 5.639E-14 | | 100. (80) |
| 13 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2\ ^1S_0$ | 26793700 | 26793821 | | 3.809E-14 | | 77.9 (81) |
| 13 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s\ ^3S_1$ | | 28880988 | | 1.486E-13 | | 70.9 (82) 29.1 (106) |
| 13 | 83 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p\ ^1P_1$ | | 28893852 | | 8.364E-14 | | 48.8 (83) 46.7 (110) 4.43 (116) |
| 13 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | | 28913594 | | 2.075E-13 | | 75.0 (84) |
| 13 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s\ ^3P_0$ | | 28921200 | | 8.401E-14 | | 57.1 (85) 41.6 (90) 1.31 (113) |
| 13 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p\ ^3D_1$ | | 28922148 | | 4.973E-14 | | 70.7 (86) 14.7 (92) 14.6 (103) |
| 13 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p\ ^3P_1$ | | 28923199 | | 1.009E-13 | | 56.1 (87) 40.4 (91) 3.43 (112) |
| 13 | 88 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | | 28926195 | | 1.335E-13 | | 75.2 (88) |
| 13 | 89 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | | 28927056 | | 5.274E-14 | | 79.5 (89) |
| 13 | 90 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | | 28929540 | | 7.891E-14 | | 44.5 (90) 38.4 (85) 17.0 (113) |
| 13 | 91 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s\ ^3P_1$ | | 28931482 | | 6.825E-14 | | 54.1 (91) 29.7 (87) 16.2 (112) |
| 13 | 92 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^1P_1$ | | 28932178 | | 4.561E-14 | | 85.1 (92) |
| 13 | 93 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 28932483 | | 5.571E-14 | | 74.7 (93) |
| 13 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 28935854 | | 5.723E-14 | | 78.6 (94) |
| 13 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 28958335 | | 5.601E-14 | | 83.3 (95) |
| 13 | 96 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 28963232 | | 5.642E-14 | | 98.9 (96) |
| 13 | 97 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 28966159 | | 4.431E-14 | | 100. (97) |
| 13 | 98 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^1D_2$ | | 28967383 | | 5.452E-14 | | 83.5 (98) |
| 13 | 99 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | | 28968156 | | 4.526E-14 | | 95.5 (99) |
| 13 | 100 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 28968706 | | 6.330E-14 | | 40.7 (100) 28.3 (102) 25.4 (114) |
| 13 | 101 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 28968715 | | 5.664E-14 | | 100. (101) |
| 13 | 102 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^3P_2$ | | 28974187 | | 5.229E-14 | | 67.6 (102) 17.1 (100) 15.3 (114) |
| 13 | 103 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 28974566 | | 1.869E-13 | | 80.1 (103) |
| 13 | 104 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^3D_2$ | | 28975874 | | 1.526E-13 | | 73.8 (104) |
| 13 | 105 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 28977316 | | 1.569E-13 | | 74.7 (105) |
| 13 | 106 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^3S_1$ | | 28982675 | | 6.040E-14 | | 69.4 (106) 27.9 (82) 2.79 (99) |
| 13 | 107 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 28990419 | | 4.994E-14 | | 96.3 (107) |
| 13 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^3D_2$ | | 28992522 | | 4.972E-14 | | 98.5 (108) |
| 13 | 109 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3D_3$ | | 28994929 | | 4.944E-14 | | 98.9 (109) |
| 13 | 110 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 28996868 | | 7.402E-14 | | 51.4 (110) 38.6 (83) 6.07 (116) |
| 13 | 111 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 29014168 | | 5.971E-14 | | 76.9 (111) |
| 13 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 29015552 | | 5.926E-14 | | 79.7 (112) |
| 13 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 29016491 | | 5.907E-14 | | 81.8 (113) |
| 13 | 114 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 29019576 | | 9.046E-14 | | 58.4 (114) 41.6 (100) |
| 13 | 115 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^1F_3$ | | 29033366 | | 4.752E-14 | | 100. (115) |
| 13 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 29045729 | | 5.418E-14 | | 89.2 (116) |
| 13 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 29056374 | | 5.515E-14 | | 75.4 (117) |
| 13 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 29722178 | | 1.861E-13 | | 71.9 (118) 28.1 (149) |
| 13 | 119 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | | 29728389 | | 9.893E-14 | | 48.2 (119) 41.6 (150) 5.14 (168) |
| 13 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 29733015 | | 2.216E-13 | | 73.8 (120) |
| 13 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 29735566 | | 9.443E-14 | | 54.8 (121) 43.2 (126) 1.97 (162) |
| 13 | 122 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 29737340 | | 1.282E-13 | | 57.9 (122) 34.6 (127) 4.67 (160) |
| 13 | 123 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 29739296 | | 1.790E-13 | | 74.5 (123) |
| 13 | 124 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 29739921 | | 6.041E-14 | | 69.9 (124) 18.6 (139) 11.5 (129) |
| 13 | 125 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 29743127 | | 6.761E-14 | | 68.2 (125) 27.3 (137) 2.70 (157) |
| 13 | 126 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 29745464 | | 8.654E-14 | | 42.7 (126) 42.6 (121) 14.7 (162) |
| 13 | 127 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 29747260 | | 7.312E-14 | | 55.8 (127) 26.4 (122) 14.4 (160) |
| 13 | 128 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 29747511 | | 8.912E-14 | | 52.8 (128) 45.5 (141) 1.69 (163) |
| 13 | 129 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^1P_1$ | | 29748392 | | 5.368E-14 | | 80.4 (129) |
| 13 | 130 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 29751307 | | 5.688E-14 | | 76.2 (130) |
| 13 | 131 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 29753734 | | 5.976E-14 | | 77.6 (131) |
| 13 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^1D_2$ | | 29756439 | | 1.048E-13 | | 39.8 (132) 39.7 (157) 13.1 (137) |
| 13 | 133 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 29756965 | | 5.099E-14 | | 97.6 (133) |
| 13 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 29757187 | | 6.332E-14 | | 79.9 (134) |
| 13 | 135 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 29758775 | | 6.221E-14 | | 72.5 (135) |
| 13 | 136 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^1D_2$ | | 29762014 | | 5.754E-14 | | 75.0 (136) |
| 13 | 137 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^3D_2$ | | 29762063 | | 1.025E-13 | | 37.1 (137) 26.4 (140) 15.5 (132) |
| 13 | 138 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 29762113 | | 8.025E-14 | | 69.3 (138) 30.7 (153) |
| 13 | 139 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 29762215 | | 1.049E-13 | | 54.3 (139) 24.2 (124) 15.5 (135) |
| 13 | 140 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^3P_2$ | | 29764394 | | 6.089E-14 | | 64.0 (140) 18.4 (137) 16.5 (125) |
| 13 | 141 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 29764590 | | 9.113E-14 | | 46.1 (141) 45.9 (128) 5.44 (163) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 13 | 142 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 29767032 | | 5.472E-14 | | 77.6 (142) |
| 13 | 143 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 29768638 | | 5.425E-14 | | 57.2 (143) 31.2 (155) 11.6 (147) |
| 13 | 144 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 29769361 | | 5.419E-14 | | 44.2 (144) 35.1 (156) 20.7 (161) |
| 13 | 145 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^3D_2$ | | 29769588 | | 7.969E-14 | | 58.4 (145) 33.2 (152) 3.72 (136) |
| 13 | 146 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 29769840 | | 5.517E-14 | | 80.8 (146) |
| 13 | 147 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | | 29769916 | | 5.679E-14 | | 49.9 (147) 27.6 (155) 15.2 (163) |
| 13 | 148 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^3F_3$ | | 29770475 | | 1.330E-13 | | 61.7 (148) 33.5 (154) 2.56 (166) |
| 13 | 149 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^3S_1$ | | 29770815 | | 6.389E-14 | | 69.2 (149) 25.0 (118) 5.79 (135) |
| 13 | 150 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 29771119 | | 7.437E-14 | | 49.1 (150) 31.9 (119) 14.1 (142) |
| 13 | 151 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^1F_3$ | | 29771814 | | 2.031E-12 | | 100. (151) |
| 13 | 152 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 29772050 | | 1.171E-13 | | 56.2 (152) 22.4 (145) 15.0 (131) |
| 13 | 153 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 29772951 | | 1.623E-13 | | 69.1 (153) 30.9 (138) |
| 13 | 154 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^3D_3$ | | 29773577 | | 6.956E-14 | | 59.5 (154) 24.5 (148) 16.0 (134) |
| 13 | 155 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 29777879 | | 5.438E-14 | | 41.8 (143) 32.3 (155) 25.9 (147) |
| 13 | 156 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 29778389 | | 5.437E-14 | | 54.4 (144) 38.2 (156) 7.40 (161) |
| 13 | 157 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 29779367 | | 8.284E-14 | | 50.7 (157) 44.2 (132) 2.95 (167) |
| 13 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 29780128 | | 6.070E-14 | | 68.4 (158) 14.8 (123) 10.3 (145) |
| 13 | 159 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 29780505 | | 5.432E-14 | | 100. (159) |
| 13 | 160 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 29781244 | | 6.046E-14 | | 76.6 (160) |
| 13 | 161 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | | 29781553 | | 5.429E-14 | | 71.9 (161) 26.7 (156) 1.44 (144) |
| 13 | 162 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 29782008 | | 6.026E-14 | | 83.3 (162) |
| 13 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 29782664 | | 5.545E-14 | | 77.6 (163) |
| 13 | 164 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 29783050 | | 5.495E-14 | | 46.7 (164) 31.6 (167) 17.7 (146) |
| 13 | 165 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | | 29785673 | | 5.527E-14 | | 97.1 (165) |
| 13 | 166 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^1F_3$ | | 29786105 | | 5.230E-14 | | 95.2 (166) |
| 13 | 167 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 29786373 | | 5.455E-14 | | 54.1 (167) 42.9 (164) 1.65 (157) |
| 13 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | | 29791919 | | 5.781E-14 | | 84.4 (168) |
| 13 | 169 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | | 29795751 | | 6.196E-14 | | 74.9 (169) |
| 13 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | | 30102929 | | 2.176E-13 | | 72.7 (170) |
| 13 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2s5p\ ^1P_1$ | | 30106091 | | 1.016E-13 | | 43.2 (171) 35.1 (210) 15.2 (179) |
| 13 | 172 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | | 30107802 | | 2.321E-13 | | 73.1 (172) |
| 13 | 173 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | | 30108640 | | 9.449E-14 | | 58.3 (173) 40.3 (178) 1.39 (223) |
| 13 | 174 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | | 30110401 | | 1.822E-13 | | 61.1 (174) 22.1 (179) 9.76 (171) |
| 13 | 175 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | | 30111385 | | 2.454E-13 | | 79.6 (175) |
| 13 | 176 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | | 30111523 | | 6.545E-14 | | 69.3 (176) 19.4 (187) 11.3 (181) |
| 13 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | | 30113637 | | 7.537E-14 | | 57.0 (177) 27.9 (188) 8.36 (215) |
| 13 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | | 30115334 | | 1.006E-13 | | 49.5 (178) 40.0 (173) 10.4 (223) |
| 13 | 179 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | | 30116998 | | 8.120E-14 | | 54.3 (179) 24.4 (174) 11.7 (171) |
| 13 | 180 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 30117198 | | 1.782E-13 | | 70.0 (180) 26.1 (208) 3.84 (225) |
| 13 | 181 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^1P_1$ | | 30117658 | | 6.021E-14 | | 55.7 (181) 24.6 (193) 7.37 (170) |
| 13 | 182 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | | 30118279 | | 6.135E-14 | | 73.6 (182) |
| 13 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^1D_2$ | | 30120088 | | 1.683E-13 | | 36.9 (183) 31.5 (188) 23.9 (215) |
| 13 | 184 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 30120763 | | 6.811E-14 | | 64.6 (184) 18.6 (200) 10.2 (214) |
| 13 | 185 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 30120858 | | 5.583E-14 | | 92.1 (185) |
| 13 | 186 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 30121075 | | 5.491E-14 | | 57.9 (186) 20.9 (218) 9.83 (212) |
| 13 | 187 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 30121795 | | 1.299E-13 | | 60.5 (187) 23.1 (193) 9.78 (176) |
| 13 | 188 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^3D_2$ | | 30123769 | | 1.454E-13 | | 35.0 (183) 30.8 (188) 21.4 (177) |
| 13 | 189 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 30124470 | | 2.346E-13 | | 76.1 (189) |
| 13 | 190 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^1D_2$ | | 30125054 | | 6.497E-14 | | 40.3 (190) 27.5 (186) 13.1 (212) |
| 13 | 191 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 30125453 | | 5.515E-14 | | 67.6 (191) 21.5 (216) 9.67 (195) |
| 13 | 192 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 30125516 | | 5.565E-14 | | 70.3 (192) 10.9 (236) 8.21 (219) |
| 13 | 193 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^3P_1$ | | 30125870 | | 5.923E-14 | | 37.8 (193) 27.3 (181) 20.0 (176) |
| 13 | 194 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 30125927 | | 5.517E-14 | | 40.6 (194) 32.0 (217) 26.2 (224) |
| 13 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 30126298 | | 5.431E-14 | | 31.7 (195) 30.2 (225) 19.1 (216) |
| 13 | 196 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 30126694 | | 5.549E-14 | | 63.9 (196) 18.9 (235) 12.9 (227) |
| 13 | 197 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 30126711 | | 5.450E-14 | | 68.5 (197) 18.0 (221) 13.4 (228) |
| 13 | 198 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 30126769 | | 5.449E-14 | | 37.5 (198) 31.5 (222) 31.1 (229) |
| 13 | 199 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 30126779 | | 2.180E-13 | | 76.1 (199) |
| 13 | 200 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | | 30126890 | | 1.737E-13 | | 70.3 (200) 10.9 (214) 6.96 (184) |
| 13 | 201 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 30127140 | | 5.903E-14 | | 48.9 (201) 24.9 (226) 18.2 (233) |
| 13 | 202 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 30127191 | | 5.508E-14 | | 46.2 (202) 29.7 (228) 22.8 (221) |
| 13 | 203 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^1F_3$ | | 30127537 | | 1.743E-12 | | 100. (203) |
| 13 | 204 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 30127584 | | 3.739E-12 | | 70.7 (204) 29.3 (207) |
| 13 | 205 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 30127596 | | 2.242E-12 | | 100. (205) |
| 13 | 206 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 30127605 | | 7.298E-12 | | 100. (206) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 13 | 207 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | | 30127658 | | 3.445E-12 | | 73.6 (207) |
| 13 | 208 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | | 30127770 | | 7.081E-14 | | 54.7 (208) 28.2 (180) 8.16 (195) |
| 13 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^3P_2$ | | 30128160 | | 5.595E-14 | | 74.9 (209) |
| 13 | 210 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | | 30129951 | | 7.240E-14 | | 56.7 (210) 27.9 (171) 8.79 (192) |
| 13 | 211 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | | 30131173 | | 6.944E-14 | | 76.4 (211) |
| 13 | 212 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^3D_2$ | | 30131223 | | 5.773E-14 | | 37.7 (212) 32.3 (190) 18.5 (182) |
| 13 | 213 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^3S_1$ | | 30131234 | | 6.163E-14 | | 67.1 (213) 18.2 (170) 12.9 (193) |
| 13 | 214 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d^3D_3$ | | 30132736 | | 5.613E-14 | | 70.6 (214) 23.5 (184) 4.23 (200) |
| 13 | 215 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^1D_2$ | | 30133948 | | 6.743E-14 | | 63.7 (215) 25.4 (183) 4.65 (209) |
| 13 | 216 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f^1F_3$ | | 30135300 | | 5.457E-14 | | 39.8 (216) 31.3 (191) 28.8 (195) |
| 13 | 217 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f^3F_4$ | | 30135577 | | 5.457E-14 | | 64.9 (217) 31.1 (194) 4.02 (224) |
| 13 | 218 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | | 30135639 | | 5.826E-14 | | 59.6 (218) 23.7 (212) 9.40 (175) |
| 13 | 219 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d^3P_1$ | | 30136326 | | 5.852E-14 | | 72.1 (219) 14.5 (192) 9.44 (174) |
| 13 | 220 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f^3G_5$ | | 30136498 | | 5.429E-14 | | 100. (220) |
| 13 | 221 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g^1G_4$ | | 30136717 | | 5.479E-14 | | 37.5 (221) 31.4 (197) 31.1 (228) |
| 13 | 222 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g^3G_5$ | | 30136767 | | 5.478E-14 | | 68.6 (222) 18.3 (198) 13.1 (229) |
| 13 | 223 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d^3P_0$ | | 30136851 | | 5.864E-14 | | 88.2 (223) |
| 13 | 224 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f^1G_4$ | | 30137142 | | 5.426E-14 | | 69.3 (224) 28.1 (194) 2.56 (217) |
| 13 | 225 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | | 30137284 | | 5.506E-14 | | 62.8 (225) 21.7 (195) 13.7 (216) |
| 13 | 226 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g^1F_3$ | | 30137501 | | 5.468E-14 | | 47.1 (201) 29.3 (226) 23.6 (233) |
| 13 | 227 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f^3D_2$ | | 30137539 | | 5.474E-14 | | 41.2 (227) 33.1 (196) 24.4 (235) |
| 13 | 228 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g^3G_4$ | | 30137541 | | 5.468E-14 | | 52.9 (202) 25.5 (228) 21.6 (221) |
| 13 | 229 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g^3H_5$ | | 30137558 | | 5.456E-14 | | 55.8 (229) 44.2 (198) |
| 13 | 230 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g^3H_6$ | | 30137592 | | 5.456E-14 | | 100. (230) |
| 13 | 231 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d^1F_3$ | | 30138460 | | 5.358E-14 | | 82.9 (231) |
| 13 | 232 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g^3F_2$ | | 30138741 | | 5.450E-14 | | 100. (232) |
| 13 | 233 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g^3F_3$ | | 30138810 | | 5.444E-14 | | 53.9 (233) 41.7 (226) 4.37 (231) |
| 13 | 234 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f^3D_1$ | | 30139107 | | 5.500E-14 | | 97.8 (234) |
| 13 | 235 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f^1D_2$ | | 30139592 | | 5.455E-14 | | 55.0 (235) 43.6 (227) 1.39 (215) |
| 13 | 236 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d^3P_1$ | | 30141284 | | 5.709E-14 | | 80.9 (236) |
| 13 | 237 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p^1S_0$ | | 30142352 | | 6.222E-14 | | 75.6 (237) |
| 13 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s^3S_1$ | | 30306779 | | 2.301E-13 | | 73.2 (238) |
| 13 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2s6p^1P_1$ | | 30308386 | | 9.756E-14 | | 36.8 (239) 30.3 (285) 24.8 (249) |
| 13 | 240 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s^1S_0$ | | 30309333 | | 2.065E-13 | | 70.2 (240) 22.8 (319) 7.04 (253) |
| 13 | 241 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s^3P_0$ | | 30309625 | | 9.223E-14 | | 61.7 (241) 38.3 (246) |
| 13 | 242 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p^3P_1$ | | 30311229 | | 2.567E-13 | | 62.3 (242) 15.7 (239) 11.0 (249) |
| 13 | 243 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p^3D_1$ | | 30311488 | | 6.794E-14 | | 68.5 (243) 19.3 (254) 11.0 (250) |
| 13 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p^3P_2$ | | 30311610 | | 2.728E-13 | | 79.5 (244) |
| 13 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p^3D_2$ | | 30312854 | | 7.773E-14 | | 49.1 (245) 25.6 (251) 14.1 (290) |
| 13 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p^3P_0$ | | 30314217 | | 1.198E-13 | | 57.4 (246) 36.3 (241) 6.33 (296) |
| 13 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d^3F_2$ | | 30315310 | | 6.194E-14 | | 72.3 (247) |
| 13 | 248 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d^3D_3$ | | 30315494 | | 3.512E-13 | | 83.8 (248) |
| 13 | 249 | $2s_{1/2}6p_{3/2}(J=1)$ | $2p6s^3P_1$ | | 30315613 | | 9.898E-14 | | 46.2 (249) 24.5 (239) 23.3 (242) |
| 13 | 250 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p^1P_1$ | | 30315645 | | 6.637E-14 | | 35.8 (250) 35.0 (283) 15.7 (238) |
| 13 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d^3D_2$ | | 30316694 | | 2.394E-13 | | 48.2 (251) 29.2 (256) 13.2 (290) |
| 13 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d^3F_3$ | | 30317002 | | 6.889E-14 | | 54.2 (252) 19.5 (272) 14.1 (291) |
| 13 | 253 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p^3P_0$ | | 30317502 | | 6.205E-14 | | 82.6 (253) |
| 13 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d^3D_1$ | | 30317670 | | 1.905E-13 | | 75.2 (254) |
| 13 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d^3P_2$ | | 30318285 | | 6.036E-14 | | 27.6 (255) 26.1 (292) 22.9 (289) |
| 13 | 256 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d^1D_2$ | | 30319128 | | 2.012E-13 | | 55.6 (256) 20.0 (251) 17.7 (245) |
| 13 | 257 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f^3G_3$ | | 30319204 | | 5.467E-14 | | 71.1 (257) 17.5 (293) 9.88 (301) |
| 13 | 258 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f^3F_4$ | | 30319399 | | 5.893E-13 | | 90.1 (258) |
| 13 | 259 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f^3G_4$ | | 30319488 | | 5.460E-14 | | 41.5 (259) 29.3 (300) 28.0 (294) |
| 13 | 260 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d^3D_1$ | | 30319760 | | 5.752E-14 | | 63.5 (260) 14.9 (321) 11.5 (295) |
| 13 | 261 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g^3H_4$ | | 30319911 | | 5.288E-14 | | 71.4 (261) 16.2 (298) 12.4 (310) |
| 13 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g^3H_5$ | | 30319946 | | 5.287E-14 | | 39.0 (262) 32.4 (305) 28.6 (299) |
| 13 | 263 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h^3I_5$ | | 30320026 | | 5.168E-14 | | 71.6 (263) 15.7 (302) 12.7 (312) |
| 13 | 264 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h^3I_6$ | | 30320044 | | 5.169E-14 | | 38.6 (264) 33.1 (304) 28.4 (303) |
| 13 | 265 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f^3D_3$ | | 30320128 | | 5.719E-14 | | 39.3 (265) 32.0 (301) 21.6 (293) |
| 13 | 266 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f^3F_2$ | | 30320197 | | 5.729E-14 | | 55.1 (266) 24.0 (320) 15.8 (308) |
| 13 | 267 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g^3G_3$ | | 30320269 | | 6.721E-14 | | 35.6 (267) 22.0 (309) 18.4 (272) |
| 13 | 268 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f^3F_2$ | | 30320272 | | 3.723E-13 | | 88.1 (268) |
| 13 | 269 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h^3H_4$ | | 30320357 | | 5.431E-14 | | 43.5 (269) 31.4 (311) 25.1 (315) |
| 13 | 270 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g^3F_4$ | | 30320363 | | 5.660E-14 | | 49.1 (270) 25.9 (310) 20.1 (298) |
| 13 | 271 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h^3G_5$ | | 30320376 | | 5.432E-14 | | 56.5 (271) 23.9 (312) 19.6 (302) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 13 | 272 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f^3F_3$ | | 30320399 | | 1.301E-13 | | 60.3 (272) 12.7 (267) 7.87 (309) |
| 13 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f^1F_3$ | | 30320770 | | 2.840E-12 | | 100. (273) |
| 13 | 274 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g^3G_4$ | | 30320790 | | 3.681E-12 | | 75.0 (274) |
| 13 | 275 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g^3G_5$ | | 30320798 | | 7.422E-12 | | 100. (275) |
| 13 | 276 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g^3G_3$ | | 30320799 | | 2.136E-12 | | 100. (276) |
| 13 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g^1G_4$ | | 30320840 | | 3.629E-12 | | 79.7 (277) |
| 13 | 278 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h^3H_4$ | | 30320897 | | 9.271E-12 | | 100. (278) |
| 13 | 279 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h^3H_5$ | | 30320898 | | 1.104E-11 | | 56.3 (279) 43.7 (280) |
| 13 | 280 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h^1H_5$ | | 30320916 | | 9.424E-12 | | 56.4 (280) 43.6 (279) |
| 13 | 281 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h^3H_6$ | | 30320917 | | 1.115E-11 | | 100. (281) |
| 13 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s^3P_2$ | | 30322634 | | 5.833E-14 | | 81.2 (282) |
| 13 | 283 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p^3P_1$ | | 30323689 | | 5.526E-14 | | 47.0 (250) 29.4 (283) 17.7 (243) |
| 13 | 284 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p^3D_3$ | | 30324427 | | 5.930E-14 | | 88.8 (284) |
| 13 | 285 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s^1P_1$ | | 30325073 | | 6.802E-14 | | 61.9 (285) 20.6 (239) 15.3 (249) |
| 13 | 286 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p^3P_2$ | | 30325140 | | 5.515E-14 | | 71.1 (286) 24.3 (245) 2.48 (251) |
| 13 | 287 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p^3S_1$ | | 30326415 | | 6.009E-14 | | 63.1 (287) 21.7 (283) 13.1 (238) |
| 13 | 288 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d^3F_4$ | | 30326705 | | 5.723E-14 | | 94.2 (288) |
| 13 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d^1D_2$ | | 30326876 | | 5.548E-14 | | 49.0 (289) 24.9 (292) 19.8 (247) |
| 13 | 290 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p^1D_2$ | | 30327704 | | 5.918E-14 | | 69.1 (290) 11.8 (286) 10.7 (256) |
| 13 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d^3D_3$ | | 30327814 | | 5.504E-14 | | 65.2 (291) 30.9 (252) 2.51 (313) |
| 13 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d^3D_2$ | | 30329178 | | 5.665E-14 | | 52.2 (255) 35.4 (292) 5.60 (244) |
| 13 | 293 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f^1F_3$ | | 30329373 | | 5.429E-14 | | 43.2 (293) 29.1 (301) 27.7 (257) |
| 13 | 294 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f^3F_4$ | | 30329531 | | 5.424E-14 | | 68.1 (294) 29.3 (259) 2.63 (300) |
| 13 | 295 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d^3P_1$ | | 30329533 | | 5.698E-14 | | 68.4 (295) 22.5 (260) 6.16 (242) |
| 13 | 296 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d^3P_0$ | | 30329825 | | 5.730E-14 | | 92.5 (296) |
| 13 | 297 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f^3G_5$ | | 30329932 | | 5.301E-14 | | 100. (297) |
| 13 | 298 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g^1G_4$ | | 30330175 | | 5.390E-14 | | 39.3 (298) 32.4 (310) 28.3 (261) |
| 13 | 299 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g^3G_5$ | | 30330206 | | 5.390E-14 | | 71.6 (299) 17.5 (262) 10.9 (305) |
| 13 | 300 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f^1G_4$ | | 30330279 | | 5.297E-14 | | 67.5 (300) 28.8 (259) 3.66 (294) |
| 13 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f^3F_3$ | | 30330394 | | 5.465E-14 | | 55.2 (265) 28.0 (301) 16.8 (293) |
| 13 | 302 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h^1H_5$ | | 30330436 | | 5.330E-14 | | 38.6 (302) 33.4 (312) 28.0 (263) |
| 13 | 303 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h^3H_6$ | | 30330453 | | 5.323E-14 | | 70.7 (303) 22.7 (264) 6.63 (304) |
| 13 | 304 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h^1I_6$ | | 30330475 | | 4.967E-14 | | 60.2 (304) 38.5 (264) 1.33 (303) |
| 13 | 305 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g^1H_5$ | | 30330488 | | 5.159E-14 | | 56.6 (305) 43.4 (262) |
| 13 | 306 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h^3I_7$ | | 30330493 | | 4.962E-14 | | 100. (306) |
| 13 | 307 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g^3H_6$ | | 30330505 | | 5.160E-14 | | 100. (307) |
| 13 | 308 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f^3D_2$ | | 30330556 | | 5.458E-14 | | 42.0 (266) 38.2 (308) 19.8 (320) |
| 13 | 309 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g^1F_3$ | | 30330663 | | 5.450E-14 | | 50.3 (267) 24.9 (309) 21.6 (317) |
| 13 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g^3G_4$ | | 30330692 | | 5.452E-14 | | 48.0 (270) 28.4 (310) 23.6 (298) |
| 13 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h^1G_4$ | | 30330739 | | 5.450E-14 | | 56.5 (269) 23.7 (311) 19.8 (315) |
| 13 | 312 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h^3H_5$ | | 30330756 | | 5.451E-14 | | 43.5 (271) 30.2 (312) 26.3 (302) |
| 13 | 313 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d^1F_3$ | | 30330806 | | 5.356E-14 | | 76.6 (313) |
| 13 | 314 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h^3G_3$ | | 30331181 | | 5.401E-14 | | 100. (314) |
| 13 | 315 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h^3G_4$ | | 30331198 | | 5.400E-14 | | 55.1 (315) 44.9 (311) |
| 13 | 316 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g^3F_2$ | | 30331406 | | 5.413E-14 | | 100. (316) |
| 13 | 317 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g^3F_3$ | | 30331441 | | 5.417E-14 | | 56.5 (317) 43.5 (309) |
| 13 | 318 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f^3D_1$ | | 30331483 | | 5.443E-14 | | 98.6 (318) |
| 13 | 319 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p^1S_0$ | | 30331634 | | 6.258E-14 | | 73.3 (319) |
| 13 | 320 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f^1D_2$ | | 30331809 | | 5.436E-14 | | 54.3 (320) 43.4 (308) 1.29 (266) |
| 13 | 321 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d^1P_1$ | | 30332215 | | 5.595E-14 | | 76.7 (321) |
| 14 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2^1S_0$ | 0 | 0 | 0 | | | 100. (1) |
| 14 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s^3S_1$ | 14835945 | 14835904 | 14835449 | 2.803E-06 | 2.844E-06 | 100. (2) |
| 14 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p^3P_0$ | 14949760 | 14949829 | 14949306 | 6.549E-09 | 6.553E-09 | 100. (3) |
| 14 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p^3P_1$ | 14951545 | 14951606 | 14951086 | 6.333E-12 | 6.354E-12 | 100. (4) |
| 14 | 5 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p^3P_2$ | 14958691 | 14958767 | 14958246 | 4.329E-09 | 4.331E-09 | 100. (5) |
| 14 | 6 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s^1S_0$ | 14958753 | 14958826 | 14958357 | 2.101E-03 | 2.062E-03 | 100. (6) |
| 14 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p^1P_1$ | 15042040 | 15041946 | 15041599 | 2.665E-14 | 2.664E-14 | 100. (7) |
| 14 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s^3S_1$ | 17546734 | 17546678 | 17546264 | 4.326E-12 | 4.334E-12 | 100. (8) |
| 14 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p^3P_0$ | 17578029 | 17577936 | 17577568 | 1.556E-12 | 1.556E-12 | 100. (9) |
| 14 | 10 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p^3P_1$ | 17578568 | 17578486 | 17578119 | 1.447E-12 | 1.448E-12 | 100. (10) |
| 14 | 11 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s^1S_0$ | 17579166 | 17578934 | 17578727 | 4.631E-12 | 4.638E-12 | 100. (11) |
| 14 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 17580689 | 17580608 | 17580241 | 1.568E-12 | 1.568E-12 | 100. (12) |
| 14 | 13 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d^3D_1$ | 17598002 | 17597850 | 17597516 | 5.282E-13 | 5.278E-13 | 100. (13) |
| 14 | 14 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 17598031 | 17597894 | 17597565 | 5.306E-13 | 5.301E-13 | 85.1 (14) |
| 14 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 17598849 | 17598702 | 17598368 | 5.297E-13 | 5.293E-13 | 100. (15) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|-----------------------|
| 14 | 16 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 17599605 | 17599534 | 17599225 | 5.447E-13 | 5.443E-13 | 85.1 (16) |
| 14 | 17 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 17603422 | 17603221 | 17602961 | 9.119E-14 | 9.102E-14 | 100. (17) |
| 14 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s^3S_1$ | 18479389 | 18479304 | 18478977 | 6.343E-12 | 6.372E-12 | 100. (18) |
| 14 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 18492307 | 18492168 | 18491844 | 2.639E-12 | 2.643E-12 | 100. (19) |
| 14 | 20 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 18492537 | 18492403 | 18492080 | 2.504E-12 | 2.508E-12 | 100. (20) |
| 14 | 21 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 18492532 | 18492404 | 18492131 | 6.730E-12 | 6.752E-12 | 100. (21) |
| 14 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 18493430 | 18493298 | 18492975 | 2.656E-12 | 2.661E-12 | 100. (22) |
| 14 | 23 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d^3D_1$ | 18500576 | 18500379 | 18500067 | 1.225E-12 | 1.225E-12 | 100. (23) |
| 14 | 24 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 18500576 | 18500413 | 18500102 | 1.231E-12 | 1.230E-12 | 88.9 (24) |
| 14 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 18500926 | 18500738 | 18500426 | 1.229E-12 | 1.229E-12 | 100. (25) |
| 14 | 26 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | 18501452 | 18501158 | 18500856 | 2.535E-12 | 2.533E-12 | 56.6 (26) 43.4 (30) |
| 14 | 27 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | 18501245 | 18501196 | 18500889 | 1.277E-12 | 1.275E-12 | 88.9 (27) |
| 14 | 28 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | 18501452 | 18501196 | 18500892 | 2.534E-12 | 2.532E-12 | 100. (28) |
| 14 | 29 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | 18501452 | 18501378 | 18501074 | 2.536E-12 | 2.535E-12 | 100. (29) |
| 14 | 30 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | 18501452 | 18501408 | 18501107 | 2.538E-12 | 2.536E-12 | 56.6 (30) 43.4 (26) |
| 14 | 31 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 18502736 | 18502565 | 18502282 | 2.164E-13 | 2.158E-13 | 100. (31) |
| 14 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 18907613 | 18907491 | 18907181 | 9.969E-12 | 1.006E-11 | 100. (32) |
| 14 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 18914144 | 18913997 | 18913686 | 4.477E-12 | 4.497E-12 | 100. (33) |
| 14 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 18914246 | 18914073 | 18913793 | 1.058E-11 | 1.062E-11 | 100. (34) |
| 14 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 18914262 | 18914118 | 18913808 | 4.275E-12 | 4.293E-12 | 100. (35) |
| 14 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 18914719 | 18914576 | 18914266 | 4.503E-12 | 4.524E-12 | 100. (36) |
| 14 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | 18918351 | 18918157 | 18917850 | 2.351E-12 | 2.353E-12 | 100. (37) |
| 14 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | 18918351 | 18918177 | 18917871 | 2.362E-12 | 2.364E-12 | 90.0 (38) |
| 14 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | 18918530 | 18918341 | 18918034 | 2.359E-12 | 2.361E-12 | 100. (39) |
| 14 | 40 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | 18918801 | 18918575 | 18918273 | 4.900E-12 | 4.898E-12 | 57.3 (40) 42.7 (45) |
| 14 | 41 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | 18918801 | 18918594 | 18918291 | 4.898E-12 | 4.896E-12 | 100. (41) |
| 14 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | 18918694 | 18918598 | 18918294 | 2.465E-12 | 2.461E-12 | 90.0 (42) |
| 14 | 43 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | 18918801 | 18918687 | 18918384 | 4.904E-12 | 4.901E-12 | 100. (43) |
| 14 | 44 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | 18918894 | 18918696 | 18918395 | 8.223E-12 | 8.218E-12 | 54.7 (44) 45.3 (48) |
| 14 | 45 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | 18918801 | 18918704 | 18918402 | 4.910E-12 | 4.906E-12 | 57.3 (45) 42.7 (40) |
| 14 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | 18918894 | 18918707 | 18918406 | 8.224E-12 | 8.219E-12 | 100. (46) |
| 14 | 47 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | 18918894 | 18918763 | 18918462 | 8.227E-12 | 8.222E-12 | 100. (47) |
| 14 | 48 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | 18918894 | 18918773 | 18918472 | 8.228E-12 | 8.223E-12 | 54.7 (48) 45.3 (44) |
| 14 | 49 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 18919421 | 18919255 | 18918971 | 4.224E-13 | 4.195E-13 | 100. (49) |
| 14 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | 19139084 | 19138976 | 19138647 | 1.560E-11 | 1.544E-11 | 100. (50) |
| 14 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | 19142846 | 19142713 | 19142384 | 7.278E-12 | 7.224E-12 | 100. (51) |
| 14 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | 19142875 | 19142747 | 19142455 | 1.557E-11 | 1.620E-11 | 100. (52) |
| 14 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | 19142915 | 19142783 | 19142455 | 6.965E-12 | 6.917E-12 | 100. (53) |
| 14 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | 19143179 | 19143048 | 19142719 | 7.316E-12 | 7.268E-12 | 100. (54) |
| 14 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | 19145268 | 19145099 | 19144777 | 4.044E-12 | 4.013E-12 | 100. (55) |
| 14 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | 19145268 | 19145111 | 19144790 | 4.059E-12 | 4.033E-12 | 90.5 (56) |
| 14 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | 19145372 | 19145205 | 19144884 | 4.058E-12 | 4.028E-12 | 100. (57) |
| 14 | 58 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | 19145529 | 19145338 | 19145028 | 8.378E-12 | 8.373E-12 | 57.8 (58) 42.2 (64) |
| 14 | 59 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | 19145529 | 19145349 | 19145038 | 8.373E-12 | 8.370E-12 | 100. (59) |
| 14 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | 19145467 | 19145360 | 19145041 | 4.177E-12 | 4.218E-12 | 90.5 (60) |
| 14 | 61 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | 19145579 | 19145402 | 19145098 | 1.411E-11 | 1.410E-11 | 54.6 (61) 45.4 (68) |
| 14 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | 19145529 | 19145403 | 19145092 | 8.381E-12 | 8.380E-12 | 100. (62) |
| 14 | 63 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | 19145579 | 19145409 | 19145105 | 1.411E-11 | 1.410E-11 | 100. (63) |
| 14 | 64 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | 19145529 | 19145412 | 19145103 | 8.395E-12 | 8.384E-12 | 57.8 (64) 42.2 (58) |
| 14 | 65 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | 19145610 | 19145440 | 19145139 | 2.128E-11 | 2.126E-11 | 53.9 (65) 46.1 (70) |
| 14 | 66 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | 19145579 | 19145442 | 19145138 | 1.412E-11 | 1.411E-11 | 100. (66) |
| 14 | 67 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | 19145610 | 19145445 | 19145143 | 2.128E-11 | 2.126E-11 | 100. (67) |
| 14 | 68 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | 19145579 | 19145447 | 19145143 | 1.412E-11 | 1.411E-11 | 54.6 (68) 45.4 (61) |
| 14 | 69 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | 19145610 | 19145466 | 19145165 | 2.128E-11 | 2.127E-11 | 100. (69) |
| 14 | 70 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | 19145610 | 19145470 | 19145169 | 2.128E-11 | 2.127E-11 | 53.9 (70) 46.1 (65) |
| 14 | 71 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | 19145877 | 19145736 | 19145436 | 7.289E-13 | 7.142E-13 | 100. (71) |
| 14 | 72 | $2s^2_{1/2}(J=0)$ | $2s^2^1S_0$ | 30812900 | 30810209 | | 1.102E-13 | | 78.1 (72) |
| 14 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 30839900 | 30836977 | | 4.447E-14 | | 100. (73) |
| 14 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 30843900 | 30841027 | | 4.450E-14 | | 100. (74) |
| 14 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 30853000 | 30850168 | | 4.461E-14 | | 100. (75) |
| 14 | 76 | $2p^2_{1/2}(J=0)$ | $2p^2^3P_0$ | 30942600 | 30939333 | | 2.204E-14 | | 100. (76) |
| 14 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 30947300 | 30944051 | | 2.198E-14 | | 100. (77) |
| 14 | 78 | $2p^2_{3/2}(J=2)$ | $2p^2^3P_2$ | 30954800 | 30951684 | | 2.200E-14 | | 98.5 (78) |
| 14 | 79 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^1D_2$ | 31007100 | 31003676 | | 2.179E-14 | | 98.5 (79) |
| 14 | 80 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 31014400 | 31012431 | | 4.192E-14 | | 100. (80) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 14 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2\ ^1S_0$ | 31177700 | 31174473 | | 2.809E-14 | | 78.3 (81) |
| 14 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s\ ^3S_1$ | | 33633260 | | 1.125E-13 | | 71.8 (82) 28.2 (106) |
| 14 | 83 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p\ ^1P_1$ | | 33647564 | | 6.212E-14 | | 48.6 (83) 45.8 (110) 4.27 (116) |
| 14 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | | 33668522 | | 1.545E-13 | | 75.5 (84) |
| 14 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s\ ^3P_0$ | | 33676267 | | 6.129E-14 | | 58.6 (85) 40.3 (90) 1.10 (113) |
| 14 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p\ ^3D_1$ | | 33677329 | | 3.677E-14 | | 70.5 (86) 15.4 (92) 14.1 (102) |
| 14 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p\ ^3P_1$ | | 33678944 | | 7.633E-14 | | 57.8 (87) 38.7 (91) 3.49 (112) |
| 14 | 88 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | | 33682770 | | 1.028E-13 | | 77.9 (88) |
| 14 | 89 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | | 33683944 | | 3.923E-14 | | 79.1 (89) |
| 14 | 90 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | | 33685728 | | 6.019E-14 | | 46.5 (90) 37.4 (85) 16.1 (113) |
| 14 | 91 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s\ ^3P_1$ | | 33688451 | | 5.061E-14 | | 55.4 (91) 28.5 (87) 15.0 (112) |
| 14 | 92 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^1P_1$ | | 33690516 | | 3.409E-14 | | 84.3 (92) |
| 14 | 93 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 33691244 | | 4.222E-14 | | 72.7 (93) |
| 14 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 33694538 | | 4.196E-14 | | 82.2 (94) |
| 14 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 33717120 | | 4.163E-14 | | 82.7 (95) |
| 14 | 96 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 33723662 | | 4.191E-14 | | 98.4 (96) |
| 14 | 97 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 33725966 | | 3.302E-14 | | 100. (97) |
| 14 | 98 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | | 33728612 | | 3.433E-14 | | 92.7 (98) |
| 14 | 99 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 33728983 | | 4.991E-14 | | 40.2 (99) 26.0 (114) 24.5 (104) |
| 14 | 100 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^1D_2$ | | 33729002 | | 4.059E-14 | | 82.0 (100) |
| 14 | 101 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 33731229 | | 4.214E-14 | | 100. (101) |
| 14 | 102 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 33734781 | | 1.308E-13 | | 78.6 (102) |
| 14 | 103 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^3D_2$ | | 33736334 | | 6.903E-14 | | 39.9 (103) 19.9 (104) 14.9 (99) |
| 14 | 104 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^3P_2$ | | 33736964 | | 4.804E-14 | | 54.9 (104) 30.3 (103) 10.0 (89) |
| 14 | 105 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 33738520 | | 1.103E-13 | | 72.7 (105) |
| 14 | 106 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^3S_1$ | | 33744683 | | 4.415E-14 | | 69.4 (106) 26.5 (82) 4.14 (98) |
| 14 | 107 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 33752783 | | 3.732E-14 | | 92.3 (107) |
| 14 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^3D_2$ | | 33755840 | | 3.709E-14 | | 96.6 (108) |
| 14 | 109 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3D_3$ | | 33759192 | | 3.678E-14 | | 98.3 (109) |
| 14 | 110 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 33760119 | | 5.478E-14 | | 51.0 (110) 38.1 (83) 5.60 (107) |
| 14 | 111 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 33779239 | | 4.410E-14 | | 76.5 (111) |
| 14 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 33780959 | | 4.376E-14 | | 80.1 (112) |
| 14 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 33782174 | | 4.364E-14 | | 82.9 (113) |
| 14 | 114 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 33784930 | | 6.519E-14 | | 56.9 (114) 43.1 (99) |
| 14 | 115 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^1F_3$ | | 33801414 | | 3.532E-14 | | 100. (115) |
| 14 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 33814221 | | 4.022E-14 | | 89.7 (116) |
| 14 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 33825316 | | 4.086E-14 | | 76.1 (117) |
| 14 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 34614325 | | 1.414E-13 | | 73.2 (118) |
| 14 | 119 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | | 34621190 | | 7.250E-14 | | 47.7 (119) 40.2 (151) 7.36 (127) |
| 14 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 34625964 | | 1.644E-13 | | 74.3 (120) |
| 14 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 34628405 | | 6.880E-14 | | 56.1 (121) 42.3 (126) 1.64 (161) |
| 14 | 122 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 34630779 | | 1.007E-13 | | 60.0 (122) 31.2 (127) 4.67 (160) |
| 14 | 123 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 34633139 | | 1.411E-13 | | 77.2 (123) |
| 14 | 124 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 34633185 | | 4.456E-14 | | 69.9 (124) 18.0 (137) 12.2 (129) |
| 14 | 125 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 34637324 | | 5.050E-14 | | 66.1 (125) 27.6 (136) 3.80 (156) |
| 14 | 126 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 34639508 | | 6.695E-14 | | 45.2 (126) 41.7 (121) 13.1 (161) |
| 14 | 127 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 34642024 | | 5.524E-14 | | 56.4 (127) 25.7 (122) 12.7 (160) |
| 14 | 128 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 34643058 | | 7.461E-14 | | 52.2 (128) 45.9 (140) 1.92 (163) |
| 14 | 129 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^1P_1$ | | 34643809 | | 4.081E-14 | | 74.0 (129) |
| 14 | 130 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 34647557 | | 4.176E-14 | | 63.7 (130) 13.3 (158) 11.3 (131) |
| 14 | 131 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 34648538 | | 4.419E-14 | | 66.0 (131) 13.9 (130) 7.27 (138) |
| 14 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^1D_2$ | | 34651814 | | 8.527E-14 | | 38.4 (132) 35.1 (156) 19.3 (136) |
| 14 | 133 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 34652337 | | 3.834E-14 | | 96.5 (133) |
| 14 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 34652816 | | 4.737E-14 | | 76.7 (134) |
| 14 | 135 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 34654510 | | 5.713E-14 | | 54.2 (135) 34.9 (137) 3.71 (124) |
| 14 | 136 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^3D_2$ | | 34658244 | | 9.138E-14 | | 40.3 (136) 20.5 (132) 20.2 (125) |
| 14 | 137 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 34658586 | | 5.959E-14 | | 38.5 (137) 27.9 (135) 22.5 (124) |
| 14 | 138 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^1D_2$ | | 34658800 | | 4.367E-14 | | 67.3 (138) 11.3 (152) 5.94 (131) |
| 14 | 139 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 34659313 | | 7.054E-14 | | 58.6 (139) 41.4 (153) |
| 14 | 140 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 34661540 | | 5.988E-14 | | 51.8 (140) 38.2 (128) 5.96 (163) |
| 14 | 141 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^3P_2$ | | 34662106 | | 4.123E-14 | | 76.8 (141) |
| 14 | 142 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 34663261 | | 4.073E-14 | | 75.1 (142) |
| 14 | 143 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 34664709 | | 4.040E-14 | | 61.0 (143) 27.3 (155) 11.7 (147) |
| 14 | 144 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 34665607 | | 4.035E-14 | | 40.5 (144) 37.0 (157) 22.5 (162) |
| 14 | 145 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 34666267 | | 4.128E-14 | | 75.8 (145) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 14 | 146 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f^3F_2$ | | 34666307 | | 9.805E-14 | | 60.5 (146) 32.4 (152) 2.47 (138) |
| 14 | 147 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f^3F_3$ | | 34666429 | | 4.304E-14 | | 45.1 (147) 26.6 (155) 19.0 (163) |
| 14 | 148 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f^3F_3$ | | 34666947 | | 1.423E-13 | | 74.1 (148) |
| 14 | 149 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f^1F_3$ | | 34668205 | | 1.645E-12 | | 100. (149) |
| 14 | 150 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p^3S_1$ | | 34668642 | | 4.642E-14 | | 68.6 (150) 22.3 (118) 7.89 (135) |
| 14 | 151 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s^1P_1$ | | 34668669 | | 5.516E-14 | | 50.6 (151) 31.5 (119) 13.2 (142) |
| 14 | 152 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d^3D_2$ | | 34669630 | | 5.534E-14 | | 39.4 (152) 28.2 (146) 15.8 (131) |
| 14 | 153 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f^3F_4$ | | 34670354 | | 9.249E-14 | | 58.4 (153) 41.6 (139) |
| 14 | 154 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^3D_3$ | | 34672132 | | 4.455E-14 | | 71.4 (154) 16.8 (134) 11.8 (148) |
| 14 | 155 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f^1F_3$ | | 34677316 | | 4.052E-14 | | 38.4 (143) 34.6 (155) 27.0 (147) |
| 14 | 156 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p^1D_2$ | | 34677615 | | 5.780E-14 | | 54.2 (156) 39.3 (132) 2.15 (167) |
| 14 | 157 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^3G_4$ | | 34677923 | | 4.051E-14 | | 57.9 (144) 35.7 (157) 6.40 (162) |
| 14 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d^3P_2$ | | 34679069 | | 4.446E-14 | | 66.4 (158) 14.2 (152) 12.7 (123) |
| 14 | 159 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | | 34680330 | | 4.047E-14 | | 100. (159) |
| 14 | 160 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d^3P_1$ | | 34680348 | | 4.440E-14 | | 75.4 (160) |
| 14 | 161 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d^3P_0$ | | 34681289 | | 4.436E-14 | | 85.3 (161) |
| 14 | 162 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^1G_4$ | | 34681532 | | 4.045E-14 | | 71.1 (162) 27.2 (157) 1.68 (144) |
| 14 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^3D_3$ | | 34682203 | | 4.115E-14 | | 73.2 (163) |
| 14 | 164 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | | 34682613 | | 4.080E-14 | | 44.4 (164) 30.0 (167) 22.5 (145) |
| 14 | 165 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | | 34685742 | | 4.107E-14 | | 97.6 (165) |
| 14 | 166 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d^1F_3$ | | 34686021 | | 3.890E-14 | | 93.6 (166) |
| 14 | 167 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | | 34686599 | | 4.061E-14 | | 53.8 (167) 43.7 (164) 1.43 (156) |
| 14 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | | 34691997 | | 4.269E-14 | | 84.0 (168) |
| 14 | 169 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | | 34695676 | | 4.560E-14 | | 75.7 (169) |
| 14 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | | 35058992 | | 1.633E-13 | | 73.6 (170) |
| 14 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2s5p^1P_1$ | | 35062387 | | 7.270E-14 | | 41.0 (171) 33.1 (210) 19.2 (179) |
| 14 | 172 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | | 35064200 | | 1.680E-13 | | 73.3 (172) |
| 14 | 173 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | | 35064893 | | 6.846E-14 | | 59.6 (173) 39.3 (178) 1.08 (220) |
| 14 | 174 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | | 35067179 | | 1.510E-13 | | 63.2 (174) 17.5 (179) 12.1 (171) |
| 14 | 175 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | | 35068043 | | 4.818E-14 | | 69.5 (175) 18.8 (186) 11.7 (181) |
| 14 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | | 35068253 | | 1.878E-13 | | 80.7 (176) |
| 14 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | | 35070635 | | 5.568E-14 | | 54.2 (177) 27.2 (183) 10.3 (215) |
| 14 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | | 35072396 | | 7.901E-14 | | 52.4 (178) 39.1 (173) 8.50 (220) |
| 14 | 179 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s^3P_1$ | | 35074632 | | 6.388E-14 | | 52.7 (179) 23.4 (174) 16.5 (171) |
| 14 | 180 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | | 35074979 | | 1.695E-13 | | 77.3 (180) |
| 14 | 181 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^1P_1$ | | 35075283 | | 4.604E-14 | | 47.0 (181) 29.5 (207) 9.68 (170) |
| 14 | 182 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | | 35075492 | | 4.555E-14 | | 73.2 (182) |
| 14 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | | 35077723 | | 1.408E-13 | | 39.0 (183) 33.2 (188) 19.3 (215) |
| 14 | 184 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | | 35078494 | | 5.080E-14 | | 60.7 (184) 19.1 (198) 11.8 (214) |
| 14 | 185 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | | 35078682 | | 4.260E-14 | | 89.1 (185) |
| 14 | 186 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | | 35079446 | | 1.150E-13 | | 67.8 (186) 16.3 (207) 11.7 (175) |
| 14 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5s^3P_2$ | | 35079788 | | 4.152E-14 | | 38.3 (187) 24.5 (217) 17.1 (199) |
| 14 | 188 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | | 35081943 | | 1.221E-13 | | 45.0 (188) 25.9 (183) 21.2 (177) |
| 14 | 189 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | | 35082774 | | 2.793E-13 | | 85.0 (189) |
| 14 | 190 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | | 35083319 | | 4.109E-14 | | 68.8 (190) 20.1 (216) 9.80 (224) |
| 14 | 191 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | | 35083600 | | 4.155E-14 | | 68.3 (191) 12.5 (236) 9.88 (219) |
| 14 | 192 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | | 35083898 | | 4.111E-14 | | 40.9 (192) 30.7 (218) 27.1 (225) |
| 14 | 193 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | | 35084220 | | 6.851E-14 | | 36.6 (193) 32.8 (187) 22.6 (213) |
| 14 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | | 35084561 | | 4.087E-14 | | 36.1 (194) 35.4 (224) 22.5 (216) |
| 14 | 195 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | | 35084712 | | 4.062E-14 | | 69.4 (195) 17.7 (222) 13.0 (228) |
| 14 | 196 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | | 35084766 | | 4.183E-14 | | 61.0 (196) 21.4 (235) 14.4 (226) |
| 14 | 197 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | | 35084791 | | 4.062E-14 | | 37.9 (197) 31.4 (229) 30.7 (223) |
| 14 | 198 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^3F_3$ | | 35084935 | | 1.245E-13 | | 68.9 (198) 8.71 (214) 7.37 (184) |
| 14 | 199 | $2s_{1/2}5f_{5/2}(J=2)$ | $2p5d^3D_2$ | | 35085007 | | 8.589E-14 | | 50.1 (193) 19.3 (187) 16.6 (199) |
| 14 | 200 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | | 35085172 | | 4.492E-14 | | 45.8 (200) 25.4 (227) 18.7 (233) |
| 14 | 201 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | | 35085235 | | 4.122E-14 | | 48.2 (201) 28.5 (228) 21.6 (222) |
| 14 | 202 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | | 35085639 | | 1.735E-12 | | 100. (202) |
| 14 | 203 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | | 35085678 | | 2.709E-12 | | 71.0 (203) 29.0 (206) |
| 14 | 204 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | | 35085689 | | 1.778E-12 | | 100. (204) |
| 14 | 205 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | | 35085713 | | 5.749E-12 | | 100. (205) |
| 14 | 206 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | | 35085773 | | 2.786E-12 | | 73.3 (206) |
| 14 | 207 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^3P_1$ | | 35085945 | | 4.162E-14 | | 36.6 (207) 36.0 (181) 18.6 (175) |
| 14 | 208 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | | 35087687 | | 4.818E-14 | | 77.7 (208) |
| 14 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^3P_2$ | | 35088645 | | 4.080E-14 | | 75.3 (209) |
| 14 | 210 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | | 35089909 | | 5.233E-14 | | 59.9 (210) 24.8 (171) 9.45 (179) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 14 | 211 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^3S_1$ | | 35091673 | | 4.464E-14 | | 66.8 (211) 16.0 (207) 15.0 (170) |
| 14 | 212 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 35091760 | | 4.644E-14 | | 86.3 (212) |
| 14 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | | 35091987 | | 4.188E-14 | | 39.6 (213) 32.6 (199) 18.9 (182) |
| 14 | 214 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^3D_3$ | | 35093758 | | 4.122E-14 | | 69.3 (214) 26.0 (184) 2.60 (198) |
| 14 | 215 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | | 35094479 | | 4.676E-14 | | 66.7 (215) 18.8 (188) 7.38 (209) |
| 14 | 216 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 35096707 | | 4.069E-14 | | 40.9 (216) 30.1 (190) 29.0 (224) |
| 14 | 217 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 35096740 | | 4.272E-14 | | 57.2 (217) 28.4 (199) 7.21 (176) |
| 14 | 218 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 35097037 | | 4.069E-14 | | 65.9 (218) 30.6 (192) 3.49 (225) |
| 14 | 219 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 35097463 | | 4.295E-14 | | 71.1 (219) 17.8 (191) 7.42 (174) |
| 14 | 220 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 35098056 | | 4.315E-14 | | 90.4 (220) |
| 14 | 221 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 35098068 | | 4.051E-14 | | 100. (221) |
| 14 | 222 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | | 35098281 | | 4.085E-14 | | 37.7 (222) 31.7 (228) 30.6 (195) |
| 14 | 223 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 35098350 | | 4.085E-14 | | 69.3 (223) 18.1 (197) 12.5 (229) |
| 14 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 35098753 | | 4.095E-14 | | 59.4 (194) 24.2 (224) 15.2 (216) |
| 14 | 225 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 35098819 | | 4.049E-14 | | 69.0 (225) 28.1 (192) 2.91 (218) |
| 14 | 226 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 35099025 | | 4.077E-14 | | 39.7 (226) 36.8 (196) 22.4 (235) |
| 14 | 227 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^1F_3$ | | 35099096 | | 4.078E-14 | | 49.3 (200) 27.8 (227) 22.9 (233) |
| 14 | 228 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | | 35099151 | | 4.078E-14 | | 50.7 (201) 26.5 (228) 22.8 (222) |
| 14 | 229 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 35099239 | | 4.070E-14 | | 56.0 (229) 44.0 (197) |
| 14 | 230 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 35099285 | | 4.070E-14 | | 100. (230) |
| 14 | 231 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 35100020 | | 3.990E-14 | | 82.6 (231) |
| 14 | 232 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 35100467 | | 4.066E-14 | | 100. (232) |
| 14 | 233 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^3F_3$ | | 35100553 | | 4.064E-14 | | 54.9 (233) 42.8 (227) 2.31 (231) |
| 14 | 234 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 35100784 | | 4.093E-14 | | 98.3 (234) |
| 14 | 235 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 35101370 | | 4.066E-14 | | 55.0 (235) 43.8 (226) 1.24 (215) |
| 14 | 236 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 35102868 | | 4.212E-14 | | 79.7 (236) |
| 14 | 237 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 35103594 | | 4.545E-14 | | 76.2 (237) |
| 14 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 35297336 | | 1.672E-13 | | 73.8 (238) |
| 14 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2s6p\ ^1P_1$ | | 35298998 | | 6.896E-14 | | 34.1 (239) 28.9 (250) 28.7 (285) |
| 14 | 240 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 35300059 | | 1.470E-13 | | 70.3 (240) 21.0 (316) 8.75 (254) |
| 14 | 241 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 35300188 | | 6.597E-14 | | 63.3 (241) 36.7 (246) |
| 14 | 242 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 35302189 | | 2.095E-13 | | 64.0 (242) 17.7 (239) 7.78 (250) |
| 14 | 243 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 35302203 | | 4.971E-14 | | 68.9 (243) 18.5 (253) 11.2 (283) |
| 14 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 35302566 | | 1.984E-13 | | 79.9 (244) |
| 14 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 35303825 | | 5.664E-14 | | 47.2 (245) 24.4 (251) 15.8 (290) |
| 14 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 35305296 | | 9.523E-14 | | 60.1 (246) 35.1 (241) 4.77 (296) |
| 14 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 35306406 | | 4.593E-14 | | 72.0 (247) 14.1 (289) 9.96 (268) |
| 14 | 248 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 35306881 | | 2.980E-13 | | 85.8 (248) |
| 14 | 249 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 35306931 | | 5.059E-14 | | 36.0 (249) 30.7 (283) 17.8 (238) |
| 14 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2p6s\ ^3P_1$ | | 35307039 | | 8.048E-14 | | 42.3 (250) 29.9 (239) 22.6 (242) |
| 14 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 35308043 | | 1.894E-13 | | 52.8 (251) 25.7 (257) 10.5 (290) |
| 14 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 35308384 | | 5.110E-14 | | 51.3 (252) 19.5 (272) 15.1 (291) |
| 14 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 35309020 | | 1.554E-13 | | 77.1 (253) |
| 14 | 254 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 35309048 | | 4.792E-14 | | 77.9 (254) |
| 14 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 35309911 | | 4.654E-14 | | 29.5 (255) 28.0 (292) 22.5 (289) |
| 14 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 35310675 | | 4.094E-14 | | 71.5 (256) 17.2 (293) 9.77 (300) |
| 14 | 257 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 35310792 | | 1.695E-13 | | 62.2 (257) 16.3 (251) 15.9 (245) |
| 14 | 258 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 35311021 | | 4.741E-13 | | 90.5 (258) |
| 14 | 259 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 35311025 | | 4.090E-14 | | 41.5 (259) 29.6 (301) 27.5 (295) |
| 14 | 260 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 35311364 | | 4.344E-14 | | 60.7 (260) 16.5 (321) 12.5 (294) |
| 14 | 261 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 35311476 | | 3.984E-14 | | 71.6 (261) 16.2 (298) 12.2 (310) |
| 14 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 35311525 | | 3.984E-14 | | 39.1 (262) 32.4 (305) 28.5 (299) |
| 14 | 263 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 35311614 | | 3.922E-14 | | 71.5 (263) 15.8 (302) 12.7 (312) |
| 14 | 264 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 35311640 | | 3.922E-14 | | 38.5 (264) 33.0 (306) 28.5 (303) |
| 14 | 265 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 35311711 | | 4.336E-14 | | 41.3 (265) 30.6 (300) 20.5 (293) |
| 14 | 266 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 35311761 | | 4.295E-14 | | 51.9 (266) 25.1 (320) 16.6 (304) |
| 14 | 267 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 35311825 | | 4.692E-14 | | 38.1 (267) 24.7 (309) 18.9 (319) |
| 14 | 268 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 35311859 | | 3.003E-13 | | 88.6 (268) |
| 14 | 269 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 35311915 | | 4.051E-14 | | 42.8 (269) 31.8 (311) 25.4 (315) |
| 14 | 270 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 35311931 | | 4.280E-14 | | 49.7 (270) 25.0 (310) 19.2 (298) |
| 14 | 271 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 35311940 | | 4.052E-14 | | 57.2 (271) 23.6 (312) 19.2 (302) |
| 14 | 272 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^3F_3$ | | 35311988 | | 1.146E-13 | | 66.6 (272) 8.74 (267) 5.82 (252) |
| 14 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 35312406 | | 2.868E-12 | | 100. (273) |
| 14 | 274 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 35312422 | | 2.771E-12 | | 76.9 (274) |
| 14 | 275 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 35312429 | | 1.722E-12 | | 100. (275) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 14 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 35312437 | | 6.482E-12 | | 100. (276) |
| 14 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 35312485 | | 3.183E-12 | | 80.2 (277) |
| 14 | 278 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 35312543 | | 8.069E-12 | | 100. (278) |
| 14 | 279 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 35312543 | | 9.430E-12 | | 56.4 (279) 43.6 (280) |
| 14 | 280 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 35312568 | | 8.238E-12 | | 56.5 (280) 43.5 (279) |
| 14 | 281 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 35312569 | | 9.531E-12 | | 100. (281) |
| 14 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 35316779 | | 4.254E-14 | | 89.0 (282) |
| 14 | 283 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^1P_1$ | | 35318071 | | 4.062E-14 | | 51.4 (283) 26.7 (249) 17.1 (243) |
| 14 | 284 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 35318800 | | 4.242E-14 | | 93.1 (284) |
| 14 | 285 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 35319197 | | 4.774E-14 | | 64.6 (285) 19.1 (250) 15.2 (239) |
| 14 | 286 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 35319651 | | 4.068E-14 | | 67.5 (286) 27.3 (245) 3.52 (290) |
| 14 | 287 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^3S_1$ | | 35320897 | | 4.318E-14 | | 63.6 (287) 24.4 (249) 9.61 (238) |
| 14 | 288 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 35321411 | | 4.188E-14 | | 96.7 (288) |
| 14 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 35321618 | | 4.114E-14 | | 52.8 (289) 22.1 (292) 20.0 (247) |
| 14 | 290 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 35322306 | | 4.241E-14 | | 69.3 (290) 16.2 (286) 7.71 (245) |
| 14 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 35322656 | | 4.091E-14 | | 63.8 (291) 33.4 (252) 2.78 (313) |
| 14 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 35324072 | | 4.168E-14 | | 51.0 (255) 38.5 (292) 4.14 (289) |
| 14 | 293 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 35324428 | | 4.061E-14 | | 43.7 (293) 29.0 (300) 27.3 (256) |
| 14 | 294 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 35324433 | | 4.186E-14 | | 68.3 (294) 24.7 (260) 4.36 (242) |
| 14 | 295 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 35324618 | | 4.058E-14 | | 68.2 (295) 29.4 (259) 2.37 (301) |
| 14 | 296 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 35324741 | | 4.207E-14 | | 94.5 (296) |
| 14 | 297 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 35325093 | | 3.997E-14 | | 100. (297) |
| 14 | 298 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 35325328 | | 4.043E-14 | | 39.1 (298) 32.6 (310) 28.3 (261) |
| 14 | 299 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 35325370 | | 4.043E-14 | | 71.6 (299) 17.7 (262) 10.7 (305) |
| 14 | 300 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 35325492 | | 4.075E-14 | | 52.9 (265) 29.5 (300) 17.6 (293) |
| 14 | 301 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 35325514 | | 3.996E-14 | | 67.5 (301) 28.6 (259) 3.96 (295) |
| 14 | 302 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 35325625 | | 4.012E-14 | | 38.2 (302) 33.5 (312) 28.3 (263) |
| 14 | 303 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 35325650 | | 4.012E-14 | | 71.6 (303) 17.4 (264) 11.0 (306) |
| 14 | 304 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 35325664 | | 4.072E-14 | | 44.1 (266) 37.5 (304) 18.3 (320) |
| 14 | 305 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 35325744 | | 3.924E-14 | | 56.8 (305) 43.2 (262) |
| 14 | 306 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 35325750 | | 3.819E-14 | | 56.0 (306) 44.0 (264) |
| 14 | 307 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 35325765 | | 3.925E-14 | | 100. (307) |
| 14 | 308 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 35325775 | | 3.819E-14 | | 100. (308) |
| 14 | 309 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^1F_3$ | | 35325821 | | 4.070E-14 | | 50.3 (267) 23.1 (309) 21.1 (319) |
| 14 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 35325860 | | 4.071E-14 | | 46.8 (270) 28.8 (310) 24.4 (298) |
| 14 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^1G_4$ | | 35325919 | | 4.070E-14 | | 57.2 (269) 23.2 (311) 19.6 (315) |
| 14 | 312 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 35325942 | | 4.070E-14 | | 42.8 (271) 30.3 (312) 26.9 (302) |
| 14 | 313 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 35325955 | | 4.012E-14 | | 73.3 (313) |
| 14 | 314 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 35326400 | | 4.038E-14 | | 100. (314) |
| 14 | 315 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^3G_4$ | | 35326424 | | 4.038E-14 | | 55.0 (315) 45.0 (311) |
| 14 | 316 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 35326588 | | 4.462E-14 | | 74.1 (316) |
| 14 | 317 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 35326635 | | 4.047E-14 | | 100. (317) |
| 14 | 318 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 35326677 | | 4.061E-14 | | 100. (318) |
| 14 | 319 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 35326685 | | 4.049E-14 | | 56.2 (319) 43.8 (309) |
| 14 | 320 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 35327065 | | 4.058E-14 | | 54.8 (320) 43.7 (304) 1.51 (266) |
| 14 | 321 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 35327373 | | 4.134E-14 | | 75.5 (321) |
| 15 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 15 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 17135769 | 17135478 | | 1.374E-06 | | 100. (2) |
| 15 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 17258746 | 17258558 | | 6.014E-09 | | 100. (3) |
| 15 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 17261163 | 17260991 | | 3.211E-12 | | 100. (4) |
| 15 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 17268828 | 17268617 | | 1.399E-03 | | 100. (5) |
| 15 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 17270908 | 17270760 | | 3.439E-09 | | 100. (6) |
| 15 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 17360546 | 17360208 | | 1.993E-14 | | 100. (7) |
| 15 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 20271101 | 20270786 | | 3.256E-12 | | 100. (8) |
| 15 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 20304936 | 20304592 | | 1.155E-12 | | 100. (9) |
| 15 | 10 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 20305682 | 20305339 | | 1.041E-12 | | 100. (10) |
| 15 | 11 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 20306284 | 20305752 | | 3.471E-12 | | 100. (11) |
| 15 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 20308579 | 20308237 | | 1.166E-12 | | 100. (12) |
| 15 | 13 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 20327307 | 20326927 | | 3.930E-13 | | 100. (13) |
| 15 | 14 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 20327351 | 20326968 | | 3.949E-13 | | 82.4 (14) |
| 15 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 20328471 | 20328091 | | 3.944E-13 | | 100. (15) |
| 15 | 16 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 20329412 | 20329010 | | 4.043E-13 | | 82.4 (16) |
| 15 | 17 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 20332953 | 20332519 | | 6.831E-14 | | 100. (17) |
| 15 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 21350958 | 21350624 | | 4.768E-12 | | 100. (18) |
| 15 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 21364940 | 21364539 | | 1.961E-12 | | 100. (19) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|------------------------------------|
| 15 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 21365193 | 21364820 | | 5.042E-12 | | 100. (20) |
| 15 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 21365251 | 21364857 | | 1.816E-12 | | 100. (21) |
| 15 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 21366469 | 21366080 | | 1.976E-12 | | 100. (22) |
| 15 | 23 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | 21374203 | 21373753 | | 9.119E-13 | | 100. (23) |
| 15 | 24 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | 21374203 | 21373791 | | 9.166E-13 | | 86.3 (24) |
| 15 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | 21374685 | 21374244 | | 9.151E-13 | | 100. (25) |
| 15 | 26 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | 21375302 | 21374704 | | 1.884E-12 | | 56.7 (26) 43.3 (30) |
| 15 | 27 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | 21375043 | 21374744 | | 9.471E-13 | | 86.3 (27) |
| 15 | 28 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | 21375302 | 21374751 | | 1.883E-12 | | 100. (28) |
| 15 | 29 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | 21375302 | 21375000 | | 1.885E-12 | | 100. (29) |
| 15 | 30 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | 21375302 | 21375038 | | 1.887E-12 | | 56.7 (30) 43.3 (26) |
| 15 | 31 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 21376454 | 21376024 | | 1.622E-13 | | 100. (31) |
| 15 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 21846994 | 21846619 | | 7.495E-12 | | 100. (32) |
| 15 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 21854063 | 21853658 | | 3.330E-12 | | 100. (33) |
| 15 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 21854145 | 21853753 | | 7.917E-12 | | 100. (34) |
| 15 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 21854223 | 21853822 | | 3.113E-12 | | 100. (35) |
| 15 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 21854847 | 21854447 | | 3.353E-12 | | 100. (36) |
| 15 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | 21858780 | 21858327 | | 1.751E-12 | | 100. (37) |
| 15 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | 21858780 | 21858351 | | 1.760E-12 | | 87.5 (38) |
| 15 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d\ ^3D_3$ | 21859026 | 21858579 | | 1.758E-12 | | 100. (39) |
| 15 | 40 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f\ ^3F_3$ | 21859341 | 21858835 | | 3.642E-12 | | 57.3 (40) 42.7 (45) |
| 15 | 41 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f\ ^3F_2$ | 21859341 | 21858859 | | 3.640E-12 | | 100. (41) |
| 15 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d\ ^1D_2$ | 21859210 | 21858859 | | 1.827E-12 | | 87.5 (42) |
| 15 | 43 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f\ ^3F_4$ | 21859341 | 21858986 | | 3.645E-12 | | 100. (43) |
| 15 | 44 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g\ ^3G_4$ | 21859465 | 21858995 | | 6.112E-12 | | 54.8 (44) 45.2 (48) |
| 15 | 45 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f\ ^1F_3$ | 21859341 | 21859007 | | 3.649E-12 | | 57.3 (45) 42.7 (40) |
| 15 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g\ ^3G_3$ | 21859465 | 21859010 | | 6.113E-12 | | 100. (46) |
| 15 | 47 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g\ ^3G_5$ | 21859465 | 21859086 | | 6.116E-12 | | 100. (47) |
| 15 | 48 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g\ ^1G_4$ | 21859465 | 21859098 | | 6.116E-12 | | 54.8 (48) 45.2 (44) |
| 15 | 49 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p\ ^1P_1$ | 21859894 | 21859467 | | 3.166E-13 | | 100. (49) |
| 15 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s\ ^3S_1$ | 22115189 | 22114824 | | 1.176E-11 | | 100. (50) |
| 15 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p\ ^3P_0$ | 22119265 | 22118867 | | 5.426E-12 | | 100. (51) |
| 15 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s\ ^1S_0$ | 22119283 | 22118911 | | 1.162E-11 | | 100. (52) |
| 15 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p\ ^3P_1$ | 22119357 | 22118962 | | 5.088E-12 | | 100. (53) |
| 15 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p\ ^3P_2$ | 22119717 | 22119324 | | 5.459E-12 | | 100. (54) |
| 15 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d\ ^3D_1$ | 22121979 | 22121548 | | 3.015E-12 | | 100. (55) |
| 15 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d\ ^3D_2$ | 22121979 | 22121562 | | 3.025E-12 | | 88.1 (56) |
| 15 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d\ ^3D_3$ | 22122121 | 22121693 | | 3.027E-12 | | 100. (57) |
| 15 | 58 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f\ ^3F_3$ | 22122303 | 22121840 | | 6.225E-12 | | 57.7 (58) 42.3 (64) |
| 15 | 59 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f\ ^3F_2$ | 22122303 | 22121853 | | 6.223E-12 | | 100. (59) |
| 15 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d\ ^1D_2$ | 22122227 | 22121862 | | 3.096E-12 | | 88.1 (60) |
| 15 | 61 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f\ ^3F_4$ | 22122303 | 22121927 | | 6.230E-12 | | 100. (61) |
| 15 | 62 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g\ ^3G_4$ | 22122371 | 22121928 | | 1.049E-11 | | 54.7 (62) 45.3 (68) |
| 15 | 63 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g\ ^3G_3$ | 22122371 | 22121936 | | 1.049E-11 | | 100. (63) |
| 15 | 64 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f\ ^1F_3$ | 22122303 | 22121939 | | 6.240E-12 | | 57.7 (64) 42.3 (58) |
| 15 | 65 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h\ ^3H_5$ | 22122413 | 22121980 | | 1.582E-11 | | 54.0 (65) 46.0 (70) |
| 15 | 66 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g\ ^3G_5$ | 22122371 | 22121981 | | 1.050E-11 | | 100. (66) |
| 15 | 67 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h\ ^3H_4$ | 22122413 | 22121985 | | 1.582E-11 | | 100. (67) |
| 15 | 68 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g\ ^1G_4$ | 22122371 | 22121987 | | 1.050E-11 | | 54.7 (68) 45.3 (62) |
| 15 | 69 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h\ ^3H_6$ | 22122413 | 22122015 | | 1.582E-11 | | 100. (69) |
| 15 | 70 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h\ ^1H_5$ | 22122413 | 22122019 | | 1.582E-11 | | 54.0 (70) 46.0 (65) |
| 15 | 71 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p\ ^1P_1$ | 22122612 | 22122207 | | 5.462E-13 | | 100. (71) |
| 15 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2\ ^1S_0$ | 35498500 | 35494664 | | 8.353E-14 | | 78.5 (72) |
| 15 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p\ ^3P_0$ | 35526700 | 35522535 | | 3.356E-14 | | 100. (73) |
| 15 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p\ ^3P_1$ | 35531900 | 35527840 | | 3.359E-14 | | 100. (74) |
| 15 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p\ ^3P_2$ | 35544000 | 35540016 | | 3.368E-14 | | 100. (75) |
| 15 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2\ ^3P_0$ | 35639000 | 35634468 | | 1.670E-14 | | 100. (76) |
| 15 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2\ ^3P_1$ | 35645300 | 35640809 | | 1.662E-14 | | 100. (77) |
| 15 | 78 | $2p_{3/2}^2(J=2)$ | $2p^2\ ^3P_2$ | 35655100 | 35650716 | | 1.664E-14 | | 97.7 (78) |
| 15 | 79 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2\ ^1D_2$ | 35711600 | 35706895 | | 1.651E-14 | | 97.7 (79) |
| 15 | 80 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p\ ^1P_1$ | 35717100 | 35713940 | | 3.190E-14 | | 100. (80) |
| 15 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2\ ^1S_0$ | 35894000 | 35889552 | | 2.114E-14 | | 78.7 (81) |
| 15 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s\ ^3S_1$ | | 38750201 | | 8.727E-14 | | 72.6 (82) |
| 15 | 83 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p\ ^1P_1$ | | 38766042 | | 4.706E-14 | | 48.7 (83) 45.2 (109) 4.14 (116) |
| 15 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | | 38788084 | | 1.176E-13 | | 76.1 (84) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 15 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 38795860 | | 4.565E-14 | | 60.7 (85) 39.3 (90) |
| 15 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 38797059 | | 2.768E-14 | | 70.6 (86) 15.9 (92) 13.6 (102) |
| 15 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 38799366 | | 5.913E-14 | | 59.6 (87) 36.8 (91) 3.55 (112) |
| 15 | 88 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 38804170 | | 8.029E-14 | | 80.1 (88) |
| 15 | 89 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 38805760 | | 2.981E-14 | | 78.7 (89) |
| 15 | 90 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 38806570 | | 4.693E-14 | | 48.7 (90) 36.2 (85) 15.1 (113) |
| 15 | 91 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 38810320 | | 3.834E-14 | | 56.9 (91) 27.4 (87) 14.0 (112) |
| 15 | 92 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 38814100 | | 2.605E-14 | | 82.7 (92) |
| 15 | 93 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 38815356 | | 3.287E-14 | | 70.3 (93) 29.7 (105) |
| 15 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 38818577 | | 3.152E-14 | | 85.0 (94) |
| 15 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 38840687 | | 3.158E-14 | | 82.3 (95) |
| 15 | 96 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 38849200 | | 3.176E-14 | | 97.8 (96) |
| 15 | 97 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 38850594 | | 2.514E-14 | | 98.7 (97) |
| 15 | 98 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^3P_1$ | | 38853999 | | 2.710E-14 | | 87.8 (98) |
| 15 | 99 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^1D_2$ | | 38854101 | | 4.059E-14 | | 38.4 (99) 25.8 (114) 21.3 (104) |
| 15 | 100 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^3D_2$ | | 38856007 | | 3.084E-14 | | 81.1 (100) |
| 15 | 101 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d^3F_4$ | | 38859447 | | 3.199E-14 | | 100. (101) |
| 15 | 102 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 38859897 | | 8.782E-14 | | 75.5 (102) |
| 15 | 103 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^3D_2$ | | 38862305 | | 7.958E-14 | | 62.0 (103) 19.5 (89) 9.42 (99) |
| 15 | 104 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^3P_2$ | | 38864764 | | 2.845E-14 | | 77.9 (104) |
| 15 | 105 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 38864849 | | 7.824E-14 | | 70.3 (105) 29.7 (93) |
| 15 | 106 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3S_1$ | | 38871956 | | 3.285E-14 | | 69.3 (106) 24.9 (82) 5.83 (98) |
| 15 | 107 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 38880068 | | 2.849E-14 | | 89.4 (107) |
| 15 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d^3D_2$ | | 38884439 | | 2.827E-14 | | 92.3 (108) |
| 15 | 109 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 38888449 | | 4.135E-14 | | 50.6 (109) 37.7 (83) 7.41 (107) |
| 15 | 110 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d^3D_3$ | | 38889009 | | 2.793E-14 | | 97.5 (110) |
| 15 | 111 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^3P_2$ | | 38909763 | | 3.318E-14 | | 75.8 (111) |
| 15 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d^3P_1$ | | 38911823 | | 3.295E-14 | | 80.3 (112) |
| 15 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d^3P_0$ | | 38913355 | | 3.288E-14 | | 84.1 (113) |
| 15 | 114 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 38915367 | | 4.775E-14 | | 55.2 (114) 44.8 (99) |
| 15 | 115 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d^1F_3$ | | 38934959 | | 2.680E-14 | | 98.9 (115) |
| 15 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d^1P_1$ | | 38948182 | | 3.044E-14 | | 88.3 (116) |
| 15 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p^3S_0$ | | 38959487 | | 3.083E-14 | | 76.8 (117) |
| 15 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s^3S_1$ | | 39881941 | | 1.100E-13 | | 74.5 (118) |
| 15 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2s4p^1P_1$ | | 39889458 | | 5.401E-14 | | 46.7 (119) 38.7 (150) 10.1 (127) |
| 15 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s^1S_0$ | | 39894356 | | 1.243E-13 | | 74.6 (120) |
| 15 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s^3P_0$ | | 39896631 | | 5.117E-14 | | 57.3 (121) 41.3 (126) 1.35 (161) |
| 15 | 122 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p^3P_1$ | | 39899723 | | 8.160E-14 | | 62.3 (122) 27.6 (127) 5.41 (119) |
| 15 | 123 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p^3D_1$ | | 39901845 | | 3.356E-14 | | 70.0 (123) 17.4 (135) 12.7 (129) |
| 15 | 124 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p^3P_2$ | | 39902511 | | 1.124E-13 | | 79.6 (124) |
| 15 | 125 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p^3D_2$ | | 39907053 | | 3.844E-14 | | 63.9 (125) 27.8 (136) 5.08 (155) |
| 15 | 126 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p^3P_0$ | | 39909005 | | 5.292E-14 | | 47.7 (126) 40.8 (121) 11.5 (161) |
| 15 | 127 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s^3P_1$ | | 39912439 | | 4.285E-14 | | 56.6 (127) 24.8 (122) 10.9 (159) |
| 15 | 128 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d^3D_3$ | | 39914300 | | 6.582E-14 | | 59.6 (128) 38.2 (140) 2.18 (163) |
| 15 | 129 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p^1P_1$ | | 39914811 | | 3.175E-14 | | 66.8 (129) 14.7 (137) 7.59 (135) |
| 15 | 130 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d^3F_2$ | | 39918391 | | 3.324E-14 | | 70.2 (130) 16.8 (138) 6.78 (146) |
| 15 | 131 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s^3P_2$ | | 39920310 | | 3.148E-14 | | 72.7 (131) |
| 15 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d^1D_2$ | | 39922726 | | 7.164E-14 | | 35.8 (132) 30.2 (155) 26.2 (136) |
| 15 | 133 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p^3P_0$ | | 39923278 | | 2.949E-14 | | 95.1 (133) |
| 15 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d^3F_3$ | | 39924031 | | 3.613E-14 | | 73.4 (134) |
| 15 | 135 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d^3D_1$ | | 39925627 | | 5.587E-14 | | 49.8 (135) 36.7 (137) 6.64 (123) |
| 15 | 136 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d^3D_2$ | | 39930056 | | 7.558E-14 | | 37.0 (136) 27.1 (132) 22.3 (125) |
| 15 | 137 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p^3P_1$ | | 39931282 | | 3.687E-14 | | 38.2 (137) 23.7 (135) 20.4 (123) |
| 15 | 138 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d^1D_2$ | | 39931321 | | 3.391E-14 | | 58.0 (138) 14.7 (152) 9.08 (131) |
| 15 | 139 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f^3F_4$ | | 39932186 | | 6.972E-14 | | 55.2 (139) 44.8 (153) |
| 15 | 140 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p^3D_3$ | | 39934589 | | 3.960E-14 | | 56.1 (140) 28.0 (128) 7.91 (163) |
| 15 | 141 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d^3D_1$ | | 39935041 | | 3.089E-14 | | 73.7 (141) |
| 15 | 142 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p^3P_2$ | | 39936117 | | 3.021E-14 | | 79.2 (142) |
| 15 | 143 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f^3G_3$ | | 39936283 | | 3.072E-14 | | 63.8 (143) 23.9 (156) 12.3 (147) |
| 15 | 144 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f^3G_4$ | | 39937372 | | 3.066E-14 | | 38.4 (144) 37.7 (157) 24.0 (162) |
| 15 | 145 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f^3F_2$ | | 39938215 | | 3.164E-14 | | 69.8 (145) 15.7 (167) 10.1 (164) |
| 15 | 146 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f^3F_2$ | | 39938311 | | 1.159E-13 | | 76.3 (146) |
| 15 | 147 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f^3F_3$ | | 39938534 | | 3.373E-14 | | 39.1 (147) 24.0 (156) 20.9 (163) |
| 15 | 148 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f^3F_3$ | | 39938850 | | 1.301E-13 | | 78.9 (148) |
| 15 | 149 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f^1F_3$ | | 39940132 | | 1.334E-12 | | 100. (149) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 15 | 150 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s^1P_1$ | | 39942177 | | 4.167E-14 | | 52.8 (150) 30.8 (119) 11.4 (141) |
| 15 | 151 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p^3S_1$ | | 39942639 | | 3.435E-14 | | 68.4 (151) 19.7 (118) 10.2 (137) |
| 15 | 152 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d^3D_2$ | | 39943771 | | 3.502E-14 | | 44.4 (152) 20.3 (138) 16.2 (130) |
| 15 | 153 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d^3F_4$ | | 39944006 | | 5.402E-14 | | 55.4 (153) 44.6 (139) |
| 15 | 154 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^3D_3$ | | 39947125 | | 3.204E-14 | | 73.9 (154) |
| 15 | 155 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p^1D_2$ | | 39951944 | | 4.088E-14 | | 58.2 (155) 34.2 (132) 3.01 (142) |
| 15 | 156 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f^1F_3$ | | 39953141 | | 3.080E-14 | | 36.3 (156) 35.9 (143) 27.8 (147) |
| 15 | 157 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^3F_4$ | | 39953855 | | 3.080E-14 | | 60.5 (157) 33.9 (144) 5.62 (162) |
| 15 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d^3P_2$ | | 39954327 | | 3.321E-14 | | 64.0 (158) 18.4 (152) 10.7 (124) |
| 15 | 159 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d^3P_1$ | | 39955731 | | 3.324E-14 | | 74.6 (159) |
| 15 | 160 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | | 39956551 | | 3.077E-14 | | 100. (160) |
| 15 | 161 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d^3P_0$ | | 39956846 | | 3.330E-14 | | 87.2 (161) |
| 15 | 162 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^1G_4$ | | 39957891 | | 3.076E-14 | | 70.4 (162) 27.7 (144) 1.92 (157) |
| 15 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^3D_3$ | | 39958144 | | 3.117E-14 | | 69.1 (163) 17.2 (147) 11.9 (156) |
| 15 | 164 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | | 39958558 | | 3.094E-14 | | 42.6 (164) 28.6 (167) 27.3 (145) |
| 15 | 165 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | | 39962186 | | 3.115E-14 | | 98.0 (165) |
| 15 | 166 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d^1F_3$ | | 39962247 | | 2.954E-14 | | 91.8 (166) |
| 15 | 167 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | | 39963210 | | 3.084E-14 | | 54.0 (167) 44.8 (164) 1.26 (155) |
| 15 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | | 39968368 | | 3.214E-14 | | 83.4 (168) |
| 15 | 169 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | | 39971709 | | 3.415E-14 | | 76.4 (169) |
| 15 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | | 40395489 | | 1.251E-13 | | 74.5 (170) |
| 15 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2s5p^1P_1$ | | 40399087 | | 5.315E-14 | | 38.7 (171) 31.5 (210) 23.1 (179) |
| 15 | 172 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | | 40401015 | | 1.235E-13 | | 73.3 (172) |
| 15 | 173 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | | 40401541 | | 5.075E-14 | | 61.4 (173) 38.6 (178) |
| 15 | 174 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | | 40404407 | | 1.276E-13 | | 65.1 (174) 14.0 (171) 13.5 (179) |
| 15 | 175 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | | 40404964 | | 3.621E-14 | | 69.9 (175) 18.1 (186) 12.0 (182) |
| 15 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | | 40405580 | | 1.446E-13 | | 80.9 (176) |
| 15 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | | 40408078 | | 4.192E-14 | | 51.8 (177) 26.4 (183) 12.1 (215) |
| 15 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | | 40409876 | | 6.321E-14 | | 55.0 (178) 38.1 (173) 6.85 (220) |
| 15 | 179 | $2s_{1/2}5p_{3/2}(J=1)$ | $2p5s^3P_1$ | | 40412767 | | 5.180E-14 | | 50.2 (179) 22.6 (174) 21.7 (171) |
| 15 | 180 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | | 40413145 | | 3.450E-14 | | 72.9 (180) |
| 15 | 181 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | | 40413197 | | 1.615E-13 | | 82.8 (181) |
| 15 | 182 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^1P_1$ | | 40413302 | | 3.580E-14 | | 40.4 (182) 33.0 (207) 11.9 (170) |
| 15 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | | 40415799 | | 1.180E-13 | | 45.2 (183) 29.7 (188) 15.6 (215) |
| 15 | 184 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | | 40416690 | | 3.858E-14 | | 57.3 (184) 19.4 (198) 13.1 (214) |
| 15 | 185 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | | 40416983 | | 3.325E-14 | | 85.7 (185) |
| 15 | 186 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | | 40417514 | | 9.830E-14 | | 72.2 (186) 12.7 (175) 12.6 (207) |
| 15 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | | 40418755 | | 3.263E-14 | | 27.1 (187) 23.1 (216) 21.5 (213) |
| 15 | 188 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | | 40420614 | | 1.047E-13 | | 53.0 (188) 21.0 (183) 19.5 (177) |
| 15 | 189 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | | 40421463 | | 3.159E-13 | | 90.6 (189) |
| 15 | 190 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | | 40421637 | | 3.122E-14 | | 69.8 (190) 19.3 (217) 9.71 (224) |
| 15 | 191 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | | 40422135 | | 3.176E-14 | | 66.3 (191) 14.1 (236) 11.3 (219) |
| 15 | 192 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | | 40422331 | | 3.124E-14 | | 41.2 (192) 29.7 (218) 27.8 (225) |
| 15 | 193 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | | 40423146 | | 3.172E-14 | | 38.7 (193) 34.2 (224) 21.9 (217) |
| 15 | 194 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | | 40423159 | | 2.015E-13 | | 86.7 (194) |
| 15 | 195 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | | 40423173 | | 3.089E-14 | | 70.0 (195) 17.4 (222) 12.6 (228) |
| 15 | 196 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | | 40423269 | | 3.197E-14 | | 57.7 (196) 23.2 (235) 15.5 (226) |
| 15 | 197 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | | 40423279 | | 3.088E-14 | | 38.3 (197) 31.7 (229) 30.0 (223) |
| 15 | 198 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^3F_3$ | | 40423443 | | 8.584E-14 | | 65.3 (198) 7.60 (199) 7.35 (184) |
| 15 | 199 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | | 40423664 | | 3.562E-14 | | 42.5 (199) 25.2 (227) 18.6 (233) |
| 15 | 200 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | | 40423742 | | 3.148E-14 | | 49.7 (200) 27.5 (228) 20.6 (222) |
| 15 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | | 40424222 | | 1.713E-12 | | 100. (201) |
| 15 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | | 40424255 | | 2.038E-12 | | 70.7 (202) 29.3 (205) |
| 15 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | | 40424265 | | 1.422E-12 | | 100. (203) |
| 15 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | | 40424308 | | 4.536E-12 | | 100. (204) |
| 15 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | | 40424375 | | 2.287E-12 | | 72.5 (205) |
| 15 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | | 40425346 | | 3.365E-14 | | 69.8 (206) 10.1 (216) 10.1 (213) |
| 15 | 207 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | | 40427379 | | 3.075E-14 | | 42.4 (182) 33.8 (207) 17.8 (175) |
| 15 | 208 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | | 40429083 | | 3.394E-14 | | 86.0 (208) |
| 15 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^3P_2$ | | 40430399 | | 3.068E-14 | | 72.1 (209) 22.0 (177) 2.72 (183) |
| 15 | 210 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | | 40431022 | | 3.829E-14 | | 62.7 (210) 21.1 (171) 12.6 (179) |
| 15 | 211 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^3S_1$ | | 40433361 | | 3.308E-14 | | 66.5 (211) 18.7 (207) 12.2 (170) |
| 15 | 212 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | | 40433773 | | 3.336E-14 | | 92.0 (212) |
| 15 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^1D_2$ | | 40434112 | | 3.143E-14 | | 45.4 (213) 28.6 (216) 19.5 (180) |
| 15 | 214 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d^3D_3$ | | 40436106 | | 3.110E-14 | | 67.4 (214) 28.5 (184) 2.44 (231) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 15 | 215 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | | 40436314 | | 3.359E-14 | | 68.1 (215) 13.3 (188) 10.9 (209) |
| 15 | 216 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | | 40439171 | | 3.206E-14 | | 55.1 (187) 32.2 (216) 5.47 (176) |
| 15 | 217 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 40439444 | | 3.095E-14 | | 41.7 (217) 29.2 (190) 29.1 (224) |
| 15 | 218 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 40439832 | | 3.095E-14 | | 66.6 (218) 30.4 (192) 3.05 (225) |
| 15 | 219 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 40439906 | | 3.223E-14 | | 70.2 (219) 20.7 (191) 5.78 (174) |
| 15 | 220 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 40440552 | | 3.243E-14 | | 93.1 (220) |
| 15 | 221 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 40440973 | | 3.083E-14 | | 100. (221) |
| 15 | 222 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^1G_4$ | | 40441183 | | 3.107E-14 | | 37.8 (222) 32.3 (228) 29.9 (195) |
| 15 | 223 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 40441274 | | 3.107E-14 | | 70.0 (223) 18.0 (197) 12.0 (229) |
| 15 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 40441569 | | 3.108E-14 | | 57.2 (213) 26.3 (224) 16.5 (217) |
| 15 | 225 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 40441824 | | 3.083E-14 | | 68.6 (225) 28.1 (192) 3.26 (218) |
| 15 | 226 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 40441849 | | 3.098E-14 | | 40.1 (196) 38.9 (226) 21.0 (235) |
| 15 | 227 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^1F_3$ | | 40442030 | | 3.103E-14 | | 51.0 (199) 26.7 (227) 22.4 (233) |
| 15 | 228 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | | 40442104 | | 3.103E-14 | | 49.0 (200) 27.2 (228) 23.8 (222) |
| 15 | 229 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 40442256 | | 3.097E-14 | | 56.3 (229) 43.7 (197) |
| 15 | 230 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 40442319 | | 3.097E-14 | | 100. (230) |
| 15 | 231 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 40442893 | | 3.034E-14 | | 81.7 (231) |
| 15 | 232 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 40443529 | | 3.095E-14 | | 100. (232) |
| 15 | 233 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^3F_3$ | | 40443638 | | 3.093E-14 | | 55.2 (233) 43.4 (227) 1.42 (231) |
| 15 | 234 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 40443788 | | 3.108E-14 | | 98.7 (234) |
| 15 | 235 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 40444480 | | 3.091E-14 | | 54.3 (235) 43.5 (226) 1.15 (196) |
| 15 | 236 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 40445768 | | 3.174E-14 | | 78.4 (236) |
| 15 | 237 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 40446047 | | 3.383E-14 | | 76.5 (237) |
| 15 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 40670988 | | 1.247E-13 | | 74.1 (238) |
| 15 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 40672695 | | 5.004E-14 | | 32.3 (239) 31.8 (250) 27.6 (285) |
| 15 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 40673847 | | 4.859E-14 | | 64.7 (240) 35.3 (246) |
| 15 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 40673869 | | 1.071E-13 | | 69.9 (241) 19.6 (314) 10.4 (254) |
| 15 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 40676022 | | 3.721E-14 | | 69.4 (242) 17.6 (253) 11.4 (283) |
| 15 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 40676257 | | 1.709E-13 | | 64.9 (243) 18.9 (250) 5.47 (239) |
| 15 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 40676653 | | 1.469E-13 | | 80.0 (244) |
| 15 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 40677924 | | 4.222E-14 | | 45.7 (245) 23.2 (251) 17.3 (290) |
| 15 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 40679482 | | 7.668E-14 | | 62.4 (246) 34.1 (240) 3.58 (295) |
| 15 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 40680634 | | 3.473E-14 | | 71.9 (247) 14.2 (289) 9.66 (268) |
| 15 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 40681322 | | 3.917E-14 | | 36.4 (248) 27.1 (283) 19.4 (238) |
| 15 | 249 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 40681394 | | 2.429E-13 | | 87.2 (249) |
| 15 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 40681584 | | 6.627E-14 | | 38.1 (239) 33.9 (250) 22.0 (243) |
| 15 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 40682526 | | 1.505E-13 | | 56.7 (251) 23.2 (257) 8.70 (290) |
| 15 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 40682907 | | 3.858E-14 | | 48.9 (252) 19.3 (272) 15.9 (291) |
| 15 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 40683507 | | 1.274E-13 | | 78.7 (253) |
| 15 | 254 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 40683713 | | 3.779E-14 | | 73.4 (254) |
| 15 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 40684618 | | 3.626E-14 | | 30.9 (255) 28.4 (292) 21.2 (289) |
| 15 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 40685280 | | 3.120E-14 | | 71.9 (256) 17.0 (294) 9.66 (300) |
| 15 | 257 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 40685599 | | 1.428E-13 | | 67.0 (257) 14.3 (245) 13.8 (251) |
| 15 | 258 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 40685702 | | 3.117E-14 | | 41.5 (258) 30.0 (301) 27.1 (296) |
| 15 | 259 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 40685786 | | 3.383E-13 | | 90.3 (259) |
| 15 | 260 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 40686090 | | 3.349E-14 | | 58.0 (260) 18.0 (321) 13.2 (293) |
| 15 | 261 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 40686177 | | 3.050E-14 | | 71.8 (261) 16.2 (298) 12.1 (309) |
| 15 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 40686244 | | 3.049E-14 | | 39.2 (262) 32.5 (306) 28.3 (299) |
| 15 | 263 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 40686339 | | 3.015E-14 | | 71.5 (263) 15.9 (303) 12.6 (313) |
| 15 | 264 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 40686373 | | 3.015E-14 | | 38.5 (264) 33.0 (307) 28.5 (304) |
| 15 | 265 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 40686429 | | 3.340E-14 | | 42.6 (265) 29.4 (300) 19.5 (294) |
| 15 | 266 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 40686461 | | 3.282E-14 | | 49.9 (266) 26.1 (320) 17.3 (302) |
| 15 | 267 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 40686525 | | 3.402E-14 | | 39.9 (267) 26.9 (305) 20.4 (319) |
| 15 | 268 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 40686598 | | 2.438E-13 | | 89.1 (268) |
| 15 | 269 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 40686620 | | 3.083E-14 | | 42.3 (269) 32.1 (312) 25.6 (316) |
| 15 | 270 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 40686647 | | 3.313E-14 | | 49.8 (270) 24.2 (309) 18.4 (298) |
| 15 | 271 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 40686654 | | 3.083E-14 | | 57.7 (271) 23.4 (313) 18.9 (303) |
| 15 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 40686734 | | 1.016E-13 | | 71.4 (272) 6.39 (252) 5.91 (267) |
| 15 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 40687207 | | 2.857E-12 | | 100. (273) |
| 15 | 274 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 40687223 | | 2.174E-12 | | 77.5 (274) |
| 15 | 275 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 40687228 | | 1.429E-12 | | 100. (275) |
| 15 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 40687247 | | 5.605E-12 | | 100. (276) |
| 15 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 40687301 | | 2.805E-12 | | 80.0 (277) |
| 15 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 40687359 | | 7.955E-12 | | 56.3 (278) 43.7 (280) |
| 15 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 40687359 | | 7.012E-12 | | 100. (279) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 15 | 280 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h^1H_5$ | | 40687394 | | 7.179E-12 | | 56.4 (280) 43.6 (278) |
| 15 | 281 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h^3H_6$ | | 40687394 | | 8.082E-12 | | 100. (281) |
| 15 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s^3P_2$ | | 40694948 | | 3.195E-14 | | 93.0 (282) |
| 15 | 283 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p^1P_1$ | | 40696463 | | 3.067E-14 | | 54.8 (283) 25.1 (248) 16.9 (242) |
| 15 | 284 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p^3D_3$ | | 40697210 | | 3.148E-14 | | 95.7 (284) |
| 15 | 285 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s^1P_1$ | | 40697302 | | 3.472E-14 | | 66.5 (285) 22.4 (239) 11.1 (250) |
| 15 | 286 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p^3P_2$ | | 40698138 | | 3.077E-14 | | 63.5 (286) 30.1 (245) 5.17 (290) |
| 15 | 287 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p^3S_1$ | | 40699353 | | 3.206E-14 | | 64.0 (287) 26.2 (248) 7.12 (238) |
| 15 | 288 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d^3F_4$ | | 40700153 | | 3.156E-14 | | 98.0 (288) |
| 15 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d^1D_2$ | | 40700378 | | 3.120E-14 | | 54.9 (289) 20.0 (292) 20.0 (247) |
| 15 | 290 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p^1D_2$ | | 40700933 | | 3.148E-14 | | 67.7 (290) 20.4 (286) 7.52 (245) |
| 15 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d^3D_3$ | | 40701509 | | 3.106E-14 | | 61.8 (291) 35.2 (252) 3.00 (311) |
| 15 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d^3D_2$ | | 40702980 | | 3.144E-14 | | 49.4 (292) 40.4 (292) 4.30 (289) |
| 15 | 293 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d^3P_1$ | | 40703336 | | 3.154E-14 | | 68.7 (293) 26.6 (260) 3.16 (243) |
| 15 | 294 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f^1F_3$ | | 40703496 | | 3.095E-14 | | 44.1 (294) 29.0 (300) 27.0 (256) |
| 15 | 295 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d^3P_0$ | | 40703656 | | 3.167E-14 | | 96.0 (295) |
| 15 | 296 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f^3F_4$ | | 40703721 | | 3.094E-14 | | 68.2 (296) 29.7 (258) 2.10 (301) |
| 15 | 297 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f^3G_5$ | | 40704261 | | 3.061E-14 | | 100. (297) |
| 15 | 298 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g^3G_4$ | | 40704496 | | 3.087E-14 | | 38.9 (298) 32.9 (309) 28.1 (261) |
| 15 | 299 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g^3G_5$ | | 40704551 | | 3.087E-14 | | 71.7 (299) 17.8 (262) 10.5 (306) |
| 15 | 300 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f^3F_3$ | | 40704613 | | 3.100E-14 | | 51.3 (265) 30.5 (300) 18.2 (294) |
| 15 | 301 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f^1G_4$ | | 40704750 | | 3.061E-14 | | 67.4 (301) 28.3 (258) 4.30 (296) |
| 15 | 302 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f^3D_2$ | | 40704790 | | 3.099E-14 | | 45.7 (266) 37.1 (302) 17.2 (320) |
| 15 | 303 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h^1H_5$ | | 40704832 | | 3.070E-14 | | 37.8 (303) 33.8 (313) 28.4 (263) |
| 15 | 304 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h^3H_6$ | | 40704865 | | 3.070E-14 | | 71.5 (304) 17.2 (264) 11.3 (307) |
| 15 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g^3F_3$ | | 40704999 | | 3.098E-14 | | 48.4 (267) 20.7 (305) 20.4 (319) |
| 15 | 306 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g^1H_5$ | | 40705000 | | 3.022E-14 | | 57.0 (306) 43.0 (262) |
| 15 | 307 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h^1I_6$ | | 40705020 | | 2.961E-14 | | 55.7 (307) 44.3 (264) |
| 15 | 308 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g^3H_6$ | | 40705028 | | 3.022E-14 | | 100. (308) |
| 15 | 309 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g^3G_4$ | | 40705052 | | 3.100E-14 | | 45.8 (270) 29.1 (309) 25.1 (298) |
| 15 | 310 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h^3I_7$ | | 40705054 | | 2.961E-14 | | 100. (310) |
| 15 | 311 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d^1F_3$ | | 40705109 | | 3.062E-14 | | 68.0 (311) 14.7 (291) 7.31 (252) |
| 15 | 312 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h^1G_4$ | | 40705123 | | 3.099E-14 | | 57.7 (269) 22.8 (312) 19.5 (316) |
| 15 | 313 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h^3H_5$ | | 40705155 | | 3.100E-14 | | 42.3 (271) 30.2 (313) 27.5 (303) |
| 15 | 314 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p^1S_0$ | | 40705473 | | 3.291E-14 | | 74.2 (314) |
| 15 | 315 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h^3G_3$ | | 40705644 | | 3.079E-14 | | 100. (315) |
| 15 | 316 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h^3G_4$ | | 40705676 | | 3.079E-14 | | 54.9 (316) 45.1 (312) |
| 15 | 317 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g^3F_2$ | | 40705885 | | 3.085E-14 | | 100. (317) |
| 15 | 318 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f^3D_1$ | | 40705886 | | 3.091E-14 | | 100. (318) |
| 15 | 319 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g^3F_3$ | | 40705951 | | 3.087E-14 | | 55.9 (319) 44.1 (305) |
| 15 | 320 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f^1D_2$ | | 40706339 | | 3.090E-14 | | 54.7 (320) 43.6 (302) 1.70 (266) |
| 15 | 321 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d^1P_1$ | | 40706537 | | 3.126E-14 | | 74.2 (321) |
| 16 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2^1S_0$ | 0 | 0 | | | | 100. (1) |
| 16 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s^3S_1$ | 19602076 | 19601811 | | 7.063E-07 | | 100. (2) |
| 16 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p^3P_0$ | 19734314 | 19734164 | | 5.547E-09 | | 100. (3) |
| 16 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p^3P_1$ | 19737521 | 19737387 | | 1.711E-12 | | 100. (4) |
| 16 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s^1S_0$ | 19745473 | 19745276 | | 1.012E-03 | | 100. (5) |
| 16 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p^3P_2$ | 19750573 | 19750450 | | 2.668E-09 | | 100. (6) |
| 16 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p^1P_1$ | 19846285 | 19845969 | | 1.521E-14 | | 100. (7) |
| 16 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s^3S_1$ | 23193163 | 23192876 | | 2.496E-12 | | 100. (8) |
| 16 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p^3P_0$ | 23229571 | 23229261 | | 8.755E-13 | | 100. (9) |
| 16 | 10 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p^3P_1$ | 23230551 | 23230244 | | 7.566E-13 | | 100. (10) |
| 16 | 11 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s^1S_0$ | 23231087 | 23230575 | | 2.651E-12 | | 100. (11) |
| 16 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 23234429 | 23234124 | | 8.848E-13 | | 100. (12) |
| 16 | 13 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d^3D_1$ | 23254611 | 23254265 | | 2.984E-13 | | 100. (13) |
| 16 | 14 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 23254645 | 23254295 | | 2.999E-13 | | 79.8 (14) |
| 16 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 23256165 | 23255820 | | 2.996E-13 | | 100. (15) |
| 16 | 16 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 23257195 | 23256829 | | 3.063E-13 | | 79.8 (16) |
| 16 | 17 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 23260416 | 23260017 | | 5.223E-14 | | 100. (17) |
| 16 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s^3S_1$ | 24431101 | 24430813 | | 3.651E-12 | | 100. (18) |
| 16 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 24446163 | 24445790 | | 1.488E-12 | | 100. (19) |
| 16 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 24446439 | 24446115 | | 3.849E-12 | | 100. (20) |
| 16 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 24446570 | 24446208 | | 1.335E-12 | | 99.0 (21) |
| 16 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 24448199 | 24447845 | | 1.501E-12 | | 100. (22) |
| 16 | 23 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d^3D_1$ | 24456527 | 24456114 | | 6.927E-13 | | 100. (23) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|------------------------------------|
| 16 | 24 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 24456527 | 24456153 | | 6.965E-13 | | 83.7 (24) |
| 16 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 24457176 | 24456770 | | 6.956E-13 | | 100. (25) |
| 16 | 26 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | 24457889 | 24457269 | | 1.429E-12 | | 56.8 (26) 43.2 (30) |
| 16 | 27 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | 24457576 | 24457314 | | 7.171E-13 | | 83.7 (27) |
| 16 | 28 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | 24457889 | 24457327 | | 1.429E-12 | | 100. (28) |
| 16 | 29 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | 24457889 | 24457659 | | 1.430E-12 | | 100. (29) |
| 16 | 30 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | 24457889 | 24457706 | | 1.431E-12 | | 56.8 (30) 43.2 (26) |
| 16 | 31 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 24458842 | 24458444 | | 1.241E-13 | | 99.0 (31) |
| 16 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 24999972 | 24999639 | | 5.741E-12 | | 100. (32) |
| 16 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 25007589 | 25007216 | | 2.528E-12 | | 100. (33) |
| 16 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 25007605 | 25007328 | | 6.039E-12 | | 100. (34) |
| 16 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 25007798 | 25007430 | | 2.299E-12 | | 98.9 (35) |
| 16 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 25008632 | 25008268 | | 2.547E-12 | | 100. (36) |
| 16 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | 25012870 | 25012449 | | 1.331E-12 | | 100. (37) |
| 16 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | 25012870 | 25012474 | | 1.338E-12 | | 85.0 (38) |
| 16 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | 25013202 | 25012785 | | 1.336E-12 | | 100. (39) |
| 16 | 40 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | 25013562 | 25013064 | | 2.762E-12 | | 57.3 (40) 42.7 (45) |
| 16 | 41 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | 25013407 | 25013089 | | 1.383E-12 | | 85.0 (41) |
| 16 | 42 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | 25013562 | 25013093 | | 2.761E-12 | | 100. (42) |
| 16 | 43 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | 25013562 | 25013262 | | 2.765E-12 | | 100. (43) |
| 16 | 44 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | 25013723 | 25013272 | | 4.637E-12 | | 54.8 (44) 45.2 (48) |
| 16 | 45 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | 25013562 | 25013288 | | 2.769E-12 | | 57.3 (45) 42.7 (40) |
| 16 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | 25013723 | 25013290 | | 4.638E-12 | | 100. (46) |
| 16 | 47 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | 25013723 | 25013392 | | 4.640E-12 | | 100. (47) |
| 16 | 48 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | 25013723 | 25013406 | | 4.641E-12 | | 54.8 (48) 45.2 (44) |
| 16 | 49 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 25014007 | 25013617 | | 2.423E-13 | | 98.9 (49) |
| 16 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | 25307614 | 25307291 | | 9.031E-12 | | 100. (50) |
| 16 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | 25312007 | 25311643 | | 4.125E-12 | | 100. (51) |
| 16 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | 25312000 | 25311696 | | 8.848E-12 | | 100. (52) |
| 16 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | 25312128 | 25311768 | | 3.767E-12 | | 98.9 (53) |
| 16 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | 25312610 | 25312253 | | 4.154E-12 | | 100. (54) |
| 16 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | 25315047 | 25314648 | | 2.292E-12 | | 100. (55) |
| 16 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | 25315047 | 25314664 | | 2.300E-12 | | 85.6 (56) |
| 16 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | 25315239 | 25314842 | | 2.304E-12 | | 100. (57) |
| 16 | 58 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | 25315445 | 25315002 | | 4.722E-12 | | 57.6 (58) 42.4 (64) |
| 16 | 59 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | 25315445 | 25315018 | | 4.720E-12 | | 100. (59) |
| 16 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | 25315357 | 25315026 | | 2.344E-12 | | 85.6 (60) |
| 16 | 61 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | 25315445 | 25315116 | | 4.727E-12 | | 100. (61) |
| 16 | 62 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | 25315534 | 25315117 | | 7.957E-12 | | 54.8 (62) 45.2 (68) |
| 16 | 63 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | 25315534 | 25315128 | | 7.958E-12 | | 100. (63) |
| 16 | 64 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | 25315445 | 25315131 | | 4.733E-12 | | 57.6 (64) 42.4 (58) |
| 16 | 65 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | 25315589 | 25315186 | | 1.200E-11 | | 54.0 (65) 46.0 (70) |
| 16 | 66 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | 25315534 | 25315187 | | 7.963E-12 | | 100. (66) |
| 16 | 67 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | 25315589 | 25315192 | | 1.200E-11 | | 100. (67) |
| 16 | 68 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | 25315534 | 25315195 | | 7.963E-12 | | 54.8 (68) 45.2 (62) |
| 16 | 69 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | 25315589 | 25315232 | | 1.200E-11 | | 100. (69) |
| 16 | 70 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | 25315589 | 25315237 | | 1.200E-11 | | 54.0 (70) 46.0 (65) |
| 16 | 71 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | 25315693 | 25315325 | | 4.179E-13 | | 98.9 (71) |
| 16 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 40511800 | 40513195 | | 6.489E-14 | | 78.9 (72) |
| 16 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 40541800 | 40541993 | | 2.583E-14 | | 100. (73) |
| 16 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 40548200 | 40548803 | | 2.585E-14 | | 100. (74) |
| 16 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 40564200 | 40564740 | | 2.594E-14 | | 100. (75) |
| 16 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 40663600 | 40664056 | | 1.289E-14 | | 100. (76) |
| 16 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 40671900 | 40672442 | | 1.281E-14 | | 100. (77) |
| 16 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | 40684300 | 40685008 | | 1.282E-14 | | 96.7 (78) |
| 16 | 79 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | 40745200 | 40745558 | | 1.272E-14 | | 96.7 (79) |
| 16 | 80 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 40748400 | 40750090 | | 2.464E-14 | | 100. (80) |
| 16 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | 40939100 | 40939773 | | 1.618E-14 | | 79.2 (81) |
| 16 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 44232445 | | 6.911E-14 | | 73.6 (82) |
| 16 | 83 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p^1P_1$ | | 44249915 | | 3.626E-14 | | 48.7 (83) 44.5 (109) 4.00 (116) |
| 16 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 44272907 | | 9.112E-14 | | 76.7 (84) |
| 16 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 44280600 | | 3.465E-14 | | 62.1 (85) 37.9 (89) |
| 16 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 44281961 | | 2.125E-14 | | 70.7 (86) 16.3 (92) 13.1 (101) |
| 16 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 44285097 | | 4.674E-14 | | 61.6 (87) 34.8 (91) 3.59 (112) |
| 16 | 88 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 44291052 | | 6.343E-14 | | 81.8 (88) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 16 | 89 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | | 44292691 | | 3.730E-14 | | 50.9 (89) 35.1 (85) 14.1 (113) |
| 16 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | | 44293168 | | 2.307E-14 | | 78.3 (90) |
| 16 | 91 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s\ ^3P_1$ | | 44297777 | | 2.961E-14 | | 58.3 (91) 26.4 (87) 12.9 (112) |
| 16 | 92 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^1P_1$ | | 44303605 | | 2.030E-14 | | 80.5 (92) |
| 16 | 93 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 44305523 | | 2.627E-14 | | 67.3 (93) 32.7 (104) |
| 16 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 44308715 | | 2.417E-14 | | 87.1 (94) |
| 16 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 44329692 | | 2.439E-14 | | 82.0 (95) |
| 16 | 96 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 44340518 | | 2.448E-14 | | 96.9 (96) |
| 16 | 97 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 44340692 | | 1.951E-14 | | 98.1 (97) |
| 16 | 98 | $2s_{1/2}3d_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 44344690 | | 3.400E-14 | | 35.2 (98) 24.5 (114) 20.4 (102) |
| 16 | 99 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | | 44344929 | | 2.265E-14 | | 78.5 (99) |
| 16 | 100 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^1D_2$ | | 44349085 | | 2.386E-14 | | 79.1 (100) |
| 16 | 101 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 44350700 | | 5.505E-14 | | 68.2 (101) 17.5 (86) 12.8 (99) |
| 16 | 102 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^3D_2$ | | 44353905 | | 5.686E-14 | | 57.3 (102) 20.1 (90) 11.3 (114) |
| 16 | 103 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 44354168 | | 2.472E-14 | | 100. (103) |
| 16 | 104 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 44357060 | | 5.583E-14 | | 67.4 (104) 32.6 (93) |
| 16 | 105 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^3P_2$ | | 44358965 | | 2.187E-14 | | 79.8 (105) |
| 16 | 106 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^3S_1$ | | 44365270 | | 2.484E-14 | | 69.0 (106) 23.2 (82) 7.80 (99) |
| 16 | 107 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 44372916 | | 2.214E-14 | | 85.2 (107) |
| 16 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^3D_2$ | | 44379078 | | 2.196E-14 | | 88.9 (108) |
| 16 | 109 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 44382574 | | 3.170E-14 | | 50.2 (109) 37.2 (83) 9.16 (107) |
| 16 | 110 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3D_3$ | | 44385171 | | 2.160E-14 | | 95.4 (110) |
| 16 | 111 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 44406559 | | 2.538E-14 | | 74.0 (111) |
| 16 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 44408939 | | 2.522E-14 | | 80.3 (112) |
| 16 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 44410821 | | 2.521E-14 | | 85.3 (113) |
| 16 | 114 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 44411628 | | 3.544E-14 | | 53.2 (114) 46.8 (98) |
| 16 | 115 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^1F_3$ | | 44434793 | | 2.071E-14 | | 98.4 (115) |
| 16 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 44448417 | | 2.344E-14 | | 88.2 (116) |
| 16 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 44459648 | | 2.364E-14 | | 76.8 (117) |
| 16 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 45525676 | | 8.728E-14 | | 75.0 (118) |
| 16 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2s4p\ ^1P_1$ | | 45533825 | | 4.078E-14 | | 45.4 (119) 37.3 (150) 13.2 (127) |
| 16 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 45538836 | | 9.540E-14 | | 74.9 (120) |
| 16 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 45540894 | | 3.881E-14 | | 58.6 (121) 40.3 (126) 1.10 (160) |
| 16 | 122 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 45544815 | | 6.781E-14 | | 64.5 (122) 24.0 (127) 6.88 (119) |
| 16 | 123 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 45546550 | | 2.573E-14 | | 70.2 (123) 16.7 (135) 13.1 (129) |
| 16 | 124 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 45548069 | | 9.023E-14 | | 81.4 (124) |
| 16 | 125 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 45552965 | | 2.972E-14 | | 60.9 (125) 27.5 (132) 6.43 (155) |
| 16 | 126 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 45554594 | | 4.259E-14 | | 50.2 (126) 39.9 (121) 9.94 (160) |
| 16 | 127 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 45559169 | | 3.411E-14 | | 56.0 (127) 23.9 (122) 11.0 (119) |
| 16 | 128 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 45561834 | | 6.088E-14 | | 67.1 (128) 30.5 (142) 2.45 (162) |
| 16 | 129 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^1P_1$ | | 45561971 | | 2.515E-14 | | 58.9 (129) 19.5 (138) 8.23 (135) |
| 16 | 130 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 45564736 | | 2.581E-14 | | 74.1 (130) |
| 16 | 131 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 45569426 | | 2.397E-14 | | 70.7 (131) 16.8 (157) 5.65 (153) |
| 16 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 45569808 | | 6.147E-14 | | 33.5 (132) 33.2 (136) 25.8 (155) |
| 16 | 133 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 45570429 | | 2.316E-14 | | 92.5 (133) |
| 16 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 45571480 | | 2.802E-14 | | 70.0 (134) 14.8 (146) 9.70 (154) |
| 16 | 135 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 45572768 | | 5.347E-14 | | 59.9 (135) 25.6 (138) 8.89 (123) |
| 16 | 136 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 45578220 | | 6.264E-14 | | 35.2 (136) 32.1 (132) 22.8 (125) |
| 16 | 137 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^1D_2$ | | 45580302 | | 2.685E-14 | | 47.6 (137) 16.5 (153) 16.3 (131) |
| 16 | 138 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^3P_1$ | | 45581183 | | 2.538E-14 | | 41.8 (138) 23.4 (129) 18.7 (123) |
| 16 | 139 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 45581203 | | 7.787E-14 | | 69.4 (139) 30.6 (152) |
| 16 | 140 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 45583019 | | 2.384E-14 | | 71.6 (140) 10.3 (168) 8.23 (159) |
| 16 | 141 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 45583982 | | 2.382E-14 | | 59.7 (141) 29.4 (156) 5.02 (147) |
| 16 | 142 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 45584409 | | 2.589E-14 | | 45.1 (142) 19.9 (147) 13.7 (162) |
| 16 | 143 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 45585326 | | 2.370E-14 | | 39.3 (143) 35.5 (158) 25.2 (163) |
| 16 | 144 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 45586128 | | 2.362E-14 | | 62.3 (144) 17.2 (167) 12.1 (164) |
| 16 | 145 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 45586392 | | 1.147E-13 | | 82.7 (145) |
| 16 | 146 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 45586913 | | 1.104E-13 | | 80.9 (146) |
| 16 | 147 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | | 45587136 | | 2.811E-14 | | 27.1 (147) 20.7 (142) 18.4 (128) |
| 16 | 148 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^3P_2$ | | 45587358 | | 2.392E-14 | | 71.7 (148) 13.0 (125) 5.73 (132) |
| 16 | 149 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | | 45588270 | | 1.085E-12 | | 100. (149) |
| 16 | 150 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 45592423 | | 3.183E-14 | | 55.8 (150) 29.7 (119) 9.16 (140) |
| 16 | 151 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^3S_1$ | | 45593612 | | 2.587E-14 | | 68.2 (151) 17.2 (118) 12.6 (138) |
| 16 | 152 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 45594912 | | 3.380E-14 | | 69.6 (152) 30.4 (139) |
| 16 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^3D_2$ | | 45595214 | | 2.531E-14 | | 41.8 (153) 28.2 (137) 16.9 (130) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 16 | 154 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^3D_3$ | | 45599302 | | 2.419E-14 | | 73.8 (154) |
| 16 | 155 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 45603205 | | 2.940E-14 | | 61.8 (155) 28.6 (136) 4.83 (148) |
| 16 | 156 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 45606150 | | 2.383E-14 | | 37.6 (156) 33.9 (141) 28.4 (147) |
| 16 | 157 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 45606727 | | 2.527E-14 | | 61.7 (157) 22.5 (153) 8.83 (124) |
| 16 | 158 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 45606985 | | 2.383E-14 | | 62.4 (158) 32.6 (143) 4.97 (163) |
| 16 | 159 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 45608208 | | 2.534E-14 | | 73.6 (159) |
| 16 | 160 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 45609485 | | 2.545E-14 | | 89.0 (160) |
| 16 | 161 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 45609968 | | 2.381E-14 | | 100. (161) |
| 16 | 162 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 45611295 | | 2.404E-14 | | 65.4 (162) 19.6 (147) 13.6 (156) |
| 16 | 163 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | | 45611431 | | 2.380E-14 | | 69.8 (163) 28.1 (143) 2.17 (158) |
| 16 | 164 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 45611695 | | 2.390E-14 | | 40.6 (164) 31.3 (144) 26.9 (167) |
| 16 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | | 45615596 | | 2.284E-14 | | 89.7 (165) |
| 16 | 166 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | | 45615801 | | 2.404E-14 | | 98.4 (166) |
| 16 | 167 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 45617012 | | 2.384E-14 | | 53.6 (167) 45.3 (164) 1.09 (155) |
| 16 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | | 45621854 | | 2.464E-14 | | 82.5 (168) |
| 16 | 169 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | | 45624657 | | 2.598E-14 | | 77.0 (169) |
| 16 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | | 46113078 | | 9.751E-14 | | 75.2 (170) |
| 16 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2s5p\ ^1P_1$ | | 46116850 | | 3.963E-14 | | 36.4 (171) 30.2 (209) 26.7 (180) |
| 16 | 172 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | | 46118904 | | 9.254E-14 | | 73.0 (172) |
| 16 | 173 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | | 46119243 | | 3.837E-14 | | 62.5 (173) 37.5 (178) |
| 16 | 174 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | | 46122731 | | 1.086E-13 | | 65.8 (174) 15.4 (171) 10.2 (180) |
| 16 | 175 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | | 46122944 | | 2.771E-14 | | 69.6 (175) 17.2 (186) 12.2 (207) |
| 16 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | | 46124033 | | 1.121E-13 | | 81.4 (176) |
| 16 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | | 46126629 | | 3.207E-14 | | 49.8 (177) 25.5 (183) 13.8 (214) |
| 16 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | | 46128428 | | 5.135E-14 | | 57.4 (178) 37.1 (173) 5.47 (220) |
| 16 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | | 46131905 | | 2.659E-14 | | 72.8 (179) |
| 16 | 180 | $2s_{1/2}5p_{3/2}(J=1)$ | $2p5s\ ^3P_1$ | | 46132037 | | 4.303E-14 | | 46.5 (180) 26.6 (171) 21.8 (174) |
| 16 | 181 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | | 46132377 | | 2.823E-14 | | 34.9 (181) 34.9 (207) 13.6 (170) |
| 16 | 182 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 46132514 | | 1.503E-13 | | 86.6 (182) |
| 16 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | | 46134983 | | 9.864E-14 | | 50.4 (183) 26.7 (188) 12.9 (214) |
| 16 | 184 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 46136012 | | 2.976E-14 | | 54.4 (184) 19.4 (198) 14.2 (215) |
| 16 | 185 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 46136394 | | 2.646E-14 | | 82.0 (185) |
| 16 | 186 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 46136683 | | 8.310E-14 | | 75.4 (186) |
| 16 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 46138615 | | 2.606E-14 | | 29.0 (187) 26.5 (216) 22.7 (213) |
| 16 | 188 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | | 46140429 | | 9.088E-14 | | 59.5 (188) 17.6 (177) 17.3 (183) |
| 16 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 46141076 | | 2.413E-14 | | 70.5 (189) 18.7 (217) 9.59 (224) |
| 16 | 190 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 46141238 | | 3.233E-13 | | 93.6 (190) |
| 16 | 191 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 46141773 | | 2.476E-14 | | 63.6 (191) 15.6 (237) 12.3 (218) |
| 16 | 192 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 46141894 | | 2.415E-14 | | 41.3 (192) 28.9 (219) 28.5 (226) |
| 16 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 46142765 | | 2.390E-14 | | 70.5 (193) 17.3 (222) 12.2 (228) |
| 16 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 46142817 | | 2.489E-14 | | 41.0 (194) 33.0 (224) 21.1 (217) |
| 16 | 195 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 46142833 | | 1.791E-13 | | 89.0 (195) |
| 16 | 196 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 46142882 | | 2.482E-14 | | 55.0 (196) 24.6 (235) 16.5 (225) |
| 16 | 197 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 46142902 | | 2.390E-14 | | 38.5 (197) 32.0 (229) 29.5 (223) |
| 16 | 198 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | | 46143087 | | 5.569E-14 | | 58.0 (198) 11.9 (199) 7.42 (227) |
| 16 | 199 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 46143290 | | 3.007E-14 | | 35.9 (199) 22.4 (227) 21.1 (198) |
| 16 | 200 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 46143382 | | 2.446E-14 | | 50.7 (200) 26.8 (228) 19.9 (222) |
| 16 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | | 46143959 | | 1.646E-12 | | 100. (201) |
| 16 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 46143991 | | 1.587E-12 | | 70.1 (202) 29.9 (205) |
| 16 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 46143999 | | 1.166E-12 | | 100. (203) |
| 16 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 46144067 | | 3.600E-12 | | 100. (204) |
| 16 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | | 46144141 | | 1.903E-12 | | 71.6 (205) 28.4 (202) |
| 16 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 46148336 | | 2.522E-14 | | 83.3 (206) |
| 16 | 207 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^1P_1$ | | 46150950 | | 2.343E-14 | | 47.0 (207) 31.3 (181) 17.3 (175) |
| 16 | 208 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 46152673 | | 2.503E-14 | | 90.8 (208) |
| 16 | 209 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 46154131 | | 2.848E-14 | | 64.8 (209) 17.3 (171) 15.8 (180) |
| 16 | 210 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^3P_2$ | | 46154202 | | 2.356E-14 | | 68.4 (210) 24.8 (177) 3.66 (214) |
| 16 | 211 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^3S_1$ | | 46157104 | | 2.504E-14 | | 66.3 (211) 20.8 (181) 9.80 (170) |
| 16 | 212 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 46157985 | | 2.506E-14 | | 95.2 (212) |
| 16 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | | 46158385 | | 2.416E-14 | | 49.6 (213) 25.7 (216) 19.8 (179) |
| 16 | 214 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | | 46160284 | | 2.494E-14 | | 69.3 (214) 15.2 (210) 9.37 (188) |
| 16 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | | 46160578 | | 2.396E-14 | | 65.3 (215) 30.7 (184) 2.77 (231) |
| 16 | 216 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | | 46163732 | | 2.455E-14 | | 53.4 (187) 35.2 (216) 4.44 (213) |
| 16 | 217 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 46164311 | | 2.396E-14 | | 42.2 (217) 29.3 (224) 28.5 (189) |
| 16 | 218 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 46164460 | | 2.467E-14 | | 69.4 (218) 23.0 (191) 4.48 (174) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 16 | 219 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 46164763 | | 2.395E-14 | | 67.0 (219) 30.3 (192) 2.68 (226) |
| 16 | 220 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 46165147 | | 2.484E-14 | | 94.5 (220) |
| 16 | 221 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 46166016 | | 2.388E-14 | | 100. (221) |
| 16 | 222 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^1G_4$ | | 46166221 | | 2.405E-14 | | 37.8 (222) 32.8 (228) 29.4 (193) |
| 16 | 223 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 46166341 | | 2.405E-14 | | 70.5 (223) 18.0 (197) 11.6 (229) |
| 16 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 46166532 | | 2.403E-14 | | 54.9 (194) 27.6 (224) 17.5 (217) |
| 16 | 225 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 46166809 | | 2.397E-14 | | 42.4 (196) 37.9 (225) 19.7 (235) |
| 16 | 226 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 46166958 | | 2.387E-14 | | 68.4 (226) 28.0 (192) 3.63 (219) |
| 16 | 227 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^1F_3$ | | 46167103 | | 2.402E-14 | | 52.3 (199) 25.7 (227) 22.1 (233) |
| 16 | 228 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | | 46167203 | | 2.402E-14 | | 47.7 (200) 27.6 (228) 24.7 (222) |
| 16 | 229 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 46167410 | | 2.398E-14 | | 56.5 (229) 43.5 (197) |
| 16 | 230 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 46167496 | | 2.398E-14 | | 100. (230) |
| 16 | 231 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 46167882 | | 2.347E-14 | | 80.2 (231) |
| 16 | 232 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 46168729 | | 2.396E-14 | | 100. (232) |
| 16 | 233 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^3F_3$ | | 46168866 | | 2.396E-14 | | 55.8 (233) 44.2 (227) |
| 16 | 234 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 46168920 | | 2.402E-14 | | 100. (234) |
| 16 | 235 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 46169726 | | 2.392E-14 | | 54.6 (235) 44.1 (225) 1.31 (196) |
| 16 | 236 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 46170540 | | 2.563E-14 | | 76.5 (236) |
| 16 | 237 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 46170794 | | 2.438E-14 | | 77.1 (237) |
| 16 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 46428426 | | 9.466E-14 | | 74.3 (238) |
| 16 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 46430163 | | 3.733E-14 | | 35.2 (239) 29.7 (250) 26.9 (284) |
| 16 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 46431282 | | 3.660E-14 | | 66.0 (240) 34.0 (246) |
| 16 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 46431454 | | 7.953E-14 | | 69.4 (241) 18.6 (312) 12.1 (254) |
| 16 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 46433620 | | 2.841E-14 | | 69.2 (242) 16.5 (253) 11.4 (283) |
| 16 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 46434110 | | 1.392E-13 | | 65.5 (243) 19.5 (250) 4.67 (293) |
| 16 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 46434556 | | 1.105E-13 | | 79.9 (244) |
| 16 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 46435830 | | 3.208E-14 | | 44.7 (245) 22.0 (251) 18.7 (290) |
| 16 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 46437453 | | 6.252E-14 | | 64.3 (246) 33.0 (240) 2.69 (294) |
| 16 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 46438667 | | 2.673E-14 | | 71.9 (247) 14.2 (289) 9.31 (269) |
| 16 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 46439499 | | 3.074E-14 | | 36.4 (248) 24.4 (283) 20.6 (238) |
| 16 | 249 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 46439722 | | 1.925E-13 | | 87.8 (249) |
| 16 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 46439923 | | 5.504E-14 | | 37.7 (250) 35.1 (239) 22.1 (243) |
| 16 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 46440826 | | 1.203E-13 | | 59.6 (251) 21.1 (258) 7.39 (290) |
| 16 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 46441244 | | 2.959E-14 | | 47.2 (252) 18.8 (272) 17.5 (308) |
| 16 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 46441813 | | 1.056E-13 | | 80.7 (253) |
| 16 | 254 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 46442161 | | 3.026E-14 | | 69.2 (254) 23.5 (241) 7.22 (312) |
| 16 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 46443110 | | 2.856E-14 | | 32.0 (255) 28.3 (292) 19.9 (289) |
| 16 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 46443695 | | 2.416E-14 | | 72.3 (256) |
| 16 | 257 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 46444193 | | 2.414E-14 | | 41.6 (257) 30.4 (302) 26.8 (296) |
| 16 | 258 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 46444228 | | 1.202E-13 | | 70.7 (258) 12.9 (245) 12.0 (251) |
| 16 | 259 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 46444378 | | 2.216E-13 | | 88.9 (259) |
| 16 | 260 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 46444613 | | 2.626E-14 | | 55.6 (260) 19.3 (321) 13.6 (293) |
| 16 | 261 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 46444690 | | 2.370E-14 | | 71.9 (261) 16.1 (298) 12.0 (307) |
| 16 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 46444776 | | 2.369E-14 | | 39.3 (262) 32.6 (306) 28.1 (299) |
| 16 | 263 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 46444875 | | 2.349E-14 | | 71.5 (263) 16.0 (303) 12.5 (314) |
| 16 | 264 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 46444921 | | 2.350E-14 | | 38.5 (264) 33.0 (309) 28.5 (304) |
| 16 | 265 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 46444962 | | 2.612E-14 | | 43.6 (265) 28.4 (300) 18.7 (295) |
| 16 | 266 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 46444970 | | 2.550E-14 | | 48.8 (266) 27.1 (320) 18.0 (301) |
| 16 | 267 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 46445040 | | 2.543E-14 | | 41.9 (267) 29.1 (319) 22.0 (305) |
| 16 | 268 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 46445144 | | 2.387E-14 | | 41.9 (268) 32.3 (313) 25.8 (316) |
| 16 | 269 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 46445172 | | 2.010E-13 | | 89.6 (269) |
| 16 | 270 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 46445184 | | 2.627E-14 | | 49.3 (270) 23.4 (307) 17.6 (298) |
| 16 | 271 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 46445189 | | 2.387E-14 | | 58.1 (271) 23.3 (314) 18.6 (303) |
| 16 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 46445316 | | 9.068E-14 | | 75.1 (272) |
| 16 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 46445852 | | 2.766E-12 | | 100. (273) |
| 16 | 274 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 46445868 | | 1.769E-12 | | 77.3 (274) |
| 16 | 275 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 46445870 | | 1.215E-12 | | 100. (275) |
| 16 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 46445904 | | 4.823E-12 | | 100. (276) |
| 16 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 46445964 | | 2.478E-12 | | 79.2 (277) |
| 16 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 46446022 | | 6.728E-12 | | 56.2 (278) 43.8 (281) |
| 16 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 46446023 | | 6.068E-12 | | 100. (279) |
| 16 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 46446068 | | 6.820E-12 | | 100. (280) |
| 16 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 46446068 | | 6.205E-12 | | 56.2 (281) 43.8 (278) |
| 16 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 46457922 | | 2.454E-14 | | 95.3 (282) |
| 16 | 283 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^1P_1$ | | 46459667 | | 2.363E-14 | | 56.4 (283) 24.0 (248) 16.7 (242) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 16 | 284 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s^1P_1$ | | 46460208 | | 2.603E-14 | | 67.2 (284) 24.9 (239) 7.89 (250) |
| 16 | 285 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p^3D_3$ | | 46460456 | | 2.403E-14 | | 97.2 (285) |
| 16 | 286 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p^3P_2$ | | 46461404 | | 2.371E-14 | | 60.0 (286) 33.0 (245) 6.97 (290) |
| 16 | 287 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p^3S_1$ | | 46462598 | | 2.440E-14 | | 64.3 (287) 27.3 (248) 5.31 (238) |
| 16 | 288 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d^3F_4$ | | 46463730 | | 2.430E-14 | | 98.8 (288) |
| 16 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d^3D_2$ | | 46463960 | | 2.411E-14 | | 56.4 (289) 20.0 (247) 18.7 (292) |
| 16 | 290 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p^1D_2$ | | 46464395 | | 2.401E-14 | | 65.6 (290) 24.6 (286) 7.03 (245) |
| 16 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d^3D_3$ | | 46465180 | | 2.401E-14 | | 60.0 (291) 36.8 (252) 3.22 (308) |
| 16 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d^3D_2$ | | 46466710 | | 2.420E-14 | | 48.7 (255) 41.8 (292) 4.51 (289) |
| 16 | 293 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d^3P_1$ | | 46467054 | | 2.426E-14 | | 68.5 (293) 27.8 (260) 2.30 (243) |
| 16 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d^3P_0$ | | 46467382 | | 2.434E-14 | | 97.0 (294) |
| 16 | 295 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f^1F_3$ | | 46467383 | | 2.399E-14 | | 44.3 (295) 29.1 (300) 26.7 (256) |
| 16 | 296 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f^3F_4$ | | 46467645 | | 2.398E-14 | | 68.2 (296) 30.0 (257) 1.85 (302) |
| 16 | 297 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f^3G_5$ | | 46468249 | | 2.379E-14 | | 100. (297) |
| 16 | 298 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g^1G_4$ | | 46468484 | | 2.395E-14 | | 38.7 (298) 33.3 (307) 28.0 (261) |
| 16 | 299 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g^3G_5$ | | 46468556 | | 2.395E-14 | | 71.8 (299) 18.0 (262) 10.1 (306) |
| 16 | 300 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f^3F_3$ | | 46468563 | | 2.400E-14 | | 50.0 (265) 31.2 (300) 18.8 (295) |
| 16 | 301 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f^3D_2$ | | 46468738 | | 2.400E-14 | | 47.0 (266) 36.7 (301) 16.3 (320) |
| 16 | 302 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f^1G_4$ | | 46468800 | | 2.381E-14 | | 67.3 (302) 28.0 (257) 4.69 (296) |
| 16 | 303 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h^1H_5$ | | 46468860 | | 2.385E-14 | | 37.5 (303) 34.2 (314) 28.4 (263) |
| 16 | 304 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h^3H_6$ | | 46468903 | | 2.385E-14 | | 71.5 (304) 17.2 (264) 11.2 (309) |
| 16 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g^3F_3$ | | 46468995 | | 2.397E-14 | | 40.6 (267) 18.8 (308) 17.8 (305) |
| 16 | 306 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g^1H_5$ | | 46469068 | | 2.358E-14 | | 57.3 (306) 42.7 (262) |
| 16 | 307 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g^3G_4$ | | 46469072 | | 2.402E-14 | | 45.1 (270) 29.2 (307) 25.7 (298) |
| 16 | 308 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d^1F_3$ | | 46469082 | | 2.377E-14 | | 55.5 (308) 13.4 (267) 13.1 (291) |
| 16 | 309 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h^1I_6$ | | 46469102 | | 2.321E-14 | | 55.8 (309) 44.2 (264) |
| 16 | 310 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g^3H_6$ | | 46469107 | | 2.358E-14 | | 100. (310) |
| 16 | 311 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h^3I_7$ | | 46469147 | | 2.321E-14 | | 100. (311) |
| 16 | 312 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p^1S_0$ | | 46469148 | | 2.491E-14 | | 73.9 (312) |
| 16 | 313 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h^1G_4$ | | 46469154 | | 2.401E-14 | | 58.1 (268) 22.4 (313) 19.5 (316) |
| 16 | 314 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h^3H_5$ | | 46469197 | | 2.402E-14 | | 41.9 (271) 30.1 (314) 28.0 (303) |
| 16 | 315 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h^3G_3$ | | 46469713 | | 2.388E-14 | | 100. (315) |
| 16 | 316 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h^3G_4$ | | 46469756 | | 2.388E-14 | | 54.7 (316) 45.3 (313) |
| 16 | 317 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f^3D_1$ | | 46469915 | | 2.394E-14 | | 100. (317) |
| 16 | 318 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g^3F_2$ | | 46469959 | | 2.392E-14 | | 100. (318) |
| 16 | 319 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g^1F_3$ | | 46470044 | | 2.393E-14 | | 55.7 (305) 44.3 (319) |
| 16 | 320 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f^1D_2$ | | 46470438 | | 2.394E-14 | | 54.7 (320) 43.4 (301) 1.87 (266) |
| 16 | 321 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d^1P_1$ | | 46470524 | | 2.410E-14 | | 73.1 (321) |
| 17 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2^1S_0$ | 0 | 0 | | | | 100. (1) |
| 17 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s^3S_1$ | 22236180 | 22235307 | | 3.783E-07 | | 100. (2) |
| 17 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p^3P_0$ | 22377820 | 22377068 | | 5.133E-09 | | 100. (3) |
| 17 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p^3P_1$ | 22381940 | 22381216 | | 9.537E-13 | | 98.8 (4) |
| 17 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s^1S_0$ | 22390000 | 22389200 | | 7.970E-04 | | 100. (5) |
| 17 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p^3P_2$ | 22399100 | 22398386 | | 2.025E-09 | | 100. (6) |
| 17 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p^1P_1$ | 22500680 | 22499758 | | 1.183E-14 | | 98.8 (7) |
| 17 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s^3S_1$ | 26314360 | 26313471 | | 1.944E-12 | | 100. (8) |
| 17 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p^3P_0$ | 26353380 | 26352470 | | 6.754E-13 | | 100. (9) |
| 17 | 10 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p^3P_1$ | 26354630 | 26353727 | | 5.547E-13 | | 98.6 (10) |
| 17 | 11 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s^1S_0$ | 26355050 | 26353930 | | 2.059E-12 | | 100. (11) |
| 17 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 26359730 | 26358831 | | 6.836E-13 | | 100. (12) |
| 17 | 13 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d^3D_1$ | 26381370 | 26380429 | | 2.307E-13 | | 100. (13) |
| 17 | 14 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 26381390 | 26380441 | | 2.318E-13 | | 77.5 (14) |
| 17 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 26383410 | 26382465 | | 2.317E-13 | | 100. (15) |
| 17 | 16 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 26384530 | 26383570 | | 2.363E-13 | | 77.5 (16) |
| 17 | 17 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 26387270 | 26386277 | | 4.067E-14 | | 98.6 (17) |
| 17 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s^3S_1$ | 27720900 | 27720428 | | 2.842E-12 | | 100. (18) |
| 17 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 27737300 | 27736483 | | 1.148E-12 | | 100. (19) |
| 17 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 27738000 | 27736848 | | 2.988E-12 | | 100. (20) |
| 17 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 27737800 | 27737016 | | 9.919E-13 | | 98.5 (21) |
| 17 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 27740000 | 27739170 | | 1.160E-12 | | 100. (22) |
| 17 | 23 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d^3D_1$ | 27749100 | 27748037 | | 5.356E-13 | | 100. (23) |
| 17 | 24 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 27749100 | 27748074 | | 5.386E-13 | | 81.2 (24) |
| 17 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 27750000 | 27748895 | | 5.381E-13 | | 100. (25) |
| 17 | 26 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | | 27749434 | | 1.103E-12 | | 56.8 (26) 43.2 (30) |
| 17 | 27 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | 27750400 | 27749485 | | 5.529E-13 | | 81.2 (27) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 17 | 28 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | | 27749505 | | 1.103E-12 | | 100. (28) |
| 17 | 29 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | | 27749939 | | 1.105E-12 | | 100. (29) |
| 17 | 30 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | | 27749996 | | 1.106E-12 | | 56.8 (30) 43.2 (26) |
| 17 | 31 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 27751600 | 27750399 | | 9.665E-14 | | 98.5 (31) |
| 17 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 28367700 | 28367122 | | 4.469E-12 | | 100. (32) |
| 17 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 28376100 | 28375244 | | 1.953E-12 | | 100. (33) |
| 17 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 28376500 | 28375373 | | 4.684E-12 | | 100. (34) |
| 17 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 28376400 | 28375518 | | 1.716E-12 | | 98.5 (35) |
| 17 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 28377500 | 28376621 | | 1.970E-12 | | 100. (36) |
| 17 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | 28382100 | 28381104 | | 1.029E-12 | | 100. (37) |
| 17 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | 28382100 | 28381129 | | 1.035E-12 | | 82.5 (38) |
| 17 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | 28382500 | 28381543 | | 1.034E-12 | | 100. (39) |
| 17 | 40 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 28381844 | | 2.133E-12 | | 57.3 (40) 42.7 (45) |
| 17 | 41 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | 28382800 | 28381872 | | 1.066E-12 | | 82.5 (41) |
| 17 | 42 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 28381879 | | 2.132E-12 | | 100. (42) |
| 17 | 43 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 28382101 | | 2.136E-12 | | 100. (43) |
| 17 | 44 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 28382113 | | 3.581E-12 | | 54.9 (44) 45.1 (48) |
| 17 | 45 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 28382132 | | 2.138E-12 | | 57.3 (45) 42.7 (40) |
| 17 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 28382134 | | 3.582E-12 | | 100. (46) |
| 17 | 47 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 28382268 | | 3.584E-12 | | 100. (47) |
| 17 | 48 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 28382285 | | 3.584E-12 | | 54.9 (48) 45.1 (44) |
| 17 | 49 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 28383400 | 28382287 | | 1.887E-13 | | 98.5 (49) |
| 17 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 28716950 | | 7.041E-12 | | 100. (50) |
| 17 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 28721616 | | 3.191E-12 | | 100. (51) |
| 17 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 28721677 | | 6.854E-12 | | 100. (52) |
| 17 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 28721774 | | 2.820E-12 | | 98.5 (53) |
| 17 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 28722413 | | 3.217E-12 | | 100. (54) |
| 17 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 28724980 | | 1.773E-12 | | 100. (55) |
| 17 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 28724996 | | 1.778E-12 | | 83.1 (56) |
| 17 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 28725235 | | 1.784E-12 | | 100. (57) |
| 17 | 58 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 28725406 | | 3.646E-12 | | 57.5 (58) 42.5 (64) |
| 17 | 59 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 28725426 | | 3.644E-12 | | 100. (59) |
| 17 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 28725433 | | 1.807E-12 | | 83.1 (60) |
| 17 | 61 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 28725555 | | 3.651E-12 | | 100. (61) |
| 17 | 62 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 28725556 | | 6.145E-12 | | 54.9 (62) 45.1 (68) |
| 17 | 63 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 28725568 | | 6.146E-12 | | 100. (63) |
| 17 | 64 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 28725573 | | 3.655E-12 | | 57.5 (64) 42.5 (58) |
| 17 | 65 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 28725645 | | 9.267E-12 | | 54.0 (65) 46.0 (71) |
| 17 | 66 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 28725646 | | 6.150E-12 | | 100. (66) |
| 17 | 67 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 28725653 | | 9.268E-12 | | 100. (67) |
| 17 | 68 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 28725656 | | 6.150E-12 | | 54.9 (68) 45.1 (62) |
| 17 | 69 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 28725666 | | 3.255E-13 | | 98.5 (69) |
| 17 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 28725704 | | 9.271E-12 | | 100. (70) |
| 17 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 28725711 | | 9.272E-12 | | 54.0 (71) 46.0 (65) |
| 17 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 45867000 | 45866664 | | 5.118E-14 | | 79.3 (72) |
| 17 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 45896700 | 45896195 | | 2.020E-14 | | 100. (73) |
| 17 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 45905600 | 45904783 | | 2.022E-14 | | 100. (74) |
| 17 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 45925500 | 45925323 | | 2.029E-14 | | 100. (75) |
| 17 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 46030000 | 46028996 | | 1.012E-14 | | 98.9 (76) |
| 17 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 46040000 | 46039938 | | 1.002E-14 | | 100. (77) |
| 17 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | 46056000 | 46055542 | | 1.003E-14 | | 95.2 (78) |
| 17 | 79 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | 46121000 | 46120794 | | 9.967E-15 | | 95.2 (79) |
| 17 | 80 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 46121500 | 46121849 | | 1.934E-14 | | 100. (80) |
| 17 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | 46327000 | 46326209 | | 1.258E-14 | | 79.8 (81) |
| 17 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 50080960 | | 5.575E-14 | | 74.6 (82) |
| 17 | 83 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p^1P_1$ | | 50100146 | | 2.834E-14 | | 48.5 (83) 43.7 (109) 3.97 (91) |
| 17 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 50123950 | | 7.170E-14 | | 76.3 (84) |
| 17 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 50131449 | | 2.674E-14 | | 63.5 (85) 36.5 (89) |
| 17 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 50133003 | | 1.658E-14 | | 70.9 (86) 16.6 (92) 12.5 (100) |
| 17 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 50137109 | | 3.761E-14 | | 62.8 (87) 32.4 (91) 3.57 (112) |
| 17 | 88 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 50144419 | | 5.064E-14 | | 83.2 (88) |
| 17 | 89 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 50145053 | | 3.013E-14 | | 53.1 (89) 33.9 (85) 13.0 (114) |
| 17 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 50147178 | | 1.814E-14 | | 76.9 (90) |
| 17 | 91 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 50151857 | | 2.328E-14 | | 59.4 (91) 25.3 (87) 11.8 (112) |
| 17 | 92 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 50160025 | | 1.610E-14 | | 78.7 (92) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 17 | 93 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 50162778 | | 2.155E-14 | | 63.7 (93) 36.3 (103) |
| 17 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 50166045 | | 1.887E-14 | | 88.6 (94) |
| 17 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 50185146 | | 1.913E-14 | | 82.0 (95) |
| 17 | 96 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 50197246 | | 1.540E-14 | | 97.5 (96) |
| 17 | 97 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 50198630 | | 1.916E-14 | | 94.5 (97) |
| 17 | 98 | $2s_{1/2}3d_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 50201724 | | 2.918E-14 | | 31.7 (98) 27.2 (102) 22.9 (113) |
| 17 | 99 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | | 50202298 | | 2.052E-14 | | 64.1 (99) 26.1 (100) 4.28 (106) |
| 17 | 100 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 50208413 | | 3.275E-14 | | 55.8 (100) 23.5 (99) 16.3 (86) |
| 17 | 101 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^1D_2$ | | 50209242 | | 1.875E-14 | | 75.5 (101) |
| 17 | 102 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^3D_2$ | | 50212380 | | 4.107E-14 | | 50.2 (102) 20.0 (90) 14.8 (113) |
| 17 | 103 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 50216283 | | 3.999E-14 | | 63.7 (103) 36.3 (93) |
| 17 | 104 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 50216553 | | 1.940E-14 | | 100. (104) |
| 17 | 105 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^3P_2$ | | 50220507 | | 1.719E-14 | | 81.7 (105) |
| 17 | 106 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^3S_1$ | | 50225762 | | 1.905E-14 | | 68.0 (106) 21.1 (82) 9.82 (99) |
| 17 | 107 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 50232314 | | 1.747E-14 | | 81.8 (107) |
| 17 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^1D_2$ | | 50240900 | | 1.734E-14 | | 84.4 (108) |
| 17 | 109 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 50243553 | | 2.471E-14 | | 49.6 (109) 36.3 (83) 10.4 (107) |
| 17 | 110 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3D_3$ | | 50248831 | | 1.697E-14 | | 93.8 (110) |
| 17 | 111 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 50270816 | | 1.969E-14 | | 72.4 (111) |
| 17 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 50273466 | | 1.960E-14 | | 80.0 (112) |
| 17 | 113 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 50274820 | | 2.660E-14 | | 50.3 (113) 48.6 (98) 1.08 (105) |
| 17 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 50275721 | | 1.963E-14 | | 86.5 (114) |
| 17 | 115 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^1F_3$ | | 50302072 | | 1.625E-14 | | 97.9 (115) |
| 17 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 50316096 | | 1.832E-14 | | 87.9 (116) |
| 17 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 50326930 | | 1.839E-14 | | 77.3 (117) |
| 17 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 51546524 | | 7.038E-14 | | 76.1 (118) |
| 17 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2s4p\ ^1P_1$ | | 51555279 | | 3.119E-14 | | 43.8 (119) 35.9 (150) 16.6 (127) |
| 17 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 51560394 | | 7.412E-14 | | 74.9 (120) |
| 17 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 51562190 | | 2.993E-14 | | 60.3 (121) 39.7 (126) |
| 17 | 122 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 51567043 | | 5.745E-14 | | 65.9 (122) 20.2 (127) 8.24 (119) |
| 17 | 123 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 51568302 | | 2.004E-14 | | 70.5 (123) 16.0 (135) 13.5 (128) |
| 17 | 124 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 51570821 | | 7.283E-14 | | 83.0 (124) |
| 17 | 125 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 51576063 | | 2.330E-14 | | 58.7 (125) 27.2 (131) 7.90 (155) |
| 17 | 126 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 51577266 | | 3.481E-14 | | 52.6 (126) 38.9 (121) 8.50 (160) |
| 17 | 127 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 51583213 | | 2.783E-14 | | 54.7 (127) 23.0 (122) 14.8 (119) |
| 17 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^1P_1$ | | 51586231 | | 2.019E-14 | | 51.3 (128) 24.0 (141) 8.64 (135) |
| 17 | 129 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 51586603 | | 5.835E-14 | | 74.0 (129) |
| 17 | 130 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 51588203 | | 2.025E-14 | | 74.8 (130) |
| 17 | 131 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 51594056 | | 5.333E-14 | | 39.9 (131) 30.0 (136) 21.7 (155) |
| 17 | 132 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 51594776 | | 1.851E-14 | | 90.2 (132) |
| 17 | 133 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 51596160 | | 1.875E-14 | | 60.4 (133) 19.6 (156) 9.39 (153) |
| 17 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 51596167 | | 2.204E-14 | | 66.7 (134) 15.1 (146) 11.2 (154) |
| 17 | 135 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 51596986 | | 4.904E-14 | | 67.4 (135) 19.4 (141) 10.4 (123) |
| 17 | 136 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 51603743 | | 5.330E-14 | | 43.2 (136) 26.8 (131) 22.0 (125) |
| 17 | 137 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^1D_2$ | | 51606980 | | 2.171E-14 | | 36.6 (137) 28.3 (133) 15.0 (153) |
| 17 | 138 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 51607253 | | 9.427E-14 | | 80.7 (138) |
| 17 | 139 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 51608195 | | 1.870E-14 | | 69.7 (139) 11.6 (168) 9.66 (159) |
| 17 | 140 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 51608940 | | 1.861E-14 | | 67.0 (140) 23.7 (157) 9.39 (143) |
| 17 | 141 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^3P_1$ | | 51609458 | | 1.873E-14 | | 41.3 (141) 30.4 (128) 17.7 (123) |
| 17 | 142 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 51610494 | | 1.861E-14 | | 39.9 (142) 33.8 (158) 26.3 (164) |
| 17 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | | 51610953 | | 1.843E-14 | | 34.0 (143) 31.9 (162) 18.5 (157) |
| 17 | 144 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 51611463 | | 1.895E-14 | | 63.8 (144) 20.5 (167) 13.9 (163) |
| 17 | 145 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 51611658 | | 9.663E-14 | | 83.0 (145) |
| 17 | 146 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 51612181 | | 9.113E-14 | | 81.9 (146) |
| 17 | 147 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | | 51613641 | | 8.855E-13 | | 100. (147) |
| 17 | 148 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 51614429 | | 2.294E-14 | | 61.3 (148) 24.9 (129) 6.27 (143) |
| 17 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | | 51616504 | | 1.828E-14 | | 77.0 (149) |
| 17 | 150 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 51620569 | | 2.451E-14 | | 58.2 (150) 27.6 (119) 7.29 (127) |
| 17 | 151 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^3S_1$ | | 51622735 | | 1.982E-14 | | 67.9 (151) 14.8 (118) 14.7 (141) |
| 17 | 152 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 51624370 | | 2.307E-14 | | 80.8 (152) |
| 17 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^3D_2$ | | 51625083 | | 1.930E-14 | | 37.4 (153) 34.9 (137) 17.6 (130) |
| 17 | 154 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^3D_3$ | | 51629808 | | 1.876E-14 | | 72.4 (154) |
| 17 | 155 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 51632627 | | 2.157E-14 | | 65.3 (155) 23.2 (136) 7.48 (149) |
| 17 | 156 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 51637449 | | 1.957E-14 | | 59.5 (156) 26.2 (153) 7.19 (124) |
| 17 | 157 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 51637509 | | 1.872E-14 | | 38.6 (157) 32.4 (140) 29.0 (143) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 17 | 158 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^3F_4$ | | 51638478 | | 1.872E-14 | | 63.8 (158) 31.8 (142) 4.41 (164) |
| 17 | 159 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d^3P_1$ | | 51638956 | | 1.964E-14 | | 72.6 (159) |
| 17 | 160 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d^3P_0$ | | 51640378 | | 1.977E-14 | | 90.6 (160) |
| 17 | 161 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | | 51641749 | | 1.870E-14 | | 100. (161) |
| 17 | 162 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^3D_3$ | | 51642828 | | 1.885E-14 | | 62.2 (162) 21.6 (143) 15.1 (157) |
| 17 | 163 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | | 51643192 | | 1.875E-14 | | 39.4 (163) 35.0 (144) 25.6 (167) |
| 17 | 164 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^1G_4$ | | 51643317 | | 1.870E-14 | | 69.3 (164) 28.3 (142) 2.45 (158) |
| 17 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^1F_3$ | | 51647240 | | 1.794E-14 | | 87.6 (165) |
| 17 | 166 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | | 51647757 | | 1.886E-14 | | 98.7 (166) |
| 17 | 167 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | | 51649173 | | 1.872E-14 | | 53.8 (167) 46.2 (163) |
| 17 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | | 51653639 | | 1.919E-14 | | 81.5 (168) |
| 17 | 169 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | | 51655704 | | 2.004E-14 | | 77.3 (169) |
| 17 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | | 52212766 | | 7.705E-14 | | 75.7 (170) |
| 17 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2s5p^1P_1$ | | 52216689 | | 3.008E-14 | | 34.2 (171) 30.0 (180) 29.1 (209) |
| 17 | 172 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | | 52218874 | | 7.035E-14 | | 72.6 (172) |
| 17 | 173 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | | 52219011 | | 2.951E-14 | | 63.6 (173) 36.4 (178) |
| 17 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | | 52222996 | | 2.155E-14 | | 70.1 (174) 16.4 (186) 12.4 (207) |
| 17 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | | 52223152 | | 9.267E-14 | | 67.0 (175) 16.5 (171) 7.73 (180) |
| 17 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | | 52224632 | | 8.758E-14 | | 81.7 (176) |
| 17 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | | 52227311 | | 2.490E-14 | | 48.2 (177) 24.6 (183) 15.3 (214) |
| 17 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | | 52229059 | | 4.224E-14 | | 59.6 (178) 36.1 (173) 4.34 (220) |
| 17 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | | 52232794 | | 2.080E-14 | | 72.7 (179) |
| 17 | 180 | $2s_{1/2}5p_{3/2}(J=1)$ | $2p5s^3P_1$ | | 52233436 | | 3.635E-14 | | 42.9 (180) 31.2 (171) 21.4 (175) |
| 17 | 181 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | | 52233530 | | 2.253E-14 | | 36.0 (181) 30.7 (207) 15.0 (170) |
| 17 | 182 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | | 52233955 | | 1.353E-13 | | 88.2 (182) |
| 17 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | | 52236298 | | 8.248E-14 | | 54.4 (183) 24.3 (188) 10.9 (214) |
| 17 | 184 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | | 52237483 | | 2.328E-14 | | 51.9 (184) 19.3 (198) 15.1 (215) |
| 17 | 185 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | | 52237908 | | 2.139E-14 | | 78.3 (185) |
| 17 | 186 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | | 52237981 | | 7.021E-14 | | 77.8 (186) |
| 17 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | | 52240470 | | 2.097E-14 | | 30.4 (187) 28.0 (216) 22.3 (213) |
| 17 | 188 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | | 52242394 | | 7.905E-14 | | 64.7 (188) 15.8 (177) 14.6 (183) |
| 17 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | | 52242661 | | 1.894E-14 | | 71.1 (189) 18.3 (218) 9.47 (224) |
| 17 | 190 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | | 52243148 | | 2.972E-13 | | 95.1 (190) |
| 17 | 191 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | | 52243529 | | 1.962E-14 | | 61.3 (191) 17.1 (237) 13.1 (217) |
| 17 | 192 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | | 52243615 | | 1.896E-14 | | 41.4 (192) 29.1 (226) 28.3 (219) |
| 17 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | | 52244512 | | 1.878E-14 | | 70.9 (193) 17.2 (222) 11.9 (228) |
| 17 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | | 52244625 | | 1.975E-14 | | 42.4 (194) 31.6 (224) 20.2 (218) |
| 17 | 195 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | | 52244634 | | 1.955E-14 | | 52.9 (195) 25.7 (236) 17.2 (225) |
| 17 | 196 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | | 52244641 | | 1.494E-13 | | 89.5 (196) |
| 17 | 197 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | | 52244688 | | 1.877E-14 | | 38.8 (197) 32.2 (229) 29.1 (223) |
| 17 | 198 | $2p_{1/2}5g_{7/2}(J=3)$ | $2s5f^3F_3$ | | 52244886 | | 3.441E-14 | | 46.0 (198) 18.8 (199) 12.2 (227) |
| 17 | 199 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | | 52245083 | | 2.785E-14 | | 33.7 (198) 28.0 (199) 18.2 (227) |
| 17 | 200 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | | 52245184 | | 1.931E-14 | | 51.5 (200) 26.3 (228) 19.2 (222) |
| 17 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | | 52245875 | | 1.512E-12 | | 100. (201) |
| 17 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | | 52245909 | | 1.271E-12 | | 69.3 (202) 30.7 (205) |
| 17 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | | 52245916 | | 9.761E-13 | | 100. (203) |
| 17 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | | 52246015 | | 2.878E-12 | | 100. (204) |
| 17 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | | 52246096 | | 1.603E-12 | | 70.5 (205) 29.5 (202) |
| 17 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | | 52254688 | | 1.954E-14 | | 89.4 (206) |
| 17 | 207 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p^1P_1$ | | 52257802 | | 1.825E-14 | | 50.0 (207) 29.5 (181) 17.0 (174) |
| 17 | 208 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | | 52259595 | | 1.909E-14 | | 93.8 (208) |
| 17 | 209 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | | 52260429 | | 2.159E-14 | | 66.3 (209) 18.8 (180) 13.7 (171) |
| 17 | 210 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^3P_2$ | | 52261207 | | 1.840E-14 | | 64.9 (210) 28.0 (177) 5.56 (214) |
| 17 | 211 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^3S_1$ | | 52264072 | | 1.932E-14 | | 66.2 (211) 22.3 (181) 7.83 (170) |
| 17 | 212 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | | 52265540 | | 1.939E-14 | | 97.0 (212) |
| 17 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^1D_2$ | | 52265963 | | 1.891E-14 | | 52.0 (213) 23.3 (216) 19.9 (179) |
| 17 | 214 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^1D_2$ | | 52267568 | | 1.904E-14 | | 68.0 (214) 19.6 (210) 6.37 (188) |
| 17 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d^3D_3$ | | 52268337 | | 1.878E-14 | | 63.9 (215) 33.0 (184) 3.10 (231) |
| 17 | 216 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^3D_2$ | | 52271590 | | 1.914E-14 | | 52.2 (187) 37.5 (216) 4.75 (213) |
| 17 | 217 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d^3P_1$ | | 52272293 | | 1.922E-14 | | 68.8 (217) 24.9 (191) 3.46 (175) |
| 17 | 218 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f^1F_3$ | | 52272474 | | 1.883E-14 | | 42.6 (218) 29.5 (224) 28.0 (189) |
| 17 | 219 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f^3F_4$ | | 52272998 | | 1.883E-14 | | 67.3 (219) 30.3 (192) 2.35 (226) |
| 17 | 220 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d^3P_0$ | | 52273010 | | 1.935E-14 | | 95.6 (220) |
| 17 | 221 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f^3G_5$ | | 52274363 | | 1.878E-14 | | 100. (221) |
| 17 | 222 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g^1G_4$ | | 52274566 | | 1.890E-14 | | 37.7 (222) 33.3 (228) 29.0 (193) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 17 | 223 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 52274720 | | 1.890E-14 | | 70.8 (223) 18.0 (197) 11.1 (229) |
| 17 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 52274808 | | 1.887E-14 | | 53.1 (194) 28.6 (224) 18.3 (218) |
| 17 | 225 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 52275072 | | 1.883E-14 | | 44.2 (195) 37.2 (225) 18.7 (236) |
| 17 | 226 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 52275388 | | 1.878E-14 | | 68.1 (226) 27.8 (192) 4.01 (219) |
| 17 | 227 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^1F_3$ | | 52275485 | | 1.888E-14 | | 53.3 (199) 24.8 (227) 21.9 (234) |
| 17 | 228 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | | 52275615 | | 1.889E-14 | | 46.7 (200) 27.8 (228) 25.5 (222) |
| 17 | 229 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 52275870 | | 1.885E-14 | | 56.8 (229) 43.2 (197) |
| 17 | 230 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 52275983 | | 1.885E-14 | | 100. (230) |
| 17 | 231 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 52276159 | | 1.845E-14 | | 78.1 (231) |
| 17 | 232 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 52277234 | | 1.884E-14 | | 100. (232) |
| 17 | 233 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 52277349 | | 1.887E-14 | | 100. (233) |
| 17 | 234 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^3F_3$ | | 52277406 | | 1.884E-14 | | 55.6 (234) 44.4 (227) |
| 17 | 235 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^3S_0$ | | 52278263 | | 1.975E-14 | | 76.3 (235) |
| 17 | 236 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 52278277 | | 1.880E-14 | | 54.5 (236) 44.1 (225) 1.44 (195) |
| 17 | 237 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 52279117 | | 1.905E-14 | | 75.8 (237) |
| 17 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 52570665 | | 7.321E-14 | | 74.4 (238) |
| 17 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 52572422 | | 2.840E-14 | | 37.7 (239) 27.9 (250) 26.4 (284) |
| 17 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 52573506 | | 2.809E-14 | | 67.2 (240) 32.8 (246) |
| 17 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 52573830 | | 6.015E-14 | | 68.7 (241) 17.7 (302) 13.6 (254) |
| 17 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 52576012 | | 2.206E-14 | | 69.7 (242) 15.6 (253) 11.5 (283) |
| 17 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 52576763 | | 1.136E-13 | | 66.0 (243) 20.0 (250) 4.35 (293) |
| 17 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 52577298 | | 8.452E-14 | | 80.3 (244) |
| 17 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 52578565 | | 2.478E-14 | | 43.9 (245) 20.9 (251) 19.8 (290) |
| 17 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 52580222 | | 5.155E-14 | | 66.0 (246) 31.9 (240) 2.03 (294) |
| 17 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 52581530 | | 2.089E-14 | | 72.0 (247) 14.2 (289) 8.93 (271) |
| 17 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 52582484 | | 2.441E-14 | | 36.4 (248) 22.3 (283) 21.4 (238) |
| 17 | 249 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 52582893 | | 1.508E-13 | | 88.0 (249) |
| 17 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 52583075 | | 4.603E-14 | | 40.1 (250) 31.9 (239) 22.1 (243) |
| 17 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 52583966 | | 9.699E-14 | | 61.9 (251) 19.5 (258) 6.40 (290) |
| 17 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 52584418 | | 2.301E-14 | | 45.8 (252) 18.9 (306) 18.2 (272) |
| 17 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 52584960 | | 8.857E-14 | | 81.8 (253) |
| 17 | 254 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 52585399 | | 2.454E-14 | | 65.5 (254) 25.9 (241) 8.63 (302) |
| 17 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 52586419 | | 2.275E-14 | | 33.0 (255) 28.1 (292) 18.8 (289) |
| 17 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 52586946 | | 1.898E-14 | | 72.6 (256) |
| 17 | 257 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 52587526 | | 1.897E-14 | | 41.6 (257) 30.7 (303) 26.5 (296) |
| 17 | 258 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 52587701 | | 1.014E-13 | | 72.7 (258) |
| 17 | 259 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 52587824 | | 1.370E-13 | | 86.8 (259) |
| 17 | 260 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 52587952 | | 2.087E-14 | | 54.0 (260) 20.6 (320) 14.0 (293) |
| 17 | 261 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 52588043 | | 1.868E-14 | | 72.1 (261) 16.0 (298) 11.9 (308) |
| 17 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 52588152 | | 1.867E-14 | | 39.4 (262) 32.7 (309) 27.9 (300) |
| 17 | 263 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 52588254 | | 1.855E-14 | | 71.6 (263) 16.1 (304) 12.3 (314) |
| 17 | 264 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 52588313 | | 1.855E-14 | | 38.6 (264) 33.0 (310) 28.4 (305) |
| 17 | 265 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 52588315 | | 2.011E-14 | | 47.5 (265) 27.7 (321) 18.4 (301) |
| 17 | 266 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 52588335 | | 2.072E-14 | | 44.3 (266) 27.6 (299) 18.0 (295) |
| 17 | 267 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 52588396 | | 1.956E-14 | | 42.8 (267) 30.4 (307) 23.0 (319) |
| 17 | 268 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 52588514 | | 1.876E-14 | | 41.6 (268) 32.5 (312) 26.0 (316) |
| 17 | 269 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 52588573 | | 2.140E-14 | | 48.1 (269) 22.4 (308) 16.7 (298) |
| 17 | 270 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 52588573 | | 1.876E-14 | | 58.4 (270) 23.3 (314) 18.3 (304) |
| 17 | 271 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 52588604 | | 1.680E-13 | | 91.0 (271) |
| 17 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 52588758 | | 8.002E-14 | | 77.8 (272) |
| 17 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 52589364 | | 2.546E-12 | | 100. (273) |
| 17 | 274 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 52589381 | | 1.481E-12 | | 76.7 (274) |
| 17 | 275 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 52589382 | | 1.054E-12 | | 100. (275) |
| 17 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 52589433 | | 4.490E-12 | | 100. (276) |
| 17 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 52589500 | | 2.194E-12 | | 78.2 (277) |
| 17 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 52589558 | | 5.673E-12 | | 56.0 (278) 44.0 (281) |
| 17 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 52589559 | | 5.239E-12 | | 100. (279) |
| 17 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 52589617 | | 5.739E-12 | | 100. (280) |
| 17 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 52589618 | | 5.359E-12 | | 56.0 (281) 44.0 (278) |
| 17 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 52606847 | | 1.920E-14 | | 97.6 (282) |
| 17 | 283 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^1P_1$ | | 52608837 | | 1.852E-14 | | 57.3 (283) 23.7 (248) 16.6 (242) |
| 17 | 284 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 52609073 | | 2.001E-14 | | 66.9 (284) 26.5 (239) 5.59 (250) |
| 17 | 285 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 52609692 | | 1.872E-14 | | 98.1 (285) |
| 17 | 286 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 52610608 | | 1.858E-14 | | 56.0 (286) 35.3 (245) 8.72 (290) |
| 17 | 287 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^3S_1$ | | 52611796 | | 1.896E-14 | | 64.7 (287) 27.6 (248) 4.00 (238) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 17 | 288 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 52613303 | | 1.905E-14 | | 100. (288) |
| 17 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 52613527 | | 1.893E-14 | | 57.3 (289) 20.1 (247) 17.9 (292) |
| 17 | 290 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 52613848 | | 1.870E-14 | | 63.3 (290) 28.4 (286) 6.37 (245) |
| 17 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 52614831 | | 1.886E-14 | | 58.4 (291) 38.2 (252) 3.44 (306) |
| 17 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 52616426 | | 1.895E-14 | | 48.2 (255) 42.8 (292) 4.75 (289) |
| 17 | 293 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 52616751 | | 1.898E-14 | | 68.3 (293) 28.6 (260) 1.69 (243) |
| 17 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 52617086 | | 1.904E-14 | | 97.8 (294) |
| 17 | 295 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 52617255 | | 1.887E-14 | | 44.3 (295) 29.3 (299) 26.4 (256) |
| 17 | 296 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 52617559 | | 1.887E-14 | | 68.1 (296) 30.3 (257) 1.60 (303) |
| 17 | 297 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 52618225 | | 1.876E-14 | | 100. (297) |
| 17 | 298 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 52618463 | | 1.886E-14 | | 38.5 (298) 33.7 (308) 27.8 (261) |
| 17 | 299 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 52618507 | | 1.887E-14 | | 49.1 (299) 31.6 (299) 19.3 (295) |
| 17 | 300 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 52618555 | | 1.886E-14 | | 71.9 (300) 18.3 (262) 9.80 (309) |
| 17 | 301 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 52618675 | | 1.887E-14 | | 47.9 (265) 36.5 (301) 15.6 (321) |
| 17 | 302 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 52618788 | | 1.926E-14 | | 73.4 (302) |
| 17 | 303 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 52618833 | | 1.877E-14 | | 67.2 (303) 27.7 (257) 5.10 (296) |
| 17 | 304 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 52618881 | | 1.880E-14 | | 37.1 (304) 34.5 (314) 28.3 (263) |
| 17 | 305 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 52618937 | | 1.880E-14 | | 71.6 (305) 17.4 (264) 11.0 (310) |
| 17 | 306 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6d\ ^1F_3$ | | 52618967 | | 1.878E-14 | | 41.3 (306) 23.3 (267) 12.0 (291) |
| 17 | 307 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^1F_3$ | | 52619052 | | 1.877E-14 | | 31.6 (306) 31.2 (267) 15.9 (307) |
| 17 | 308 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 52619088 | | 1.889E-14 | | 44.5 (269) 29.2 (308) 26.3 (298) |
| 17 | 309 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 52619123 | | 1.864E-14 | | 57.6 (309) 42.4 (262) |
| 17 | 310 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 52619171 | | 1.840E-14 | | 56.0 (310) 44.0 (264) |
| 17 | 311 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 52619176 | | 1.864E-14 | | 100. (311) |
| 17 | 312 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^1G_4$ | | 52619182 | | 1.889E-14 | | 58.4 (268) 22.1 (312) 19.5 (316) |
| 17 | 313 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 52619229 | | 1.840E-14 | | 100. (313) |
| 17 | 314 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 52619236 | | 1.889E-14 | | 41.5 (270) 29.9 (314) 28.5 (304) |
| 17 | 315 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 52619779 | | 1.880E-14 | | 100. (315) |
| 17 | 316 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^3G_4$ | | 52619835 | | 1.880E-14 | | 54.5 (316) 45.5 (312) |
| 17 | 317 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 52619932 | | 1.883E-14 | | 100. (317) |
| 17 | 318 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 52620025 | | 1.883E-14 | | 100. (318) |
| 17 | 319 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 52620131 | | 1.884E-14 | | 55.4 (319) 44.6 (307) |
| 17 | 320 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 52620499 | | 1.889E-14 | | 72.1 (320) 14.3 (260) 12.4 (293) |
| 17 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 52620529 | | 1.883E-14 | | 54.6 (321) 43.3 (301) 2.02 (265) |
| 18 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | 0 | | | 100. (1) |
| 18 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 25036647 | 25036335 | 25035494 | 2.101E-07 | 2.126E-07 | 100. (2) |
| 18 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 25187805 | 25187645 | 25186738 | 4.765E-09 | 4.767E-09 | 100. (3) |
| 18 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 25193006 | 25192850 | 25191948 | 5.538E-13 | 5.551E-13 | 98.4 (4) |
| 18 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 25200961 | 25200766 | 25199938 | 6.796E-04 | 6.623E-04 | 100. (5) |
| 18 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 25215228 | 25215082 | 25214178 | 1.510E-09 | 1.510E-09 | 100. (6) |
| 18 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 25322440 | 25322086 | 25321364 | 9.349E-15 | 9.346E-15 | 98.4 (7) |
| 18 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 29633366 | 29633053 | 29632250 | 1.536E-12 | 1.538E-12 | 100. (8) |
| 18 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 29675029 | 29674704 | 29673932 | 5.293E-13 | 5.293E-13 | 100. (9) |
| 18 | 10 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 29676590 | 29676271 | 29675502 | 4.093E-13 | 4.096E-13 | 98.1 (10) |
| 18 | 11 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 29676853 | 29676300 | 29675663 | 1.623E-12 | 1.624E-12 | 100. (11) |
| 18 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 29683203 | 29682887 | 29682116 | 5.366E-13 | 5.366E-13 | 100. (12) |
| 18 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 29706292 | 29705930 | 29705195 | 1.820E-13 | 1.819E-13 | 75.4 (13) |
| 18 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 29706303 | 29705946 | 29705205 | 1.811E-13 | 1.810E-13 | 100. (14) |
| 18 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 29708923 | 29708566 | 29707826 | 1.820E-13 | 1.819E-13 | 100. (15) |
| 18 | 16 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 29710147 | 29709772 | 29709049 | 1.852E-13 | 1.851E-13 | 75.4 (16) |
| 18 | 17 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 29712236 | 29711827 | 29711149 | 3.219E-14 | 3.215E-14 | 98.1 (17) |
| 18 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 31219860 | 31219988 | 31219253 | 2.244E-12 | 2.250E-12 | 100. (18) |
| 18 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 31237290 | 31237134 | 31236400 | 9.005E-13 | 9.014E-13 | 100. (19) |
| 18 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 31238060 | 31237537 | 31236846 | 2.354E-12 | 2.358E-12 | 100. (20) |
| 18 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 31237960 | 31237798 | 31237065 | 7.426E-13 | 7.435E-13 | 98.0 (21) |
| 18 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 31240750 | 31240591 | 31239858 | 9.107E-13 | 9.116E-13 | 100. (22) |
| 18 | 23 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | 31250460 | 31250057 | 31249334 | 4.205E-13 | 4.204E-13 | 100. (23) |
| 18 | 24 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | 31250560 | 31250089 | 31249367 | 4.229E-13 | 4.228E-13 | 78.9 (24) |
| 18 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | 31251560 | 31251163 | 31250440 | 4.228E-13 | 4.228E-13 | 100. (25) |
| 18 | 26 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 31251742 | 31251026 | 8.655E-13 | 8.651E-13 | 56.8 (26) 43.2 (31) |
| 18 | 27 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | 31252060 | 31251800 | 31251081 | 4.331E-13 | 4.328E-13 | 78.9 (27) |
| 18 | 28 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 31251827 | 31251110 | 8.654E-13 | 8.650E-13 | 100. (28) |
| 18 | 29 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 31252385 | 31251668 | 8.667E-13 | 8.664E-13 | 100. (29) |
| 18 | 30 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 31253060 | 31252427 | 31251728 | 7.653E-14 | 7.639E-14 | 98.0 (30) |
| 18 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 31252453 | 31251738 | 8.674E-13 | 8.670E-13 | 56.8 (31) 43.2 (26) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 18 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 31949560 | 31949600 | 31948878 | 3.530E-12 | 3.544E-12 | 100. (32) |
| 18 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 31958520 | 31958275 | 31957551 | 1.533E-12 | 1.535E-12 | 100. (33) |
| 18 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 31958960 | 31958418 | 31957722 | 3.686E-12 | 3.703E-12 | 100. (34) |
| 18 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 31958860 | 31958615 | 31957892 | 1.292E-12 | 1.294E-12 | 98.0 (35) |
| 18 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 31960290 | 31960045 | 31959322 | 1.548E-12 | 1.551E-12 | 100. (36) |
| 18 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | 31965340 | 31964831 | 31964112 | 8.083E-13 | 8.081E-13 | 100. (37) |
| 18 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | 31965260 | 31964855 | 31964136 | 8.131E-13 | 8.130E-13 | 80.2 (38) |
| 18 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d\ ^3D_3$ | 31965910 | 31965397 | 31964678 | 8.129E-13 | 8.130E-13 | 100. (39) |
| 18 | 40 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f\ ^3F_3$ | | 31965720 | 31965004 | 1.673E-12 | 1.672E-12 | 57.2 (40) 42.8 (46) |
| 18 | 41 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d\ ^1D_2$ | 31966160 | 31965751 | 31965034 | 8.347E-13 | 8.343E-13 | 80.2 (41) |
| 18 | 42 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f\ ^3F_2$ | | 31965762 | 31965046 | 1.672E-12 | 1.672E-12 | 100. (42) |
| 18 | 43 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p\ ^1P_1$ | 31966560 | 31966016 | 31965317 | 1.495E-13 | 1.488E-13 | 98.0 (43) |
| 18 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f\ ^3F_4$ | | 31966048 | 31965332 | 1.676E-12 | 1.675E-12 | 100. (44) |
| 18 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g\ ^3G_4$ | | 31966060 | 31965346 | 2.809E-12 | 2.808E-12 | 54.9 (45) 45.1 (49) |
| 18 | 46 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f\ ^1F_3$ | | 31966085 | 31965369 | 1.677E-12 | 1.676E-12 | 57.2 (46) 42.8 (40) |
| 18 | 47 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g\ ^3G_3$ | | 31966086 | 31965371 | 2.810E-12 | 2.809E-12 | 100. (47) |
| 18 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g\ ^3G_5$ | | 31966258 | 31965543 | 2.812E-12 | 2.811E-12 | 100. (48) |
| 18 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g\ ^1G_4$ | | 31966279 | 31965564 | 2.812E-12 | 2.811E-12 | 54.9 (49) 45.1 (45) |
| 18 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s\ ^3S_1$ | | 32344339 | 32343589 | 5.564E-12 | 5.435E-12 | 100. (50) |
| 18 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p\ ^3P_0$ | | 32349321 | 32348572 | 2.505E-12 | 2.466E-12 | 100. (51) |
| 18 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s\ ^1S_0$ | | 32349391 | 32348676 | 5.393E-12 | 5.639E-12 | 100. (52) |
| 18 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p\ ^3P_1$ | | 32349518 | 32348771 | 2.127E-12 | 2.101E-12 | 98.0 (53) |
| 18 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p\ ^3P_2$ | | 32350346 | 32349598 | 2.528E-12 | 2.491E-12 | 100. (54) |
| 18 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d\ ^3D_1$ | | 32353087 | 32352348 | 1.393E-12 | 1.379E-12 | 100. (55) |
| 18 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d\ ^3D_2$ | | 32353103 | 32352364 | 1.396E-12 | 1.388E-12 | 80.8 (56) |
| 18 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d\ ^3D_3$ | | 32353415 | 32352676 | 1.402E-12 | 1.388E-12 | 100. (57) |
| 18 | 58 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f\ ^3F_3$ | | 32353598 | 32352873 | 2.859E-12 | 2.859E-12 | 57.5 (58) 42.5 (65) |
| 18 | 59 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f\ ^3F_2$ | | 32353623 | 32352896 | 2.858E-12 | 2.858E-12 | 100. (59) |
| 18 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d\ ^1D_2$ | | 32353628 | 32352891 | 1.415E-12 | 1.427E-12 | 80.8 (60) |
| 18 | 61 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p\ ^1P_1$ | | 32353775 | 32353054 | 2.577E-13 | 2.543E-13 | 98.0 (61) |
| 18 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f\ ^3F_4$ | | 32353788 | 32353061 | 2.864E-12 | 2.864E-12 | 100. (62) |
| 18 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g\ ^3G_4$ | | 32353789 | 32353070 | 4.821E-12 | 4.819E-12 | 54.9 (63) 45.1 (69) |
| 18 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g\ ^3G_3$ | | 32353804 | 32353085 | 4.821E-12 | 4.819E-12 | 100. (64) |
| 18 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f\ ^1F_3$ | | 32353810 | 32353084 | 2.867E-12 | 2.865E-12 | 57.5 (65) 42.5 (58) |
| 18 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h\ ^3H_5$ | | 32353902 | 32353187 | 7.271E-12 | 7.268E-12 | 54.1 (66) 45.9 (71) |
| 18 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g\ ^3G_5$ | | 32353903 | 32353185 | 4.825E-12 | 4.823E-12 | 100. (67) |
| 18 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h\ ^3H_4$ | | 32353912 | 32353196 | 7.271E-12 | 7.268E-12 | 100. (68) |
| 18 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g\ ^1G_4$ | | 32353915 | 32353197 | 4.825E-12 | 4.823E-12 | 54.9 (69) 45.1 (63) |
| 18 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h\ ^3H_6$ | | 32353978 | 32353263 | 7.274E-12 | 7.271E-12 | 100. (70) |
| 18 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h\ ^1H_5$ | | 32353986 | 32353271 | 7.274E-12 | 7.271E-12 | 54.1 (71) 45.9 (66) |
| 18 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2\ ^1S_0$ | 51555000 | 51555833 | | 4.094E-14 | | 79.7 (72) |
| 18 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p\ ^3P_0$ | 51586000 | 51585904 | | 1.602E-14 | | 100. (73) |
| 18 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p\ ^3P_1$ | 51596600 | 51596558 | | 1.604E-14 | | 100. (74) |
| 18 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p\ ^3P_2$ | 51622500 | 51622674 | | 1.611E-14 | | 100. (75) |
| 18 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2\ ^3P_0$ | 51730100 | 51730094 | | 8.064E-15 | | 98.5 (76) |
| 18 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2\ ^3P_1$ | 51744000 | 51744207 | | 7.957E-15 | | 100. (77) |
| 18 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2\ ^3P_2$ | 51762800 | 51763202 | | 7.963E-15 | | 93.3 (78) |
| 18 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p\ ^1P_1$ | 51829200 | 51830108 | | 1.539E-14 | | 100. (79) |
| 18 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2\ ^1D_2$ | 51833400 | 51833687 | | 7.918E-15 | | 93.3 (80) |
| 18 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2\ ^1S_0$ | 52049600 | 52049873 | | 9.915E-15 | | 80.4 (81) |
| 18 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s\ ^3S_1$ | | 56296627 | | 4.571E-14 | | 75.7 (82) |
| 18 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p\ ^1P_1$ | | 56317605 | | 2.242E-14 | | 48.1 (83) 42.8 (109) 5.36 (91) |
| 18 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | | 56342086 | | 5.714E-14 | | 76.6 (84) |
| 18 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s\ ^3P_0$ | | 56349283 | | 2.094E-14 | | 64.8 (85) 35.2 (88) |
| 18 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p\ ^3D_1$ | | 56351064 | | 1.312E-14 | | 71.2 (86) 16.8 (92) 12.0 (100) |
| 18 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p\ ^3P_1$ | | 56356284 | | 3.073E-14 | | 64.7 (87) 30.3 (91) 3.55 (113) |
| 18 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | | 56364531 | | 2.468E-14 | | 55.3 (88) 32.9 (85) 11.9 (114) |
| 18 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | | 56365191 | | 4.083E-14 | | 84.3 (89) |
| 18 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | | 56368708 | | 1.447E-14 | | 75.2 (90) |
| 18 | 91 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s\ ^3P_1$ | | 56373514 | | 1.862E-14 | | 60.1 (91) 24.3 (87) 10.6 (113) |
| 18 | 92 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^1P_1$ | | 56384231 | | 1.299E-14 | | 75.1 (92) |
| 18 | 93 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 56388044 | | 1.817E-14 | | 59.2 (93) 40.8 (103) |
| 18 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 56391574 | | 1.497E-14 | | 89.5 (94) |
| 18 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 56407973 | | 1.522E-14 | | 81.0 (95) |
| 18 | 96 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 56421144 | | 1.234E-14 | | 96.7 (96) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 18 | 97 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 56424459 | | 1.520E-14 | | 92.8 (97) |
| 18 | 98 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d\ ^3D_2$ | | 56426103 | | 2.546E-14 | | 33.9 (98) 28.2 (112) 21.1 (102) |
| 18 | 99 | $2s_{1/2}3d_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | | 56426883 | | 2.004E-14 | | 48.7 (99) 40.9 (100) 4.42 (86) |
| 18 | 100 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 56434259 | | 2.010E-14 | | 40.6 (100) 35.8 (99) 14.4 (86) |
| 18 | 101 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d\ ^1D_2$ | | 56437358 | | 1.495E-14 | | 72.1 (101) 14.7 (95) 6.97 (108) |
| 18 | 102 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 56438739 | | 3.062E-14 | | 43.3 (98) 19.9 (90) 18.9 (102) |
| 18 | 103 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 56443604 | | 2.875E-14 | | 59.2 (103) 40.8 (93) |
| 18 | 104 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 56447687 | | 1.544E-14 | | 100. (104) |
| 18 | 105 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^3P_2$ | | 56450386 | | 1.374E-14 | | 82.3 (105) |
| 18 | 106 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^3S_1$ | | 56454499 | | 1.481E-14 | | 67.5 (106) 19.2 (82) 11.9 (99) |
| 18 | 107 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 56459171 | | 1.395E-14 | | 78.6 (107) |
| 18 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^3D_2$ | | 56471017 | | 1.389E-14 | | 78.1 (108) |
| 18 | 109 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 56472363 | | 1.955E-14 | | 49.7 (109) 35.7 (83) 11.2 (107) |
| 18 | 110 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3D_3$ | | 56481073 | | 1.352E-14 | | 92.0 (110) |
| 18 | 111 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 56503653 | | 1.548E-14 | | 70.5 (111) 13.2 (108) 10.5 (89) |
| 18 | 112 | $2s_{1/2}3d_{5/2}(J=2)$ | $2p3p\ ^1D_2$ | | 56506000 | | 2.014E-14 | | 51.0 (112) 47.3 (102) 1.67 (105) |
| 18 | 113 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 56506496 | | 1.543E-14 | | 79.6 (113) |
| 18 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 56509136 | | 1.549E-14 | | 87.7 (114) |
| 18 | 115 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^1F_3$ | | 56537883 | | 1.293E-14 | | 96.2 (115) |
| 18 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 56552326 | | 1.452E-14 | | 87.5 (116) |
| 18 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 56562398 | | 1.448E-14 | | 77.8 (117) |
| 18 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 57945390 | | 5.754E-14 | | 76.2 (118) |
| 18 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2s4p\ ^1P_1$ | | 57954721 | | 2.415E-14 | | 41.6 (119) 34.2 (150) 19.8 (127) |
| 18 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 57959934 | | 5.819E-14 | | 74.9 (120) |
| 18 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 57961429 | | 2.342E-14 | | 61.3 (121) 38.7 (126) |
| 18 | 122 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 57967305 | | 4.936E-14 | | 67.7 (122) 17.0 (127) 9.56 (119) |
| 18 | 123 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 57968012 | | 1.583E-14 | | 70.9 (123) 15.3 (134) 13.8 (128) |
| 18 | 124 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 57971693 | | 5.911E-14 | | 83.2 (124) |
| 18 | 125 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 57977269 | | 1.849E-14 | | 56.5 (125) 26.8 (131) 9.39 (155) |
| 18 | 126 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 57977920 | | 2.881E-14 | | 54.8 (126) 38.0 (121) 7.20 (160) |
| 18 | 127 | $2s_{1/2}4p_{3/2}(J=1)$ | $2p4s\ ^3P_1$ | | 57985469 | | 2.323E-14 | | 52.6 (127) 22.2 (122) 19.1 (119) |
| 18 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^1P_1$ | | 57988477 | | 1.639E-14 | | 44.5 (128) 27.7 (146) 9.16 (118) |
| 18 | 129 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 57989486 | | 5.697E-14 | | 79.7 (129) |
| 18 | 130 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 57989753 | | 1.610E-14 | | 74.7 (130) |
| 18 | 131 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 57996391 | | 4.645E-14 | | 45.7 (131) 27.3 (136) 18.5 (155) |
| 18 | 132 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 57997207 | | 1.503E-14 | | 87.7 (132) |
| 18 | 133 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 57999013 | | 1.756E-14 | | 63.6 (133) 15.4 (145) 12.5 (154) |
| 18 | 134 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 57999247 | | 4.369E-14 | | 71.8 (134) 15.6 (146) 11.2 (123) |
| 18 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4s\ ^3P_2$ | | 58001071 | | 1.506E-14 | | 44.2 (135) 23.4 (156) 15.1 (153) |
| 18 | 136 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 58007517 | | 4.664E-14 | | 50.8 (136) 22.2 (131) 20.6 (125) |
| 18 | 137 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 58011257 | | 1.160E-13 | | 88.1 (137) |
| 18 | 138 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 58011481 | | 1.490E-14 | | 68.0 (138) 13.0 (168) 11.0 (158) |
| 18 | 139 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 58012001 | | 1.482E-14 | | 68.3 (139) 22.2 (157) 9.56 (162) |
| 18 | 140 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4d\ ^1D_2$ | | 58012637 | | 1.935E-14 | | 41.0 (135) 25.0 (140) 17.1 (144) |
| 18 | 141 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 58013814 | | 1.482E-14 | | 40.4 (141) 32.4 (159) 27.2 (164) |
| 18 | 142 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 58014783 | | 1.486E-14 | | 37.4 (142) 37.1 (162) 21.6 (157) |
| 18 | 143 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 58014840 | | 1.515E-14 | | 60.7 (143) 22.2 (167) 15.0 (163) |
| 18 | 144 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 58015190 | | 5.481E-14 | | 73.4 (144) |
| 18 | 145 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 58015597 | | 7.474E-14 | | 82.4 (145) |
| 18 | 146 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^3P_1$ | | 58017169 | | 1.441E-14 | | 39.3 (146) 36.3 (128) 17.1 (123) |
| 18 | 147 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | | 58017187 | | 7.240E-13 | | 100. (147) |
| 18 | 148 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 58022022 | | 1.683E-14 | | 79.7 (148) |
| 18 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | | 58024917 | | 1.443E-14 | | 74.2 (149) |
| 18 | 150 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 58027722 | | 1.902E-14 | | 60.6 (150) 25.0 (119) 9.49 (127) |
| 18 | 151 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^3S_1$ | | 58031100 | | 1.543E-14 | | 67.7 (151) 16.5 (146) 12.6 (118) |
| 18 | 152 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 58033486 | | 1.693E-14 | | 88.2 (152) |
| 18 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^3D_2$ | | 58034442 | | 1.515E-14 | | 40.7 (140) 33.6 (153) 18.4 (130) |
| 18 | 154 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^3D_3$ | | 58039723 | | 1.483E-14 | | 70.4 (154) 24.9 (133) 2.79 (165) |
| 18 | 155 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 58041376 | | 1.619E-14 | | 67.5 (155) 18.0 (136) 11.0 (149) |
| 18 | 156 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 58047589 | | 1.539E-14 | | 57.6 (156) 29.4 (153) 5.81 (124) |
| 18 | 157 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 58048304 | | 1.492E-14 | | 39.2 (157) 31.2 (139) 29.5 (162) |
| 18 | 158 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 58049073 | | 1.545E-14 | | 71.6 (158) 19.0 (138) 5.89 (122) |
| 18 | 159 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 58049425 | | 1.491E-14 | | 64.9 (159) 31.2 (141) 3.92 (164) |
| 18 | 160 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 58050619 | | 1.558E-14 | | 92.1 (160) |
| 18 | 161 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 58052984 | | 1.490E-14 | | 100. (161) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 18 | 162 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^3F_3$ | | 58053831 | | 1.499E-14 | | 60.1 (142) 23.3 (162) 16.6 (157) |
| 18 | 163 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | | 58054138 | | 1.493E-14 | | 37.9 (163) 37.8 (143) 24.2 (167) |
| 18 | 164 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^1G_4$ | | 58054636 | | 1.490E-14 | | 68.9 (164) 28.4 (141) 2.74 (159) |
| 18 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^1F_3$ | | 58058277 | | 1.429E-14 | | 85.5 (165) |
| 18 | 166 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | | 58059142 | | 1.500E-14 | | 98.9 (166) |
| 18 | 167 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | | 58060785 | | 1.491E-14 | | 53.6 (167) 46.4 (163) |
| 18 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | | 58064828 | | 1.517E-14 | | 80.3 (168) |
| 18 | 169 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | | 58065962 | | 1.567E-14 | | 77.6 (169) |
| 18 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | | 58695476 | | 6.164E-14 | | 76.2 (170) |
| 18 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s^3P_1$ | | 58699530 | | 2.320E-14 | | 32.9 (171) 32.2 (181) 28.4 (209) |
| 18 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | | 58701769 | | 2.306E-14 | | 64.7 (172) 35.3 (178) |
| 18 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | | 58701847 | | 5.419E-14 | | 72.1 (173) 18.1 (234) 9.76 (186) |
| 18 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | | 58706045 | | 1.700E-14 | | 69.8 (174) 15.4 (185) 12.4 (207) |
| 18 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | | 58706588 | | 7.903E-14 | | 67.9 (175) 17.3 (181) 5.93 (171) |
| 18 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | | 58708311 | | 6.910E-14 | | 81.9 (176) |
| 18 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | | 58711057 | | 1.959E-14 | | 46.9 (177) 23.6 (183) 16.6 (214) |
| 18 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | | 58712690 | | 3.511E-14 | | 61.4 (178) 35.1 (172) 3.43 (219) |
| 18 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | | 58716747 | | 1.650E-14 | | 72.6 (179) |
| 18 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | | 58717701 | | 1.815E-14 | | 36.5 (180) 27.5 (207) 16.1 (170) |
| 18 | 181 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p^1P_1$ | | 58717879 | | 3.106E-14 | | 38.9 (171) 34.9 (181) 20.9 (175) |
| 18 | 182 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | | 58718466 | | 1.181E-13 | | 89.7 (182) |
| 18 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | | 58720684 | | 6.914E-14 | | 57.7 (183) 22.3 (189) 9.40 (214) |
| 18 | 184 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | | 58722038 | | 1.843E-14 | | 49.9 (184) 19.0 (198) 15.8 (215) |
| 18 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | | 58722348 | | 5.962E-14 | | 79.2 (185) |
| 18 | 186 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | | 58722433 | | 1.752E-14 | | 74.6 (186) |
| 18 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | | 58725319 | | 1.700E-14 | | 32.0 (187) 28.9 (216) 21.5 (213) |
| 18 | 188 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | | 58727330 | | 1.507E-14 | | 72.3 (188) |
| 18 | 189 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | | 58727440 | | 6.865E-14 | | 68.7 (189) 14.3 (177) 12.7 (183) |
| 18 | 190 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | | 58728149 | | 2.493E-13 | | 95.8 (190) |
| 18 | 191 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | | 58728332 | | 1.576E-14 | | 59.1 (191) 18.4 (237) 13.7 (217) |
| 18 | 192 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | | 58728431 | | 1.508E-14 | | 41.5 (192) 29.6 (226) 27.8 (220) |
| 18 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | | 58729355 | | 1.495E-14 | | 71.3 (193) 17.1 (222) 11.6 (228) |
| 18 | 194 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | | 58729462 | | 1.560E-14 | | 51.2 (194) 26.6 (236) 17.8 (225) |
| 18 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | | 58729517 | | 1.585E-14 | | 43.5 (195) 30.6 (223) 19.3 (218) |
| 18 | 196 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | | 58729548 | | 1.254E-13 | | 90.0 (196) |
| 18 | 197 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | | 58729577 | | 1.495E-14 | | 38.9 (197) 32.3 (229) 28.7 (224) |
| 18 | 198 | $2p_{1/2}5g_{7/2}(J=3)$ | $2s5f^3F_3$ | | 58729774 | | 2.162E-14 | | 31.0 (198) 27.2 (199) 18.3 (227) |
| 18 | 199 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | | 58729987 | | 2.862E-14 | | 49.0 (198) 18.8 (199) 12.6 (227) |
| 18 | 200 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | | 58730088 | | 1.547E-14 | | 52.0 (200) 25.8 (228) 18.6 (222) |
| 18 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | | 58730912 | | 1.328E-12 | | 100. (201) |
| 18 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | | 58730950 | | 1.043E-12 | | 68.4 (202) 31.6 (205) |
| 18 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | | 58730956 | | 8.320E-13 | | 100. (203) |
| 18 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | | 58731093 | | 2.321E-12 | | 100. (204) |
| 18 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | | 58731182 | | 1.365E-12 | | 69.4 (205) 30.6 (202) |
| 18 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | | 58745402 | | 1.543E-14 | | 92.8 (206) |
| 18 | 207 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p^1P_1$ | | 58749006 | | 1.446E-14 | | 52.4 (207) 28.9 (180) 17.0 (174) |
| 18 | 208 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | | 58750921 | | 1.492E-14 | | 95.7 (208) |
| 18 | 209 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | | 58751024 | | 1.667E-14 | | 67.7 (209) 21.6 (171) 10.7 (181) |
| 18 | 210 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^3P_2$ | | 58752491 | | 1.459E-14 | | 60.5 (210) 30.8 (177) 7.57 (214) |
| 18 | 211 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^3S_1$ | | 58755355 | | 1.517E-14 | | 66.3 (211) 23.0 (180) 6.24 (170) |
| 18 | 212 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | | 58757510 | | 1.531E-14 | | 98.0 (212) |
| 18 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^1D_2$ | | 58757926 | | 1.503E-14 | | 53.7 (213) 21.8 (216) 20.0 (179) |
| 18 | 214 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^1D_2$ | | 58759256 | | 1.488E-14 | | 66.0 (214) 24.0 (210) 5.65 (177) |
| 18 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d^3D_3$ | | 58760470 | | 1.494E-14 | | 61.8 (215) 34.8 (184) 3.39 (230) |
| 18 | 216 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^3D_2$ | | 58763833 | | 1.516E-14 | | 51.3 (187) 39.1 (216) 5.08 (213) |
| 18 | 217 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d^3P_1$ | | 58764494 | | 1.521E-14 | | 69.0 (217) 26.6 (191) 2.71 (175) |
| 18 | 218 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f^1F_3$ | | 58765023 | | 1.501E-14 | | 42.7 (218) 29.8 (223) 27.5 (188) |
| 18 | 219 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d^3P_0$ | | 58765234 | | 1.531E-14 | | 96.5 (219) |
| 18 | 220 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f^3F_4$ | | 58765626 | | 1.501E-14 | | 67.4 (220) 30.5 (192) 2.04 (226) |
| 18 | 221 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f^3G_5$ | | 58767106 | | 1.497E-14 | | 100. (221) |
| 18 | 222 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g^1G_4$ | | 58767308 | | 1.506E-14 | | 37.5 (222) 33.9 (228) 28.7 (193) |
| 18 | 223 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f^3F_3$ | | 58767485 | | 1.503E-14 | | 51.7 (195) 29.2 (223) 19.1 (218) |
| 18 | 224 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g^3G_5$ | | 58767502 | | 1.506E-14 | | 71.1 (224) 18.2 (197) 10.7 (229) |
| 18 | 225 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f^3D_2$ | | 58767725 | | 1.500E-14 | | 45.6 (194) 36.6 (225) 17.8 (236) |
| 18 | 226 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f^1G_4$ | | 58768205 | | 1.497E-14 | | 68.0 (226) 27.6 (192) 4.42 (220) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 18 | 227 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^1F_3$ | | 58768264 | | 1.505E-14 | | 54.0 (199) 24.1 (227) 21.9 (235) |
| 18 | 228 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | | 58768433 | | 1.505E-14 | | 45.9 (200) 27.9 (228) 26.2 (222) |
| 18 | 229 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 58768726 | | 1.503E-14 | | 57.1 (229) 42.9 (197) |
| 18 | 230 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 58768813 | | 1.470E-14 | | 76.1 (230) |
| 18 | 231 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 58768874 | | 1.503E-14 | | 100. (231) |
| 18 | 232 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 58770136 | | 1.502E-14 | | 100. (232) |
| 18 | 233 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 58770163 | | 1.502E-14 | | 100. (233) |
| 18 | 234 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 58770325 | | 1.546E-14 | | 75.8 (234) |
| 18 | 235 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^3F_3$ | | 58770350 | | 1.502E-14 | | 55.3 (235) 44.7 (227) |
| 18 | 236 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 58771223 | | 1.498E-14 | | 54.3 (236) 44.1 (225) 1.57 (194) |
| 18 | 237 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 58771831 | | 1.510E-14 | | 74.6 (237) |
| 18 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 59098641 | | 5.746E-14 | | 74.4 (238) |
| 18 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 59100409 | | 2.197E-14 | | 39.9 (239) 26.2 (250) 26.2 (283) |
| 18 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 59101453 | | 2.191E-14 | | 68.4 (240) 31.6 (246) |
| 18 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 59101932 | | 4.615E-14 | | 67.9 (241) 17.0 (298) 15.1 (254) |
| 18 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 59104130 | | 1.739E-14 | | 70.1 (242) 14.6 (253) 11.6 (284) |
| 18 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 59105151 | | 9.312E-14 | | 66.4 (243) 20.2 (250) 4.05 (293) |
| 18 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 59105819 | | 6.556E-14 | | 79.8 (244) |
| 18 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 59107066 | | 1.942E-14 | | 43.4 (245) 20.8 (290) 19.8 (251) |
| 18 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 59108722 | | 4.296E-14 | | 67.6 (246) 30.9 (240) 1.54 (294) |
| 18 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 59110157 | | 1.656E-14 | | 72.1 (247) 14.2 (289) 8.52 (271) |
| 18 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 59111216 | | 1.958E-14 | | 36.3 (248) 22.1 (238) 20.7 (284) |
| 18 | 249 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 59111853 | | 1.177E-13 | | 87.9 (249) |
| 18 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 59111978 | | 3.876E-14 | | 42.0 (250) 29.2 (239) 22.3 (243) |
| 18 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 59112887 | | 7.894E-14 | | 63.7 (251) 18.1 (258) 5.64 (290) |
| 18 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 59113370 | | 1.813E-14 | | 44.8 (252) 20.2 (305) 17.5 (291) |
| 18 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 59113886 | | 7.526E-14 | | 82.8 (253) |
| 18 | 254 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 59114356 | | 2.011E-14 | | 62.1 (254) 28.0 (241) 9.92 (298) |
| 18 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 59115492 | | 1.832E-14 | | 34.0 (255) 28.0 (292) 18.8 (244) |
| 18 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 59115972 | | 1.511E-14 | | 72.9 (256) |
| 18 | 257 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 59116640 | | 1.510E-14 | | 41.6 (257) 31.0 (303) 26.3 (296) |
| 18 | 258 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 59116961 | | 8.591E-14 | | 74.8 (258) |
| 18 | 259 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 59117045 | | 1.679E-14 | | 52.1 (259) 21.5 (320) 14.1 (293) |
| 18 | 260 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 59117067 | | 7.981E-14 | | 81.7 (260) |
| 18 | 261 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 59117176 | | 1.495E-14 | | 72.3 (261) |
| 18 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 59117313 | | 1.490E-14 | | 39.5 (262) 32.8 (309) 27.7 (301) |
| 18 | 263 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 59117416 | | 1.483E-14 | | 71.6 (263) 16.2 (304) 12.2 (313) |
| 18 | 264 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 59117433 | | 1.608E-14 | | 46.4 (264) 28.2 (321) 18.7 (302) |
| 18 | 265 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 59117491 | | 1.665E-14 | | 44.8 (265) 27.0 (300) 17.4 (295) |
| 18 | 266 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 59117492 | | 1.483E-14 | | 38.6 (266) 33.1 (311) 28.3 (306) |
| 18 | 267 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 59117533 | | 1.539E-14 | | 42.9 (267) 31.1 (307) 23.4 (319) |
| 18 | 268 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 59117671 | | 1.495E-14 | | 41.3 (268) 32.6 (310) 26.1 (316) |
| 18 | 269 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 59117745 | | 1.496E-14 | | 58.7 (269) 23.3 (313) 18.1 (304) |
| 18 | 270 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 59117755 | | 1.807E-14 | | 45.7 (270) 21.0 (308) 17.8 (260) |
| 18 | 271 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 59117836 | | 1.424E-13 | | 91.5 (271) |
| 18 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 59118001 | | 7.032E-14 | | 80.5 (272) |
| 18 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 59118685 | | 2.225E-12 | | 100. (273) |
| 18 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 59118703 | | 9.301E-13 | | 100. (274) |
| 18 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 59118705 | | 1.268E-12 | | 75.7 (275) |
| 18 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 59118778 | | 3.471E-12 | | 100. (276) |
| 18 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 59118851 | | 1.946E-12 | | 76.9 (277) |
| 18 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 59118909 | | 4.781E-12 | | 55.9 (278) 44.1 (281) |
| 18 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 59118910 | | 4.511E-12 | | 100. (279) |
| 18 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 59118984 | | 4.826E-12 | | 100. (280) |
| 18 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 59118985 | | 4.684E-12 | | 55.9 (281) 44.1 (278) |
| 18 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 59142800 | | 1.525E-14 | | 100. (282) |
| 18 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 59144979 | | 1.570E-14 | | 67.7 (283) 28.2 (239) 4.07 (250) |
| 18 | 284 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^1P_1$ | | 59145055 | | 1.473E-14 | | 57.5 (284) 24.1 (248) 16.6 (242) |
| 18 | 285 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 59146003 | | 1.484E-14 | | 98.7 (285) |
| 18 | 286 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 59146831 | | 1.477E-14 | | 52.2 (286) 37.3 (245) 10.4 (290) |
| 18 | 287 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^3S_1$ | | 59148036 | | 1.498E-14 | | 65.3 (287) 27.1 (248) 4.57 (284) |
| 18 | 288 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 59149958 | | 1.515E-14 | | 100. (288) |
| 18 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 59150166 | | 1.507E-14 | | 57.9 (289) 20.2 (247) 17.5 (292) |
| 18 | 290 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 59150377 | | 1.482E-14 | | 61.0 (290) 32.1 (286) 5.67 (245) |
| 18 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 59151551 | | 1.502E-14 | | 56.9 (291) 39.4 (252) 3.68 (305) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 18 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 59153217 | | 1.506E-14 | | 47.9 (255) 43.3 (292) 5.04 (289) |
| 18 | 293 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 59153515 | | 1.508E-14 | | 68.1 (293) 29.2 (259) 1.38 (320) |
| 18 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 59153857 | | 1.511E-14 | | 98.3 (294) |
| 18 | 295 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 59154204 | | 1.505E-14 | | 44.2 (295) 29.6 (300) 26.2 (256) |
| 18 | 296 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 59154553 | | 1.505E-14 | | 67.9 (296) 30.8 (257) 1.36 (303) |
| 18 | 297 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 59155281 | | 1.498E-14 | | 100. (297) |
| 18 | 298 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 59155493 | | 1.516E-14 | | 72.8 (298) |
| 18 | 299 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 59155524 | | 1.505E-14 | | 38.2 (299) 34.2 (308) 27.6 (261) |
| 18 | 300 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 59155535 | | 1.504E-14 | | 48.3 (265) 31.8 (300) 19.9 (295) |
| 18 | 301 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 59155640 | | 1.505E-14 | | 72.0 (301) 18.5 (262) 9.42 (309) |
| 18 | 302 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 59155689 | | 1.504E-14 | | 48.6 (264) 36.3 (302) 15.1 (321) |
| 18 | 303 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 59155941 | | 1.499E-14 | | 67.2 (303) 27.2 (257) 5.55 (296) |
| 18 | 304 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 59155989 | | 1.501E-14 | | 36.8 (304) 35.0 (313) 28.3 (263) |
| 18 | 305 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 59155997 | | 1.493E-14 | | 58.2 (305) 17.9 (291) 9.43 (267) |
| 18 | 306 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 59156060 | | 1.501E-14 | | 71.6 (306) 17.7 (266) 10.8 (311) |
| 18 | 307 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 59156120 | | 1.502E-14 | | 46.0 (267) 20.9 (307) 15.4 (319) |
| 18 | 308 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 59156192 | | 1.506E-14 | | 44.0 (270) 29.1 (308) 26.9 (299) |
| 18 | 309 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 59156257 | | 1.491E-14 | | 57.9 (309) 42.1 (262) |
| 18 | 310 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 59156296 | | 1.506E-14 | | 58.7 (268) 21.8 (310) 19.6 (316) |
| 18 | 311 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 59156322 | | 1.476E-14 | | 56.2 (311) 43.8 (266) |
| 18 | 312 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 59156328 | | 1.491E-14 | | 100. (312) |
| 18 | 313 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 59156366 | | 1.507E-14 | | 41.3 (269) 29.7 (313) 29.1 (304) |
| 18 | 314 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 59156396 | | 1.476E-14 | | 100. (314) |
| 18 | 315 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 59156931 | | 1.500E-14 | | 100. (315) |
| 18 | 316 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^3G_4$ | | 59157003 | | 1.500E-14 | | 54.4 (316) 45.6 (310) |
| 18 | 317 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 59157026 | | 1.501E-14 | | 100. (317) |
| 18 | 318 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 59157173 | | 1.502E-14 | | 100. (318) |
| 18 | 319 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 59157306 | | 1.503E-14 | | 55.2 (319) 44.8 (307) |
| 18 | 320 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 59157553 | | 1.502E-14 | | 71.9 (320) 15.0 (259) 13.1 (293) |
| 18 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 59157703 | | 1.501E-14 | | 54.6 (321) 43.2 (302) 2.15 (264) |
| 19 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 19 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 28005899 | 28005156 | | 1.205E-07 | | 100. (2) |
| 19 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 28166731 | 28166154 | | 4.434E-09 | | 100. (3) |
| 19 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 28173110 | 28172539 | | 3.339E-13 | | 97.9 (4) |
| 19 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 28180867 | 28180240 | | 6.236E-04 | | 100. (5) |
| 19 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 28201500 | 28200943 | | 1.111E-09 | | 100. (6) |
| 19 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 28314166 | 28313369 | | 7.498E-15 | | 97.9 (7) |
| 19 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 33151400 | 33151991 | | 1.229E-12 | | 100. (8) |
| 19 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 33195600 | 33196328 | | 4.205E-13 | | 100. (9) |
| 19 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 33197700 | 33198056 | | 1.295E-12 | | 100. (10) |
| 19 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 33197559 | 33198239 | | 3.036E-13 | | 97.5 (11) |
| 19 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 33205986 | 33206700 | | 4.271E-13 | | 100. (12) |
| 19 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 33230700 | 33231173 | | 1.448E-13 | | 73.5 (13) |
| 19 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 33230648 | 33231225 | | 1.441E-13 | | 100. (14) |
| 19 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 33234084 | 33234549 | | 1.450E-13 | | 100. (15) |
| 19 | 16 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 33235300 | 33235861 | | 1.472E-13 | | 73.5 (16) |
| 19 | 17 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 33236700 | 33237080 | | 2.585E-14 | | 97.5 (17) |
| 19 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 34928800 | 34929891 | | 1.794E-12 | | 100. (18) |
| 19 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 34947500 | 34948143 | | 7.159E-13 | | 100. (19) |
| 19 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 34948300 | 34948580 | | 1.878E-12 | | 100. (20) |
| 19 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 34948325 | 34948951 | | 5.596E-13 | | 97.4 (21) |
| 19 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 34951879 | 34952524 | | 7.250E-13 | | 100. (22) |
| 19 | 23 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | 34962178 | 34962592 | | 3.347E-13 | | 100. (23) |
| 19 | 24 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | 34962200 | 34962615 | | 3.366E-13 | | 76.8 (24) |
| 19 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | 34963624 | 34963995 | | 3.368E-13 | | 100. (25) |
| 19 | 26 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 34964613 | | 6.883E-13 | | 56.8 (26) 43.2 (31) |
| 19 | 27 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | 34964200 | 34964682 | | 3.441E-13 | | 76.8 (27) |
| 19 | 28 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 34964714 | | 6.883E-13 | | 100. (28) |
| 19 | 29 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 34964700 | 34964944 | | 6.148E-14 | | 97.4 (29) |
| 19 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 34965421 | | 6.895E-13 | | 100. (30) |
| 19 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 34965502 | | 6.900E-13 | | 56.8 (31) 43.2 (26) |
| 19 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 35746600 | 35747483 | | 2.824E-12 | | 100. (32) |
| 19 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 35756100 | 35756717 | | 1.219E-12 | | 100. (33) |
| 19 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 35756500 | 35756873 | | 2.939E-12 | | 100. (34) |
| 19 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 35756522 | 35757131 | | 9.799E-13 | | 97.4 (35) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 19 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 35758341 | 35758960 | | 1.233E-12 | | 100. (36) |
| 19 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | 35763589 | 35764050 | | 6.436E-13 | | 100. (37) |
| 19 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | 35763600 | 35764071 | | 6.474E-13 | | 78.0 (38) |
| 19 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | 35764329 | 35764768 | | 6.478E-13 | | 100. (39) |
| 19 | 40 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 35765114 | | 1.330E-12 | | 57.2 (40) 42.8 (46) |
| 19 | 41 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | 35764600 | 35765149 | | 6.629E-13 | | 78.0 (41) |
| 19 | 42 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 35765164 | | 1.330E-12 | | 100. (42) |
| 19 | 43 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 35764900 | 35765225 | | 1.201E-13 | | 97.4 (43) |
| 19 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 35765526 | | 1.333E-12 | | 100. (44) |
| 19 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 35765539 | | 2.235E-12 | | 55.0 (45) 45.0 (49) |
| 19 | 46 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 35765569 | | 1.334E-12 | | 57.2 (46) 42.8 (40) |
| 19 | 47 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 35765570 | | 2.235E-12 | | 100. (47) |
| 19 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 35765788 | | 2.237E-12 | | 100. (48) |
| 19 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 35765812 | | 2.237E-12 | | 55.0 (49) 45.0 (45) |
| 19 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 36189872 | | 4.450E-12 | | 100. (50) |
| 19 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 36195175 | | 1.993E-12 | | 100. (51) |
| 19 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 36195252 | | 4.302E-12 | | 100. (52) |
| 19 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 36195415 | | 1.616E-12 | | 97.3 (53) |
| 19 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 36196474 | | 2.014E-12 | | 100. (54) |
| 19 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 36199389 | | 1.109E-12 | | 100. (55) |
| 19 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 36199403 | | 1.111E-12 | | 78.6 (56) |
| 19 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 36199804 | | 1.117E-12 | | 100. (57) |
| 19 | 58 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 36200000 | | 2.274E-12 | | 57.4 (58) 42.6 (65) |
| 19 | 59 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 36200029 | | 2.273E-12 | | 100. (59) |
| 19 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 36200033 | | 1.124E-12 | | 78.6 (60) |
| 19 | 61 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 36200071 | | 2.070E-13 | | 97.3 (61) |
| 19 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 36200238 | | 2.278E-12 | | 100. (62) |
| 19 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 36200239 | | 3.834E-12 | | 55.0 (63) 45.0 (69) |
| 19 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 36200257 | | 3.835E-12 | | 100. (64) |
| 19 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 36200264 | | 2.281E-12 | | 57.4 (65) 42.6 (58) |
| 19 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 36200381 | | 5.784E-12 | | 54.1 (66) 45.9 (71) |
| 19 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 36200383 | | 3.838E-12 | | 100. (67) |
| 19 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 36200393 | | 5.784E-12 | | 100. (68) |
| 19 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 36200397 | | 3.838E-12 | | 55.0 (69) 45.0 (63) |
| 19 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 36200477 | | 5.787E-12 | | 100. (70) |
| 19 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 36200487 | | 5.787E-12 | | 54.1 (71) 45.9 (66) |
| 19 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | | 57581244 | | 3.313E-14 | | 80.1 (72) |
| 19 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | | 57611651 | | 1.287E-14 | | 100. (73) |
| 19 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | | 57624675 | | 1.288E-14 | | 100. (74) |
| 19 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | | 57657486 | | 1.295E-14 | | 100. (75) |
| 19 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | | 57767909 | | 6.513E-15 | | 98.0 (76) |
| 19 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | | 57785932 | | 6.397E-15 | | 100. (77) |
| 19 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | | 57808630 | | 6.401E-15 | | 91.0 (78) |
| 19 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | | 57875547 | | 1.240E-14 | | 100. (79) |
| 19 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | | 57885119 | | 6.371E-15 | | 91.0 (80) |
| 19 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | | 58111576 | | 7.907E-15 | | 80.0 (81) |
| 19 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 62880094 | | 3.803E-14 | | 76.7 (82) |
| 19 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p^1P_1$ | | 62902919 | | 1.793E-14 | | 47.5 (83) 41.9 (108) 7.05 (91) |
| 19 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 62927958 | | 4.600E-14 | | 76.8 (84) |
| 19 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 62934741 | | 1.663E-14 | | 66.0 (85) 34.0 (88) |
| 19 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 62936782 | | 1.051E-14 | | 71.5 (86) 17.0 (92) 11.4 (99) |
| 19 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 62943264 | | 2.543E-14 | | 66.4 (87) 28.3 (91) 3.50 (113) |
| 19 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 62951760 | | 2.047E-14 | | 57.4 (88) 31.8 (85) 10.8 (114) |
| 19 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 62954060 | | 3.323E-14 | | 85.3 (89) |
| 19 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 62958439 | | 1.169E-14 | | 74.1 (90) |
| 19 | 91 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 62963467 | | 1.513E-14 | | 60.3 (91) 23.3 (87) 9.54 (113) |
| 19 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 62976817 | | 1.064E-14 | | 71.5 (92) 9.76 (86) 7.79 (99) |
| 19 | 93 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 62981972 | | 1.577E-14 | | 53.9 (93) 46.1 (103) |
| 19 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 62986059 | | 1.203E-14 | | 89.0 (94) |
| 19 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 62998872 | | 1.225E-14 | | 80.2 (95) |
| 19 | 96 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 63013028 | | 1.003E-14 | | 95.7 (96) |
| 19 | 97 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 63018507 | | 2.241E-14 | | 40.0 (97) 24.9 (112) 19.3 (101) |
| 19 | 98 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 63018675 | | 1.220E-14 | | 90.9 (98) |
| 19 | 99 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 63019302 | | 1.997E-14 | | 53.2 (99) 35.4 (100) 6.23 (86) |
| 19 | 100 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3P_1$ | | 63029199 | | 1.352E-14 | | 45.3 (100) 28.0 (99) 13.0 (86) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 19 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 63033731 | | 2.369E-14 | | 37.0 (97) 23.4 (101) 19.8 (90) |
| 19 | 102 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d^1D_2$ | | 63034029 | | 1.207E-14 | | 67.6 (102) 13.4 (95) 9.90 (109) |
| 19 | 103 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 63039921 | | 2.077E-14 | | 53.9 (103) 46.1 (93) |
| 19 | 104 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d^3F_4$ | | 63048425 | | 1.244E-14 | | 100. (104) |
| 19 | 105 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^3P_2$ | | 63049364 | | 1.114E-14 | | 82.6 (105) |
| 19 | 106 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3S_1$ | | 63052323 | | 1.167E-14 | | 67.0 (106) 17.3 (82) 13.7 (100) |
| 19 | 107 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 63054161 | | 1.126E-14 | | 75.9 (107) |
| 19 | 108 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 63069757 | | 1.568E-14 | | 50.2 (108) 35.2 (83) 11.2 (107) |
| 19 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d^3D_2$ | | 63070366 | | 1.126E-14 | | 71.6 (109) 10.9 (102) 8.04 (111) |
| 19 | 110 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d^3D_3$ | | 63082754 | | 1.091E-14 | | 89.9 (110) |
| 19 | 111 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^3P_2$ | | 63105962 | | 1.232E-14 | | 68.4 (111) 16.3 (109) 9.28 (89) |
| 19 | 112 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^1D_2$ | | 63106019 | | 1.537E-14 | | 53.6 (112) 43.8 (101) 2.56 (105) |
| 19 | 113 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d^3P_1$ | | 63108895 | | 1.230E-14 | | 78.0 (113) |
| 19 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d^3P_0$ | | 63111917 | | 1.238E-14 | | 88.9 (114) |
| 19 | 115 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d^1F_3$ | | 63143092 | | 1.042E-14 | | 95.1 (115) |
| 19 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d^3P_1$ | | 63157985 | | 1.165E-14 | | 86.9 (116) |
| 19 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p^1S_0$ | | 63166903 | | 1.153E-14 | | 78.2 (117) |
| 19 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s^3S_1$ | | 64722947 | | 4.757E-14 | | 77.0 (118) |
| 19 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2s4p^1P_1$ | | 64732816 | | 1.891E-14 | | 39.6 (119) 33.0 (150) 23.2 (127) |
| 19 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s^1S_0$ | | 64738127 | | 4.610E-14 | | 74.7 (120) |
| 19 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s^3P_0$ | | 64739283 | | 1.858E-14 | | 62.4 (121) 37.6 (125) |
| 19 | 122 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p^3P_1$ | | 64746262 | | 4.277E-14 | | 69.3 (122) 14.2 (127) 10.7 (119) |
| 19 | 123 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p^3D_1$ | | 64746350 | | 1.266E-14 | | 71.4 (123) 14.5 (133) 14.1 (128) |
| 19 | 124 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p^3P_2$ | | 64751379 | | 4.824E-14 | | 83.1 (124) |
| 19 | 125 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p^3P_0$ | | 64757225 | | 2.410E-14 | | 56.8 (125) 37.1 (121) 6.05 (160) |
| 19 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p^3D_2$ | | 64757266 | | 1.482E-14 | | 54.6 (126) 26.2 (131) 10.8 (155) |
| 19 | 127 | $2s_{1/2}4p_{3/2}(J=1)$ | $2p4s^3P_1$ | | 64766591 | | 1.978E-14 | | 49.9 (127) 23.8 (119) 21.6 (122) |
| 19 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p^1P_1$ | | 64769384 | | 1.341E-14 | | 38.9 (128) 30.4 (147) 10.4 (118) |
| 19 | 129 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d^3F_2$ | | 64770079 | | 1.295E-14 | | 74.6 (129) |
| 19 | 130 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d^3D_3$ | | 64771153 | | 5.567E-14 | | 84.2 (130) |
| 19 | 131 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d^3D_2$ | | 64777508 | | 4.051E-14 | | 50.5 (131) 25.0 (136) 15.9 (155) |
| 19 | 132 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p^3P_0$ | | 64778366 | | 1.237E-14 | | 84.9 (132) |
| 19 | 133 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d^3D_1$ | | 64780269 | | 3.838E-14 | | 74.2 (133) |
| 19 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d^3F_3$ | | 64780701 | | 1.414E-14 | | 60.8 (134) 15.6 (144) 13.6 (154) |
| 19 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d^3P_2$ | | 64784465 | | 1.238E-14 | | 27.3 (145) 26.5 (135) 20.8 (156) |
| 19 | 136 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d^1D_2$ | | 64790188 | | 4.162E-14 | | 57.4 (136) 18.9 (126) 18.5 (131) |
| 19 | 137 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d^3D_1$ | | 64793546 | | 1.203E-14 | | 66.4 (137) 14.4 (168) 12.1 (158) |
| 19 | 138 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f^3G_3$ | | 64793883 | | 1.194E-14 | | 69.3 (138) 21.2 (157) 9.48 (162) |
| 19 | 139 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f^3F_4$ | | 64793970 | | 1.384E-13 | | 92.6 (139) |
| 19 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f^3G_4$ | | 64795982 | | 1.194E-14 | | 40.7 (140) 31.3 (159) 27.9 (164) |
| 19 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f^3F_2$ | | 64796728 | | 6.710E-14 | | 84.3 (141) |
| 19 | 142 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f^3F_2$ | | 64797017 | | 1.223E-14 | | 58.1 (142) 23.6 (167) 15.9 (163) |
| 19 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f^3D_3$ | | 64797207 | | 1.215E-14 | | 39.5 (143) 35.8 (162) 21.1 (157) |
| 19 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f^3F_3$ | | 64797871 | | 6.153E-14 | | 82.7 (144) |
| 19 | 145 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s^3P_2$ | | 64799464 | | 1.388E-14 | | 58.9 (145) 13.4 (156) 10.1 (153) |
| 19 | 146 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f^1F_3$ | | 64799616 | | 5.917E-13 | | 100. (146) |
| 19 | 147 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p^3P_1$ | | 64805138 | | 1.138E-14 | | 40.7 (128) 37.4 (147) 16.8 (123) |
| 19 | 148 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p^3D_3$ | | 64810164 | | 1.273E-14 | | 86.3 (148) |
| 19 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p^3P_2$ | | 64813356 | | 1.155E-14 | | 70.2 (149) 20.4 (126) 4.22 (155) |
| 19 | 150 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s^1P_1$ | | 64814777 | | 1.488E-14 | | 62.8 (150) 22.0 (119) 11.9 (127) |
| 19 | 151 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p^3S_1$ | | 64819569 | | 1.219E-14 | | 67.5 (151) 17.7 (147) 10.6 (118) |
| 19 | 152 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d^3F_4$ | | 64823069 | | 1.304E-14 | | 92.6 (152) |
| 19 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d^1D_2$ | | 64824126 | | 1.211E-14 | | 44.7 (153) 30.2 (156) 18.9 (129) |
| 19 | 154 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d^3D_3$ | | 64829898 | | 1.191E-14 | | 68.3 (154) 27.2 (134) 3.19 (165) |
| 19 | 155 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p^1D_2$ | | 64830372 | | 1.244E-14 | | 67.7 (155) 15.1 (149) 13.4 (136) |
| 19 | 156 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d^3D_2$ | | 64838006 | | 1.229E-14 | | 56.0 (135) 32.0 (156) 4.68 (124) |
| 19 | 157 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f^1F_3$ | | 64839390 | | 1.203E-14 | | 39.7 (157) 30.3 (138) 30.0 (162) |
| 19 | 158 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d^3P_1$ | | 64839418 | | 1.233E-14 | | 70.7 (158) 21.2 (137) 4.82 (122) |
| 19 | 159 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^3F_4$ | | 64840681 | | 1.203E-14 | | 65.7 (159) 30.9 (140) 3.47 (164) |
| 19 | 160 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d^3P_0$ | | 64841067 | | 1.245E-14 | | 94.2 (160) |
| 19 | 161 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | | 64844530 | | 1.202E-14 | | 100. (161) |
| 19 | 162 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^3F_3$ | | 64845164 | | 1.207E-14 | | 57.8 (143) 24.4 (162) 17.8 (157) |
| 19 | 163 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | | 64845387 | | 1.203E-14 | | 40.2 (142) 36.8 (163) 23.0 (167) |
| 19 | 164 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^1G_4$ | | 64846246 | | 1.201E-14 | | 68.6 (164) 28.4 (140) 3.07 (159) |
| 19 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^1F_3$ | | 64849570 | | 1.152E-14 | | 83.3 (165) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 19 | 166 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | | 64850813 | | 1.208E-14 | | 100. (166) |
| 19 | 167 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | | 64852706 | | 1.202E-14 | | 53.4 (167) 46.6 (163) |
| 19 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | | 64856289 | | 1.215E-14 | | 79.1 (168) |
| 19 | 169 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | | 64856319 | | 1.241E-14 | | 77.6 (169) |
| 19 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | | 65561895 | | 4.982E-14 | | 76.6 (170) |
| 19 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s^3P_1$ | | 65566058 | | 1.815E-14 | | 35.6 (171) 30.2 (181) 27.8 (208) |
| 19 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | | 65568202 | | 1.824E-14 | | 65.7 (172) 34.3 (178) |
| 19 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | | 65568508 | | 4.224E-14 | | 71.5 (173) 17.4 (232) 11.1 (186) |
| 19 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | | 65572774 | | 1.358E-14 | | 70.2 (174) 14.5 (185) 12.6 (207) |
| 19 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | | 65573724 | | 6.733E-14 | | 68.6 (175) 17.9 (181) 4.62 (171) |
| 19 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | | 65575770 | | 5.502E-14 | | 81.9 (176) |
| 19 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | | 65578560 | | 1.559E-14 | | 45.9 (177) 22.5 (183) 17.8 (214) |
| 19 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | | 65580007 | | 2.948E-14 | | 63.2 (178) 34.1 (172) 2.71 (218) |
| 19 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | | 65584455 | | 1.325E-14 | | 72.7 (179) |
| 19 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | | 65585584 | | 1.476E-14 | | 36.9 (180) 25.0 (207) 16.9 (170) |
| 19 | 181 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p^1P_1$ | | 65586052 | | 2.676E-14 | | 38.2 (181) 35.6 (171) 20.9 (175) |
| 19 | 182 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | | 65586759 | | 1.007E-13 | | 89.6 (182) |
| 19 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | | 65588844 | | 5.825E-14 | | 60.3 (183) 20.7 (189) 8.21 (214) |
| 19 | 184 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | | 65590371 | | 1.475E-14 | | 48.3 (184) 18.6 (199) 16.6 (229) |
| 19 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | | 65590485 | | 5.107E-14 | | 80.4 (185) |
| 19 | 186 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | | 65590637 | | 1.451E-14 | | 71.1 (186) 21.5 (173) 7.36 (232) |
| 19 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | | 65593890 | | 1.388E-14 | | 33.0 (187) 29.0 (216) 20.4 (213) |
| 19 | 188 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | | 65595776 | | 1.214E-14 | | 72.7 (188) |
| 19 | 189 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | | 65596267 | | 5.956E-14 | | 71.8 (189) 12.9 (177) 11.3 (183) |
| 19 | 190 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | | 65596870 | | 1.280E-14 | | 57.2 (190) 19.6 (237) 14.1 (217) |
| 19 | 191 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | | 65596956 | | 1.940E-13 | | 96.1 (191) |
| 19 | 192 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | | 65597038 | | 1.215E-14 | | 41.5 (192) 30.0 (226) 27.4 (220) |
| 19 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | | 65597989 | | 1.206E-14 | | 71.5 (193) 17.1 (222) 11.4 (228) |
| 19 | 194 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | | 65598064 | | 1.260E-14 | | 49.7 (194) 27.3 (236) 18.3 (225) |
| 19 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | | 65598193 | | 1.286E-14 | | 44.5 (195) 29.8 (223) 18.7 (219) |
| 19 | 196 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | | 65598263 | | 1.065E-13 | | 91.3 (196) |
| 19 | 197 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | | 65598264 | | 1.205E-14 | | 39.1 (197) 32.5 (230) 28.4 (224) |
| 19 | 198 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | | 65598444 | | 1.466E-14 | | 34.6 (198) 23.8 (227) 18.1 (235) |
| 19 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^3F_3$ | | 65598710 | | 3.132E-14 | | 62.8 (199) 10.8 (198) 7.47 (227) |
| 19 | 200 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | | 65598791 | | 1.257E-14 | | 52.2 (200) 25.4 (228) 18.0 (222) |
| 19 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | | 65599775 | | 1.123E-12 | | 100. (201) |
| 19 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | | 65599821 | | 8.748E-13 | | 67.5 (202) 32.5 (205) |
| 19 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | | 65599826 | | 7.204E-13 | | 100. (203) |
| 19 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | | 65600010 | | 1.888E-12 | | 100. (204) |
| 19 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | | 65600107 | | 1.173E-12 | | 68.4 (205) 31.6 (202) |
| 19 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | | 65621286 | | 1.237E-14 | | 94.9 (206) |
| 19 | 207 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p^1P_1$ | | 65625399 | | 1.162E-14 | | 53.3 (207) 28.6 (180) 16.9 (174) |
| 19 | 208 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | | 65626773 | | 1.313E-14 | | 68.0 (208) 23.8 (171) 8.19 (181) |
| 19 | 209 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | | 65627493 | | 1.188E-14 | | 97.0 (209) |
| 19 | 210 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^3P_2$ | | 65628898 | | 1.172E-14 | | 56.7 (210) 33.6 (177) 9.71 (214) |
| 19 | 211 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^3S_1$ | | 65631809 | | 1.209E-14 | | 66.5 (211) 23.1 (180) 5.42 (207) |
| 19 | 212 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | | 65634741 | | 1.228E-14 | | 98.7 (212) |
| 19 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^1D_2$ | | 65635125 | | 1.210E-14 | | 54.9 (213) 20.8 (216) 20.2 (179) |
| 19 | 214 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^1D_2$ | | 65636197 | | 1.185E-14 | | 63.6 (214) 28.3 (210) 5.13 (177) |
| 19 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d^3D_3$ | | 65637829 | | 1.204E-14 | | 59.9 (215) 36.4 (184) 3.70 (229) |
| 19 | 216 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^3D_2$ | | 65641314 | | 1.217E-14 | | 50.6 (187) 40.2 (216) 5.43 (213) |
| 19 | 217 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d^3P_1$ | | 65641915 | | 1.221E-14 | | 68.5 (217) 27.7 (190) 2.10 (175) |
| 19 | 218 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d^3P_0$ | | 65642675 | | 1.228E-14 | | 97.3 (218) |
| 19 | 219 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f^1F_3$ | | 65642814 | | 1.211E-14 | | 42.7 (219) 30.1 (223) 27.2 (188) |
| 19 | 220 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f^3F_4$ | | 65643504 | | 1.210E-14 | | 67.4 (220) 30.8 (192) 1.75 (226) |
| 19 | 221 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f^3G_5$ | | 65645101 | | 1.208E-14 | | 100. (221) |
| 19 | 222 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g^1G_4$ | | 65645303 | | 1.215E-14 | | 37.2 (222) 34.4 (228) 28.4 (193) |
| 19 | 223 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f^3F_3$ | | 65645421 | | 1.211E-14 | | 50.6 (195) 29.6 (223) 19.8 (219) |
| 19 | 224 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g^3G_5$ | | 65645545 | | 1.215E-14 | | 71.4 (224) 18.4 (197) 10.2 (230) |
| 19 | 225 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f^3D_2$ | | 65645621 | | 1.210E-14 | | 46.7 (194) 36.2 (225) 17.1 (236) |
| 19 | 226 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f^1G_4$ | | 65646263 | | 1.208E-14 | | 67.9 (226) 27.3 (192) 4.87 (220) |
| 19 | 227 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g^1F_3$ | | 65646296 | | 1.214E-14 | | 54.0 (198) 23.0 (227) 21.8 (235) |
| 19 | 228 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g^3G_4$ | | 65646513 | | 1.214E-14 | | 45.2 (200) 27.8 (228) 26.9 (222) |
| 19 | 229 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d^1F_3$ | | 65646701 | | 1.186E-14 | | 73.5 (229) |
| 19 | 230 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g^1H_5$ | | 65646834 | | 1.212E-14 | | 57.4 (230) 42.6 (197) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 19 | 231 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g^3H_6$ | | 65647025 | | 1.213E-14 | | 100. (231) |
| 19 | 232 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p^1S_0$ | | 65647598 | | 1.229E-14 | | 75.2 (232) |
| 19 | 233 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f^3D_1$ | | 65648218 | | 1.211E-14 | | 100. (233) |
| 19 | 234 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g^3F_2$ | | 65648290 | | 1.212E-14 | | 100. (234) |
| 19 | 235 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g^3F_3$ | | 65648554 | | 1.212E-14 | | 55.1 (235) 44.9 (227) |
| 19 | 236 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f^1D_2$ | | 65649423 | | 1.208E-14 | | 54.2 (236) 44.1 (225) 1.69 (194) |
| 19 | 237 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d^1P_1$ | | 65649790 | | 1.214E-14 | | 73.6 (237) |
| 19 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s^3S_1$ | | 66013050 | | 4.562E-14 | | 74.3 (238) |
| 19 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s^3P_1$ | | 66014813 | | 1.724E-14 | | 41.9 (239) 26.1 (283) 24.6 (250) |
| 19 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s^3P_0$ | | 66015812 | | 1.731E-14 | | 69.6 (240) 30.4 (246) |
| 19 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s^1S_0$ | | 66016455 | | 3.596E-14 | | 67.0 (241) 16.5 (297) 16.5 (254) |
| 19 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p^3D_1$ | | 66018663 | | 1.389E-14 | | 70.5 (242) 13.6 (253) 11.7 (284) |
| 19 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p^3P_1$ | | 66019971 | | 7.672E-14 | | 66.6 (243) 20.4 (250) 3.81 (258) |
| 19 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p^3P_2$ | | 66020822 | | 5.147E-14 | | 79.2 (244) |
| 19 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p^3D_2$ | | 66022028 | | 1.541E-14 | | 43.1 (245) 21.7 (290) 18.7 (251) |
| 19 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p^3P_0$ | | 66023648 | | 3.622E-14 | | 69.0 (246) 29.8 (240) 1.18 (294) |
| 19 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d^3F_2$ | | 66025241 | | 1.328E-14 | | 72.3 (247) |
| 19 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p^3P_1$ | | 66026389 | | 1.587E-14 | | 36.3 (248) 22.5 (238) 19.4 (284) |
| 19 | 249 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d^3D_3$ | | 66027307 | | 9.181E-14 | | 88.3 (249) |
| 19 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p^1P_1$ | | 66027334 | | 3.291E-14 | | 43.6 (250) 26.8 (239) 22.7 (243) |
| 19 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d^3D_2$ | | 66028292 | | 6.483E-14 | | 65.2 (251) 17.0 (259) 5.01 (290) |
| 19 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d^3F_3$ | | 66028793 | | 1.444E-14 | | 44.1 (252) 21.4 (303) 17.9 (291) |
| 19 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d^3D_1$ | | 66029294 | | 6.484E-14 | | 83.9 (253) |
| 19 | 254 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p^3P_0$ | | 66029718 | | 1.665E-14 | | 59.1 (254) 29.8 (241) 11.0 (297) |
| 19 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d^3P_2$ | | 66031029 | | 1.491E-14 | | 34.5 (255) 27.7 (292) 19.6 (244) |
| 19 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f^3G_3$ | | 66031466 | | 1.217E-14 | | 73.8 (256) |
| 19 | 257 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f^3G_4$ | | 66032231 | | 1.217E-14 | | 42.0 (257) 31.6 (304) 26.4 (296) |
| 19 | 258 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d^3D_1$ | | 66032584 | | 1.365E-14 | | 50.6 (258) 22.2 (320) 14.2 (293) |
| 19 | 259 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d^1D_2$ | | 66032713 | | 7.284E-14 | | 76.9 (259) |
| 19 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g^3H_4$ | | 66032781 | | 1.294E-14 | | 64.9 (260) 20.4 (300) 6.98 (261) |
| 19 | 261 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f^3F_4$ | | 66032810 | | 3.574E-14 | | 66.8 (261) 13.2 (270) 12.2 (308) |
| 19 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g^3H_5$ | | 66032953 | | 1.203E-14 | | 39.5 (262) 32.8 (309) 27.6 (302) |
| 19 | 263 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f^3F_2$ | | 66033022 | | 1.302E-14 | | 45.3 (263) 28.4 (321) 18.8 (301) |
| 19 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h^3I_5$ | | 66033058 | | 1.199E-14 | | 71.7 (264) 16.3 (305) 12.0 (313) |
| 19 | 265 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f^3D_3$ | | 66033125 | | 1.354E-14 | | 45.1 (265) 26.5 (299) 16.9 (295) |
| 19 | 266 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g^3G_3$ | | 66033146 | | 1.230E-14 | | 42.9 (266) 31.6 (307) 23.7 (319) |
| 19 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h^3I_6$ | | 66033153 | | 1.199E-14 | | 38.6 (267) 33.1 (311) 28.3 (306) |
| 19 | 268 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h^3H_4$ | | 66033308 | | 1.206E-14 | | 41.1 (268) 32.7 (310) 26.2 (317) |
| 19 | 269 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h^3G_5$ | | 66033401 | | 1.206E-14 | | 58.9 (269) 23.3 (313) 17.8 (305) |
| 19 | 270 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g^3F_4$ | | 66033433 | | 1.620E-14 | | 41.4 (270) 26.1 (261) 18.8 (308) |
| 19 | 271 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f^3F_2$ | | 66033573 | | 1.226E-13 | | 91.9 (271) |
| 19 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f^3F_3$ | | 66033748 | | 6.229E-14 | | 82.7 (272) |
| 19 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f^1F_3$ | | 66034521 | | 1.863E-12 | | 100. (273) |
| 19 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g^3G_3$ | | 66034542 | | 8.339E-13 | | 100. (274) |
| 19 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g^3G_4$ | | 66034545 | | 1.111E-12 | | 74.6 (275) |
| 19 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g^3G_5$ | | 66034644 | | 2.934E-12 | | 100. (276) |
| 19 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g^1G_4$ | | 66034722 | | 1.729E-12 | | 75.5 (277) |
| 19 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h^3H_5$ | | 66034780 | | 4.029E-12 | | 55.8 (278) 44.2 (281) |
| 19 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h^3H_4$ | | 66034783 | | 3.870E-12 | | 100. (279) |
| 19 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h^3H_6$ | | 66034875 | | 4.061E-12 | | 100. (280) |
| 19 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h^1H_5$ | | 66034877 | | 3.995E-12 | | 55.8 (281) 44.2 (278) |
| 19 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s^3P_2$ | | 66066626 | | 1.227E-14 | | 100. (282) |
| 19 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s^1P_1$ | | 66068772 | | 1.253E-14 | | 67.7 (283) 29.3 (239) 2.97 (250) |
| 19 | 284 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p^1P_1$ | | 66069167 | | 1.187E-14 | | 57.2 (284) 25.1 (248) 16.6 (242) |
| 19 | 285 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p^3D_3$ | | 66070238 | | 1.193E-14 | | 100. (285) |
| 19 | 286 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p^3P_2$ | | 66070922 | | 1.189E-14 | | 48.8 (286) 39.1 (245) 12.1 (290) |
| 19 | 287 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p^3S_1$ | | 66072171 | | 1.201E-14 | | 65.8 (287) 26.1 (248) 5.78 (284) |
| 19 | 288 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d^3F_4$ | | 66074549 | | 1.221E-14 | | 100. (288) |
| 19 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d^1D_2$ | | 66074729 | | 1.215E-14 | | 58.2 (289) 20.3 (247) 17.4 (292) |
| 19 | 290 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p^1D_2$ | | 66074833 | | 1.191E-14 | | 59.3 (290) 35.7 (286) 5.01 (245) |
| 19 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d^3D_3$ | | 66076194 | | 1.211E-14 | | 55.6 (291) 40.5 (252) 3.94 (303) |
| 19 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d^3D_2$ | | 66077937 | | 1.213E-14 | | 48.1 (255) 43.9 (292) 5.43 (289) |
| 19 | 293 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d^3P_1$ | | 66078200 | | 1.214E-14 | | 68.6 (293) 30.0 (258) 1.37 (320) |
| 19 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d^3P_0$ | | 66078548 | | 1.216E-14 | | 98.7 (294) |
| 19 | 295 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f^1F_3$ | | 66079084 | | 1.214E-14 | | 44.0 (295) 29.9 (299) 26.1 (256) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 19 | 296 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 66079483 | | 1.214E-14 | | 67.6 (296) 31.3 (257) 1.13 (304) |
| 19 | 297 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 66080122 | | 1.213E-14 | | 72.2 (297) 24.6 (254) 3.21 (241) |
| 19 | 298 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 66080275 | | 1.210E-14 | | 100. (298) |
| 19 | 299 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 66080504 | | 1.214E-14 | | 47.7 (265) 31.8 (299) 20.5 (295) |
| 19 | 300 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 66080523 | | 1.215E-14 | | 37.8 (300) 34.6 (308) 27.5 (260) |
| 19 | 301 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 66080636 | | 1.214E-14 | | 49.2 (263) 36.2 (301) 14.6 (321) |
| 19 | 302 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 66080667 | | 1.215E-14 | | 72.1 (302) 18.9 (262) 9.02 (309) |
| 19 | 303 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 66080945 | | 1.203E-14 | | 64.3 (303) 21.1 (291) 7.48 (252) |
| 19 | 304 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 66080979 | | 1.211E-14 | | 67.2 (304) 26.7 (257) 6.06 (296) |
| 19 | 305 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 66081039 | | 1.213E-14 | | 36.4 (305) 35.4 (313) 28.2 (264) |
| 19 | 306 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 66081129 | | 1.212E-14 | | 71.6 (306) 18.0 (267) 10.4 (311) |
| 19 | 307 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^1F_3$ | | 66081135 | | 1.214E-14 | | 52.3 (266) 22.4 (307) 18.3 (319) |
| 19 | 308 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 66081239 | | 1.216E-14 | | 43.7 (270) 28.9 (308) 27.5 (300) |
| 19 | 309 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 66081327 | | 1.206E-14 | | 58.3 (309) 41.7 (262) |
| 19 | 310 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^1G_4$ | | 66081355 | | 1.216E-14 | | 58.9 (268) 21.5 (310) 19.7 (317) |
| 19 | 311 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 66081413 | | 1.196E-14 | | 56.6 (311) 43.4 (267) |
| 19 | 312 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 66081420 | | 1.206E-14 | | 100. (312) |
| 19 | 313 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 66081443 | | 1.216E-14 | | 41.1 (269) 29.6 (305) 29.4 (313) |
| 19 | 314 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^1I_7$ | | 66081506 | | 1.196E-14 | | 100. (314) |
| 19 | 315 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 66082028 | | 1.212E-14 | | 100. (315) |
| 19 | 316 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 66082052 | | 1.211E-14 | | 100. (316) |
| 19 | 317 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^3G_4$ | | 66082118 | | 1.212E-14 | | 54.2 (317) 45.8 (310) |
| 19 | 318 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 66082261 | | 1.213E-14 | | 100. (318) |
| 19 | 319 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 66082424 | | 1.213E-14 | | 54.9 (319) 45.1 (307) |
| 19 | 320 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 66082543 | | 1.210E-14 | | 71.0 (320) 15.5 (258) 13.5 (293) |
| 19 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 66082816 | | 1.212E-14 | | 54.6 (321) 43.1 (301) 2.27 (263) |
| 20 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 20 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 31142150 | 31142315 | | 7.119E-08 | | 100. (2) |
| 20 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 31312840 | 31313161 | | 4.135E-09 | | 100. (3) |
| 20 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 31321060 | 31320835 | | 2.084E-13 | | 97.2 (4) |
| 20 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 31328450 | 31328172 | | 6.187E-04 | | 100. (5) |
| 20 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 31356380 | 31356694 | | 8.111E-10 | | 100. (6) |
| 20 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 31473810 | 31474329 | | 6.094E-15 | | 97.2 (7) |
| 20 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 36870940 | 36870980 | | 9.940E-13 | | 100. (8) |
| 20 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 36918070 | 36918046 | | 3.383E-13 | | 100. (9) |
| 20 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 36919930 | 36919896 | | 1.046E-12 | | 100. (10) |
| 20 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 36920260 | 36920328 | | 2.263E-13 | | 96.8 (11) |
| 20 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 36930850 | 36931020 | | 3.442E-13 | | 100. (12) |
| 20 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | | 36956916 | | 1.166E-13 | | 71.9 (13) 28.1 (16) |
| 20 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | | 36957016 | | 1.161E-13 | | 100. (14) |
| 20 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | | 36961175 | | 1.169E-13 | | 100. (15) |
| 20 | 16 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | | 36962601 | | 1.185E-13 | | 71.9 (16) 28.1 (13) |
| 20 | 17 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 36962850 | 36962786 | | 2.104E-14 | | 96.8 (17) |
| 20 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 38850670 | 38850878 | | 1.450E-12 | | 100. (18) |
| 20 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 38870230 | 38870253 | | 5.762E-13 | | 100. (19) |
| 20 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 38870530 | 38870721 | | 1.516E-12 | | 100. (20) |
| 20 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 38871150 | 38871216 | | 4.242E-13 | | 96.7 (21) |
| 20 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 38875630 | 38875732 | | 5.844E-13 | | 100. (22) |
| 20 | 23 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | | 38886405 | | 2.697E-13 | | 100. (23) |
| 20 | 24 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | | 38886414 | | 2.712E-13 | | 74.9 (24) |
| 20 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | | 38888160 | | 2.716E-13 | | 100. (25) |
| 20 | 26 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 38888680 | 38888715 | | 5.004E-14 | | 96.7 (26) |
| 20 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 38888818 | | 5.542E-13 | | 56.8 (27) 43.2 (31) |
| 20 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | | 38888900 | | 2.768E-13 | | 74.9 (28) |
| 20 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 38888937 | | 5.542E-13 | | 100. (29) |
| 20 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 38889821 | | 5.553E-13 | | 100. (30) |
| 20 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 38889916 | | 5.557E-13 | | 56.8 (31) 43.2 (27) |
| 20 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 39761380 | 39761529 | | 2.285E-12 | | 100. (32) |
| 20 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 39771270 | 39771331 | | 9.823E-13 | | 100. (33) |
| 20 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 39771310 | 39771498 | | 2.370E-12 | | 100. (34) |
| 20 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 39771750 | 39771824 | | 7.477E-13 | | 96.6 (35) |
| 20 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 39774040 | 39774136 | | 9.947E-13 | | 100. (36) |
| 20 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | | 39779532 | | 5.188E-13 | | 100. (37) |
| 20 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | | 39779547 | | 5.216E-13 | | 76.0 (38) |
| 20 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d\ ^3D_3$ | | 39780431 | | 5.226E-13 | | 100. (39) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 20 | 40 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 39780630 | 39780684 | | 9.777E-14 | | 96.6 (40) |
| 20 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 39780798 | | 1.071E-12 | | 57.1 (41) 42.9 (47) |
| 20 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 39780840 | | 5.331E-13 | | 76.0 (42) |
| 20 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 39780858 | | 1.071E-12 | | 100. (43) |
| 20 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 39781311 | | 1.073E-12 | | 100. (44) |
| 20 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 39781325 | | 1.800E-12 | | 55.0 (45) 45.0 (49) |
| 20 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 39781361 | | 1.800E-12 | | 100. (46) |
| 20 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 39781361 | | 1.074E-12 | | 57.1 (47) 42.9 (41) |
| 20 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 39781633 | | 1.802E-12 | | 100. (48) |
| 20 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 39781662 | | 1.802E-12 | | 55.0 (49) 45.0 (45) |
| 20 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 40254308 | | 3.598E-12 | | 100. (50) |
| 20 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 40259938 | | 1.604E-12 | | 100. (51) |
| 20 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 40260018 | | 3.474E-12 | | 100. (52) |
| 20 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 40260223 | | 1.235E-12 | | 96.6 (53) |
| 20 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 40261562 | | 1.623E-12 | | 100. (54) |
| 20 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 40264653 | | 8.936E-13 | | 100. (55) |
| 20 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 40264665 | | 8.948E-13 | | 76.6 (56) |
| 20 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 40265173 | | 9.010E-13 | | 100. (57) |
| 20 | 58 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 40265321 | | 1.685E-13 | | 96.6 (58) |
| 20 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 40265385 | | 1.831E-12 | | 57.3 (59) 42.7 (65) |
| 20 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 40265418 | | 1.830E-12 | | 100. (60) |
| 20 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 40265419 | | 9.049E-13 | | 76.6 (61) |
| 20 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 40265680 | | 1.834E-12 | | 100. (62) |
| 20 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 40265683 | | 3.088E-12 | | 55.0 (63) 45.0 (69) |
| 20 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 40265704 | | 3.088E-12 | | 100. (64) |
| 20 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 40265710 | | 1.837E-12 | | 57.3 (65) 42.7 (59) |
| 20 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 40265861 | | 4.658E-12 | | 54.1 (66) 45.9 (71) |
| 20 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 40265862 | | 3.091E-12 | | 100. (67) |
| 20 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 40265874 | | 4.658E-12 | | 100. (68) |
| 20 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 40265878 | | 3.091E-12 | | 55.0 (69) 45.0 (63) |
| 20 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 40265979 | | 4.661E-12 | | 100. (70) |
| 20 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 40265991 | | 4.661E-12 | | 54.1 (71) 45.9 (66) |
| 20 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | | 63944025 | | 2.700E-14 | | 79.5 (72) |
| 20 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | | 63974572 | | 1.045E-14 | | 100. (73) |
| 20 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | | 63990280 | | 1.046E-14 | | 99.0 (74) |
| 20 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | | 64031065 | | 1.052E-14 | | 100. (75) |
| 20 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | | 64143608 | | 5.326E-15 | | 97.5 (76) |
| 20 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | | 64166425 | | 5.202E-15 | | 100. (77) |
| 20 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | | 64193079 | | 5.204E-15 | | 88.2 (78) |
| 20 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | | 64259464 | | 1.012E-14 | | 99.0 (79) |
| 20 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | | 64276629 | | 5.188E-15 | | 88.2 (80) |
| 20 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | | 64512786 | | 6.374E-15 | | 80.3 (81) |
| 20 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 69832638 | | 3.205E-14 | | 77.9 (82) |
| 20 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p^1P_1$ | | 69857350 | | 1.447E-14 | | 46.7 (83) 40.9 (108) 9.03 (91) |
| 20 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 69882836 | | 3.736E-14 | | 76.9 (84) |
| 20 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 69889110 | | 1.336E-14 | | 67.2 (85) 32.8 (88) |
| 20 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 69891446 | | 8.521E-15 | | 71.9 (86) 17.2 (92) 10.9 (98) |
| 20 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 69899333 | | 2.126E-14 | | 68.0 (87) 26.4 (91) 3.42 (113) |
| 20 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 69908015 | | 1.715E-14 | | 59.4 (88) 30.9 (85) 9.68 (114) |
| 20 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 69912359 | | 2.728E-14 | | 86.1 (89) |
| 20 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 69917698 | | 9.543E-15 | | 72.8 (90) |
| 20 | 91 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 69923079 | | 1.249E-14 | | 60.0 (91) 22.4 (87) 9.11 (83) |
| 20 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 69938988 | | 8.829E-15 | | 67.0 (92) 9.06 (86) 8.73 (98) |
| 20 | 93 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 69945831 | | 1.411E-14 | | 52.1 (93) 47.9 (103) |
| 20 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 69950852 | | 9.781E-15 | | 85.6 (94) |
| 20 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 69959257 | | 9.975E-15 | | 78.6 (95) |
| 20 | 96 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 69974181 | | 8.252E-15 | | 94.6 (96) |
| 20 | 97 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 69980272 | | 1.981E-14 | | 45.1 (97) 22.1 (111) 17.7 (101) |
| 20 | 98 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 69980924 | | 1.941E-14 | | 61.6 (98) 26.4 (100) 7.45 (86) |
| 20 | 99 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 69982609 | | 9.898E-15 | | 88.7 (99) |
| 20 | 100 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3P_1$ | | 69994798 | | 9.857E-15 | | 50.4 (100) 19.2 (98) 12.2 (86) |
| 20 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 69998734 | | 1.900E-14 | | 31.5 (97) 28.2 (101) 19.7 (90) |
| 20 | 102 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d^1D_2$ | | 70000484 | | 9.863E-15 | | 62.0 (102) 13.3 (109) 11.8 (95) |
| 20 | 103 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 70006827 | | 1.511E-14 | | 52.1 (103) 47.9 (93) |
| 20 | 104 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 70018612 | | 9.173E-15 | | 73.7 (104) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 20 | 105 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^3P_2$ | | 70018830 | | 9.143E-15 | | 83.2 (105) |
| 20 | 106 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 70020297 | | 1.014E-14 | | 100. (106) |
| 20 | 107 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^3S_1$ | | 70020742 | | 9.309E-15 | | 66.7 (107) 15.6 (82) 15.3 (100) |
| 20 | 108 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 70037149 | | 1.272E-14 | | 51.6 (108) 34.9 (83) 10.6 (104) |
| 20 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^3D_2$ | | 70040592 | | 9.233E-15 | | 64.6 (109) 15.7 (102) 8.56 (112) |
| 20 | 110 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3D_3$ | | 70055401 | | 8.910E-15 | | 87.5 (110) |
| 20 | 111 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 70076440 | | 1.181E-14 | | 56.3 (111) 39.8 (101) 3.87 (105) |
| 20 | 112 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 70079297 | | 9.924E-15 | | 66.4 (112) 19.4 (109) 8.11 (89) |
| 20 | 113 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 70082201 | | 9.919E-15 | | 77.0 (113) |
| 20 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 70085589 | | 1.001E-14 | | 90.1 (114) |
| 20 | 115 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | | 70119236 | | 8.495E-15 | | 93.8 (115) |
| 20 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 70134628 | | 9.446E-15 | | 86.2 (116) |
| 20 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 70141972 | | 9.282E-15 | | 78.6 (117) |
| 20 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 71880516 | | 3.972E-14 | | 77.8 (118) |
| 20 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2s4p\ ^1P_1$ | | 71890889 | | 1.497E-14 | | 37.5 (119) 32.1 (149) 26.5 (127) |
| 20 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 71896293 | | 3.681E-14 | | 74.4 (120) |
| 20 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 71897083 | | 1.491E-14 | | 63.4 (121) 36.6 (125) |
| 20 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 71904650 | | 1.024E-14 | | 71.1 (122) 14.2 (128) 13.6 (133) |
| 20 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 71905227 | | 3.726E-14 | | 70.7 (123) 11.9 (127) 11.8 (119) |
| 20 | 124 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 71911225 | | 3.960E-14 | | 83.6 (124) |
| 20 | 125 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 71916500 | | 2.035E-14 | | 58.7 (125) 36.2 (121) 5.06 (159) |
| 20 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 71917402 | | 1.200E-14 | | 52.9 (126) 25.5 (131) 12.3 (154) |
| 20 | 127 | $2s_{1/2}4p_{3/2}(J=1)$ | $2p4s\ ^3P_1$ | | 71927883 | | 1.713E-14 | | 46.8 (127) 28.4 (119) 21.2 (123) |
| 20 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^1P_1$ | | 71930304 | | 1.106E-14 | | 34.3 (128) 32.4 (147) 11.3 (118) |
| 20 | 129 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 71930536 | | 1.053E-14 | | 74.5 (129) |
| 20 | 130 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 71932953 | | 5.377E-14 | | 87.5 (130) |
| 20 | 131 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 71938759 | | 3.538E-14 | | 54.5 (131) 23.0 (136) 13.8 (154) |
| 20 | 132 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 71939555 | | 1.030E-14 | | 81.9 (132) |
| 20 | 133 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 71941412 | | 3.355E-14 | | 76.1 (133) |
| 20 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 71942583 | | 1.151E-14 | | 58.3 (134) 15.6 (144) 14.6 (155) |
| 20 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 71947576 | | 1.031E-14 | | 28.9 (135) 24.8 (156) 20.8 (153) |
| 20 | 136 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 71953064 | | 3.749E-14 | | 63.4 (136) 17.3 (126) 15.8 (131) |
| 20 | 137 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 71955729 | | 9.835E-15 | | 64.8 (137) 15.8 (169) 13.0 (157) |
| 20 | 138 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 71955949 | | 9.731E-15 | | 70.1 (138) 20.6 (158) 9.34 (162) |
| 20 | 139 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 71956806 | | 1.570E-13 | | 95.2 (139) |
| 20 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 71958364 | | 9.728E-15 | | 41.0 (140) 30.4 (160) 28.6 (164) |
| 20 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 71959352 | | 8.846E-14 | | 92.2 (141) |
| 20 | 142 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 71959363 | | 9.979E-15 | | 56.0 (142) 24.8 (167) 16.6 (163) |
| 20 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 71959769 | | 9.986E-15 | | 41.5 (143) 34.9 (162) 20.6 (158) |
| 20 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 71960359 | | 5.108E-14 | | 82.0 (144) |
| 20 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | | 71962287 | | 4.824E-13 | | 98.7 (145) |
| 20 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 71967384 | | 1.040E-14 | | 78.9 (146) |
| 20 | 147 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^3P_1$ | | 71974855 | | 9.157E-15 | | 43.9 (128) 36.0 (147) 16.7 (122) |
| 20 | 148 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 71980213 | | 9.935E-15 | | 90.2 (148) |
| 20 | 149 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 71983300 | | 1.176E-14 | | 64.5 (149) 18.9 (119) 14.4 (127) |
| 20 | 150 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | | 71983321 | | 9.347E-15 | | 65.7 (150) 23.4 (126) 6.49 (154) |
| 20 | 151 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^3S_1$ | | 71989678 | | 9.765E-15 | | 67.5 (151) 18.4 (147) 8.93 (118) |
| 20 | 152 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 71994598 | | 1.036E-14 | | 95.3 (152) |
| 20 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | | 71995648 | | 9.824E-15 | | 48.0 (153) 27.9 (156) 19.4 (129) |
| 20 | 154 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 72001191 | | 9.779E-15 | | 66.8 (154) 19.6 (150) 9.81 (136) |
| 20 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | | 72001859 | | 9.684E-15 | | 66.7 (155) 29.6 (134) 3.63 (165) |
| 20 | 156 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | | 72010235 | | 9.935E-15 | | 54.7 (135) 34.0 (156) 5.03 (153) |
| 20 | 157 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 72011527 | | 9.970E-15 | | 69.9 (157) 23.0 (137) 3.93 (123) |
| 20 | 158 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 72012300 | | 9.807E-15 | | 39.9 (158) 30.5 (162) 29.6 (138) |
| 20 | 159 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 72013262 | | 1.007E-14 | | 95.2 (159) |
| 20 | 160 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 72013783 | | 9.805E-15 | | 66.2 (160) 30.8 (140) 3.04 (164) |
| 20 | 161 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 72017925 | | 9.797E-15 | | 100. (161) |
| 20 | 162 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | | 72018359 | | 9.830E-15 | | 55.8 (143) 25.3 (162) 18.9 (158) |
| 20 | 163 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 72018471 | | 9.805E-15 | | 42.1 (142) 35.9 (163) 22.0 (167) |
| 20 | 164 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | | 72019680 | | 9.796E-15 | | 68.3 (164) 28.2 (140) 3.43 (160) |
| 20 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | | 72022656 | | 9.390E-15 | | 81.2 (165) |
| 20 | 166 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | | 72024305 | | 9.835E-15 | | 100. (166) |
| 20 | 167 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 72026476 | | 9.794E-15 | | 53.2 (167) 46.8 (163) |
| 20 | 168 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | | 72028339 | | 9.946E-15 | | 77.4 (168) |
| 20 | 169 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | | 72029566 | | 9.846E-15 | | 77.9 (169) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 20 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | 72813367 | | | 4.066E-14 | | 76.9 (170) |
| 20 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | 72817623 | | | 1.438E-14 | | 38.0 (171) 28.4 (181) 27.5 (208) |
| 20 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | 72819657 | | | 1.461E-14 | | 66.8 (172) 33.2 (178) |
| 20 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | 72820202 | | | 3.331E-14 | | 70.8 (173) 16.8 (230) 12.4 (186) |
| 20 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | 72824534 | | | 1.098E-14 | | 70.5 (174) 13.5 (184) 12.7 (207) |
| 20 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | 72825904 | | | 5.740E-14 | | 69.1 (175) 18.3 (181) 3.82 (217) |
| 20 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | 72828368 | | | 4.425E-14 | | 82.4 (176) |
| 20 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | 72831183 | | | 1.254E-14 | | 45.2 (177) 21.5 (183) 18.9 (214) |
| 20 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | 72832358 | | | 2.496E-14 | | 64.7 (178) 33.1 (172) 2.15 (218) |
| 20 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | 72837279 | | | 1.076E-14 | | 72.7 (179) |
| 20 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | 72838543 | | | 1.209E-14 | | 37.1 (180) 23.0 (207) 17.4 (170) |
| 20 | 181 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | 72839310 | | | 2.322E-14 | | 41.3 (181) 32.7 (171) 21.2 (175) |
| 20 | 182 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | 72840201 | | | 8.454E-14 | | 90.0 (182) |
| 20 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | 72842139 | | | 4.939E-14 | | 62.4 (183) 19.4 (189) 7.27 (214) |
| 20 | 184 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | 72843753 | | | 4.412E-14 | | 81.6 (184) |
| 20 | 185 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | 72843846 | | | 1.192E-14 | | 47.1 (185) 18.0 (199) 18.0 (228) |
| 20 | 186 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | 72843861 | | | 1.213E-14 | | 67.9 (186) 23.6 (173) 8.59 (230) |
| 20 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | 72847566 | | | 1.142E-14 | | 33.9 (187) 29.0 (216) 19.4 (213) |
| 20 | 188 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | 72849366 | | | 9.882E-15 | | 73.0 (188) |
| 20 | 189 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | 72850237 | | | 5.155E-14 | | 74.4 (189) |
| 20 | 190 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | 72850503 | | | 1.050E-14 | | 55.9 (190) 20.8 (237) 14.5 (217) |
| 20 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | 72850802 | | | 9.888E-15 | | 42.0 (191) 30.7 (226) 27.3 (220) |
| 20 | 192 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | 72850938 | | | 1.427E-13 | | 94.5 (192) |
| 20 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | 72851779 | | | 9.829E-15 | | 71.8 (193) 17.0 (222) 11.2 (229) |
| 20 | 194 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | 72851804 | | | 1.028E-14 | | 48.6 (194) 27.9 (236) 18.6 (224) |
| 20 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | 72852022 | | | 1.054E-14 | | 45.2 (195) 29.1 (223) 18.1 (219) |
| 20 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | 72852117 | | | 9.825E-15 | | 39.2 (196) 32.6 (231) 28.2 (225) |
| 20 | 197 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | 72852149 | | | 9.151E-14 | | 91.7 (197) |
| 20 | 198 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | 72852261 | | | 1.094E-14 | | 38.6 (198) 27.2 (235) 20.6 (227) |
| 20 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | 72852614 | | | 3.263E-14 | | 71.1 (199) 6.40 (185) 6.25 (198) |
| 20 | 200 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | 72852662 | | | 1.035E-14 | | 52.2 (200) 25.0 (229) 17.5 (222) |
| 20 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | 72853827 | | | 9.197E-13 | | 98.9 (201) |
| 20 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | 72853884 | | | 7.460E-13 | | 66.6 (202) 33.4 (205) |
| 20 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | 72853889 | | | 6.313E-13 | | 100. (203) |
| 20 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | 72854128 | | | 1.548E-12 | | 100. (204) |
| 20 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | 72854233 | | | 1.015E-12 | | 67.3 (205) 32.7 (202) |
| 20 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | 72883846 | | | 1.005E-14 | | 96.2 (206) |
| 20 | 207 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^1P_1$ | 72888497 | | | 9.451E-15 | | 53.8 (207) 29.3 (180) 16.9 (174) |
| 20 | 208 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | 72889207 | | | 1.052E-14 | | 68.2 (208) 25.6 (171) 6.25 (181) |
| 20 | 209 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | 72890838 | | | 9.608E-15 | | 97.9 (209) |
| 20 | 210 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^3P_2$ | 72891952 | | | 9.526E-15 | | 52.5 (210) 35.8 (177) 11.7 (214) |
| 20 | 211 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^3S_1$ | 72894971 | | | 9.762E-15 | | 66.8 (211) 22.5 (180) 6.75 (207) |
| 20 | 212 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | 72898764 | | | 9.981E-15 | | 100. (212) |
| 20 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | 72899090 | | | 9.859E-15 | | 55.6 (213) 20.3 (179) 20.2 (216) |
| 20 | 214 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | 72899918 | | | 9.584E-15 | | 61.2 (214) 32.2 (210) 4.54 (177) |
| 20 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | 72901947 | | | 9.808E-15 | | 58.2 (215) 37.8 (185) 4.01 (228) |
| 20 | 216 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | 72905570 | | | 9.891E-15 | | 50.2 (187) 40.9 (216) 5.84 (213) |
| 20 | 217 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | 72906092 | | | 9.913E-15 | | 68.2 (217) 28.5 (190) 1.66 (237) |
| 20 | 218 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | 72906867 | | | 9.970E-15 | | 97.8 (218) |
| 20 | 219 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | 72907382 | | | 9.873E-15 | | 42.6 (219) 30.6 (223) 26.9 (188) |
| 20 | 220 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | 72908170 | | | 9.872E-15 | | 67.3 (220) 31.3 (191) 1.46 (226) |
| 20 | 221 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | 72909888 | | | 9.851E-15 | | 100. (221) |
| 20 | 222 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^1G_4$ | 72910090 | | | 9.910E-15 | | 36.9 (222) 35.0 (229) 28.1 (193) |
| 20 | 223 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | 72910152 | | | 9.877E-15 | | 49.7 (195) 29.8 (223) 20.5 (219) |
| 20 | 224 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | 72910300 | | | 9.868E-15 | | 47.6 (194) 35.8 (224) 16.6 (236) |
| 20 | 225 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | 72910388 | | | 9.910E-15 | | 71.5 (225) 18.7 (196) 9.77 (231) |
| 20 | 226 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | 72911102 | | | 9.852E-15 | | 67.8 (226) 26.8 (191) 5.37 (220) |
| 20 | 227 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^3F_3$ | 72911118 | | | 9.890E-15 | | 52.2 (198) 21.3 (227) 21.2 (235) |
| 20 | 228 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | 72911362 | | | 9.682E-15 | | 68.9 (228) 18.6 (215) 7.13 (185) |
| 20 | 229 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | 72911394 | | | 9.904E-15 | | 44.7 (200) 27.7 (229) 27.6 (222) |
| 20 | 230 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | 72911628 | | | 9.898E-15 | | 74.6 (230) |
| 20 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | 72911734 | | | 9.891E-15 | | 57.8 (231) 42.2 (196) |
| 20 | 232 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | 72911977 | | | 9.891E-15 | | 100. (232) |
| 20 | 233 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | 72913052 | | | 9.872E-15 | | 100. (233) |
| 20 | 234 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | 72913237 | | | 9.888E-15 | | 100. (234) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 20 | 235 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^1F_3$ | 72913559 | | | 9.887E-15 | | 54.8 (227) 45.2 (235) |
| 20 | 236 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | 72914415 | | | 9.853E-15 | | 54.1 (236) 44.1 (224) 1.80 (194) |
| 20 | 237 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | 72914535 | | | 9.867E-15 | | 72.6 (237) |
| 20 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | 73315242 | | | 3.649E-14 | | 74.3 (238) |
| 20 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | 73316987 | | | 1.370E-14 | | 43.7 (239) 26.2 (283) 23.1 (249) |
| 20 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | 73317932 | | | 1.385E-14 | | 70.8 (240) 29.2 (246) |
| 20 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | 73318746 | | | 2.838E-14 | | 66.1 (241) 17.8 (254) 16.2 (297) |
| 20 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | 73320963 | | | 1.123E-14 | | 70.9 (242) 12.6 (253) 11.8 (284) |
| 20 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | 73322574 | | | 6.367E-14 | | 66.8 (243) 20.6 (249) 4.02 (258) |
| 20 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | 73323661 | | | 4.089E-14 | | 78.7 (244) |
| 20 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | 73324808 | | | 1.236E-14 | | 43.0 (245) 22.5 (289) 17.6 (251) |
| 20 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | 73326348 | | | 3.084E-14 | | 71.1 (246) 28.9 (240) |
| 20 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | 73328143 | | | 1.078E-14 | | 72.6 (247) |
| 20 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | 73329360 | | | 1.296E-14 | | 36.3 (248) 22.8 (238) 18.6 (287) |
| 20 | 249 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | 73330501 | | | 2.817E-14 | | 44.9 (249) 24.7 (239) 23.2 (243) |
| 20 | 250 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | 73330617 | | | 7.193E-14 | | 87.7 (250) |
| 20 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | 73331539 | | | 5.373E-14 | | 66.5 (251) 16.1 (260) 4.48 (289) |
| 20 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | 73332049 | | | 1.162E-14 | | 43.6 (252) 22.5 (303) 18.3 (291) |
| 20 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | 73332539 | | | 5.658E-14 | | 84.9 (253) |
| 20 | 254 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | 73332836 | | | 1.390E-14 | | 56.5 (254) 31.5 (241) 12.0 (297) |
| 20 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | 73334393 | | | 1.225E-14 | | 35.2 (255) 27.7 (292) 20.4 (244) |
| 20 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | 73334794 | | | 9.916E-15 | | 74.0 (256) |
| 20 | 257 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | 73335663 | | | 9.908E-15 | | 42.0 (257) 31.8 (304) 26.2 (296) |
| 20 | 258 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | 73335929 | | | 1.121E-14 | | 49.3 (258) 22.9 (319) 14.2 (293) |
| 20 | 259 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | 73336234 | | | 9.844E-15 | | 72.4 (259) |
| 20 | 260 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | 73336311 | | | 5.585E-14 | | 79.1 (260) |
| 20 | 261 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | 73336396 | | | 2.489E-14 | | 60.8 (261) 22.3 (270) 11.2 (308) |
| 20 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | 73336442 | | | 9.818E-15 | | 39.6 (262) 32.9 (309) 27.5 (302) |
| 20 | 263 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | 73336445 | | | 1.086E-14 | | 43.2 (263) 27.9 (321) 18.3 (301) |
| 20 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | 73336550 | | | 9.790E-15 | | 71.7 (264) 16.4 (305) 11.8 (313) |
| 20 | 265 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | 73336602 | | | 9.973E-15 | | 42.9 (265) 31.9 (306) 24.0 (320) |
| 20 | 266 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | 73336602 | | | 1.113E-14 | | 45.3 (266) 26.0 (299) 16.5 (295) |
| 20 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | 73336668 | | | 9.790E-15 | | 38.6 (267) 33.1 (311) 28.2 (307) |
| 20 | 268 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | 73336795 | | | 9.837E-15 | | 41.0 (268) 32.8 (310) 26.2 (317) |
| 20 | 269 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | 73336911 | | | 9.838E-15 | | 59.0 (269) 23.4 (313) 17.6 (305) |
| 20 | 270 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | 73336984 | | | 1.593E-14 | | 38.9 (261) 34.4 (270) 15.5 (308) |
| 20 | 271 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | 73337174 | | | 1.069E-13 | | 92.4 (271) |
| 20 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | 73337360 | | | 5.545E-14 | | 83.7 (272) |
| 20 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | 73338231 | | | 1.512E-12 | | 98.8 (273) |
| 20 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | 73338258 | | | 7.560E-13 | | 100. (274) |
| 20 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | 73338264 | | | 9.865E-13 | | 73.4 (275) |
| 20 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | 73338393 | | | 2.475E-12 | | 100. (276) |
| 20 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | 73338478 | | | 1.538E-12 | | 74.2 (277) |
| 20 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | 73338537 | | | 3.401E-12 | | 55.6 (278) 44.4 (281) |
| 20 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | 73338540 | | | 3.318E-12 | | 100. (279) |
| 20 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | 73338654 | | | 3.424E-12 | | 100. (280) |
| 20 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | 73338657 | | | 3.406E-12 | | 55.6 (281) 44.4 (278) |
| 20 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | 73379845 | | | 9.994E-15 | | 100. (282) |
| 20 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | 73381971 | | | 1.015E-14 | | 67.7 (283) 30.1 (239) 2.19 (249) |
| 20 | 284 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^1P_1$ | 73382695 | | | 9.669E-15 | | 56.4 (284) 26.9 (248) 16.8 (242) |
| 20 | 285 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | 73383926 | | | 9.703E-15 | | 100. (285) |
| 20 | 286 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | 73384403 | | | 9.685E-15 | | 45.7 (286) 40.6 (245) 13.7 (289) |
| 20 | 287 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^3S_1$ | 73385734 | | | 9.752E-15 | | 66.4 (287) 24.4 (248) 7.47 (284) |
| 20 | 288 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | 73388609 | | | 9.948E-15 | | 100. (288) |
| 20 | 289 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | 73388742 | | | 9.689E-15 | | 57.1 (289) 38.6 (286) 4.33 (245) |
| 20 | 290 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | 73388749 | | | 9.906E-15 | | 58.3 (290) 20.4 (247) 17.5 (292) |
| 20 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | 73390292 | | | 9.878E-15 | | 54.3 (291) 41.5 (252) 4.24 (303) |
| 20 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | 73392119 | | | 9.881E-15 | | 48.0 (295) 43.7 (292) 5.85 (290) |
| 20 | 293 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | 73392336 | | | 9.884E-15 | | 68.3 (293) 30.3 (258) 1.36 (319) |
| 20 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | 73392692 | | | 9.900E-15 | | 100. (294) |
| 20 | 295 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | 73393433 | | | 9.908E-15 | | 43.7 (295) 30.4 (299) 25.9 (256) |
| 20 | 296 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | 73393888 | | | 9.907E-15 | | 67.8 (296) 32.2 (257) |
| 20 | 297 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | 73394204 | | | 9.827E-15 | | 71.7 (297) 25.9 (254) 2.47 (241) |
| 20 | 298 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | 73394744 | | | 9.883E-15 | | 100. (298) |
| 20 | 299 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | 73394951 | | | 9.902E-15 | | 47.3 (266) 31.7 (299) 21.1 (295) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 20 | 300 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 73395001 | | 9.914E-15 | | 37.5 (300) 35.1 (308) 27.4 (259) |
| 20 | 301 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 73395053 | | 9.901E-15 | | 49.7 (263) 36.1 (301) 14.3 (321) |
| 20 | 302 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 73395178 | | 9.914E-15 | | 72.1 (302) 19.3 (262) 8.58 (309) |
| 20 | 303 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 73395349 | | 9.811E-15 | | 65.5 (303) 22.9 (291) 7.73 (252) |
| 20 | 304 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 73395487 | | 9.890E-15 | | 67.3 (304) 26.1 (257) 6.62 (296) |
| 20 | 305 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 73395573 | | 9.900E-15 | | 36.0 (305) 35.9 (313) 28.1 (264) |
| 20 | 306 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^1F_3$ | | 73395633 | | 9.912E-15 | | 54.9 (265) 22.5 (306) 19.7 (320) |
| 20 | 307 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 73395685 | | 9.900E-15 | | 71.6 (307) 18.5 (267) 9.97 (311) |
| 20 | 308 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 73395771 | | 9.919E-15 | | 43.4 (270) 28.6 (308) 28.0 (300) |
| 20 | 309 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 73395873 | | 9.860E-15 | | 58.8 (309) 41.2 (262) |
| 20 | 310 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^1G_4$ | | 73395899 | | 9.921E-15 | | 59.0 (268) 21.2 (310) 19.8 (317) |
| 20 | 311 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 73395986 | | 9.793E-15 | | 57.0 (311) 43.0 (267) |
| 20 | 312 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 73395994 | | 9.860E-15 | | 100. (312) |
| 20 | 313 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 73396009 | | 9.922E-15 | | 40.9 (269) 30.1 (305) 29.0 (313) |
| 20 | 314 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 73396101 | | 9.793E-15 | | 100. (314) |
| 20 | 315 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 73396548 | | 9.884E-15 | | 100. (315) |
| 20 | 316 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 73396609 | | 9.893E-15 | | 100. (316) |
| 20 | 317 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^3G_4$ | | 73396721 | | 9.893E-15 | | 54.0 (317) 46.0 (310) |
| 20 | 318 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 73396828 | | 9.899E-15 | | 100. (318) |
| 20 | 319 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 73397000 | | 9.862E-15 | | 70.2 (319) 15.9 (258) 13.9 (293) |
| 20 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 73397026 | | 9.902E-15 | | 54.6 (320) 45.4 (306) |
| 20 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 73397407 | | 9.888E-15 | | 54.6 (321) 43.1 (301) 2.38 (263) |
| 21 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 21 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 34448120 | 34448308 | | 4.315E-08 | | 100. (2) |
| 21 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 34628770 | 34629173 | | 3.864E-09 | | 100. (3) |
| 21 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 34638550 | 34638223 | | 1.343E-13 | | 96.5 (4) |
| 21 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 34645360 | 34645074 | | 6.614E-04 | | 100. (5) |
| 21 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 34682810 | 34683009 | | 5.902E-10 | | 100. (6) |
| 21 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 34805000 | 34805659 | | 5.014E-15 | | 96.5 (7) |
| 21 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 40790620 | 40790661 | | 8.122E-13 | | 100. (8) |
| 21 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 40840530 | 40840500 | | 2.751E-13 | | 100. (9) |
| 21 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 40842480 | 40842462 | | 8.529E-13 | | 100. (10) |
| 21 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 40843100 | 40843177 | | 1.697E-13 | | 96.0 (11) |
| 21 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 40856320 | 40856540 | | 2.805E-13 | | 100. (12) |
| 21 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | | 40883855 | | 9.496E-14 | | 70.5 (13) 29.5 (17) |
| 21 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | | 40884013 | | 9.457E-14 | | 100. (14) |
| 21 | 15 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | | 40889156 | | 9.526E-14 | | 100. (15) |
| 21 | 16 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 40889690 | 40889644 | | 1.732E-14 | | 96.0 (16) |
| 21 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | | 40890702 | | 9.644E-14 | | 70.5 (17) 29.5 (13) |
| 21 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 42983370 | 42983634 | | 1.185E-12 | | 100. (18) |
| 21 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 43004100 | 43004149 | | 4.688E-13 | | 100. (19) |
| 21 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 43004390 | 43004644 | | 1.237E-12 | | 100. (20) |
| 21 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 43005180 | 43005276 | | 3.235E-13 | | 95.8 (21) |
| 21 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 43010770 | 43010923 | | 4.763E-13 | | 100. (22) |
| 21 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | | 43022192 | | 2.208E-13 | | 73.2 (23) |
| 21 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | | 43022202 | | 2.197E-13 | | 100. (24) |
| 21 | 25 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | | 43024372 | | 2.214E-13 | | 100. (25) |
| 21 | 26 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 43024380 | 43024449 | | 4.123E-14 | | 95.8 (26) |
| 21 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 43025071 | | 4.512E-13 | | 56.8 (27) 43.2 (31) |
| 21 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | | 43025169 | | 2.252E-13 | | 73.2 (28) |
| 21 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 43025210 | | 4.512E-13 | | 100. (29) |
| 21 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 43026302 | | 4.522E-13 | | 100. (30) |
| 21 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 43026413 | | 4.525E-13 | | 56.8 (31) 43.2 (27) |
| 21 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 43992240 | 43992441 | | 1.868E-12 | | 100. (32) |
| 21 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 44002720 | 44002819 | | 7.999E-13 | | 100. (33) |
| 21 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 44002740 | 44002997 | | 1.931E-12 | | 100. (34) |
| 21 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 44003270 | 44003396 | | 5.741E-13 | | 95.7 (35) |
| 21 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 44006140 | 44006287 | | 8.112E-13 | | 100. (36) |
| 21 | 37 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | | 44011990 | | 4.227E-13 | | 100. (37) |
| 21 | 38 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | | 44011997 | | 4.249E-13 | | 74.3 (38) |
| 21 | 39 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d\ ^3D_3$ | | 44013101 | | 4.262E-13 | | 100. (39) |
| 21 | 40 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p\ ^1P_1$ | 44013010 | 44013109 | | 8.055E-14 | | 95.7 (40) |
| 21 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f\ ^3F_3$ | | 44013491 | | 8.719E-13 | | 57.1 (41) 42.9 (47) |
| 21 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d\ ^1D_2$ | | 44013540 | | 4.335E-13 | | 74.3 (42) |
| 21 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f\ ^3F_2$ | | 44013561 | | 8.718E-13 | | 100. (43) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 21 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 44014120 | | 8.741E-13 | | 100. (44) |
| 21 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 44014136 | | 1.465E-12 | | 55.0 (45) 45.0 (49) |
| 21 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 44014178 | | 1.466E-12 | | 100. (46) |
| 21 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 44014179 | | 8.749E-13 | | 57.1 (47) 42.9 (41) |
| 21 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 44014514 | | 1.467E-12 | | 100. (48) |
| 21 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 44014547 | | 1.467E-12 | | 55.0 (49) 45.0 (45) |
| 21 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 44538374 | | 2.937E-12 | | 100. (50) |
| 21 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 44544335 | | 1.305E-12 | | 100. (51) |
| 21 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 44544420 | | 2.836E-12 | | 100. (52) |
| 21 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 44544668 | | 9.502E-13 | | 95.7 (53) |
| 21 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 44546342 | | 1.322E-12 | | 100. (54) |
| 21 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 44549609 | | 7.278E-13 | | 100. (55) |
| 21 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 44549616 | | 7.284E-13 | | 74.8 (56) |
| 21 | 57 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 44550252 | | 7.344E-13 | | 100. (57) |
| 21 | 58 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 44550258 | | 1.388E-13 | | 95.7 (58) |
| 21 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 44550476 | | 1.490E-12 | | 57.2 (59) 42.8 (65) |
| 21 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 44550515 | | 1.490E-12 | | 100. (60) |
| 21 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 44550515 | | 7.364E-13 | | 74.8 (61) |
| 21 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 44550839 | | 1.494E-12 | | 100. (62) |
| 21 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 44550842 | | 2.514E-12 | | 55.0 (63) 45.0 (69) |
| 21 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 44550866 | | 2.514E-12 | | 100. (64) |
| 21 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 44550874 | | 1.495E-12 | | 57.2 (65) 42.8 (59) |
| 21 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 44551060 | | 3.793E-12 | | 54.1 (66) 45.9 (71) |
| 21 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 44551061 | | 2.517E-12 | | 100. (67) |
| 21 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 44551076 | | 3.794E-12 | | 100. (68) |
| 21 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 44551080 | | 2.518E-12 | | 55.0 (69) 45.0 (63) |
| 21 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 44551206 | | 3.796E-12 | | 100. (70) |
| 21 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 44551219 | | 3.796E-12 | | 54.1 (71) 45.9 (66) |
| 21 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | | 70645171 | | 2.226E-14 | | 79.7 (72) |
| 21 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | | 70675688 | | 8.575E-15 | | 100. (73) |
| 21 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | | 70694399 | | 8.583E-15 | | 98.7 (74) |
| 21 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | | 70744610 | | 8.641E-15 | | 100. (75) |
| 21 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | | 70858223 | | 4.404E-15 | | 96.8 (76) |
| 21 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | | 70886887 | | 4.273E-15 | | 100. (77) |
| 21 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | | 70917678 | | 4.274E-15 | | 85.0 (78) |
| 21 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | | 70983047 | | 8.330E-15 | | 98.7 (79) |
| 21 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | | 71009668 | | 4.265E-15 | | 85.0 (80) |
| 21 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | | 71254884 | | 5.186E-15 | | 80.6 (81) |
| 21 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 77155420 | | 2.732E-14 | | 78.1 (82) |
| 21 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p^1P_1$ | | 77182040 | | 1.177E-14 | | 45.7 (83) 39.9 (108) 11.3 (91) |
| 21 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 77207879 | | 3.057E-14 | | 77.0 (84) |
| 21 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 77213555 | | 1.086E-14 | | 68.3 (85) 31.7 (88) |
| 21 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 77216226 | | 6.978E-15 | | 72.3 (86) |
| 21 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 77225652 | | 1.792E-14 | | 69.5 (87) 24.7 (91) 3.30 (113) |
| 21 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 77234446 | | 1.451E-14 | | 61.3 (88) 30.0 (85) 8.64 (114) |
| 21 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 77241304 | | 2.259E-14 | | 86.8 (89) |
| 21 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 77247695 | | 7.868E-15 | | 71.4 (90) 23.0 (97) 3.21 (111) |
| 21 | 91 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 77253586 | | 1.047E-14 | | 58.4 (91) 21.5 (87) 11.7 (83) |
| 21 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 77271806 | | 7.406E-15 | | 61.7 (92) 10.1 (100) 9.66 (98) |
| 21 | 93 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 77280733 | | 1.303E-14 | | 58.7 (93) 41.3 (103) |
| 21 | 94 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 77286693 | | 8.066E-15 | | 63.1 (94) 18.8 (95) 10.5 (102) |
| 21 | 95 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 77290908 | | 8.173E-15 | | 61.5 (95) 24.9 (94) 8.91 (102) |
| 21 | 96 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 77305752 | | 6.869E-15 | | 92.1 (96) |
| 21 | 97 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 77312627 | | 1.753E-14 | | 49.4 (97) 19.8 (111) 16.5 (101) |
| 21 | 98 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 77313021 | | 1.826E-14 | | 67.0 (98) 20.8 (100) 8.13 (86) |
| 21 | 99 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 77317468 | | 8.108E-15 | | 86.4 (99) |
| 21 | 100 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3P_1$ | | 77332509 | | 7.562E-15 | | 52.3 (100) 16.5 (92) 13.3 (98) |
| 21 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 77334984 | | 1.579E-14 | | 33.1 (101) 27.0 (97) 19.6 (90) |
| 21 | 102 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d^1D_2$ | | 77337845 | | 8.141E-15 | | 55.6 (102) 16.8 (109) 10.1 (95) |
| 21 | 103 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 77345847 | | 1.113E-14 | | 58.7 (103) 41.3 (93) |
| 21 | 104 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 77353731 | | 7.536E-15 | | 71.9 (104) 9.33 (116) 8.77 (113) |
| 21 | 105 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^3P_2$ | | 77360057 | | 7.578E-15 | | 81.7 (105) |
| 21 | 106 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3S_1$ | | 77361162 | | 7.512E-15 | | 66.6 (106) 16.3 (100) 13.9 (82) |
| 21 | 107 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d^3F_4$ | | 77364723 | | 8.343E-15 | | 100. (107) |
| 21 | 108 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 77375860 | | 1.042E-14 | | 52.7 (108) 34.0 (83) 9.50 (104) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 21 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^3D_2$ | | 77383247 | | 7.640E-15 | | 57.5 (109) 21.2 (102) 9.82 (95) |
| 21 | 110 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3D_3$ | | 77400432 | | 7.349E-15 | | 84.9 (110) |
| 21 | 111 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 77418743 | | 9.148E-15 | | 58.9 (111) 35.3 (101) 5.76 (105) |
| 21 | 112 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 77425098 | | 8.079E-15 | | 64.3 (112) 22.4 (109) 7.02 (89) |
| 21 | 113 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 77427840 | | 8.083E-15 | | 76.0 (113) |
| 21 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 77431572 | | 8.175E-15 | | 91.2 (114) |
| 21 | 115 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | | 77467745 | | 6.994E-15 | | 92.4 (115) |
| 21 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 77483702 | | 7.741E-15 | | 85.4 (116) |
| 21 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 77489039 | | 7.540E-15 | | 78.9 (117) |
| 21 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 79419300 | | 3.345E-14 | | 78.5 (118) |
| 21 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2s4p\ ^1P_1$ | | 79430148 | | 1.198E-14 | | 35.5 (119) 31.3 (149) 29.6 (127) |
| 21 | 120 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 79435636 | | 2.964E-14 | | 74.1 (120) |
| 21 | 121 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 79436038 | | 1.210E-14 | | 64.3 (121) 35.7 (125) |
| 21 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 79444122 | | 8.375E-15 | | 71.4 (122) 14.4 (147) 12.7 (133) |
| 21 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 79445399 | | 3.254E-14 | | 71.9 (123) 12.6 (119) 10.0 (127) |
| 21 | 124 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 79452463 | | 3.273E-14 | | 83.9 (124) |
| 21 | 125 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 79456947 | | 1.732E-14 | | 60.4 (125) 35.4 (121) 4.21 (159) |
| 21 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 79458909 | | 9.801E-15 | | 51.5 (126) 24.8 (131) 13.6 (154) |
| 21 | 127 | $2s_{1/2}4p_{3/2}(J=1)$ | $2p4s\ ^3P_1$ | | 79470537 | | 1.503E-14 | | 43.4 (127) 32.9 (119) 21.0 (123) |
| 21 | 128 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 79472360 | | 8.645E-15 | | 74.4 (128) |
| 21 | 129 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 79472477 | | 9.175E-15 | | 33.8 (129) 30.6 (147) 13.0 (151) |
| 21 | 130 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 79476128 | | 5.102E-14 | | 90.0 (130) |
| 21 | 131 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 79481382 | | 3.092E-14 | | 57.8 (131) 21.5 (136) 12.1 (154) |
| 21 | 132 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 79481957 | | 8.668E-15 | | 79.0 (132) |
| 21 | 133 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 79483915 | | 2.932E-14 | | 77.5 (133) |
| 21 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 79485893 | | 9.445E-15 | | 56.1 (134) 15.6 (144) 15.4 (155) |
| 21 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 79491742 | | 8.636E-15 | | 30.6 (135) 27.2 (156) 21.3 (153) |
| 21 | 136 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 79497352 | | 3.383E-14 | | 67.6 (136) 15.5 (126) 13.6 (131) |
| 21 | 137 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 79499252 | | 8.123E-15 | | 62.6 (137) 17.0 (169) 13.6 (157) |
| 21 | 138 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 79499440 | | 8.008E-15 | | 70.7 (138) 20.1 (158) 9.19 (163) |
| 21 | 139 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 79501047 | | 1.690E-13 | | 96.8 (139) |
| 21 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 79502204 | | 8.005E-15 | | 41.1 (140) 29.7 (160) 29.1 (164) |
| 21 | 141 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 79503120 | | 8.219E-15 | | 54.2 (141) 25.7 (168) 17.3 (162) |
| 21 | 142 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 79503251 | | 7.819E-14 | | 92.4 (142) |
| 21 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 79503752 | | 8.268E-15 | | 42.8 (143) 33.7 (163) 19.9 (158) |
| 21 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 79504301 | | 4.283E-14 | | 81.5 (144) |
| 21 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | | 79506443 | | 3.922E-13 | | 97.9 (145) |
| 21 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 79518756 | | 8.435E-15 | | 86.2 (146) |
| 21 | 147 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | | 79527694 | | 7.479E-15 | | 46.1 (147) 35.7 (129) 16.7 (122) |
| 21 | 148 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 79533541 | | 7.942E-15 | | 92.9 (148) |
| 21 | 149 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 79534744 | | 9.404E-15 | | 65.8 (149) 16.9 (127) 15.8 (119) |
| 21 | 150 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | | 79536208 | | 7.645E-15 | | 60.9 (150) 26.3 (126) 8.99 (154) |
| 21 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | | 79542856 | | 7.921E-15 | | 67.6 (151) 18.4 (129) 7.47 (118) |
| 21 | 152 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 79549455 | | 8.399E-15 | | 96.8 (152) |
| 21 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | | 79550413 | | 8.064E-15 | | 50.0 (153) 26.1 (156) 19.6 (128) |
| 21 | 154 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 79555276 | | 7.839E-15 | | 65.1 (154) 24.3 (150) 7.06 (136) |
| 21 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | | 79557025 | | 7.961E-15 | | 64.4 (155) 31.6 (134) 4.03 (165) |
| 21 | 156 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | | 79565696 | | 8.127E-15 | | 53.7 (135) 35.5 (156) 5.51 (153) |
| 21 | 157 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 79566820 | | 8.152E-15 | | 69.3 (157) 24.6 (137) 3.20 (123) |
| 21 | 158 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 79568456 | | 8.075E-15 | | 40.0 (158) 31.1 (163) 28.9 (138) |
| 21 | 159 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 79568627 | | 8.232E-15 | | 96.0 (159) |
| 21 | 160 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 79570154 | | 8.075E-15 | | 66.5 (160) 30.9 (140) 2.63 (164) |
| 21 | 161 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 79574595 | | 8.069E-15 | | 100. (161) |
| 21 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 79574810 | | 8.072E-15 | | 43.7 (141) 35.2 (162) 21.0 (168) |
| 21 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | | 79574841 | | 8.089E-15 | | 54.3 (143) 25.8 (163) 19.9 (158) |
| 21 | 164 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | | 79576363 | | 8.067E-15 | | 68.2 (164) 27.9 (140) 3.85 (160) |
| 21 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | | 79578962 | | 7.732E-15 | | 79.2 (165) |
| 21 | 166 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | | 79581041 | | 8.092E-15 | | 100. (166) |
| 21 | 167 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | | 79583473 | | 8.061E-15 | | 77.1 (167) |
| 21 | 168 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 79583521 | | 8.063E-15 | | 52.6 (168) 46.4 (162) 1.06 (141) |
| 21 | 169 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | | 79586089 | | 8.069E-15 | | 76.7 (169) |
| 21 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | | 80451117 | | 3.348E-14 | | 77.2 (170) |
| 21 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | | 80455454 | | 1.152E-14 | | 40.2 (171) 27.3 (208) 26.7 (181) |
| 21 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | | 80457364 | | 1.184E-14 | | 67.7 (172) 32.3 (178) |
| 21 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | | 80458155 | | 2.656E-14 | | 70.1 (173) 16.3 (226) 13.6 (184) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 21 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | | 80462551 | | 8.971E-15 | | 70.9 (174) 12.9 (207) 12.6 (185) |
| 21 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | | 80464354 | | 4.904E-14 | | 69.5 (175) 18.7 (181) 3.54 (217) |
| 21 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | | 80467344 | | 3.593E-14 | | 82.2 (176) |
| 21 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | | 80470163 | | 1.018E-14 | | 44.7 (177) 20.5 (183) 19.9 (214) |
| 21 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | | 80470962 | | 2.130E-14 | | 66.1 (178) 32.2 (172) 1.71 (218) |
| 21 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | | 80476460 | | 8.823E-15 | | 72.9 (179) |
| 21 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | | 80477820 | | 9.981E-15 | | 37.3 (180) 21.5 (207) 17.7 (170) |
| 21 | 181 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | | 80478892 | | 2.027E-14 | | 43.5 (181) 29.8 (171) 21.4 (175) |
| 21 | 182 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 80480040 | | 7.046E-14 | | 90.2 (182) |
| 21 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | | 80481810 | | 4.218E-14 | | 64.2 (183) 18.4 (190) 6.50 (214) |
| 21 | 184 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 80483327 | | 1.022E-14 | | 64.9 (184) 25.4 (173) 9.73 (226) |
| 21 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 80483390 | | 3.846E-14 | | 82.6 (185) |
| 21 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 80483706 | | 9.728E-15 | | 46.1 (186) 19.2 (227) 17.4 (199) |
| 21 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 80487600 | | 9.471E-15 | | 35.0 (187) 29.1 (216) 18.8 (213) |
| 21 | 188 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 80489340 | | 8.126E-15 | | 73.2 (188) |
| 21 | 189 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 80490469 | | 8.693E-15 | | 54.3 (189) 21.7 (236) 14.6 (217) |
| 21 | 190 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | | 80490594 | | 4.448E-14 | | 75.8 (190) |
| 21 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 80490969 | | 8.131E-15 | | 42.0 (191) 31.0 (228) 27.0 (220) |
| 21 | 192 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 80491341 | | 1.001E-13 | | 93.1 (192) |
| 21 | 193 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 80491926 | | 8.486E-15 | | 47.5 (193) 28.3 (237) 18.9 (224) |
| 21 | 194 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 80491971 | | 8.094E-15 | | 71.9 (194) 16.9 (222) 11.1 (230) |
| 21 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 80492250 | | 8.718E-15 | | 45.8 (195) 28.6 (223) 17.6 (219) |
| 21 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 80492382 | | 8.088E-15 | | 39.3 (196) 32.7 (231) 28.0 (225) |
| 21 | 197 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 80492447 | | 7.944E-14 | | 92.1 (197) |
| 21 | 198 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 80492473 | | 8.627E-15 | | 41.1 (198) 29.5 (229) 22.2 (235) |
| 21 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | | 80492939 | | 3.189E-14 | | 74.5 (199) |
| 21 | 200 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 80492947 | | 8.643E-15 | | 51.8 (200) 24.6 (230) 16.9 (222) |
| 21 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | | 80494310 | | 7.393E-13 | | 98.2 (201) |
| 21 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 80494381 | | 6.439E-13 | | 65.8 (202) 34.2 (205) |
| 21 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 80494386 | | 5.584E-13 | | 100. (203) |
| 21 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 80494691 | | 1.280E-12 | | 100. (204) |
| 21 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | | 80494804 | | 8.825E-13 | | 66.4 (205) 33.6 (202) |
| 21 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 80534483 | | 8.256E-15 | | 100. (206) |
| 21 | 207 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^1P_1$ | | 80539704 | | 7.771E-15 | | 52.9 (207) 30.4 (180) 16.8 (174) |
| 21 | 208 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 80539737 | | 8.548E-15 | | 68.2 (208) 27.0 (171) 4.78 (181) |
| 21 | 209 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 80542369 | | 7.868E-15 | | 98.5 (209) |
| 21 | 210 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^3P_2$ | | 80543064 | | 7.825E-15 | | 48.7 (210) 37.7 (177) 13.6 (214) |
| 21 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^3S_1$ | | 80546269 | | 7.979E-15 | | 67.1 (211) 21.3 (180) 8.52 (207) |
| 21 | 212 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 80551000 | | 8.204E-15 | | 100. (212) |
| 21 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | | 80551243 | | 8.114E-15 | | 56.0 (213) 20.4 (179) 20.0 (216) |
| 21 | 214 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | | 80551835 | | 7.849E-15 | | 58.8 (214) 35.8 (210) 3.95 (177) |
| 21 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | | 80554248 | | 8.075E-15 | | 56.6 (215) 39.1 (186) 4.35 (227) |
| 21 | 216 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | | 80558022 | | 8.125E-15 | | 49.9 (187) 41.2 (216) 6.30 (213) |
| 21 | 217 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 80558446 | | 8.139E-15 | | 67.9 (217) 29.2 (189) 1.65 (236) |
| 21 | 218 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 80559238 | | 8.182E-15 | | 98.3 (218) |
| 21 | 219 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 80560155 | | 8.132E-15 | | 42.3 (219) 31.1 (223) 26.6 (188) |
| 21 | 220 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 80561051 | | 8.131E-15 | | 67.0 (220) 31.8 (191) 1.19 (228) |
| 21 | 221 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 80562893 | | 8.117E-15 | | 100. (221) |
| 21 | 222 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^1G_4$ | | 80563097 | | 8.163E-15 | | 36.5 (222) 35.5 (230) 27.9 (194) |
| 21 | 223 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 80563105 | | 8.134E-15 | | 49.0 (195) 29.8 (223) 21.3 (219) |
| 21 | 224 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 80563183 | | 8.128E-15 | | 48.3 (193) 35.6 (224) 16.1 (237) |
| 21 | 225 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 80563460 | | 8.163E-15 | | 71.7 (225) 19.1 (196) 9.28 (231) |
| 21 | 226 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 80563844 | | 8.070E-15 | | 74.0 (226) |
| 21 | 227 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5d\ ^1F_3$ | | 80564127 | | 8.072E-15 | | 31.4 (198) 30.6 (227) 14.2 (235) |
| 21 | 228 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 80564146 | | 8.117E-15 | | 67.8 (228) 26.3 (191) 5.93 (220) |
| 21 | 229 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^1F_3$ | | 80564251 | | 8.046E-15 | | 41.3 (227) 23.5 (198) 11.5 (229) |
| 21 | 230 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | | 80564506 | | 8.159E-15 | | 44.2 (200) 28.3 (222) 27.5 (230) |
| 21 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 80564854 | | 8.148E-15 | | 58.2 (231) 41.8 (196) |
| 21 | 232 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 80565157 | | 8.149E-15 | | 100. (232) |
| 21 | 233 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 80566091 | | 8.129E-15 | | 100. (233) |
| 21 | 234 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 80566404 | | 8.146E-15 | | 100. (234) |
| 21 | 235 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^3F_3$ | | 80566794 | | 8.146E-15 | | 54.6 (235) 45.4 (229) |
| 21 | 236 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 80567489 | | 8.109E-15 | | 72.5 (236) |
| 21 | 237 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 80567628 | | 8.116E-15 | | 54.1 (237) 44.0 (224) 1.91 (193) |
| 21 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 81006466 | | 2.961E-14 | | 74.2 (238) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 21 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 81008179 | | 1.101E-14 | | 45.4 (239) 26.3 (283) 21.6 (249) |
| 21 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 81009064 | | 1.121E-14 | | 71.9 (240) 28.1 (246) |
| 21 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 81010058 | | 2.265E-14 | | 65.1 (241) 19.0 (254) 15.9 (296) |
| 21 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 81012278 | | 9.191E-15 | | 71.2 (242) 11.8 (284) 11.6 (253) |
| 21 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 81014208 | | 5.329E-14 | | 67.0 (243) 20.8 (249) 4.18 (258) |
| 21 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 81015593 | | 3.282E-14 | | 78.1 (244) |
| 21 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 81016662 | | 1.002E-14 | | 43.0 (245) 23.3 (288) 16.6 (251) |
| 21 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 81018074 | | 2.648E-14 | | 72.2 (246) 27.8 (240) |
| 21 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 81020116 | | 8.834E-15 | | 72.0 (247) 14.0 (290) 7.09 (271) |
| 21 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 81021386 | | 1.067E-14 | | 36.4 (248) 22.9 (238) 19.4 (287) |
| 21 | 249 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 81022737 | | 2.428E-14 | | 46.1 (249) 23.8 (243) 22.7 (239) |
| 21 | 250 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 81023035 | | 5.661E-14 | | 87.0 (250) |
| 21 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 81023880 | | 4.486E-14 | | 67.5 (251) 15.3 (262) 4.03 (288) |
| 21 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 81024392 | | 9.444E-15 | | 43.3 (252) 23.5 (303) 18.6 (291) |
| 21 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 81024877 | | 4.989E-14 | | 85.9 (253) |
| 21 | 254 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 81024963 | | 1.170E-14 | | 54.2 (254) 33.0 (241) 12.8 (296) |
| 21 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 81026840 | | 1.016E-14 | | 35.5 (255) 27.4 (292) 21.0 (244) |
| 21 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 81027204 | | 8.157E-15 | | 74.1 (256) |
| 21 | 257 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 81028188 | | 8.150E-15 | | 42.0 (257) 32.0 (304) 26.1 (297) |
| 21 | 258 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 81028334 | | 9.285E-15 | | 48.2 (258) 23.4 (319) 14.2 (293) |
| 21 | 259 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 81028776 | | 8.096E-15 | | 72.5 (259) |
| 21 | 260 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 81028935 | | 9.724E-15 | | 39.6 (260) 25.7 (321) 17.5 (300) |
| 21 | 261 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 81029028 | | 8.089E-15 | | 39.7 (261) 33.0 (309) 27.4 (302) |
| 21 | 262 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 81029034 | | 3.355E-14 | | 63.6 (262) 13.6 (251) 8.34 (245) |
| 21 | 263 | $2p_{1/2}6g_{9/2}(J=4)$ | $2s6f\ ^3F_4$ | | 81029069 | | 1.454E-14 | | 44.4 (263) 31.7 (270) 15.0 (308) |
| 21 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^1I_5$ | | 81029136 | | 8.072E-15 | | 71.8 (264) 16.6 (313) 11.7 (305) |
| 21 | 265 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 81029148 | | 8.182E-15 | | 43.2 (265) 32.4 (306) 24.4 (320) |
| 21 | 266 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 81029177 | | 9.246E-15 | | 45.4 (266) 25.6 (299) 16.1 (295) |
| 21 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 81029281 | | 8.072E-15 | | 38.7 (267) 33.2 (311) 28.2 (307) |
| 21 | 268 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 81029379 | | 8.101E-15 | | 40.8 (268) 32.9 (310) 26.3 (317) |
| 21 | 269 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 81029522 | | 8.101E-15 | | 59.1 (269) 23.5 (305) 17.4 (313) |
| 21 | 270 | $2s_{1/2}6f_{7/2}(J=4)$ | $2p6g\ ^3F_4$ | | 81029672 | | 1.786E-14 | | 55.3 (270) 25.2 (270) 11.3 (308) |
| 21 | 271 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 81029889 | | 9.418E-14 | | 92.9 (271) |
| 21 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 81030088 | | 4.969E-14 | | 84.0 (272) |
| 21 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 81031065 | | 1.207E-12 | | 98.2 (273) |
| 21 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 81031099 | | 6.903E-13 | | 100. (274) |
| 21 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 81031107 | | 8.825E-13 | | 72.2 (275) 27.8 (277) |
| 21 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 81031273 | | 2.086E-12 | | 100. (276) |
| 21 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 81031364 | | 1.368E-12 | | 72.8 (277) |
| 21 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 81031423 | | 2.878E-12 | | 55.5 (278) 44.5 (281) |
| 21 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 81031427 | | 2.845E-12 | | 100. (279) |
| 21 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 81031568 | | 2.895E-12 | | 100. (280) |
| 21 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 81031571 | | 2.907E-12 | | 55.5 (281) 44.5 (278) |
| 21 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 81083891 | | 8.224E-15 | | 100. (282) |
| 21 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 81086009 | | 8.315E-15 | | 67.6 (283) 30.7 (239) 1.63 (249) |
| 21 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 81087065 | | 7.960E-15 | | 54.3 (284) 29.0 (248) 16.7 (242) |
| 21 | 285 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 81088504 | | 7.979E-15 | | 100. (285) |
| 21 | 286 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 81088708 | | 7.969E-15 | | 43.0 (286) 41.8 (245) 15.2 (288) |
| 21 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3S_1$ | | 81090169 | | 8.008E-15 | | 66.7 (287) 22.1 (248) 9.76 (284) |
| 21 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 81093544 | | 7.968E-15 | | 55.0 (288) 41.2 (286) 3.72 (245) |
| 21 | 289 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 81093575 | | 8.191E-15 | | 100. (289) |
| 21 | 290 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 81093661 | | 8.157E-15 | | 58.1 (290) 20.6 (247) 17.8 (292) |
| 21 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 81095281 | | 8.135E-15 | | 53.0 (291) 42.4 (252) 4.56 (303) |
| 21 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 81097200 | | 8.132E-15 | | 48.0 (255) 43.4 (292) 6.35 (290) |
| 21 | 293 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 81097361 | | 8.133E-15 | | 68.0 (293) 30.6 (258) 1.37 (319) |
| 21 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 81097725 | | 8.145E-15 | | 100. (294) |
| 21 | 295 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 81098684 | | 8.163E-15 | | 43.3 (295) 30.9 (299) 25.8 (256) |
| 21 | 296 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 81099185 | | 8.045E-15 | | 71.1 (296) 26.9 (254) 1.92 (241) |
| 21 | 297 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 81099200 | | 8.163E-15 | | 67.2 (297) 32.8 (257) |
| 21 | 298 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 81100123 | | 8.147E-15 | | 100. (298) |
| 21 | 299 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 81100309 | | 8.158E-15 | | 46.9 (266) 31.4 (299) 21.7 (295) |
| 21 | 300 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 81100371 | | 8.157E-15 | | 50.0 (260) 36.0 (300) 14.0 (321) |
| 21 | 301 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 81100387 | | 8.170E-15 | | 37.1 (301) 35.6 (308) 27.3 (259) |
| 21 | 302 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 81100602 | | 8.170E-15 | | 72.1 (302) 19.8 (261) 8.10 (309) |
| 21 | 303 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 81100650 | | 8.081E-15 | | 65.5 (303) 24.4 (291) 7.73 (252) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 21 | 304 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 81100897 | | 8.153E-15 | | 67.3 (304) 25.4 (257) 7.26 (297) |
| 21 | 305 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 81101021 | | 8.162E-15 | | 36.3 (305) 35.6 (313) 28.1 (264) |
| 21 | 306 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^1F_3$ | | 81101043 | | 8.169E-15 | | 55.8 (265) 22.2 (306) 20.4 (320) |
| 21 | 307 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 81101157 | | 8.162E-15 | | 71.5 (307) 19.1 (267) 9.45 (311) |
| 21 | 308 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 81101219 | | 8.173E-15 | | 43.1 (270) 28.6 (301) 28.3 (308) |
| 21 | 309 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 81101328 | | 8.136E-15 | | 59.3 (309) 40.7 (261) |
| 21 | 310 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^1G_4$ | | 81101357 | | 8.176E-15 | | 59.1 (268) 20.9 (310) 20.0 (317) |
| 21 | 311 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 81101471 | | 8.090E-15 | | 57.6 (311) 42.4 (267) |
| 21 | 312 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 81101482 | | 8.136E-15 | | 100. (312) |
| 21 | 313 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 81101493 | | 8.176E-15 | | 40.7 (269) 30.6 (313) 28.7 (305) |
| 21 | 314 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 81101612 | | 8.090E-15 | | 100. (314) |
| 21 | 315 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 81101947 | | 8.145E-15 | | 100. (315) |
| 21 | 316 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 81102104 | | 8.156E-15 | | 100. (316) |
| 21 | 317 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^3G_4$ | | 81102242 | | 8.156E-15 | | 53.7 (317) 46.3 (310) |
| 21 | 318 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 81102304 | | 8.159E-15 | | 100. (318) |
| 21 | 319 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^3P_1$ | | 81102363 | | 8.119E-15 | | 69.6 (319) 16.1 (258) 14.3 (293) |
| 21 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 81102543 | | 8.161E-15 | | 54.4 (320) 45.6 (306) |
| 21 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 81102908 | | 8.148E-15 | | 54.6 (321) 43.0 (300) 2.48 (260) |
| 22 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | 0 | | | 100. (1) |
| 22 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 37923880 | 37923509 | 37922221 | 2.678E-08 | 2.704E-08 | 100. (2) |
| 22 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 38114760 | 38114564 | 38113210 | 3.617E-09 | 3.619E-09 | 100. (3) |
| 22 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 38125260 | 38125056 | 38123713 | 8.920E-14 | 8.937E-14 | 95.6 (4) |
| 22 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 38131640 | 38131323 | 38130063 | 7.602E-04 | 7.328E-04 | 100. (5) |
| 22 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 38180620 | 38180443 | 38179094 | 4.295E-10 | 4.296E-10 | 100. (6) |
| 22 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 38308340 | 38307933 | 38306785 | 4.171E-15 | 4.169E-15 | 95.6 (7) |
| 22 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 44911910 | 44911544 | 44910299 | 6.698E-13 | 6.704E-13 | 100. (8) |
| 22 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 44964560 | 44964200 | 44962976 | 2.260E-13 | 2.260E-13 | 100. (9) |
| 22 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 44966970 | 44966265 | 44965160 | 7.023E-13 | 7.026E-13 | 100. (10) |
| 22 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 44967630 | 44967286 | 44966068 | 1.282E-13 | 1.283E-13 | 95.0 (11) |
| 22 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 44984160 | 44983824 | 44982602 | 2.309E-13 | 2.309E-13 | 100. (12) |
| 22 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 45012940 | 45012550 | 45011363 | 7.808E-14 | 7.805E-14 | 69.2 (13) 30.8 (17) |
| 22 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 45013170 | 45012778 | 45011586 | 7.780E-14 | 7.777E-14 | 100. (14) |
| 22 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 45018670 | 45018224 | 45017088 | 1.443E-14 | 1.441E-14 | 95.0 (15) |
| 22 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 45019460 | 45019071 | 45017879 | 7.843E-14 | 7.840E-14 | 100. (16) |
| 22 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 45021140 | 45020744 | 45019565 | 7.929E-14 | 7.925E-14 | 69.2 (17) 30.8 (13) |
| 22 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 47328500 | 47328706 | 47327518 | 9.767E-13 | 9.789E-13 | 100. (18) |
| 22 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 47350600 | 47350380 | 47349190 | 3.853E-13 | 3.856E-13 | 100. (19) |
| 22 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 47351600 | 47350900 | 47349750 | 1.018E-12 | 1.019E-12 | 100. (20) |
| 22 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 47351900 | 47351677 | 47350490 | 2.484E-13 | 2.486E-13 | 94.8 (21) |
| 22 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 47358900 | 47358666 | 47357477 | 3.921E-13 | 3.924E-13 | 100. (22) |
| 22 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | 47371000 | 47370522 | 47369345 | 1.816E-13 | 1.816E-13 | 71.7 (23) 28.3 (28) |
| 22 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | 47371100 | 47370555 | 47369377 | 1.808E-13 | 1.807E-13 | 100. (24) |
| 22 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 47373500 | 47372720 | 47371564 | 3.434E-14 | 3.429E-14 | 94.8 (25) |
| 22 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | 47373800 | 47373210 | 47372032 | 1.823E-13 | 1.823E-13 | 100. (26) |
| 22 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 47373949 | 47372778 | 3.710E-13 | 3.709E-13 | 56.8 (27) 43.2 (31) |
| 22 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | 47374500 | 47374065 | 47372890 | 1.851E-13 | 1.849E-13 | 71.7 (28) 28.3 (23) |
| 22 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 47374109 | 47372937 | 3.710E-13 | 3.709E-13 | 100. (29) |
| 22 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 47375445 | 47374273 | 3.720E-13 | 3.719E-13 | 100. (30) |
| 22 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 47375573 | 47374402 | 3.722E-13 | 3.721E-13 | 56.8 (31) 43.2 (27) |
| 22 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 48440800 | 48440781 | 48439604 | 1.541E-12 | 1.540E-12 | 100. (32) |
| 22 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 48451630 | 48451745 | 48450566 | 6.579E-13 | 6.571E-13 | 100. (33) |
| 22 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 48452600 | 48451931 | 48450777 | 1.588E-12 | 1.599E-12 | 100. (34) |
| 22 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 48452700 | 48452408 | 48451230 | 4.438E-13 | 4.435E-13 | 94.7 (35) |
| 22 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 48456300 | 48455987 | 48454808 | 6.681E-13 | 6.675E-13 | 100. (36) |
| 22 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | | 48461994 | 48460820 | 3.494E-13 | 3.493E-13 | 72.7 (37) |
| 22 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | | 48461998 | 48460824 | 3.479E-13 | 3.475E-13 | 100. (38) |
| 22 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p\ ^1P_1$ | 48463700 | 48463074 | 48461918 | 6.709E-14 | 6.686E-14 | 94.7 (39) |
| 22 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d\ ^3D_3$ | | 48463358 | 48462184 | 3.511E-13 | 3.507E-13 | 100. (40) |
| 22 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f\ ^3F_3$ | | 48463770 | 48462598 | 7.170E-13 | 7.169E-13 | 57.1 (41) 42.9 (47) |
| 22 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d\ ^1D_2$ | | 48463828 | 48462656 | 3.562E-13 | 3.562E-13 | 72.7 (42) |
| 22 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f\ ^3F_2$ | | 48463851 | 48462678 | 7.169E-13 | 7.167E-13 | 100. (43) |
| 22 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f\ ^3F_4$ | | 48464535 | 48463362 | 7.189E-13 | 7.188E-13 | 100. (44) |
| 22 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g\ ^3G_4$ | | 48464551 | 48463380 | 1.205E-12 | 1.205E-12 | 55.1 (45) 44.9 (49) |
| 22 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g\ ^3G_3$ | | 48464600 | 48463429 | 1.206E-12 | 1.205E-12 | 100. (46) |
| 22 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f\ ^1F_3$ | | 48464602 | 48463431 | 7.196E-13 | 7.193E-13 | 57.1 (47) 42.9 (41) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 22 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 48465011 | 48463840 | 1.207E-12 | 1.207E-12 | 100. (48) |
| 22 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 48465050 | 48463879 | 1.207E-12 | 1.207E-12 | 55.1 (49) 44.9 (45) |
| 22 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 49042631 | 49041421 | 2.419E-12 | 2.361E-12 | 100. (50) |
| 22 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 49048928 | 49047719 | 1.072E-12 | 1.056E-12 | 100. (51) |
| 22 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 49049018 | 49047842 | 2.339E-12 | 2.434E-12 | 100. (52) |
| 22 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | 49000000 | 49049311 | 49048104 | 7.356E-13 | 7.284E-13 | 94.7 (53) |
| 22 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 49051383 | 49050174 | 1.088E-12 | 1.072E-12 | 100. (54) |
| 22 | 55 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 49054826 | 49053629 | 5.985E-13 | 5.931E-13 | 100. (55) |
| 22 | 56 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 49054828 | 49053631 | 5.988E-13 | 5.966E-13 | 73.2 (56) |
| 22 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | 49000000 | 49055452 | 49054269 | 1.156E-13 | 1.145E-13 | 94.7 (57) |
| 22 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 49055613 | 49054416 | 6.045E-13 | 5.990E-13 | 100. (58) |
| 22 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 49055849 | 49054666 | 1.225E-12 | 1.225E-12 | 57.2 (59) 42.8 (65) |
| 22 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 49055895 | 49054699 | 6.054E-13 | 6.089E-13 | 73.2 (60) |
| 22 | 61 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 49055895 | 49054712 | 1.225E-12 | 1.225E-12 | 100. (61) |
| 22 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 49056291 | 49055108 | 1.228E-12 | 1.229E-12 | 100. (62) |
| 22 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 49056294 | 49055119 | 2.068E-12 | 2.067E-12 | 55.1 (63) 44.9 (69) |
| 22 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 49056322 | 49055147 | 2.068E-12 | 2.067E-12 | 100. (64) |
| 22 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 49056331 | 49055148 | 1.230E-12 | 1.229E-12 | 57.2 (65) 42.8 (59) |
| 22 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 49056559 | 49055388 | 3.120E-12 | 3.120E-12 | 54.2 (66) 45.8 (71) |
| 22 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 49056560 | 49055385 | 2.071E-12 | 2.070E-12 | 100. (67) |
| 22 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 49056577 | 49055406 | 3.121E-12 | 3.120E-12 | 100. (68) |
| 22 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 49056583 | 49055408 | 2.071E-12 | 2.070E-12 | 55.1 (69) 44.9 (63) |
| 22 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 49056736 | 49055565 | 3.123E-12 | 3.122E-12 | 100. (70) |
| 22 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 49056751 | 49055580 | 3.123E-12 | 3.122E-12 | 54.2 (71) 45.8 (66) |
| 22 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 77684000 | 77685450 | | 1.849E-14 | | 79.8 (72) |
| 22 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 77717000 | 77715764 | | 7.104E-15 | | 100. (73) |
| 22 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 77739000 | 77737796 | | 7.110E-15 | | 98.3 (74) |
| 22 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 77798000 | 77799077 | | 7.164E-15 | | 100. (75) |
| 22 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 77913000 | 77912506 | | 3.679E-15 | | 96.0 (76) |
| 22 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 77948000 | 77948269 | | 3.542E-15 | | 100. (77) |
| 22 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | 77984000 | 77983306 | | 3.542E-15 | | 81.4 (78) |
| 22 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 78046000 | 78047258 | | 6.919E-15 | | 98.3 (79) |
| 22 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | 78085000 | 78085447 | | 3.539E-15 | | 81.4 (80) |
| 22 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | 78338000 | 78339031 | | 4.257E-15 | | 80.9 (81) |
| 22 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 84849340 | | 2.352E-14 | | 79.0 (82) |
| 22 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p^1P_1$ | | 84877865 | | 9.650E-15 | | 44.5 (83) 38.8 (108) 13.7 (91) |
| 22 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 84903982 | | 2.517E-14 | | 76.9 (84) |
| 22 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 84908978 | | 8.913E-15 | | 69.3 (85) 30.7 (88) |
| 22 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 84912017 | | 5.769E-15 | | 71.9 (86) 17.4 (92) 9.57 (98) |
| 22 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 84923116 | | 1.522E-14 | | 70.7 (87) 23.2 (91) 3.14 (113) |
| 22 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 84931947 | | 1.237E-14 | | 63.1 (88) 29.2 (85) 7.67 (114) |
| 22 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 84941858 | | 1.885E-14 | | 87.4 (89) |
| 22 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 84949368 | | 6.543E-15 | | 70.0 (90) 23.2 (97) 3.96 (111) |
| 22 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2p3s^3P_1$ | | 84955954 | | 8.905E-15 | | 56.8 (91) 20.9 (87) 14.8 (83) |
| 22 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 84976071 | | 6.264E-15 | | 56.0 (92) 13.0 (101) 10.5 (98) |
| 22 | 93 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 84987509 | | 1.238E-14 | | 65.4 (93) 34.6 (103) |
| 22 | 94 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 84991303 | | 6.781E-15 | | 68.2 (94) 20.0 (102) 9.89 (95) |
| 22 | 95 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 84998066 | | 6.689E-15 | | 76.5 (95) |
| 22 | 96 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 85008612 | | 5.777E-15 | | 90.3 (96) |
| 22 | 97 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 85016538 | | 1.553E-14 | | 53.0 (97) 17.8 (111) 15.4 (100) |
| 22 | 98 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 85016594 | | 1.674E-14 | | 70.6 (98) 17.2 (101) 8.44 (86) |
| 22 | 99 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 85024187 | | 6.700E-15 | | 83.9 (99) |
| 22 | 100 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 85043432 | | 1.355E-14 | | 38.3 (100) 23.2 (97) 19.4 (90) |
| 22 | 101 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3P_1$ | | 85043533 | | 5.992E-15 | | 52.4 (101) 21.0 (92) 12.2 (86) |
| 22 | 102 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d^1D_2$ | | 85047027 | | 6.783E-15 | | 49.0 (102) 19.9 (109) 8.85 (112) |
| 22 | 103 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 85058275 | | 8.331E-15 | | 65.4 (103) 34.6 (93) |
| 22 | 104 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 85060457 | | 6.242E-15 | | 70.9 (104) 10.5 (116) 10.0 (113) |
| 22 | 105 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^3P_2$ | | 85074039 | | 6.328E-15 | | 80.0 (105) |
| 22 | 106 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3S_1$ | | 85074742 | | 6.128E-15 | | 66.7 (106) 16.8 (101) 12.3 (82) |
| 22 | 107 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d^3F_4$ | | 85082863 | | 6.929E-15 | | 100. (107) |
| 22 | 108 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 85086986 | | 8.592E-15 | | 54.2 (108) 32.9 (83) 8.10 (104) |
| 22 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d^3D_2$ | | 85099599 | | 6.374E-15 | | 51.5 (109) 27.0 (102) 11.7 (94) |
| 22 | 110 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d^3D_3$ | | 85119012 | | 6.118E-15 | | 82.3 (110) |
| 22 | 111 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^1D_2$ | | 85134210 | | 7.150E-15 | | 61.2 (111) 30.4 (100) 8.34 (105) |
| 22 | 112 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^3P_2$ | | 85144541 | | 6.645E-15 | | 62.5 (112) 25.0 (109) 6.04 (89) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 22 | 113 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 85146979 | | 6.652E-15 | | 75.0 (113) |
| 22 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 85151024 | | 6.742E-15 | | 92.2 (114) |
| 22 | 115 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | | 85189801 | | 5.812E-15 | | 90.9 (115) |
| 22 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 85206396 | | 6.402E-15 | | 84.5 (116) |
| 22 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 85209291 | | 6.179E-15 | | 79.1 (117) |
| 22 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 87340241 | | 2.838E-14 | | 79.1 (118) |
| 22 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2s4p\ ^1P_1$ | | 87351533 | | 9.686E-15 | | 33.5 (119) 32.5 (127) 30.6 (148) |
| 22 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 87357089 | | 9.911E-15 | | 65.2 (120) 34.8 (125) |
| 22 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 87357095 | | 2.405E-14 | | 73.6 (121) |
| 22 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 87365703 | | 6.913E-15 | | 71.7 (122) 14.6 (147) 11.9 (133) |
| 22 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 87367716 | | 2.845E-14 | | 72.0 (123) 13.2 (119) 8.45 (127) |
| 22 | 124 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 87376062 | | 2.723E-14 | | 84.1 (124) |
| 22 | 125 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 87379507 | | 1.484E-14 | | 62.0 (125) 34.5 (120) 3.49 (158) |
| 22 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 87382748 | | 8.069E-15 | | 50.3 (126) 23.9 (131) 14.8 (154) |
| 22 | 127 | $2s_{1/2}4p_{3/2}(J=1)$ | $2p4s\ ^3P_1$ | | 87395485 | | 1.332E-14 | | 39.6 (127) 36.7 (119) 20.8 (123) |
| 22 | 128 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 87396512 | | 7.163E-15 | | 74.4 (128) |
| 22 | 129 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 87396876 | | 7.657E-15 | | 34.8 (129) 27.7 (147) 14.5 (151) |
| 22 | 130 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 87401666 | | 4.747E-14 | | 91.7 (130) |
| 22 | 131 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 87406350 | | 2.713E-14 | | 60.5 (131) 20.2 (136) 10.8 (154) |
| 22 | 132 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 87406488 | | 7.355E-15 | | 76.0 (132) |
| 22 | 133 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 87408752 | | 2.570E-14 | | 78.8 (133) |
| 22 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 87411596 | | 7.817E-15 | | 54.2 (134) 16.1 (155) 15.5 (144) |
| 22 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 87418054 | | 7.265E-15 | | 31.9 (135) 28.4 (156) 21.0 (153) |
| 22 | 136 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 87424009 | | 3.043E-14 | | 70.9 (136) 14.0 (126) 12.0 (131) |
| 22 | 137 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 87425069 | | 6.769E-15 | | 60.9 (137) 18.2 (169) 14.2 (157) |
| 22 | 138 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 87425323 | | 6.650E-15 | | 71.2 (138) 19.7 (159) 9.04 (163) |
| 22 | 139 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 87427702 | | 1.732E-13 | | 97.8 (139) |
| 22 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 87428472 | | 6.647E-15 | | 41.3 (140) 29.6 (164) 29.1 (160) |
| 22 | 141 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 87429261 | | 6.831E-15 | | 52.7 (141) 26.6 (168) 17.8 (161) |
| 22 | 142 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 87429549 | | 6.788E-14 | | 93.5 (142) |
| 22 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 87430142 | | 6.896E-15 | | 44.0 (143) 32.8 (163) 19.2 (159) |
| 22 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 87430675 | | 3.631E-14 | | 80.7 (144) |
| 22 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | | 87433067 | | 3.182E-13 | | 96.8 (145) |
| 22 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 87454452 | | 6.950E-15 | | 90.6 (146) |
| 22 | 147 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | | 87464762 | | 6.181E-15 | | 46.8 (147) 35.7 (129) 16.5 (122) |
| 22 | 148 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 87470285 | | 7.613E-15 | | 67.4 (148) 19.4 (127) 13.2 (119) |
| 22 | 149 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 87471281 | | 6.466E-15 | | 94.8 (149) |
| 22 | 150 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | | 87473156 | | 6.312E-15 | | 56.2 (150) 29.0 (126) 11.5 (154) |
| 22 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | | 87480272 | | 6.498E-15 | | 67.7 (151) 17.9 (129) 8.18 (147) |
| 22 | 152 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 87488776 | | 6.914E-15 | | 97.8 (152) |
| 22 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | | 87489568 | | 6.686E-15 | | 51.4 (153) 24.9 (156) 19.9 (128) |
| 22 | 154 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 87493787 | | 6.391E-15 | | 62.9 (154) 28.8 (150) 5.07 (136) |
| 22 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | | 87496551 | | 6.608E-15 | | 62.2 (155) 33.4 (134) 4.44 (165) |
| 22 | 156 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | | 87505550 | | 6.718E-15 | | 53.0 (155) 36.6 (156) 6.03 (153) |
| 22 | 157 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 87506455 | | 6.735E-15 | | 69.4 (157) 26.1 (137) 2.63 (123) |
| 22 | 158 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 87508323 | | 6.800E-15 | | 96.7 (158) |
| 22 | 159 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 87509020 | | 6.710E-15 | | 39.9 (159) 31.7 (163) 28.4 (138) |
| 22 | 160 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 87510958 | | 6.710E-15 | | 66.6 (160) 31.2 (140) 2.23 (164) |
| 22 | 161 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 87515565 | | 6.706E-15 | | 45.0 (141) 34.7 (161) 20.3 (168) |
| 22 | 162 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 87515703 | | 6.705E-15 | | 100. (162) |
| 22 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | | 87515774 | | 6.718E-15 | | 52.9 (143) 26.2 (163) 20.9 (159) |
| 22 | 164 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | | 87517457 | | 6.704E-15 | | 68.1 (164) 27.5 (140) 4.33 (160) |
| 22 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | | 87519651 | | 6.425E-15 | | 77.3 (165) |
| 22 | 166 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | | 87522184 | | 6.719E-15 | | 100. (166) |
| 22 | 167 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | | 87522907 | | 6.604E-15 | | 76.7 (167) |
| 22 | 168 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 87525008 | | 6.699E-15 | | 52.5 (168) 46.4 (161) 1.14 (141) |
| 22 | 169 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | | 87527022 | | 6.678E-15 | | 75.6 (169) |
| 22 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | | 88476107 | | 2.779E-14 | | 77.5 (170) |
| 22 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | | 88480506 | | 9.327E-15 | | 42.2 (171) 27.3 (207) 25.1 (181) |
| 22 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | | 88482277 | | 9.680E-15 | | 68.7 (172) 31.3 (178) |
| 22 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | | 88483325 | | 2.139E-14 | | 69.4 (173) 15.9 (222) 14.7 (184) |
| 22 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | | 88487781 | | 7.404E-15 | | 71.2 (174) 13.0 (208) 11.7 (185) |
| 22 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | | 88490037 | | 4.204E-14 | | 69.8 (175) 19.0 (181) 3.28 (217) |
| 22 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | | 88493670 | | 2.944E-14 | | 81.9 (176) |
| 22 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | | 88496470 | | 8.344E-15 | | 44.3 (177) 20.8 (214) 19.6 (183) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 22 | 178 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | | 88496786 | | 1.831E-14 | | 67.4 (178) 31.2 (172) 1.36 (218) |
| 22 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | | 88502963 | | 7.302E-15 | | 73.0 (179) |
| 22 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | | 88504382 | | 8.292E-15 | | 37.6 (180) 20.2 (208) 18.6 (211) |
| 22 | 181 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | | 88505771 | | 1.781E-14 | | 45.4 (181) 27.2 (171) 21.8 (175) |
| 22 | 182 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 88507257 | | 5.853E-14 | | 90.3 (182) |
| 22 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | | 88508833 | | 3.629E-14 | | 65.7 (183) 17.5 (190) 5.85 (214) |
| 22 | 184 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 88509988 | | 8.671E-15 | | 62.2 (184) 27.0 (173) 10.8 (222) |
| 22 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 88510371 | | 3.385E-14 | | 83.7 (185) |
| 22 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 88510922 | | 8.002E-15 | | 45.3 (186) 20.3 (227) 17.7 (215) |
| 22 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 88514970 | | 7.912E-15 | | 35.5 (187) 28.9 (216) 18.0 (213) |
| 22 | 188 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 88516669 | | 6.744E-15 | | 73.4 (188) |
| 22 | 189 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 88517736 | | 7.253E-15 | | 53.0 (189) 22.5 (236) 14.8 (217) |
| 22 | 190 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | | 88518315 | | 3.803E-14 | | 77.6 (190) |
| 22 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 88518508 | | 6.746E-15 | | 41.9 (191) 31.3 (228) 26.8 (220) |
| 22 | 192 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 88519145 | | 6.645E-14 | | 91.0 (192) |
| 22 | 193 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 88519402 | | 7.081E-15 | | 46.6 (193) 28.6 (237) 19.0 (223) |
| 22 | 194 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 88519537 | | 6.735E-15 | | 72.1 (194) 16.7 (225) 11.2 (230) |
| 22 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 88519849 | | 7.272E-15 | | 46.3 (195) 28.1 (224) 17.2 (219) |
| 22 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 88520032 | | 6.717E-15 | | 39.4 (196) 32.7 (231) 27.9 (226) |
| 22 | 197 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 88520054 | | 7.001E-15 | | 42.2 (197) 30.7 (229) 23.1 (235) |
| 22 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 88520137 | | 6.968E-14 | | 92.5 (198) |
| 22 | 199 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 88520621 | | 7.334E-15 | | 51.0 (199) 24.0 (230) 16.3 (225) |
| 22 | 200 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | | 88520660 | | 3.016E-14 | | 76.7 (200) |
| 22 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | | 88522206 | | 5.891E-13 | | 97.4 (201) |
| 22 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 88522294 | | 5.621E-13 | | 65.0 (202) 35.0 (205) |
| 22 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 88522299 | | 4.977E-13 | | 100. (203) |
| 22 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 88522680 | | 1.067E-12 | | 100. (204) |
| 22 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | | 88522801 | | 7.707E-13 | | 65.4 (205) 34.6 (202) |
| 22 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 88574338 | | 6.849E-15 | | 100. (206) |
| 22 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 88579509 | | 7.032E-15 | | 68.2 (207) 28.2 (171) 3.67 (181) |
| 22 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^1P_1$ | | 88580155 | | 6.452E-15 | | 51.3 (208) 32.0 (180) 16.7 (174) |
| 22 | 209 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 88583242 | | 6.512E-15 | | 98.9 (209) |
| 22 | 210 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^3P_2$ | | 88583382 | | 6.489E-15 | | 45.3 (210) 39.3 (177) 15.4 (214) |
| 22 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^3S_1$ | | 88586869 | | 6.590E-15 | | 67.2 (211) 19.5 (180) 10.8 (208) |
| 22 | 212 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 88592609 | | 6.809E-15 | | 100. (212) |
| 22 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | | 88592741 | | 6.740E-15 | | 56.2 (213) 20.6 (179) 20.1 (216) |
| 22 | 214 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | | 88593102 | | 6.497E-15 | | 56.5 (214) 39.1 (210) 3.40 (177) |
| 22 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | | 88595889 | | 6.709E-15 | | 55.0 (215) 40.3 (186) 4.72 (227) |
| 22 | 216 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | | 88599834 | | 6.739E-15 | | 50.2 (187) 41.6 (216) 6.90 (213) |
| 22 | 217 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 88600135 | | 6.748E-15 | | 68.3 (217) 30.1 (189) 1.66 (236) |
| 22 | 218 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 88600944 | | 6.781E-15 | | 98.6 (218) |
| 22 | 219 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 88602294 | | 6.759E-15 | | 42.0 (219) 31.6 (224) 26.4 (188) |
| 22 | 220 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 88603310 | | 6.759E-15 | | 67.3 (220) 32.7 (191) |
| 22 | 221 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 88605280 | | 6.747E-15 | | 100. (221) |
| 22 | 222 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 88605409 | | 6.652E-15 | | 73.3 (222) |
| 22 | 223 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 88605434 | | 6.755E-15 | | 48.9 (193) 35.4 (223) 15.6 (237) |
| 22 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 88605443 | | 6.760E-15 | | 48.3 (195) 29.6 (224) 22.0 (219) |
| 22 | 225 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^1G_4$ | | 88605487 | | 6.785E-15 | | 36.2 (225) 36.1 (230) 27.8 (194) |
| 22 | 226 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 88605926 | | 6.785E-15 | | 71.7 (226) 19.5 (196) 8.75 (231) |
| 22 | 227 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 88606384 | | 6.631E-15 | | 65.0 (227) 21.6 (215) 6.58 (186) |
| 22 | 228 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 88606560 | | 6.748E-15 | | 67.8 (228) 25.6 (191) 6.57 (220) |
| 22 | 229 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^1F_3$ | | 88606633 | | 6.769E-15 | | 52.0 (197) 21.7 (229) 19.2 (235) |
| 22 | 230 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | | 88607014 | | 6.782E-15 | | 43.8 (199) 28.9 (225) 27.2 (230) |
| 22 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 88607356 | | 6.774E-15 | | 58.8 (231) 41.2 (196) |
| 22 | 232 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 88607731 | | 6.774E-15 | | 100. (232) |
| 22 | 233 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 88608497 | | 6.755E-15 | | 100. (233) |
| 22 | 234 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 88608955 | | 6.772E-15 | | 100. (234) |
| 22 | 235 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^3F_3$ | | 88609423 | | 6.772E-15 | | 54.3 (235) 45.7 (229) |
| 22 | 236 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 88609814 | | 6.727E-15 | | 71.6 (236) 14.5 (189) 14.0 (217) |
| 22 | 237 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 88610224 | | 6.746E-15 | | 54.0 (237) 44.0 (223) 2.01 (193) |
| 22 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 89087685 | | 2.420E-14 | | 73.1 (238) |
| 22 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 89089347 | | 8.931E-15 | | 47.5 (239) 26.8 (283) 20.4 (249) |
| 22 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 89090164 | | 9.155E-15 | | 73.1 (240) |
| 22 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 89091349 | | 1.826E-14 | | 64.1 (241) 20.2 (253) 15.7 (296) |
| 22 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 89093565 | | 7.602E-15 | | 71.5 (242) 11.8 (284) 10.7 (254) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 22 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 89095839 | | 4.496E-14 | | 67.7 (243) 21.2 (249) 4.34 (257) |
| 22 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 89097587 | | 2.657E-14 | | 77.6 (244) |
| 22 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 89098553 | | 8.200E-15 | | 43.1 (245) 24.0 (288) 15.6 (251) |
| 22 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 89099786 | | 2.295E-14 | | 73.4 (246) |
| 22 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 89102120 | | 7.310E-15 | | 72.1 (247) 13.9 (290) 6.63 (271) |
| 22 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 89103430 | | 8.852E-15 | | 36.6 (248) 23.0 (238) 20.1 (287) |
| 22 | 249 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 89105013 | | 2.110E-14 | | 46.5 (249) 24.2 (243) 20.7 (239) |
| 22 | 250 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 89105536 | | 4.471E-14 | | 86.2 (250) |
| 22 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 89106288 | | 3.770E-14 | | 68.4 (251) 14.7 (266) 3.83 (260) |
| 22 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 89106788 | | 7.746E-15 | | 43.1 (252) 24.4 (302) 19.0 (291) |
| 22 | 253 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 89107056 | | 9.933E-15 | | 52.1 (253) 34.4 (241) 13.5 (296) |
| 22 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 89107277 | | 4.450E-14 | | 86.9 (254) |
| 22 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3F_2$ | | 89109339 | | 8.495E-15 | | 35.7 (255) 27.1 (292) 21.6 (244) |
| 22 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 89109666 | | 6.771E-15 | | 74.2 (256) |
| 22 | 257 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 89110763 | | 7.754E-15 | | 47.3 (257) 23.9 (317) 14.2 (293) |
| 22 | 258 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 89110775 | | 6.764E-15 | | 41.9 (258) 32.1 (304) 26.0 (297) |
| 22 | 259 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 89111379 | | 6.726E-15 | | 72.6 (259) |
| 22 | 260 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 89111497 | | 7.458E-15 | | 42.6 (260) 28.3 (321) 19.0 (300) |
| 22 | 261 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 89111681 | | 6.723E-15 | | 39.7 (261) 33.0 (309) 27.3 (303) |
| 22 | 262 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 89111755 | | 6.780E-15 | | 43.0 (262) 32.6 (305) 24.5 (320) |
| 22 | 263 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 89111790 | | 6.712E-15 | | 71.8 (263) 16.7 (313) 11.5 (306) |
| 22 | 264 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 89111791 | | 9.409E-15 | | 40.8 (264) 28.5 (270) 18.9 (308) |
| 22 | 265 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 89111816 | | 7.755E-15 | | 45.3 (265) 25.2 (299) 15.8 (295) |
| 22 | 266 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 89111816 | | 4.310E-14 | | 76.0 (266) |
| 22 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 89111966 | | 6.712E-15 | | 38.7 (267) 33.2 (311) 28.1 (307) |
| 22 | 268 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 89112031 | | 6.731E-15 | | 40.7 (268) 32.9 (310) 26.3 (318) |
| 22 | 269 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 89112204 | | 6.731E-15 | | 59.3 (269) 23.5 (306) 17.2 (313) |
| 22 | 270 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 89112480 | | 2.289E-14 | | 71.3 (270) 16.2 (264) 7.23 (308) |
| 22 | 271 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 89112694 | | 8.390E-14 | | 93.4 (271) |
| 22 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 89112906 | | 4.502E-14 | | 84.4 (272) |
| 22 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 89114001 | | 9.590E-13 | | 97.6 (273) |
| 22 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 89114045 | | 6.342E-13 | | 100. (274) |
| 22 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 89114055 | | 7.961E-13 | | 71.0 (275) 29.0 (277) |
| 22 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 89114263 | | 1.764E-12 | | 100. (276) |
| 22 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 89114360 | | 1.217E-12 | | 71.5 (277) 28.5 (275) |
| 22 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 89114419 | | 2.443E-12 | | 55.4 (278) 44.6 (281) |
| 22 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 89114424 | | 2.440E-12 | | 100. (279) |
| 22 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 89114595 | | 2.456E-12 | | 100. (280) |
| 22 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 89114600 | | 2.484E-12 | | 55.4 (281) 44.6 (278) |
| 22 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 89179908 | | 6.830E-15 | | 100. (282) |
| 22 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 89182029 | | 6.886E-15 | | 67.6 (283) 31.2 (239) 1.23 (249) |
| 22 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 89183418 | | 6.614E-15 | | 51.8 (284) 31.6 (248) 16.6 (242) |
| 22 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 89184982 | | 6.619E-15 | | 43.0 (245) 40.4 (285) 16.6 (288) |
| 22 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 89185124 | | 6.624E-15 | | 100. (286) |
| 22 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3S_1$ | | 89186634 | | 6.641E-15 | | 66.8 (287) 19.4 (248) 12.7 (284) |
| 22 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 89190389 | | 6.616E-15 | | 53.2 (288) 43.7 (285) 3.19 (245) |
| 22 | 289 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 89190602 | | 6.805E-15 | | 100. (289) |
| 22 | 290 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 89190621 | | 6.778E-15 | | 57.9 (290) 20.7 (247) 18.3 (292) |
| 22 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 89192315 | | 6.761E-15 | | 51.8 (291) 43.3 (252) 4.92 (302) |
| 22 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 89194338 | | 6.755E-15 | | 48.6 (255) 43.3 (292) 7.00 (290) |
| 22 | 293 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 89194428 | | 6.755E-15 | | 67.7 (293) 30.9 (257) 1.39 (317) |
| 22 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 89194801 | | 6.764E-15 | | 100. (294) |
| 22 | 295 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 89195995 | | 6.786E-15 | | 42.9 (295) 31.4 (299) 25.7 (256) |
| 22 | 296 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 89196217 | | 6.666E-15 | | 70.7 (296) 27.8 (253) 1.49 (241) |
| 22 | 297 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 89196580 | | 6.786E-15 | | 66.4 (297) 33.6 (258) |
| 22 | 298 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 89197573 | | 6.776E-15 | | 100. (298) |
| 22 | 299 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 89197739 | | 6.781E-15 | | 46.6 (265) 31.1 (299) 22.4 (295) |
| 22 | 300 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 89197751 | | 6.781E-15 | | 50.3 (260) 36.0 (300) 13.7 (321) |
| 22 | 301 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 89197844 | | 6.794E-15 | | 36.7 (301) 36.1 (308) 27.2 (259) |
| 22 | 302 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 89198005 | | 6.716E-15 | | 66.2 (302) 26.1 (291) 7.72 (252) |
| 22 | 303 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 89198103 | | 6.794E-15 | | 72.0 (303) 20.5 (261) 7.56 (309) |
| 22 | 304 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 89198370 | | 6.781E-15 | | 67.4 (304) 24.7 (258) 7.98 (297) |
| 22 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 89198524 | | 6.793E-15 | | 56.3 (262) 21.8 (305) 20.9 (320) |
| 22 | 306 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^3H_5$ | | 89198546 | | 6.789E-15 | | 36.8 (306) 35.2 (313) 28.0 (263) |
| 22 | 307 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 89198712 | | 6.789E-15 | | 71.4 (307) 19.8 (267) 8.82 (311) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 22 | 308 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 89198744 | | 6.795E-15 | | 42.9 (264) 29.2 (301) 28.0 (308) |
| 22 | 309 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 89198853 | | 6.771E-15 | | 59.9 (309) 40.1 (261) |
| 22 | 310 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^1G_4$ | | 89198893 | | 6.798E-15 | | 59.2 (268) 20.6 (310) 20.2 (318) |
| 22 | 311 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 89199032 | | 6.740E-15 | | 58.3 (311) 41.7 (267) |
| 22 | 312 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 89199044 | | 6.771E-15 | | 100. (312) |
| 22 | 313 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 89199059 | | 6.798E-15 | | 40.6 (269) 31.1 (313) 28.3 (306) |
| 22 | 314 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 89199203 | | 6.740E-15 | | 100. (314) |
| 22 | 315 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 89199407 | | 6.772E-15 | | 100. (315) |
| 22 | 316 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 89199678 | | 6.784E-15 | | 100. (316) |
| 22 | 317 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 89199791 | | 6.746E-15 | | 69.0 (317) 16.3 (257) 14.7 (293) |
| 22 | 318 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^3G_4$ | | 89199846 | | 6.784E-15 | | 53.5 (318) 46.5 (310) |
| 22 | 319 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 89199853 | | 6.785E-15 | | 100. (319) |
| 22 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 89200137 | | 6.787E-15 | | 54.1 (320) 45.9 (305) |
| 22 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 89200483 | | 6.774E-15 | | 54.6 (321) 42.9 (300) 2.57 (260) |
| 23 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 23 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 41568880 | 41568458 | | 1.698E-08 | | 100. (2) |
| 23 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 41770130 | 41769888 | | 3.390E-09 | | 100. (3) |
| 23 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 41782100 | 41781855 | | 6.094E-14 | | 94.7 (4) |
| 23 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 41787830 | 41787465 | | 9.382E-04 | | 100. (5) |
| 23 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 41849950 | 41849736 | | 3.135E-10 | | 100. (6) |
| 23 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 41982380 | 41981912 | | 3.505E-15 | | 94.7 (7) |
| 23 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 49234710 | 49234329 | | 5.570E-13 | | 100. (8) |
| 23 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 49290220 | 49289850 | | 1.874E-13 | | 100. (9) |
| 23 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 49292760 | 49292011 | | 5.832E-13 | | 100. (10) |
| 23 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 49293700 | 49293352 | | 9.755E-14 | | 94.0 (11) |
| 23 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 49313970 | 49313631 | | 1.918E-13 | | 100. (12) |
| 23 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 49344160 | 49343762 | | 6.479E-14 | | 68.1 (13) 31.9 (17) |
| 23 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 49344470 | 49344073 | | 6.458E-14 | | 100. (14) |
| 23 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 49349740 | 49349293 | | 1.213E-14 | | 94.0 (15) |
| 23 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 49352090 | 49351698 | | 6.516E-14 | | 100. (16) |
| 23 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 49353910 | 49353505 | | 6.579E-14 | | 68.1 (17) 31.9 (13) |
| 23 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 51886600 | 51886846 | | 8.120E-13 | | 100. (18) |
| 23 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 51909900 | 51909696 | | 3.195E-13 | | 100. (19) |
| 23 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 51910900 | 51910237 | | 8.455E-13 | | 100. (20) |
| 23 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 51911400 | 51911166 | | 1.921E-13 | | 93.8 (21) |
| 23 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 51919900 | 51919737 | | 3.257E-13 | | 100. (22) |
| 23 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | 51932600 | 51932176 | | 1.507E-13 | | 70.4 (23) 29.6 (28) |
| 23 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | 51932700 | 51932238 | | 1.501E-13 | | 100. (24) |
| 23 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 51935100 | 51934305 | | 2.889E-14 | | 93.8 (25) |
| 23 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | 51935800 | 51935456 | | 1.515E-13 | | 100. (26) |
| 23 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 51936235 | | 3.079E-13 | | 56.8 (27) 43.2 (31) |
| 23 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | 51936800 | 51936373 | | 1.535E-13 | | 70.4 (28) 29.6 (23) |
| 23 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 51936419 | | 3.079E-13 | | 100. (29) |
| 23 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 51938037 | | 3.088E-13 | | 100. (30) |
| 23 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 51938183 | | 3.090E-13 | | 56.8 (31) 43.2 (27) |
| 23 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 53107300 | 53107319 | | 1.282E-12 | | 100. (32) |
| 23 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 53118760 | 53118878 | | 5.460E-13 | | 100. (33) |
| 23 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 53119700 | 53119070 | | 1.318E-12 | | 100. (34) |
| 23 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 53119900 | 53119628 | | 3.455E-13 | | 93.7 (35) |
| 23 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 53124300 | 53124017 | | 5.554E-13 | | 100. (36) |
| 23 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | | 53130321 | | 2.900E-13 | | 71.3 (37) 28.7 (42) |
| 23 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | | 53130339 | | 2.889E-13 | | 100. (38) |
| 23 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p\ ^1P_1$ | 53132000 | 53131364 | | 5.644E-14 | | 93.7 (39) |
| 23 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d\ ^3D_3$ | | 53131986 | | 2.918E-13 | | 100. (40) |
| 23 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f\ ^3F_3$ | | 53132421 | | 5.949E-13 | | 57.0 (41) 43.0 (47) |
| 23 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d\ ^1D_2$ | | 53132489 | | 2.953E-13 | | 71.3 (42) 28.7 (37) |
| 23 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f\ ^3F_2$ | | 53132513 | | 5.949E-13 | | 100. (43) |
| 23 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f\ ^3F_4$ | | 53133342 | | 5.967E-13 | | 100. (44) |
| 23 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g\ ^3G_4$ | | 53133360 | | 1.000E-12 | | 55.1 (45) 44.9 (49) |
| 23 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g\ ^3G_3$ | | 53133416 | | 1.001E-12 | | 100. (46) |
| 23 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f\ ^1F_3$ | | 53133419 | | 5.972E-13 | | 57.0 (47) 43.0 (41) |
| 23 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g\ ^3G_5$ | | 53133913 | | 1.002E-12 | | 100. (48) |
| 23 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g\ ^1G_4$ | | 53133958 | | 1.002E-12 | | 55.1 (49) 44.9 (45) |
| 23 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s\ ^3S_1$ | | 53767859 | | 2.008E-12 | | 100. (50) |
| 23 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p\ ^3P_0$ | | 53774496 | | 8.887E-13 | | 100. (51) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 23 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s\ ^1S_0$ | | 53774590 | | 1.946E-12 | | 100. (52) |
| 23 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p\ ^3P_1$ | | 53774929 | | 5.736E-13 | | 93.6 (53) |
| 23 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p\ ^3P_2$ | | 53777471 | | 9.027E-13 | | 100. (54) |
| 23 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d\ ^3D_2$ | | 53781085 | | 4.966E-13 | | 71.7 (55) 28.3 (60) |
| 23 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d\ ^3D_1$ | | 53781091 | | 4.966E-13 | | 100. (56) |
| 23 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p\ ^1P_1$ | | 53781688 | | 9.728E-14 | | 93.6 (57) |
| 23 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d\ ^3D_3$ | | 53782045 | | 5.021E-13 | | 100. (58) |
| 23 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f\ ^3F_3$ | | 53782293 | | 1.017E-12 | | 57.2 (59) 42.8 (65) |
| 23 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d\ ^1D_2$ | | 53782346 | | 5.023E-13 | | 71.7 (60) 28.3 (55) |
| 23 | 61 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f\ ^3F_2$ | | 53782346 | | 1.016E-12 | | 100. (61) |
| 23 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f\ ^3F_4$ | | 53782826 | | 1.020E-12 | | 100. (62) |
| 23 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g\ ^3G_4$ | | 53782829 | | 1.716E-12 | | 55.1 (63) 44.9 (69) |
| 23 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g\ ^3G_3$ | | 53782861 | | 1.716E-12 | | 100. (64) |
| 23 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f\ ^1F_3$ | | 53782871 | | 1.021E-12 | | 57.1 (65) 42.9 (59) |
| 23 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h\ ^3H_5$ | | 53783148 | | 2.590E-12 | | 54.2 (66) 45.8 (71) |
| 23 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g\ ^3G_5$ | | 53783149 | | 1.719E-12 | | 100. (67) |
| 23 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h\ ^3H_4$ | | 53783169 | | 2.590E-12 | | 100. (68) |
| 23 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g\ ^1G_4$ | | 53783175 | | 1.719E-12 | | 55.1 (69) 44.9 (63) |
| 23 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h\ ^3H_6$ | | 53783361 | | 2.592E-12 | | 100. (70) |
| 23 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h\ ^1H_5$ | | 53783379 | | 2.592E-12 | | 54.2 (71) 45.8 (66) |
| 23 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2\ ^1S_0$ | 85064000 | 85065956 | | 1.545E-14 | | 79.9 (72) |
| 23 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p\ ^3P_0$ | 85098000 | 85095911 | | 5.935E-15 | | 100. (73) |
| 23 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p\ ^3P_1$ | 85123000 | 85121579 | | 5.940E-15 | | 97.9 (74) |
| 23 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p\ ^3P_2$ | 85195000 | 85195780 | | 5.990E-15 | | 100. (75) |
| 23 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2\ ^3P_0$ | 85309000 | 85307552 | | 3.102E-15 | | 94.0 (76) |
| 23 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2\ ^3P_1$ | 85352000 | 85351884 | | 2.962E-15 | | 100. (77) |
| 23 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2\ ^3P_2$ | 85392000 | 85391207 | | 2.961E-15 | | 77.7 (78) |
| 23 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p\ ^1P_1$ | 85452000 | 85453414 | | 5.796E-15 | | 97.9 (79) |
| 23 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2\ ^1D_2$ | 85505000 | 85505549 | | 2.962E-15 | | 77.7 (80) |
| 23 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2\ ^1S_0$ | 85766000 | 85766782 | | 3.522E-15 | | 81.1 (81) |
| 23 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s\ ^3S_1$ | | 92915662 | | 2.043E-14 | | 80.0 (82) |
| 23 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p\ ^1P_1$ | | 92946070 | | 7.969E-15 | | 43.1 (83) 37.8 (107) 16.3 (91) |
| 23 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | | 92972406 | | 2.085E-14 | | 76.9 (84) |
| 23 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s\ ^3P_0$ | | 92976654 | | 7.384E-15 | | 70.2 (85) 29.8 (88) |
| 23 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p\ ^3D_1$ | | 92980093 | | 4.812E-15 | | 72.1 (86) 17.5 (92) 8.96 (97) |
| 23 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p\ ^3P_1$ | | 92992994 | | 1.299E-14 | | 71.8 (87) 22.0 (91) 3.32 (83) |
| 23 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | | 93001775 | | 1.062E-14 | | 64.8 (88) 28.5 (85) 6.77 (114) |
| 23 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | | 93015351 | | 1.585E-14 | | 87.1 (89) |
| 23 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | | 93024035 | | 5.483E-15 | | 68.6 (90) 23.3 (98) 4.80 (111) |
| 23 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2p3s\ ^3P_1$ | | 93031505 | | 7.677E-15 | | 54.7 (91) 20.5 (87) 18.2 (83) |
| 23 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^1P_1$ | | 93052996 | | 5.328E-15 | | 50.2 (92) 16.0 (102) 11.2 (97) |
| 23 | 93 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 93066887 | | 5.689E-15 | | 76.1 (93) |
| 23 | 94 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 93067373 | | 1.207E-14 | | 71.8 (94) 28.2 (104) |
| 23 | 95 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 93081213 | | 5.577E-15 | | 81.7 (95) |
| 23 | 96 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 93084003 | | 4.904E-15 | | 88.4 (96) |
| 23 | 97 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 93093005 | | 1.512E-14 | | 73.9 (97) |
| 23 | 98 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d\ ^3D_2$ | | 93093349 | | 1.377E-14 | | 55.9 (98) 16.2 (111) 14.6 (100) |
| 23 | 99 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 93104084 | | 5.582E-15 | | 81.4 (99) |
| 23 | 100 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 93125372 | | 1.198E-14 | | 44.1 (100) 20.4 (98) 19.2 (90) |
| 23 | 101 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d\ ^1D_2$ | | 93129429 | | 5.701E-15 | | 42.6 (101) 22.1 (109) 11.5 (95) |
| 23 | 102 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^3P_1$ | | 93129430 | | 4.856E-15 | | 52.2 (102) 25.4 (92) 12.6 (86) |
| 23 | 103 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 93140105 | | 5.212E-15 | | 69.3 (103) 11.6 (116) 11.1 (113) |
| 23 | 104 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 93145787 | | 6.368E-15 | | 71.8 (104) 28.2 (94) |
| 23 | 105 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^3P_2$ | | 93162155 | | 5.310E-15 | | 78.0 (105) |
| 23 | 106 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^3S_1$ | | 93163045 | | 5.049E-15 | | 66.9 (106) 16.7 (102) 10.9 (82) |
| 23 | 107 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 93172028 | | 7.129E-15 | | 55.9 (107) 31.5 (83) 6.64 (103) |
| 23 | 108 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 93176276 | | 5.802E-15 | | 100. (108) |
| 23 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^3D_2$ | | 93191261 | | 5.357E-15 | | 45.8 (109) 32.2 (101) 13.3 (93) |
| 23 | 110 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3D_3$ | | 93212692 | | 5.136E-15 | | 79.5 (110) |
| 23 | 111 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 93224541 | | 5.651E-15 | | 62.2 (111) 25.1 (100) 11.6 (105) |
| 23 | 112 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 93239192 | | 5.517E-15 | | 60.8 (112) 27.3 (109) 5.17 (89) |
| 23 | 113 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 93241174 | | 5.525E-15 | | 74.0 (113) |
| 23 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 93245500 | | 5.609E-15 | | 93.1 (114) |
| 23 | 115 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | | 93286977 | | 4.870E-15 | | 89.3 (115) |
| 23 | 116 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 93304290 | | 5.341E-15 | | 83.4 (116) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 23 | 117 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | 93304312 | | | 5.106E-15 | | 79.2 (117) |
| 23 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | 95644655 | | | 2.423E-14 | | 79.7 (118) |
| 23 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | 95656367 | | | 7.903E-15 | | 35.2 (119) 31.5 (127) 30.1 (148) |
| 23 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | 95661558 | | | 8.194E-15 | | 66.1 (120) 33.9 (125) |
| 23 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | 95661989 | | | 1.966E-14 | | 73.2 (121) |
| 23 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | 95670718 | | | 5.757E-15 | | 72.0 (122) 14.8 (147) 11.1 (133) |
| 23 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | 95673492 | | | 2.491E-14 | | 72.7 (123) |
| 23 | 124 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | 95683370 | | | 2.281E-14 | | 84.3 (124) |
| 23 | 125 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | 95685496 | | | 1.280E-14 | | 63.4 (125) 33.7 (120) 2.90 (158) |
| 23 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | 95690267 | | | 6.693E-15 | | 49.2 (126) 23.1 (132) 16.0 (154) |
| 23 | 127 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | 95704053 | | | 1.190E-14 | | 39.9 (127) 35.7 (119) 20.7 (123) |
| 23 | 128 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | 95704340 | | | 5.984E-15 | | 74.4 (128) |
| 23 | 129 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | 95704855 | | | 6.426E-15 | | 35.6 (129) 25.3 (147) 15.9 (151) |
| 23 | 130 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | 95710936 | | | 4.341E-14 | | 92.9 (130) |
| 23 | 131 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | 95714452 | | | 6.286E-15 | | 73.2 (131) |
| 23 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | 95715015 | | | 2.390E-14 | | 62.7 (132) 19.2 (136) 9.68 (154) |
| 23 | 133 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | 95717273 | | | 2.264E-14 | | 79.9 (133) |
| 23 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | 95721046 | | | 6.519E-15 | | 52.5 (134) 16.7 (155) 15.6 (165) |
| 23 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3F_2$ | 95727956 | | | 6.139E-15 | | 33.0 (135) 29.1 (156) 20.4 (153) |
| 23 | 136 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | 95734383 | | | 2.719E-14 | | 73.6 (136) |
| 23 | 137 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | 95734522 | | | 5.686E-15 | | 59.4 (137) 19.3 (169) 14.6 (157) |
| 23 | 138 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | 95734956 | | | 5.567E-15 | | 71.7 (138) 19.4 (159) 8.90 (162) |
| 23 | 139 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | 95738147 | | | 1.704E-13 | | 98.5 (139) |
| 23 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | 95738529 | | | 5.565E-15 | | 41.4 (140) 30.0 (164) 28.6 (160) |
| 23 | 141 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | 95739142 | | | 5.725E-15 | | 51.4 (141) 27.2 (168) 18.2 (161) |
| 23 | 142 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | 95739623 | | | 5.922E-14 | | 93.7 (142) |
| 23 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | 95740307 | | | 5.792E-15 | | 44.9 (143) 32.0 (162) 18.7 (159) |
| 23 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | 95740835 | | | 3.113E-14 | | 79.9 (144) |
| 23 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | 95743519 | | | 2.582E-13 | | 95.6 (145) |
| 23 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | 95775901 | | | 5.790E-15 | | 93.2 (146) |
| 23 | 147 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | 95787561 | | | 5.161E-15 | | 46.8 (147) 36.7 (129) 16.5 (122) |
| 23 | 148 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | 95791483 | | | 6.239E-15 | | 67.9 (148) 21.4 (119) 10.7 (127) |
| 23 | 149 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | 95794967 | | | 5.340E-15 | | 96.2 (149) |
| 23 | 150 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | 95795698 | | | 5.259E-15 | | 51.8 (150) 31.5 (126) 13.9 (154) |
| 23 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | 95803500 | | | 5.386E-15 | | 67.7 (151) 16.8 (129) 10.3 (147) |
| 23 | 152 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | 95814101 | | | 5.759E-15 | | 98.5 (152) |
| 23 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | 95814657 | | | 5.594E-15 | | 52.3 (153) 24.1 (156) 20.1 (128) |
| 23 | 154 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | 95818273 | | | 5.283E-15 | | 60.4 (154) 33.1 (150) 3.65 (136) |
| 23 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | 95821988 | | | 5.533E-15 | | 60.1 (155) 35.0 (134) 4.87 (165) |
| 23 | 156 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | 95831355 | | | 5.605E-15 | | 52.4 (135) 37.3 (156) 6.60 (153) |
| 23 | 157 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | 95831987 | | | 5.616E-15 | | 68.8 (157) 27.2 (137) 2.14 (123) |
| 23 | 158 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | 95833909 | | | 5.670E-15 | | 97.2 (158) |
| 23 | 159 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^3F_3$ | 95835551 | | | 5.622E-15 | | 39.7 (159) 32.3 (162) 28.0 (138) |
| 23 | 160 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | 95837757 | | | 5.622E-15 | | 66.5 (160) 31.6 (140) 1.84 (164) |
| 23 | 161 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | 95842294 | | | 5.618E-15 | | 46.1 (141) 34.3 (161) 19.6 (168) |
| 23 | 162 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | 95842719 | | | 5.626E-15 | | 51.8 (143) 26.4 (162) 21.8 (159) |
| 23 | 163 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | 95842815 | | | 5.618E-15 | | 100. (163) |
| 23 | 164 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | 95844525 | | | 5.617E-15 | | 68.1 (164) 27.0 (140) 4.88 (160) |
| 23 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | 95846286 | | | 5.384E-15 | | 75.5 (165) |
| 23 | 166 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | 95848215 | | | 5.464E-15 | | 76.2 (166) |
| 23 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | 95849293 | | | 5.627E-15 | | 100. (167) |
| 23 | 168 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | 95852498 | | | 5.612E-15 | | 52.4 (168) 46.3 (161) 1.23 (141) |
| 23 | 169 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | 95853928 | | | 5.577E-15 | | 74.6 (169) |
| 23 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | 96889677 | | | 2.323E-14 | | 77.7 (170) |
| 23 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | 96894122 | | | 7.623E-15 | | 44.1 (171) 27.3 (207) 23.5 (181) |
| 23 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | 96895737 | | | 7.987E-15 | | 69.7 (172) 30.3 (177) |
| 23 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | 96897054 | | | 1.739E-14 | | 68.6 (173) 15.8 (184) 15.6 (221) |
| 23 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | 96901564 | | | 6.169E-15 | | 71.4 (174) 13.1 (208) 10.8 (185) |
| 23 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | 96904295 | | | 3.619E-14 | | 70.1 (175) 19.3 (181) 3.04 (217) |
| 23 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | 96908705 | | | 2.433E-14 | | 81.6 (176) |
| 23 | 177 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | 96911170 | | | 1.586E-14 | | 68.7 (177) 30.2 (172) 1.09 (218) |
| 23 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | 96911458 | | | 6.893E-15 | | 44.1 (178) 21.6 (214) 18.6 (183) |
| 23 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | 96918143 | | | 6.093E-15 | | 72.4 (179) |
| 23 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | 96919586 | | | 6.930E-15 | | 37.4 (180) 19.3 (211) 18.9 (208) |
| 23 | 181 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | 96921306 | | | 1.573E-14 | | 47.1 (181) 24.9 (171) 22.2 (175) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 23 | 182 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 96923216 | | 4.861E-14 | | 91.0 (182) |
| 23 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | | 96924563 | | 3.147E-14 | | 67.0 (183) 16.9 (190) 5.30 (214) |
| 23 | 184 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 96925184 | | 7.407E-15 | | 59.8 (184) 28.4 (173) 11.7 (221) |
| 23 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 96926053 | | 3.007E-14 | | 84.7 (185) |
| 23 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 96926851 | | 6.634E-15 | | 44.7 (186) 21.3 (227) 18.1 (215) |
| 23 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 96931040 | | 6.655E-15 | | 36.0 (187) 28.8 (216) 17.3 (212) |
| 23 | 188 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 96932712 | | 5.643E-15 | | 73.6 (188) |
| 23 | 189 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 96933659 | | 6.095E-15 | | 51.8 (189) 23.2 (236) 14.9 (217) |
| 23 | 190 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | | 96934760 | | 3.142E-14 | | 78.5 (190) |
| 23 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 96934781 | | 5.644E-15 | | 41.9 (191) 31.5 (228) 26.6 (220) |
| 23 | 192 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 96935593 | | 5.999E-15 | | 45.6 (192) 28.7 (237) 19.0 (223) |
| 23 | 193 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 96935709 | | 3.543E-14 | | 85.0 (193) |
| 23 | 194 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 96935838 | | 5.802E-15 | | 70.1 (194) 14.6 (230) 12.3 (225) |
| 23 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 96936182 | | 6.115E-15 | | 46.6 (195) 27.8 (224) 16.8 (219) |
| 23 | 196 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 96936366 | | 5.785E-15 | | 42.5 (196) 31.3 (229) 23.5 (235) |
| 23 | 197 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 96936426 | | 5.625E-15 | | 39.5 (197) 32.8 (231) 27.7 (226) |
| 23 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 96936579 | | 6.171E-14 | | 92.9 (198) |
| 23 | 199 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 96937049 | | 6.352E-15 | | 49.5 (199) 23.1 (225) 15.6 (230) |
| 23 | 200 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | | 96937133 | | 2.801E-14 | | 78.5 (200) |
| 23 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | | 96938876 | | 4.692E-13 | | 96.5 (201) |
| 23 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 96938982 | | 4.948E-13 | | 64.2 (202) 35.8 (205) |
| 23 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 96938988 | | 4.463E-13 | | 100. (203) |
| 23 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 96939458 | | 8.953E-13 | | 100. (204) |
| 23 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | | 96939589 | | 6.752E-13 | | 64.6 (205) 35.4 (202) |
| 23 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 97004955 | | 5.731E-15 | | 100. (206) |
| 23 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 97010064 | | 5.848E-15 | | 68.1 (207) 29.1 (171) 2.83 (181) |
| 23 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^1P_1$ | | 97011386 | | 5.403E-15 | | 49.2 (208) 34.3 (180) 16.5 (174) |
| 23 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^3P_2$ | | 97014450 | | 5.429E-15 | | 42.3 (209) 40.7 (178) 17.0 (214) |
| 23 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 97015012 | | 5.441E-15 | | 100. (210) |
| 23 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^3S_1$ | | 97018341 | | 5.495E-15 | | 67.0 (211) 17.3 (180) 13.7 (208) |
| 23 | 212 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | | 97025141 | | 5.645E-15 | | 56.1 (212) 20.7 (179) 20.3 (216) |
| 23 | 213 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 97025149 | | 5.700E-15 | | 100. (213) |
| 23 | 214 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | | 97025274 | | 5.430E-15 | | 54.8 (214) 42.3 (209) 2.93 (178) |
| 23 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | | 97028429 | | 5.621E-15 | | 53.5 (215) 41.4 (186) 5.13 (227) |
| 23 | 216 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | | 97032565 | | 5.639E-15 | | 50.1 (187) 41.2 (216) 7.51 (212) |
| 23 | 217 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 97032717 | | 5.644E-15 | | 67.8 (217) 30.5 (189) 1.67 (236) |
| 23 | 218 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 97033545 | | 5.670E-15 | | 98.9 (218) |
| 23 | 219 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 97035360 | | 5.665E-15 | | 41.6 (219) 32.2 (224) 26.2 (188) |
| 23 | 220 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 97036509 | | 5.664E-15 | | 66.6 (220) 33.4 (191) |
| 23 | 221 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 97037885 | | 5.538E-15 | | 72.7 (221) |
| 23 | 222 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 97038615 | | 5.656E-15 | | 100. (222) |
| 23 | 223 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 97038615 | | 5.661E-15 | | 49.4 (192) 35.3 (223) 15.3 (237) |
| 23 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 97038731 | | 5.664E-15 | | 47.8 (195) 29.4 (224) 22.8 (219) |
| 23 | 225 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | | 97038825 | | 5.686E-15 | | 36.6 (225) 35.8 (230) 27.6 (194) |
| 23 | 226 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 97039350 | | 5.686E-15 | | 71.7 (226) 20.1 (197) 8.17 (231) |
| 23 | 227 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 97039516 | | 5.550E-15 | | 67.7 (227) 24.2 (215) 6.91 (186) |
| 23 | 228 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 97039906 | | 5.656E-15 | | 67.8 (228) 24.9 (191) 7.30 (220) |
| 23 | 229 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^1F_3$ | | 97040006 | | 5.681E-15 | | 55.3 (196) 22.0 (229) 21.1 (235) |
| 23 | 230 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^1G_4$ | | 97040481 | | 5.684E-15 | | 43.5 (199) 29.6 (230) 26.9 (225) |
| 23 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 97040808 | | 5.677E-15 | | 59.4 (231) 40.6 (197) |
| 23 | 232 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 97041265 | | 5.678E-15 | | 100. (232) |
| 23 | 233 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 97041832 | | 5.660E-15 | | 100. (233) |
| 23 | 234 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 97042453 | | 5.676E-15 | | 100. (234) |
| 23 | 235 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^3F_3$ | | 97043011 | | 5.676E-15 | | 54.0 (235) 46.0 (229) |
| 23 | 236 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 97043073 | | 5.629E-15 | | 70.8 (236) 14.8 (189) 14.5 (217) |
| 23 | 237 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 97043769 | | 5.654E-15 | | 54.0 (237) 43.9 (223) 2.10 (192) |
| 23 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 97560249 | | 1.991E-14 | | 72.6 (238) |
| 23 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 97561841 | | 7.316E-15 | | 48.9 (239) 27.1 (283) 19.0 (249) |
| 23 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 97562581 | | 7.545E-15 | | 74.3 (240) |
| 23 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 97563970 | | 1.485E-14 | | 63.1 (241) 21.3 (252) 15.6 (295) |
| 23 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 97566174 | | 6.353E-15 | | 71.6 (242) 11.7 (284) 9.73 (254) |
| 23 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 97568819 | | 3.825E-14 | | 67.6 (243) 21.3 (249) 4.41 (257) |
| 23 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 97571001 | | 2.168E-14 | | 77.0 (244) |
| 23 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 97571837 | | 6.768E-15 | | 43.3 (245) 24.6 (288) 14.5 (251) |
| 23 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 97572837 | | 2.007E-14 | | 74.5 (246) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 23 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 97575516 | | 6.102E-15 | | 72.3 (247) |
| 23 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 97576848 | | 7.388E-15 | | 36.5 (248) 22.6 (238) 20.5 (287) |
| 23 | 249 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 97578688 | | 1.846E-14 | | 47.2 (249) 24.9 (243) 19.0 (239) |
| 23 | 250 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 97579482 | | 3.545E-14 | | 85.3 (250) |
| 23 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 97580121 | | 3.187E-14 | | 69.1 (251) 14.2 (266) 4.04 (260) |
| 23 | 252 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3F_0$ | | 97580468 | | 8.494E-15 | | 50.3 (252) 35.7 (241) 14.0 (295) |
| 23 | 253 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 97580596 | | 6.408E-15 | | 43.0 (253) 25.2 (302) 19.3 (291) |
| 23 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 97581099 | | 4.011E-14 | | 87.9 (254) |
| 23 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 97583249 | | 7.160E-15 | | 35.9 (255) 26.9 (292) 22.2 (244) |
| 23 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 97583539 | | 5.667E-15 | | 74.3 (256) |
| 23 | 257 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 97584574 | | 6.525E-15 | | 46.5 (257) 24.2 (316) 14.2 (293) |
| 23 | 258 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 97584784 | | 5.660E-15 | | 41.9 (258) 32.2 (304) 25.8 (297) |
| 23 | 259 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 97585404 | | 5.634E-15 | | 72.6 (259) |
| 23 | 260 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 97585466 | | 6.227E-15 | | 42.4 (260) 28.6 (321) 19.1 (299) |
| 23 | 261 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 97585763 | | 5.633E-15 | | 39.7 (261) 33.0 (309) 27.2 (303) |
| 23 | 262 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 97585785 | | 5.669E-15 | | 42.8 (262) 32.7 (305) 24.5 (320) |
| 23 | 263 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 97585873 | | 5.626E-15 | | 71.8 (263) 16.8 (313) 11.3 (306) |
| 23 | 264 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 97585882 | | 6.563E-15 | | 45.2 (264) 24.9 (300) 15.4 (296) |
| 23 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 97585921 | | 6.813E-15 | | 47.3 (265) 21.7 (301) 17.3 (270) |
| 23 | 266 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 97586044 | | 3.974E-14 | | 77.6 (266) |
| 23 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 97586085 | | 5.626E-15 | | 38.7 (267) 33.2 (311) 28.1 (308) |
| 23 | 268 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 97586112 | | 5.638E-15 | | 40.6 (268) 33.0 (319) 26.4 (310) |
| 23 | 269 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 97586322 | | 5.638E-15 | | 59.3 (269) 23.6 (306) 17.0 (313) |
| 23 | 270 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 97586776 | | 3.116E-14 | | 82.6 (270) |
| 23 | 271 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 97586951 | | 7.548E-14 | | 93.9 (271) |
| 23 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 97587177 | | 4.120E-14 | | 84.6 (272) |
| 23 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 97588402 | | 7.646E-13 | | 96.8 (273) |
| 23 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 97588456 | | 5.851E-13 | | 100. (274) |
| 23 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 97588467 | | 7.215E-13 | | 69.8 (275) 30.2 (277) |
| 23 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 97588726 | | 1.497E-12 | | 100. (276) |
| 23 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 97588829 | | 1.083E-12 | | 70.2 (277) 29.8 (275) |
| 23 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 97588888 | | 2.082E-12 | | 55.3 (278) 44.7 (281) |
| 23 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 97588894 | | 2.096E-12 | | 100. (279) |
| 23 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 97589100 | | 2.091E-12 | | 100. (280) |
| 23 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 97589106 | | 2.126E-12 | | 55.3 (281) 44.7 (278) |
| 23 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 97669451 | | 5.721E-15 | | 100. (282) |
| 23 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 97671583 | | 5.756E-15 | | 68.1 (283) 31.9 (239) |
| 23 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 97673301 | | 5.541E-15 | | 48.8 (284) 34.7 (248) 16.5 (242) |
| 23 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 97674780 | | 5.544E-15 | | 43.9 (285) 38.2 (285) 17.9 (288) |
| 23 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 97675348 | | 5.546E-15 | | 100. (286) |
| 23 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3S_1$ | | 97676698 | | 5.557E-15 | | 66.9 (287) 16.6 (248) 16.5 (284) |
| 23 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 97680840 | | 5.541E-15 | | 51.4 (288) 45.8 (285) 2.71 (245) |
| 23 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 97681189 | | 5.679E-15 | | 57.4 (289) 20.9 (247) 19.0 (292) |
| 23 | 290 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 97681257 | | 5.702E-15 | | 100. (290) |
| 23 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 97682957 | | 5.665E-15 | | 50.6 (291) 44.1 (253) 5.33 (302) |
| 23 | 292 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 97685095 | | 5.659E-15 | | 49.2 (255) 43.0 (292) 7.76 (289) |
| 23 | 293 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 97685099 | | 5.658E-15 | | 67.4 (293) 31.2 (257) 1.42 (316) |
| 23 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 97685483 | | 5.665E-15 | | 100. (294) |
| 23 | 295 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 97686859 | | 5.574E-15 | | 70.3 (295) 28.6 (252) 1.17 (241) |
| 23 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 97686933 | | 5.688E-15 | | 42.3 (296) 32.0 (300) 25.6 (256) |
| 23 | 297 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 97687592 | | 5.687E-15 | | 65.6 (297) 34.4 (258) |
| 23 | 298 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 97688657 | | 5.681E-15 | | 100. (298) |
| 23 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 97688757 | | 5.684E-15 | | 50.6 (260) 36.0 (299) 13.5 (321) |
| 23 | 300 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 97688806 | | 5.684E-15 | | 46.3 (264) 30.6 (300) 23.1 (296) |
| 23 | 301 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 97688939 | | 5.695E-15 | | 36.6 (301) 36.2 (307) 27.1 (259) |
| 23 | 302 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 97688978 | | 5.628E-15 | | 65.3 (302) 27.3 (291) 7.45 (253) |
| 23 | 303 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 97689248 | | 5.695E-15 | | 71.8 (303) 21.2 (261) 6.96 (309) |
| 23 | 304 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 97689471 | | 5.685E-15 | | 67.4 (304) 23.8 (258) 8.80 (297) |
| 23 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^1F_3$ | | 97689644 | | 5.695E-15 | | 57.1 (262) 21.5 (305) 21.4 (320) |
| 23 | 306 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 97689715 | | 5.693E-15 | | 37.3 (306) 34.7 (313) 28.0 (263) |
| 23 | 307 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^1G_4$ | | 97689914 | | 5.696E-15 | | 42.7 (265) 29.7 (307) 27.6 (301) |
| 23 | 308 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 97689915 | | 5.692E-15 | | 71.2 (308) 20.7 (267) 8.07 (311) |
| 23 | 309 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 97690014 | | 5.680E-15 | | 60.6 (309) 39.4 (261) |
| 23 | 310 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 97690074 | | 5.699E-15 | | 59.3 (268) 20.4 (310) 20.3 (319) |
| 23 | 311 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 97690236 | | 5.659E-15 | | 59.2 (311) 40.8 (267) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 23 | 312 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 97690251 | | 5.680E-15 | | 100. (312) |
| 23 | 313 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 97690274 | | 5.699E-15 | | 40.5 (269) 31.6 (313) 27.9 (306) |
| 23 | 314 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 97690442 | | 5.659E-15 | | 100. (314) |
| 23 | 315 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 97690494 | | 5.677E-15 | | 100. (315) |
| 23 | 316 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 97690845 | | 5.652E-15 | | 68.5 (316) 16.4 (257) 15.0 (293) |
| 23 | 317 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 97690896 | | 5.689E-15 | | 100. (317) |
| 23 | 318 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 97691038 | | 5.689E-15 | | 100. (318) |
| 23 | 319 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 97691099 | | 5.689E-15 | | 53.3 (310) 46.7 (319) |
| 23 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^3F_3$ | | 97691377 | | 5.690E-15 | | 53.8 (320) 46.2 (305) |
| 23 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 97691694 | | 5.679E-15 | | 54.6 (321) 42.7 (299) 2.65 (260) |
| 24 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 24 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 45384110 | 45383654 | | 1.098E-08 | | 100. (2) |
| 24 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 45595910 | 45595648 | | 3.182E-09 | | 100. (3) |
| 24 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 45609360 | 45609096 | | 4.273E-14 | | 93.6 (4) |
| 24 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 45614410 | 45614009 | | 1.231E-03 | | 100. (5) |
| 24 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 45691820 | 45691593 | | 2.300E-10 | | 100. (6) |
| 24 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 45828830 | 45828328 | | 2.973E-15 | | 93.6 (7) |
| 24 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 53760100 | 53759678 | | 4.667E-13 | | 100. (8) |
| 24 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 53818510 | 53818113 | | 1.566E-13 | | 100. (9) |
| 24 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 53821190 | 53820359 | | 4.880E-13 | | 100. (10) |
| 24 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 53822410 | 53822026 | | 7.494E-14 | | 92.9 (11) |
| 24 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 53847040 | 53846683 | | 1.607E-13 | | 100. (12) |
| 24 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 53878640 | 53878212 | | 5.419E-14 | | 67.2 (13) 32.8 (17) |
| 24 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 53879040 | 53878618 | | 5.405E-14 | | 100. (14) |
| 24 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 53884060 | 53883580 | | 1.030E-14 | | 92.9 (15) |
| 24 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 53888200 | 53887778 | | 5.458E-14 | | 100. (16) |
| 24 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 53890160 | 53889727 | | 5.504E-14 | | 67.2 (17) 32.8 (13) |
| 24 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 56658500 | 56658761 | | 6.802E-13 | | 100. (18) |
| 24 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 56683000 | 56682808 | | 2.672E-13 | | 100. (19) |
| 24 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 56684100 | 56683367 | | 7.075E-13 | | 100. (20) |
| 24 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 56684700 | 56684447 | | 1.498E-13 | | 92.6 (21) |
| 24 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 56695100 | 56694868 | | 2.728E-13 | | 100. (22) |
| 24 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | 56708400 | 56707889 | | 1.261E-13 | | 69.3 (23) 30.7 (28) |
| 24 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | 56708600 | 56707985 | | 1.256E-13 | | 100. (24) |
| 24 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 56710700 | 56709942 | | 2.452E-14 | | 92.6 (25) |
| 24 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | 56712400 | 56711851 | | 1.269E-13 | | 100. (26) |
| 24 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 56712669 | | 2.576E-13 | | 56.8 (27) 43.2 (31) |
| 24 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | 56713200 | 56712833 | | 1.284E-13 | | 69.3 (28) 30.7 (23) |
| 24 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 56712881 | | 2.576E-13 | | 100. (29) |
| 24 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 56714823 | | 2.584E-13 | | 100. (30) |
| 24 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 56714989 | | 2.586E-13 | | 56.8 (31) 43.2 (27) |
| 24 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 57992700 | 57992781 | | 1.075E-12 | | 100. (32) |
| 24 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 58004840 | 58004944 | | 4.568E-13 | | 100. (33) |
| 24 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 58005800 | 58005141 | | 1.102E-12 | | 100. (34) |
| 24 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 58006100 | 58005780 | | 2.711E-13 | | 92.5 (35) |
| 24 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 58011400 | 58011117 | | 4.654E-13 | | 100. (36) |
| 24 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | | 58017717 | | 2.426E-13 | | 70.1 (37) 29.9 (42) |
| 24 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | | 58017750 | | 2.418E-13 | | 100. (38) |
| 24 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p\ ^1P_1$ | 58019400 | 58018718 | | 4.791E-14 | | 92.5 (39) |
| 24 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d\ ^3D_3$ | | 58019730 | | 2.445E-13 | | 100. (40) |
| 24 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f\ ^3F_3$ | | 58020186 | | 4.977E-13 | | 57.0 (41) 43.0 (47) |
| 24 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d\ ^1D_2$ | | 58020267 | | 2.469E-13 | | 70.1 (42) 29.9 (37) |
| 24 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f\ ^3F_2$ | | 58020292 | | 4.977E-13 | | 100. (43) |
| 24 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f\ ^3F_4$ | | 58021287 | | 4.994E-13 | | 100. (44) |
| 24 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g\ ^3G_4$ | | 58021306 | | 8.372E-13 | | 55.1 (45) 44.9 (49) |
| 24 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g\ ^3G_3$ | | 58021370 | | 8.374E-13 | | 100. (46) |
| 24 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f\ ^1F_3$ | | 58021375 | | 4.998E-13 | | 57.0 (47) 43.0 (41) |
| 24 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g\ ^3G_5$ | | 58021967 | | 8.385E-13 | | 100. (48) |
| 24 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g\ ^1G_4$ | | 58022018 | | 8.386E-13 | | 55.1 (49) 44.9 (45) |
| 24 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s\ ^3S_1$ | | 58714790 | | 1.679E-12 | | 100. (50) |
| 24 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p\ ^3P_0$ | | 58721774 | | 7.424E-13 | | 100. (51) |
| 24 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s\ ^1S_0$ | | 58721870 | | 1.632E-12 | | 100. (52) |
| 24 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p\ ^3P_1$ | | 58722257 | | 4.508E-13 | | 92.4 (53) |
| 24 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p\ ^3P_2$ | | 58725347 | | 7.552E-13 | | 100. (54) |
| 24 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d\ ^3D_2$ | | 58729130 | | 4.152E-13 | | 70.5 (55) 29.5 (61) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 24 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 58729145 | | 4.154E-13 | | 100. (56) |
| 24 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 58729710 | | 8.256E-14 | | 92.4 (57) |
| 24 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 58730291 | | 4.203E-13 | | 100. (58) |
| 24 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 58730551 | | 8.504E-13 | | 57.1 (59) 42.9 (65) |
| 24 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 58730612 | | 8.502E-13 | | 100. (60) |
| 24 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 58730612 | | 4.202E-13 | | 70.5 (61) 29.5 (55) |
| 24 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 58731188 | | 8.532E-13 | | 100. (62) |
| 24 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 58731191 | | 1.436E-12 | | 55.1 (63) 44.9 (69) |
| 24 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 58731228 | | 1.436E-12 | | 100. (64) |
| 24 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 58731240 | | 8.542E-13 | | 57.1 (65) 42.9 (59) |
| 24 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 58731572 | | 2.168E-12 | | 54.2 (66) 45.8 (71) |
| 24 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 58731573 | | 1.438E-12 | | 100. (67) |
| 24 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 58731596 | | 2.168E-12 | | 100. (68) |
| 24 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 58731603 | | 1.439E-12 | | 55.1 (69) 44.9 (63) |
| 24 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 58731827 | | 2.170E-12 | | 100. (70) |
| 24 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 58731847 | | 2.170E-12 | | 54.2 (71) 45.8 (66) |
| 24 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 92786000 | 92787698 | | 1.299E-14 | | 79.9 (72) |
| 24 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 92820000 | 92817152 | | 4.997E-15 | | 100. (73) |
| 24 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 92848000 | 92846758 | | 5.000E-15 | | 97.4 (74) |
| 24 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 92935000 | 92935952 | | 5.047E-15 | | 100. (75) |
| 24 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 93047000 | 93044341 | | 2.639E-15 | | 92.7 (76) |
| 24 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 93100000 | 93098963 | | 2.495E-15 | | 100. (77) |
| 24 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | 93143000 | 93142554 | | 2.494E-15 | | 73.9 (78) |
| 24 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 93201000 | 93202760 | | 4.892E-15 | | 97.4 (79) |
| 24 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | 93271000 | 93271476 | | 2.497E-15 | | 73.9 (80) |
| 24 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | 93539000 | 93539634 | | 2.936E-15 | | 81.2 (81) |
| 24 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 101355562 | | 1.788E-14 | | 81.0 (82) |
| 24 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p^1P_1$ | | 101387814 | | 6.626E-15 | | 41.6 (83) 36.8 (107) 19.0 (91) |
| 24 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 101414330 | | 1.736E-14 | | 76.7 (84) |
| 24 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 101417766 | | 6.168E-15 | | 71.1 (85) 28.9 (88) |
| 24 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 101421635 | | 4.046E-15 | | 72.3 (86) |
| 24 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 101436461 | | 1.114E-14 | | 72.6 (87) |
| 24 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 101445104 | | 9.177E-15 | | 66.3 (88) 27.7 (85) 5.94 (114) |
| 24 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 101463032 | | 1.343E-14 | | 87.4 (89) |
| 24 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 101472924 | | 4.626E-15 | | 67.1 (90) 23.4 (98) 5.70 (111) |
| 24 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2p3s^3P_1$ | | 101481462 | | 6.702E-15 | | 52.0 (91) 21.9 (83) 20.3 (87) |
| 24 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 101503753 | | 4.550E-15 | | 44.8 (92) 18.8 (102) 11.7 (97) |
| 24 | 93 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 101516352 | | 4.800E-15 | | 77.5 (93) |
| 24 | 94 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 101521481 | | 1.196E-14 | | 77.6 (94) |
| 24 | 95 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 101533069 | | 4.198E-15 | | 86.3 (95) |
| 24 | 96 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 101539876 | | 4.692E-15 | | 78.1 (96) |
| 24 | 97 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 101543517 | | 1.355E-14 | | 75.8 (97) |
| 24 | 98 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 101544315 | | 1.224E-14 | | 58.3 (98) 14.8 (111) 14.0 (100) |
| 24 | 99 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 101558392 | | 4.686E-15 | | 78.9 (99) |
| 24 | 100 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 101581991 | | 1.089E-14 | | 49.5 (100) 18.5 (90) 17.8 (98) |
| 24 | 101 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d^1D_2$ | | 101586493 | | 4.829E-15 | | 36.5 (101) 23.1 (109) 16.7 (96) |
| 24 | 102 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3P_1$ | | 101591624 | | 4.004E-15 | | 51.5 (102) 28.8 (92) 12.9 (86) |
| 24 | 103 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 101593894 | | 4.385E-15 | | 68.0 (103) 12.8 (117) 12.1 (113) |
| 24 | 104 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 101609955 | | 4.978E-15 | | 77.6 (104) |
| 24 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p^3P_2$ | | 101625723 | | 4.465E-15 | | 73.8 (105) |
| 24 | 106 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p^3S_1$ | | 101627571 | | 4.197E-15 | | 67.2 (106) 16.0 (102) 9.60 (82) |
| 24 | 107 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 101632436 | | 5.944E-15 | | 57.7 (107) 29.7 (83) 7.35 (91) |
| 24 | 108 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d^3F_4$ | | 101646436 | | 4.896E-15 | | 100. (108) |
| 24 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d^3D_2$ | | 101659719 | | 4.533E-15 | | 41.5 (109) 36.9 (101) 14.7 (93) |
| 24 | 110 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d^3D_3$ | | 101682947 | | 4.345E-15 | | 76.6 (110) |
| 24 | 111 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^1D_2$ | | 101691369 | | 4.526E-15 | | 62.9 (111) 20.3 (100) 15.6 (105) |
| 24 | 112 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^3P_2$ | | 101710530 | | 4.621E-15 | | 59.4 (112) 29.1 (109) 4.61 (101) |
| 24 | 113 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d^3P_1$ | | 101711900 | | 4.628E-15 | | 73.1 (113) |
| 24 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d^3P_0$ | | 101716473 | | 4.705E-15 | | 94.0 (114) |
| 24 | 115 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d^1F_3$ | | 101760768 | | 4.112E-15 | | 87.5 (115) |
| 24 | 116 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p^1S_0$ | | 101775615 | | 4.253E-15 | | 79.1 (116) |
| 24 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d^3P_1$ | | 101778883 | | 4.492E-15 | | 82.4 (117) |
| 24 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s^3S_1$ | | 104333776 | | 2.081E-14 | | 80.3 (118) |
| 24 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s^3P_1$ | | 104345880 | | 6.506E-15 | | 37.7 (119) 29.8 (148) 29.7 (128) |
| 24 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s^3P_0$ | | 104350678 | | 6.829E-15 | | 67.0 (120) 33.0 (125) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 24 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 104351549 | | 1.619E-14 | | 72.6 (121) |
| 24 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 104360396 | | 4.835E-15 | | 72.2 (122) 14.9 (147) 10.2 (133) |
| 24 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 104363961 | | 2.182E-14 | | 73.2 (123) |
| 24 | 124 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 104375649 | | 1.924E-14 | | 85.1 (124) |
| 24 | 125 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 104376146 | | 1.111E-14 | | 64.7 (125) 32.9 (120) 2.40 (158) |
| 24 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 104382723 | | 5.589E-15 | | 48.4 (126) 22.2 (132) 17.1 (154) |
| 24 | 127 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 104397101 | | 5.037E-15 | | 74.5 (127) |
| 24 | 128 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | | 104397489 | | 1.069E-14 | | 43.4 (128) 32.8 (119) 21.1 (123) |
| 24 | 129 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 104397682 | | 5.420E-15 | | 36.2 (129) 23.4 (147) 17.1 (151) |
| 24 | 130 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 104405217 | | 3.916E-14 | | 93.8 (130) |
| 24 | 131 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 104407066 | | 5.408E-15 | | 70.5 (131) 21.4 (121) 8.11 (166) |
| 24 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 104408645 | | 2.116E-14 | | 64.0 (132) 18.2 (138) 8.66 (154) |
| 24 | 133 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 104410742 | | 2.005E-14 | | 81.0 (133) |
| 24 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 104415505 | | 5.473E-15 | | 51.1 (134) 17.2 (155) 16.8 (165) |
| 24 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 104422759 | | 5.213E-15 | | 34.0 (135) 29.4 (156) 19.7 (153) |
| 24 | 136 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 104428865 | | 4.809E-15 | | 58.5 (136) 20.6 (169) 15.0 (157) |
| 24 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 104429603 | | 4.696E-15 | | 72.0 (137) 19.2 (159) 8.76 (162) |
| 24 | 138 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 104429742 | | 2.411E-14 | | 75.8 (138) |
| 24 | 139 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 104433645 | | 4.694E-15 | | 41.4 (139) 30.4 (164) 28.2 (160) |
| 24 | 140 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 104433669 | | 1.624E-13 | | 98.9 (140) |
| 24 | 141 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 104434032 | | 4.838E-15 | | 50.3 (141) 27.8 (168) 18.6 (161) |
| 24 | 142 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 104434748 | | 5.205E-14 | | 93.9 (142) |
| 24 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 104435518 | | 4.899E-15 | | 45.8 (143) 31.4 (162) 18.2 (159) |
| 24 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 104436050 | | 2.697E-14 | | 78.9 (144) |
| 24 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | | 104439073 | | 2.101E-13 | | 94.2 (145) |
| 24 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 104484499 | | 4.869E-15 | | 95.0 (146) |
| 24 | 147 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | | 104497504 | | 4.347E-15 | | 45.7 (147) 38.0 (129) 16.3 (122) |
| 24 | 148 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 104499800 | | 5.171E-15 | | 68.1 (148) 23.2 (119) 8.69 (128) |
| 24 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | | 104505288 | | 4.418E-15 | | 48.3 (149) 34.1 (126) 16.3 (154) |
| 24 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 104506056 | | 4.462E-15 | | 97.1 (150) |
| 24 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | | 104514035 | | 4.505E-15 | | 67.5 (151) 15.2 (129) 13.0 (147) |
| 24 | 152 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 104526899 | | 4.843E-15 | | 98.9 (152) |
| 24 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | | 104527148 | | 4.717E-15 | | 52.9 (153) 23.8 (156) 20.3 (127) |
| 24 | 154 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 104530193 | | 4.419E-15 | | 58.0 (154) 36.9 (149) 2.65 (138) |
| 24 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | | 104534811 | | 4.669E-15 | | 58.1 (155) 36.6 (134) 5.32 (165) |
| 24 | 156 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | | 104544589 | | 4.716E-15 | | 52.0 (135) 37.6 (156) 7.22 (153) |
| 24 | 157 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 104544885 | | 4.723E-15 | | 68.3 (157) 28.1 (136) 1.89 (169) |
| 24 | 158 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 104546858 | | 4.767E-15 | | 97.7 (158) |
| 24 | 159 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 104549530 | | 4.746E-15 | | 39.5 (159) 32.9 (162) 27.6 (137) |
| 24 | 160 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 104552031 | | 4.746E-15 | | 66.3 (160) 32.2 (139) 1.46 (164) |
| 24 | 161 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 104556476 | | 4.743E-15 | | 47.0 (141) 34.0 (161) 18.9 (168) |
| 24 | 162 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | | 104557160 | | 4.748E-15 | | 50.9 (143) 26.4 (162) 22.7 (159) |
| 24 | 163 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 104557413 | | 4.743E-15 | | 100. (163) |
| 24 | 164 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | | 104559047 | | 4.742E-15 | | 68.1 (164) 26.3 (139) 5.53 (160) |
| 24 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | | 104560346 | | 4.545E-15 | | 73.8 (165) |
| 24 | 166 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^3S_0$ | | 104560890 | | 4.564E-15 | | 75.6 (166) |
| 24 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | | 104563849 | | 4.748E-15 | | 100. (167) |
| 24 | 168 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 104567477 | | 4.738E-15 | | 52.4 (168) 46.3 (161) 1.31 (141) |
| 24 | 169 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | | 104568288 | | 4.695E-15 | | 73.7 (169) |
| 24 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | | 105693080 | | 1.954E-14 | | 77.0 (170) |
| 24 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | | 105697552 | | 6.284E-15 | | 45.9 (171) 27.4 (207) 22.0 (181) |
| 24 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | | 105698995 | | 6.643E-15 | | 70.7 (172) 29.3 (177) |
| 24 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | | 105700594 | | 1.426E-14 | | 67.8 (173) 16.9 (183) 15.3 (221) |
| 24 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | | 105705152 | | 5.185E-15 | | 71.6 (174) 13.2 (208) 9.92 (185) |
| 24 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | | 105708384 | | 3.132E-14 | | 70.2 (175) 19.6 (181) 2.81 (216) |
| 24 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | | 105713714 | | 2.025E-14 | | 81.4 (176) |
| 24 | 177 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | | 105715369 | | 1.383E-14 | | 70.5 (177) 29.5 (172) |
| 24 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | | 105716389 | | 5.738E-15 | | 44.0 (178) 22.4 (212) 17.6 (184) |
| 24 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | | 105723263 | | 5.124E-15 | | 72.5 (179) |
| 24 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | | 105724696 | | 5.824E-15 | | 37.7 (180) 20.1 (211) 18.0 (208) |
| 24 | 181 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | | 105726766 | | 1.399E-14 | | 48.5 (181) 22.8 (175) 22.7 (171) |
| 24 | 182 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 105729189 | | 4.044E-14 | | 90.6 (182) |
| 24 | 183 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 105730168 | | 6.367E-15 | | 57.7 (183) 29.8 (173) 12.5 (221) |
| 24 | 184 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | | 105730271 | | 2.750E-14 | | 68.2 (184) 16.4 (191) 4.81 (212) |
| 24 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 105731703 | | 2.694E-14 | | 85.7 (185) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 24 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 105732760 | | 5.540E-15 | | 44.2 (186) 22.3 (226) 18.4 (215) |
| 24 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 105737077 | | 5.634E-15 | | 36.5 (187) 28.6 (217) 17.1 (176) |
| 24 | 188 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 105738734 | | 4.758E-15 | | 73.7 (188) |
| 24 | 189 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 105739499 | | 5.156E-15 | | 50.9 (189) 23.8 (235) 14.9 (216) |
| 24 | 190 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 105741056 | | 4.758E-15 | | 41.9 (190) 31.7 (228) 26.4 (220) |
| 24 | 191 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | | 105741192 | | 2.276E-14 | | 76.1 (191) |
| 24 | 192 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 105741774 | | 5.273E-15 | | 42.4 (192) 27.4 (237) 18.0 (222) |
| 24 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 105742130 | | 4.828E-15 | | 70.7 (193) 19.1 (230) 8.40 (225) |
| 24 | 194 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 105742317 | | 2.449E-14 | | 81.4 (194) |
| 24 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 105742516 | | 5.179E-15 | | 46.9 (195) 27.5 (224) 16.5 (219) |
| 24 | 196 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 105742679 | | 4.841E-15 | | 42.6 (196) 31.7 (236) 23.8 (229) |
| 24 | 197 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 105742836 | | 4.746E-15 | | 39.5 (197) 32.9 (231) 27.6 (227) |
| 24 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 105743044 | | 5.515E-14 | | 93.3 (198) |
| 24 | 199 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 105743504 | | 5.673E-15 | | 46.9 (199) 21.8 (225) 16.7 (194) |
| 24 | 200 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | | 105743632 | | 2.587E-14 | | 79.7 (200) |
| 24 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | | 105745591 | | 3.757E-13 | | 95.5 (201) |
| 24 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 105745720 | | 4.386E-13 | | 63.5 (202) 36.5 (205) |
| 24 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 105745729 | | 4.020E-13 | | 100. (203) |
| 24 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 105746300 | | 7.564E-13 | | 100. (204) |
| 24 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | | 105746439 | | 5.929E-13 | | 63.8 (205) 36.2 (202) |
| 24 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 105827793 | | 4.834E-15 | | 100. (206) |
| 24 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 105832864 | | 4.910E-15 | | 68.0 (207) 29.8 (171) 2.20 (181) |
| 24 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^3P_1$ | | 105834842 | | 4.560E-15 | | 46.7 (208) 36.9 (180) 16.4 (174) |
| 24 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^3P_2$ | | 105837732 | | 4.577E-15 | | 41.9 (178) 39.6 (209) 18.4 (212) |
| 24 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 105839152 | | 4.584E-15 | | 100. (210) |
| 24 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^3S_1$ | | 105842175 | | 4.621E-15 | | 66.5 (211) 17.2 (208) 14.8 (180) |
| 24 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | | 105849822 | | 4.575E-15 | | 52.8 (212) 44.8 (209) 2.48 (178) |
| 24 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | | 105849920 | | 4.765E-15 | | 55.8 (213) 20.9 (179) 20.8 (217) |
| 24 | 214 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 105850102 | | 4.810E-15 | | 100. (214) |
| 24 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | | 105853345 | | 4.746E-15 | | 52.0 (215) 42.4 (186) 5.57 (226) |
| 24 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 105857669 | | 4.758E-15 | | 67.4 (216) 30.9 (189) 1.69 (235) |
| 24 | 217 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | | 105857696 | | 4.755E-15 | | 50.0 (187) 40.7 (217) 8.21 (213) |
| 24 | 218 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 105858518 | | 4.778E-15 | | 100. (218) |
| 24 | 219 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 105860838 | | 4.783E-15 | | 41.1 (219) 32.8 (224) 26.1 (188) |
| 24 | 220 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 105862131 | | 4.782E-15 | | 65.8 (220) 34.2 (190) |
| 24 | 221 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 105862748 | | 4.651E-15 | | 72.2 (221) 25.5 (183) 2.30 (173) |
| 24 | 222 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 105864206 | | 4.780E-15 | | 49.8 (192) 35.2 (222) 14.9 (237) |
| 24 | 223 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 105864379 | | 4.776E-15 | | 100. (223) |
| 24 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 105864451 | | 4.782E-15 | | 47.4 (195) 29.1 (224) 23.5 (219) |
| 24 | 225 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | | 105864594 | | 4.801E-15 | | 37.2 (225) 35.4 (230) 27.5 (193) |
| 24 | 226 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 105865040 | | 4.685E-15 | | 67.4 (226) 25.8 (215) 6.80 (186) |
| 24 | 227 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 105865219 | | 4.801E-15 | | 71.6 (227) 20.9 (197) 7.52 (231) |
| 24 | 228 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 105865668 | | 4.777E-15 | | 67.8 (228) 24.0 (190) 8.13 (220) |
| 24 | 229 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^3F_3$ | | 105865817 | | 4.798E-15 | | 56.4 (196) 21.8 (229) 21.8 (236) |
| 24 | 230 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^1G_4$ | | 105866395 | | 4.799E-15 | | 43.2 (199) 30.2 (230) 26.6 (225) |
| 24 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 105866690 | | 4.794E-15 | | 60.1 (231) 39.9 (197) |
| 24 | 232 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 105867242 | | 4.795E-15 | | 100. (232) |
| 24 | 233 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 105867579 | | 4.779E-15 | | 100. (233) |
| 24 | 234 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 105868384 | | 4.794E-15 | | 100. (234) |
| 24 | 235 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 105868745 | | 4.748E-15 | | 70.1 (235) 15.0 (189) 14.9 (216) |
| 24 | 236 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^1F_3$ | | 105869046 | | 4.793E-15 | | 53.7 (229) 46.3 (236) |
| 24 | 237 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 105869746 | | 4.774E-15 | | 54.0 (237) 43.8 (222) 2.19 (192) |
| 24 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 106425421 | | 1.644E-14 | | 72.1 (238) 11.5 (287) 7.55 (284) |
| 24 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 106426918 | | 6.044E-15 | | 50.4 (239) 27.4 (283) 17.7 (249) |
| 24 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 106427575 | | 6.267E-15 | | 75.5 (240) |
| 24 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 106429181 | | 1.217E-14 | | 62.0 (241) 22.4 (251) 15.6 (295) |
| 24 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 106431365 | | 5.363E-15 | | 71.5 (242) 11.6 (284) 8.82 (254) |
| 24 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 106434412 | | 3.280E-14 | | 67.6 (243) 21.6 (249) 4.45 (257) |
| 24 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 106437107 | | 1.779E-14 | | 76.3 (244) |
| 24 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 106437782 | | 5.629E-15 | | 43.5 (245) 25.3 (288) 13.6 (252) |
| 24 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 106438490 | | 1.770E-14 | | 75.7 (246) |
| 24 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 106441569 | | 5.135E-15 | | 72.4 (247) |
| 24 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 106442907 | | 6.204E-15 | | 36.7 (248) 22.4 (238) 21.0 (287) |
| 24 | 249 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 106445036 | | 1.625E-14 | | 47.8 (249) 25.7 (243) 17.5 (239) |
| 24 | 250 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 106446145 | | 2.821E-14 | | 84.3 (250) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 24 | 251 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 106446460 | | 7.316E-15 | | 48.6 (251) 37.0 (241) 14.4 (295) |
| 24 | 252 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 106446650 | | 2.707E-14 | | 69.6 (252) 13.8 (268) 4.26 (259) |
| 24 | 253 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 106447085 | | 5.343E-15 | | 43.0 (253) 26.0 (301) 19.5 (291) |
| 24 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 106447614 | | 3.653E-14 | | 88.9 (254) |
| 24 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 106449840 | | 6.079E-15 | | 35.9 (255) 26.7 (293) 22.7 (244) |
| 24 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 106450091 | | 4.779E-15 | | 74.3 (256) |
| 24 | 257 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 106451033 | | 5.530E-15 | | 45.9 (257) 24.6 (316) 14.2 (292) |
| 24 | 258 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 106451485 | | 4.772E-15 | | 41.9 (258) 32.4 (304) 25.8 (297) |
| 24 | 259 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 106452114 | | 5.268E-15 | | 42.0 (259) 28.8 (321) 19.2 (299) |
| 24 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 106452120 | | 4.755E-15 | | 72.7 (260) |
| 24 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 106452506 | | 4.778E-15 | | 42.7 (261) 32.7 (320) 24.6 (305) |
| 24 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 106452544 | | 4.754E-15 | | 39.8 (262) 33.1 (309) 27.2 (303) |
| 24 | 263 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 106452647 | | 5.603E-15 | | 44.9 (263) 24.5 (300) 15.6 (250) |
| 24 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 106452655 | | 4.751E-15 | | 71.9 (264) 16.9 (313) 11.2 (306) |
| 24 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 106452733 | | 5.316E-15 | | 51.3 (265) 23.4 (302) 14.7 (307) |
| 24 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 106452893 | | 4.758E-15 | | 40.6 (266) 33.0 (319) 26.4 (310) |
| 24 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 106452909 | | 4.751E-15 | | 38.7 (267) 33.2 (311) 28.1 (308) |
| 24 | 268 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 106452987 | | 3.582E-14 | | 78.5 (268) |
| 24 | 269 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 106453143 | | 4.758E-15 | | 59.4 (269) 23.7 (306) 16.8 (313) |
| 24 | 270 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 106453825 | | 4.219E-14 | | 89.4 (270) |
| 24 | 271 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 106453931 | | 6.854E-14 | | 94.3 (271) |
| 24 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 106454173 | | 3.811E-14 | | 84.7 (272) |
| 24 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 106455540 | | 6.145E-13 | | 96.0 (273) |
| 24 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 106455607 | | 5.412E-13 | | 100. (274) |
| 24 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 106455619 | | 6.562E-13 | | 68.7 (275) 31.3 (277) |
| 24 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 106455936 | | 1.274E-12 | | 100. (276) |
| 24 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 106456046 | | 9.628E-13 | | 69.0 (277) 31.0 (275) |
| 24 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 106456105 | | 1.780E-12 | | 55.2 (278) 44.8 (281) |
| 24 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 106456113 | | 1.803E-12 | | 100. (279) |
| 24 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 106456358 | | 1.787E-12 | | 100. (280) |
| 24 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 106456365 | | 1.821E-12 | | 55.2 (281) 44.8 (278) |
| 24 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 106553993 | | 4.829E-15 | | 100. (282) |
| 24 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 106556143 | | 4.851E-15 | | 67.9 (283) 32.1 (239) |
| 24 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 106558178 | | 4.678E-15 | | 44.7 (284) 37.5 (248) 16.1 (242) |
| 24 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 106559574 | | 4.679E-15 | | 44.7 (245) 36.1 (285) 19.2 (288) |
| 24 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 106560655 | | 4.680E-15 | | 100. (286) |
| 24 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3S_1$ | | 106561849 | | 4.687E-15 | | 65.8 (287) 20.6 (284) 13.6 (248) |
| 24 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 106566376 | | 4.676E-15 | | 49.9 (288) 47.8 (285) 2.31 (245) |
| 24 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 106566847 | | 4.794E-15 | | 56.9 (289) 21.1 (247) 19.8 (293) |
| 24 | 290 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 106567020 | | 4.813E-15 | | 100. (290) |
| 24 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 106568687 | | 4.783E-15 | | 49.4 (291) 44.9 (253) 5.78 (301) |
| 24 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 106570854 | | 4.776E-15 | | 67.1 (292) 31.4 (257) 1.47 (316) |
| 24 | 293 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 106570954 | | 4.777E-15 | | 49.4 (255) 42.1 (293) 8.54 (289) |
| 24 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 106571250 | | 4.782E-15 | | 100. (294) |
| 24 | 295 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 106572590 | | 4.700E-15 | | 70.5 (295) 29.5 (251) |
| 24 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 106572979 | | 4.803E-15 | | 41.8 (296) 32.7 (300) 25.6 (256) |
| 24 | 297 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 106573720 | | 4.803E-15 | | 64.6 (297) 35.4 (258) |
| 24 | 298 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 106574862 | | 4.799E-15 | | 100. (298) |
| 24 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 106574871 | | 4.800E-15 | | 50.8 (259) 36.0 (299) 13.2 (321) |
| 24 | 300 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 106574994 | | 4.800E-15 | | 46.1 (263) 30.2 (300) 23.8 (296) |
| 24 | 301 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 106575052 | | 4.752E-15 | | 64.4 (301) 28.5 (291) 7.13 (253) |
| 24 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 106575154 | | 4.810E-15 | | 37.2 (302) 35.8 (307) 27.1 (260) |
| 24 | 303 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 106575519 | | 4.810E-15 | | 71.6 (303) 22.1 (262) 6.28 (309) |
| 24 | 304 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 106575683 | | 4.802E-15 | | 67.5 (304) 22.8 (258) 9.75 (297) |
| 24 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 106575885 | | 4.809E-15 | | 57.2 (261) 21.8 (305) 21.1 (320) |
| 24 | 306 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^3H_5$ | | 106576012 | | 4.809E-15 | | 37.7 (306) 34.3 (313) 27.9 (264) |
| 24 | 307 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^1G_4$ | | 106576212 | | 4.810E-15 | | 42.5 (265) 30.3 (307) 27.2 (302) |
| 24 | 308 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 106576251 | | 4.809E-15 | | 70.9 (308) 22.0 (267) 7.15 (311) |
| 24 | 309 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 106576295 | | 4.800E-15 | | 60.6 (309) 38.1 (262) 1.27 (303) |
| 24 | 310 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 106576384 | | 4.813E-15 | | 59.4 (266) 20.6 (310) 20.0 (319) |
| 24 | 311 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 106576568 | | 4.786E-15 | | 59.6 (311) 39.3 (267) 1.07 (308) |
| 24 | 312 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 106576584 | | 4.800E-15 | | 100. (312) |
| 24 | 313 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 106576624 | | 4.813E-15 | | 40.4 (269) 32.1 (313) 27.6 (306) |
| 24 | 314 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 106576691 | | 4.794E-15 | | 100. (314) |
| 24 | 315 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 106576812 | | 4.786E-15 | | 100. (315) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 24 | 316 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d^1P_1$ | | 106577008 | | 4.771E-15 | | 68.1 (316) 16.5 (257) 15.4 (292) |
| 24 | 317 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h^3G_3$ | | 106577243 | | 4.806E-15 | | 100. (317) |
| 24 | 318 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g^3F_2$ | | 106577345 | | 4.805E-15 | | 100. (318) |
| 24 | 319 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h^1G_4$ | | 106577485 | | 4.806E-15 | | 53.0 (310) 47.0 (319) |
| 24 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g^1F_3$ | | 106577744 | | 4.806E-15 | | 53.5 (305) 46.5 (320) |
| 24 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f^1D_2$ | | 106578027 | | 4.796E-15 | | 54.6 (321) 42.6 (299) 2.73 (259) |
| 25 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2^1S_0$ | 0 | 0 | | | | 100. (1) |
| 25 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s^3S_1$ | 49370240 | 49369728 | | 7.225E-09 | | 100. (2) |
| 25 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p^3P_0$ | 49592800 | 49592493 | | 2.990E-09 | | 100. (3) |
| 25 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p^3P_1$ | 49607700 | 49607392 | | 3.070E-14 | | 92.5 (4) |
| 25 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s^1S_0$ | 49612040 | 49611593 | | 1.693E-03 | | 100. (5) |
| 25 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p^3P_2$ | 49707130 | 49706873 | | 1.697E-10 | | 100. (6) |
| 25 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p^1P_1$ | 49848620 | 49848061 | | 2.543E-15 | | 92.5 (7) |
| 25 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s^3S_1$ | 58488800 | 58488406 | | 3.937E-13 | | 100. (8) |
| 25 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p^3P_0$ | 58550200 | 58549808 | | 1.319E-13 | | 100. (9) |
| 25 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s^1S_0$ | 58553000 | 58552130 | | 4.112E-13 | | 100. (10) |
| 25 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p^3P_1$ | 58554500 | 58554122 | | 5.815E-14 | | 91.7 (11) |
| 25 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 58584200 | 58583864 | | 1.356E-13 | | 100. (12) |
| 25 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 58617200 | 58616783 | | 4.567E-14 | | 66.4 (13) 33.6 (17) |
| 25 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d^3D_1$ | 58617700 | 58617298 | | 4.557E-14 | | 100. (14) |
| 25 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 58622500 | 58621975 | | 8.812E-15 | | 91.7 (15) |
| 25 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 58628600 | 58628212 | | 4.606E-14 | | 100. (16) |
| 25 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 58630700 | 58630312 | | 4.639E-14 | | 66.4 (17) 33.6 (13) |
| 25 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s^3S_1$ | 61644700 | 61645321 | | 5.738E-13 | | 100. (18) |
| 25 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 61670600 | 61670585 | | 2.251E-13 | | 100. (19) |
| 25 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 61671800 | 61671158 | | 5.962E-13 | | 100. (20) |
| 25 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 61672500 | 61672389 | | 1.179E-13 | | 91.4 (21) |
| 25 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 61685000 | 61684960 | | 2.303E-13 | | 100. (22) |
| 25 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 61699000 | 61698560 | | 1.062E-13 | | 68.2 (23) 31.8 (28) |
| 25 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d^3D_1$ | 61698800 | 61698696 | | 1.059E-13 | | 100. (24) |
| 25 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 61701200 | 61700531 | | 2.098E-14 | | 91.4 (25) |
| 25 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 61703400 | 61703302 | | 1.071E-13 | | 100. (26) |
| 25 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | | 61704160 | | 2.172E-13 | | 56.8 (27) 43.2 (31) |
| 25 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | 61704700 | 61704353 | | 1.082E-13 | | 68.2 (28) 31.8 (23) |
| 25 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | | 61704401 | | 2.172E-13 | | 100. (29) |
| 25 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | | 61706713 | | 2.179E-13 | | 100. (30) |
| 25 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | | 61706902 | | 2.181E-13 | | 56.8 (31) 43.2 (27) |
| 25 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 63097900 | 63098059 | | 9.073E-13 | | 100. (32) |
| 25 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 63110750 | 63110836 | | 3.851E-13 | | 100. (33) |
| 25 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 63111600 | 63111037 | | 9.274E-13 | | 100. (34) |
| 25 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 63111900 | 63111755 | | 2.146E-13 | | 91.3 (35) |
| 25 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 63118300 | 63118194 | | 3.930E-13 | | 100. (36) |
| 25 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | | 63125087 | | 2.044E-13 | | 69.0 (37) 31.0 (42) |
| 25 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | | 63125140 | | 2.040E-13 | | 100. (38) |
| 25 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 63126600 | 63126046 | | 4.100E-14 | | 91.3 (39) |
| 25 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | | 63127499 | | 2.065E-13 | | 100. (40) |
| 25 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 63127977 | | 4.195E-13 | | 57.0 (41) 43.0 (47) |
| 25 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 63128073 | | 2.080E-13 | | 69.0 (42) 31.0 (37) |
| 25 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 63128098 | | 4.195E-13 | | 100. (43) |
| 25 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 63129283 | | 4.211E-13 | | 100. (44) |
| 25 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 63129303 | | 7.060E-13 | | 55.1 (45) 44.9 (49) |
| 25 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 63129375 | | 7.061E-13 | | 100. (46) |
| 25 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 63129382 | | 4.214E-13 | | 57.0 (47) 43.0 (41) |
| 25 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 63130087 | | 7.071E-13 | | 100. (48) |
| 25 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 63130144 | | 7.072E-13 | | 55.1 (49) 44.9 (45) |
| 25 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 63884328 | | 1.414E-12 | | 100. (50) |
| 25 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 63891664 | | 6.248E-13 | | 100. (51) |
| 25 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 63891761 | | 1.379E-12 | | 100. (52) |
| 25 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 63892194 | | 3.574E-13 | | 91.2 (53) |
| 25 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 63895922 | | 6.365E-13 | | 100. (54) |
| 25 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 63899873 | | 3.497E-13 | | 69.4 (55) 30.6 (61) |
| 25 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 63899899 | | 3.500E-13 | | 100. (56) |
| 25 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 63900429 | | 7.064E-14 | | 91.2 (57) |
| 25 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 63901264 | | 3.546E-13 | | 100. (58) |
| 25 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 63901537 | | 7.168E-13 | | 57.1 (59) 42.9 (65) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 25 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f\ ^3F_2$ | | 63901606 | | 7.167E-13 | | 100. (60) |
| 25 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d\ ^1D_2$ | | 63901607 | | 3.543E-13 | | 69.4 (61) 30.6 (55) |
| 25 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f\ ^3F_4$ | | 63902292 | | 7.194E-13 | | 100. (62) |
| 25 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g\ ^3G_4$ | | 63902295 | | 1.211E-12 | | 55.1 (63) 44.9 (69) |
| 25 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g\ ^3G_3$ | | 63902337 | | 1.211E-12 | | 100. (64) |
| 25 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f\ ^1F_3$ | | 63902350 | | 7.202E-13 | | 57.1 (65) 42.9 (59) |
| 25 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h\ ^3H_5$ | | 63902747 | | 1.828E-12 | | 54.2 (66) 45.8 (71) |
| 25 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g\ ^3G_5$ | | 63902749 | | 1.213E-12 | | 100. (67) |
| 25 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h\ ^3H_4$ | | 63902774 | | 1.828E-12 | | 100. (68) |
| 25 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g\ ^1G_4$ | | 63902782 | | 1.213E-12 | | 55.1 (69) 44.9 (63) |
| 25 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h\ ^3H_6$ | | 63903049 | | 1.830E-12 | | 100. (70) |
| 25 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h\ ^1H_5$ | | 63903072 | | 1.830E-12 | | 54.2 (71) 45.8 (66) |
| 25 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2\ ^1S_0$ | 100851000 | 100851956 | | 1.097E-14 | | 79.9 (72) |
| 25 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p\ ^3P_0$ | 100885000 | 100880786 | | 4.237E-15 | | 100. (73) |
| 25 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p\ ^3P_1$ | 100917000 | 100914619 | | 4.239E-15 | | 96.8 (74) |
| 25 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p\ ^3P_2$ | 101020000 | 101021116 | | 4.284E-15 | | 100. (75) |
| 25 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2\ ^3P_0$ | 101126000 | 101124128 | | 2.262E-15 | | 91.2 (76) |
| 25 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2\ ^3P_1$ | 101192000 | 101191034 | | 2.117E-15 | | 100. (77) |
| 25 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2\ ^3P_2$ | 101240000 | 101238828 | | 2.116E-15 | | 70.2 (78) 29.8 (80) |
| 25 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p\ ^1P_1$ | 101297000 | 101296837 | | 4.157E-15 | | 96.8 (79) |
| 25 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2\ ^1D_2$ | 101384000 | 101385020 | | 2.121E-15 | | 70.2 (80) 29.8 (78) |
| 25 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2\ ^1S_0$ | 101659000 | 101659410 | | 2.464E-15 | | 81.2 (81) |
| 25 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s\ ^3S_1$ | | 110170511 | | 1.575E-14 | | 81.9 (82) |
| 25 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p\ ^1P_1$ | | 110204559 | | 5.547E-15 | | 39.6 (83) 35.5 (106) 21.4 (91) |
| 25 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | | 110231222 | | 1.452E-14 | | 76.5 (84) |
| 25 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s\ ^3P_0$ | | 110233800 | | 5.192E-15 | | 71.9 (85) 28.1 (88) |
| 25 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p\ ^3D_1$ | | 110238125 | | 3.427E-15 | | 72.5 (86) |
| 25 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p\ ^3P_1$ | | 110254989 | | 9.585E-15 | | 73.2 (87) |
| 25 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | | 110263404 | | 7.974E-15 | | 67.7 (88) 27.1 (85) 5.19 (114) |
| 25 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | | 110286450 | | 1.145E-14 | | 88.6 (89) |
| 25 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | | 110297572 | | 3.926E-15 | | 65.6 (90) 23.3 (97) 6.66 (111) |
| 25 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2p3s\ ^3P_1$ | | 110307337 | | 5.920E-15 | | 49.5 (91) 26.1 (83) 20.4 (87) |
| 25 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^1P_1$ | | 110329867 | | 3.897E-15 | | 40.0 (92) 21.4 (103) 13.1 (107) |
| 25 | 93 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 110341436 | | 4.077E-15 | | 78.4 (93) |
| 25 | 94 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 110351334 | | 1.195E-14 | | 82.5 (94) |
| 25 | 95 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 110357254 | | 3.620E-15 | | 84.2 (95) |
| 25 | 96 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 110369693 | | 1.210E-14 | | 77.3 (96) |
| 25 | 97 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d\ ^3D_2$ | | 110370994 | | 1.090E-14 | | 60.3 (97) 13.7 (111) 13.6 (100) |
| 25 | 98 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 110375237 | | 3.975E-15 | | 71.9 (98) 14.5 (112) 6.61 (109) |
| 25 | 99 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 110388657 | | 3.961E-15 | | 76.4 (99) |
| 25 | 100 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 110414754 | | 1.015E-14 | | 54.8 (100) 17.7 (90) 15.7 (97) |
| 25 | 101 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d\ ^1D_2$ | | 110420140 | | 4.120E-15 | | 30.6 (101) 24.2 (98) 22.7 (109) |
| 25 | 102 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 110423353 | | 3.716E-15 | | 66.7 (102) 13.9 (117) 13.0 (113) |
| 25 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^3P_1$ | | 110431799 | | 3.347E-15 | | 51.7 (103) 31.4 (92) 13.3 (86) |
| 25 | 104 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 110452627 | | 3.979E-15 | | 82.5 (104) |
| 25 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p\ ^3P_2$ | | 110466413 | | 3.758E-15 | | 69.6 (105) 15.3 (100) 9.77 (90) |
| 25 | 106 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 110469992 | | 4.977E-15 | | 59.4 (106) 27.7 (83) 8.85 (91) |
| 25 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^3S_1$ | | 110470156 | | 3.519E-15 | | 67.5 (107) 14.8 (103) 9.27 (92) |
| 25 | 108 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 110495146 | | 4.160E-15 | | 100. (108) |
| 25 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^3D_2$ | | 110506749 | | 3.860E-15 | | 40.4 (101) 37.8 (109) 15.8 (93) |
| 25 | 110 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^3D_3$ | | 110531566 | | 3.702E-15 | | 73.8 (110) |
| 25 | 111 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 110536624 | | 3.680E-15 | | 62.7 (111) 20.2 (105) 16.0 (100) |
| 25 | 112 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 110560357 | | 3.902E-15 | | 58.2 (112) 30.7 (109) 5.19 (101) |
| 25 | 113 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 110560942 | | 3.907E-15 | | 72.2 (113) 21.1 (102) 3.63 (87) |
| 25 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 110565737 | | 3.976E-15 | | 95.7 (114) |
| 25 | 115 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | | 110612988 | | 3.497E-15 | | 85.7 (115) |
| 25 | 116 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 110625032 | | 3.568E-15 | | 79.0 (116) |
| 25 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 110631991 | | 3.805E-15 | | 81.3 (117) |
| 25 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 113409135 | | 1.796E-14 | | 80.9 (118) |
| 25 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 113421610 | | 5.400E-15 | | 40.0 (119) 29.5 (148) 27.9 (129) |
| 25 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 113425988 | | 5.734E-15 | | 67.8 (120) 32.2 (124) |
| 25 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 113427312 | | 1.342E-14 | | 72.1 (121) 15.8 (164) 12.1 (130) |
| 25 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 113436275 | | 4.092E-15 | | 72.4 (122) |
| 25 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 113440657 | | 1.914E-14 | | 73.5 (123) |
| 25 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 113452996 | | 9.689E-15 | | 65.9 (124) 32.1 (120) 1.99 (158) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 25 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | 113454465 | | | 1.633E-14 | | 85.1 (125) |
| 25 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | 113461686 | | | 4.698E-15 | | 47.8 (126) 21.4 (132) 18.1 (154) |
| 25 | 127 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | 113476364 | | | 4.269E-15 | | 74.5 (127) |
| 25 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | 113476929 | | | 4.593E-15 | | 36.8 (128) 21.8 (147) 18.2 (151) |
| 25 | 129 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | 113477355 | | | 9.654E-15 | | 46.0 (129) 29.6 (119) 21.3 (123) |
| 25 | 130 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | 113485860 | | | 4.678E-15 | | 68.0 (130) 22.9 (121) 9.12 (164) |
| 25 | 131 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | 113486094 | | | 3.499E-14 | | 94.4 (131) |
| 25 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | 113488808 | | | 1.882E-14 | | 65.6 (132) 17.6 (138) 7.87 (154) |
| 25 | 133 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | 113490728 | | | 1.785E-14 | | 82.0 (133) |
| 25 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | 113496553 | | | 4.624E-15 | | 49.9 (134) 17.9 (166) 17.6 (155) |
| 25 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | 113504073 | | | 4.447E-15 | | 34.9 (135) 29.6 (157) 19.0 (152) |
| 25 | 136 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | 113509667 | | | 4.094E-15 | | 57.2 (136) 21.5 (169) 15.2 (156) |
| 25 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | 113510841 | | | 3.989E-15 | | 72.3 (137) |
| 25 | 138 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | 113511661 | | | 2.115E-14 | | 77.7 (138) |
| 25 | 139 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | 113515398 | | | 3.986E-15 | | 41.5 (139) 30.7 (165) 27.8 (160) |
| 25 | 140 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | 113515509 | | | 4.123E-15 | | 49.4 (140) 28.3 (168) 18.9 (161) |
| 25 | 141 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | 113515854 | | | 1.512E-13 | | 100. (141) |
| 25 | 142 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | 113516502 | | | 4.606E-14 | | 94.2 (142) |
| 25 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | 113517359 | | | 4.169E-15 | | 46.5 (143) 30.9 (162) 17.8 (159) |
| 25 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | 113517897 | | | 2.360E-14 | | 77.9 (144) |
| 25 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | 113521308 | | | 1.719E-13 | | 92.7 (145) |
| 25 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | 113581983 | | | 4.128E-15 | | 96.1 (146) |
| 25 | 147 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | 113596325 | | | 3.691E-15 | | 43.9 (147) 39.9 (128) 16.1 (122) |
| 25 | 148 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | 113597014 | | | 4.332E-15 | | 68.3 (148) 24.7 (119) 7.01 (129) |
| 25 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | 113603698 | | | 3.740E-15 | | 44.7 (149) 36.0 (126) 18.2 (154) |
| 25 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | 113606334 | | | 3.765E-15 | | 97.8 (150) |
| 25 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | 113613702 | | | 3.800E-15 | | 67.0 (151) 16.2 (147) 13.3 (128) |
| 25 | 152 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | 113628832 | | | 4.007E-15 | | 53.2 (152) 23.7 (157) 20.4 (127) |
| 25 | 153 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | 113628966 | | | 4.106E-15 | | 100. (153) |
| 25 | 154 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | 113631331 | | | 3.732E-15 | | 55.6 (154) 40.3 (149) 2.13 (126) |
| 25 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | 113636812 | | | 3.968E-15 | | 56.2 (155) 38.0 (134) 5.80 (166) |
| 25 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | 113646947 | | | 4.002E-15 | | 67.8 (156) 28.8 (136) 1.91 (169) |
| 25 | 157 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^1D_2$ | 113647054 | | | 3.999E-15 | | 51.7 (135) 37.6 (157) 7.92 (152) |
| 25 | 158 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | 113648969 | | | 4.038E-15 | | 98.1 (158) |
| 25 | 159 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | 113652757 | | | 4.035E-15 | | 39.1 (159) 33.6 (162) 27.3 (137) |
| 25 | 160 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | 113655585 | | | 4.035E-15 | | 65.9 (160) 33.0 (139) 1.10 (165) |
| 25 | 161 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | 113659912 | | | 4.031E-15 | | 47.8 (140) 33.8 (161) 18.4 (168) |
| 25 | 162 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | 113660900 | | | 4.036E-15 | | 50.1 (143) 26.3 (162) 23.6 (159) |
| 25 | 163 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | 113661305 | | | 4.032E-15 | | 100. (163) |
| 25 | 164 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | 113662739 | | | 3.844E-15 | | 75.0 (164) |
| 25 | 165 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | 113662829 | | | 4.032E-15 | | 68.2 (165) 25.5 (139) 6.28 (160) |
| 25 | 166 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | 113663632 | | | 3.863E-15 | | 72.2 (166) 22.1 (155) 5.67 (134) |
| 25 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | 113667656 | | | 4.035E-15 | | 100. (167) |
| 25 | 168 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | 113671753 | | | 4.027E-15 | | 52.4 (168) 46.2 (161) 1.40 (140) |
| 25 | 169 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | 113671906 | | | 3.982E-15 | | 72.8 (169) |
| 25 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | 114887877 | | | 1.651E-14 | | 76.9 (170) |
| 25 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | 114892354 | | | 5.222E-15 | | 48.0 (171) 27.9 (207) 20.8 (181) |
| 25 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | 114893612 | | | 5.566E-15 | | 71.6 (172) 28.4 (177) |
| 25 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | 114895505 | | | 1.178E-14 | | 67.0 (173) 17.9 (182) 15.1 (220) |
| 25 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | 114900105 | | | 4.395E-15 | | 71.6 (174) 13.2 (208) 9.06 (185) |
| 25 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | 114903864 | | | 2.725E-14 | | 70.4 (175) 20.0 (181) 2.80 (189) |
| 25 | 176 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | 114910274 | | | 1.699E-14 | | 81.2 (176) |
| 25 | 177 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | 114910942 | | | 1.214E-14 | | 71.5 (177) 28.5 (172) |
| 25 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | 114912841 | | | 4.809E-15 | | 44.0 (178) 23.1 (212) 16.7 (184) |
| 25 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | 114919898 | | | 4.340E-15 | | 72.6 (179) |
| 25 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | 114921289 | | | 4.920E-15 | | 38.0 (180) 20.8 (211) 17.2 (208) |
| 25 | 181 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | 114923732 | | | 1.251E-14 | | 49.8 (181) 23.4 (175) 20.8 (171) |
| 25 | 182 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | 114926503 | | | 5.505E-15 | | 55.8 (182) 31.0 (173) 13.2 (220) |
| 25 | 183 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | 114926758 | | | 3.375E-14 | | 90.3 (183) |
| 25 | 184 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | 114927532 | | | 2.421E-14 | | 69.2 (184) 16.0 (191) 4.38 (212) |
| 25 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | 114928897 | | | 2.434E-14 | | 86.6 (185) |
| 25 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | 114930231 | | | 4.658E-15 | | 43.9 (186) 23.1 (226) 18.7 (215) |
| 25 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | 114934664 | | | 4.799E-15 | | 36.8 (187) 28.5 (217) 17.4 (176) |
| 25 | 188 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | 114936317 | | | 4.040E-15 | | 73.8 (188) |
| 25 | 189 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | 114936834 | | | 4.388E-15 | | 50.1 (189) 24.4 (235) 15.0 (216) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 25 | 190 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 114938916 | | 4.039E-15 | | 41.9 (190) 31.9 (228) 26.3 (221) |
| 25 | 191 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | | 114939162 | | 1.114E-14 | | 64.4 (191) 12.9 (192) 8.19 (237) |
| 25 | 192 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 114939557 | | 5.460E-15 | | 32.5 (192) 21.5 (237) 15.7 (191) |
| 25 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 114940016 | | 4.043E-15 | | 72.3 (193) |
| 25 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 114940435 | | 4.417E-15 | | 47.1 (194) 27.2 (224) 16.2 (219) |
| 25 | 195 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 114940519 | | 1.560E-14 | | 75.2 (195) |
| 25 | 196 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 114940574 | | 4.092E-15 | | 42.6 (196) 32.0 (236) 24.0 (229) |
| 25 | 197 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 114940845 | | 4.032E-15 | | 39.6 (197) 32.9 (231) 27.5 (227) |
| 25 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 114941111 | | 4.968E-14 | | 93.8 (198) |
| 25 | 199 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 114941581 | | 5.325E-15 | | 42.5 (199) 24.8 (195) 19.7 (225) |
| 25 | 200 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | | 114941735 | | 2.386E-14 | | 80.4 (200) |
| 25 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | | 114943935 | | 3.036E-13 | | 94.4 (201) |
| 25 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 114944088 | | 3.905E-13 | | 62.8 (202) 37.2 (205) |
| 25 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 114944099 | | 3.631E-13 | | 100. (203) |
| 25 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 114944786 | | 6.430E-13 | | 100. (204) |
| 25 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | | 114944935 | | 5.218E-13 | | 63.1 (205) 36.9 (202) |
| 25 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 115044640 | | 4.107E-15 | | 100. (206) |
| 25 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 115049693 | | 4.156E-15 | | 67.9 (207) 30.4 (171) 1.73 (181) |
| 25 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^1P_1$ | | 115052301 | | 3.876E-15 | | 43.0 (208) 39.1 (180) 15.9 (174) |
| 25 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^3P_2$ | | 115055019 | | 3.887E-15 | | 42.9 (178) 37.3 (209) 19.8 (212) |
| 25 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 115057463 | | 3.891E-15 | | 100. (210) |
| 25 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^3S_1$ | | 115060188 | | 3.915E-15 | | 65.4 (211) 21.0 (208) 12.3 (180) |
| 25 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | | 115068549 | | 3.884E-15 | | 50.9 (212) 47.0 (209) 2.10 (178) |
| 25 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | | 115068879 | | 4.050E-15 | | 55.4 (213) 21.5 (217) 21.0 (179) |
| 25 | 214 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 115069275 | | 4.087E-15 | | 100. (214) |
| 25 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | | 115072440 | | 4.035E-15 | | 50.6 (215) 43.4 (186) 6.05 (226) |
| 25 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 115076794 | | 4.041E-15 | | 67.1 (216) 31.2 (189) 1.73 (235) |
| 25 | 217 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | | 115077034 | | 4.039E-15 | | 50.5 (187) 40.4 (217) 9.09 (213) |
| 25 | 218 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 115077664 | | 4.057E-15 | | 100. (218) |
| 25 | 219 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 115080531 | | 4.067E-15 | | 40.6 (219) 33.5 (224) 26.0 (188) |
| 25 | 220 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 115081800 | | 3.938E-15 | | 71.7 (220) 26.5 (182) 1.87 (173) |
| 25 | 221 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 115081985 | | 4.066E-15 | | 64.8 (221) 35.2 (190) |
| 25 | 222 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 115084015 | | 4.064E-15 | | 50.1 (192) 35.2 (222) 14.6 (237) |
| 25 | 223 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 115084383 | | 4.061E-15 | | 100. (223) |
| 25 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 115084413 | | 4.066E-15 | | 47.0 (194) 28.7 (224) 24.3 (219) |
| 25 | 225 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | | 115084604 | | 4.082E-15 | | 37.7 (225) 34.9 (230) 27.4 (193) |
| 25 | 226 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 115084768 | | 3.983E-15 | | 66.2 (226) 27.2 (215) 6.54 (186) |
| 25 | 227 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 115085339 | | 4.082E-15 | | 71.4 (227) 21.8 (197) 6.79 (231) |
| 25 | 228 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 115085653 | | 4.062E-15 | | 67.9 (228) 23.0 (190) 9.10 (221) |
| 25 | 229 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^3F_3$ | | 115085872 | | 4.080E-15 | | 56.6 (196) 22.1 (229) 21.3 (236) |
| 25 | 230 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^1G_4$ | | 115086563 | | 4.081E-15 | | 43.0 (199) 30.8 (230) 26.2 (225) |
| 25 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 115086814 | | 4.077E-15 | | 60.3 (231) 38.6 (197) 1.08 (227) |
| 25 | 232 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 115087474 | | 4.077E-15 | | 100. (232) |
| 25 | 233 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 115087542 | | 4.063E-15 | | 100. (233) |
| 25 | 234 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 115088554 | | 4.076E-15 | | 100. (234) |
| 25 | 235 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 115088639 | | 4.033E-15 | | 69.5 (235) 15.3 (216) 15.2 (189) |
| 25 | 236 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^1F_3$ | | 115089334 | | 4.076E-15 | | 53.4 (229) 46.6 (236) |
| 25 | 237 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 115089965 | | 4.059E-15 | | 54.0 (237) 43.7 (222) 2.27 (192) |
| 25 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 115684769 | | 1.361E-14 | | 71.3 (238) 11.1 (287) 8.07 (284) |
| 25 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 115686148 | | 5.033E-15 | | 51.7 (239) 27.7 (283) 16.4 (249) |
| 25 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 115686715 | | 5.245E-15 | | 76.6 (240) |
| 25 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 115688553 | | 1.005E-14 | | 60.9 (241) 23.4 (250) 15.6 (295) |
| 25 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 115690711 | | 4.573E-15 | | 71.2 (242) 11.4 (284) 7.95 (254) |
| 25 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 115694189 | | 2.835E-14 | | 67.5 (243) 21.8 (249) 4.45 (257) |
| 25 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 115697480 | | 1.468E-14 | | 75.7 (244) |
| 25 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 115697966 | | 4.717E-15 | | 43.8 (245) 25.8 (288) 13.2 (285) |
| 25 | 246 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 115698316 | | 1.572E-14 | | 76.8 (246) |
| 25 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 115701860 | | 4.356E-15 | | 72.4 (247) |
| 25 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 115703187 | | 5.239E-15 | | 37.0 (248) 22.1 (238) 21.5 (287) |
| 25 | 249 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 115705635 | | 1.437E-14 | | 48.3 (249) 26.4 (243) 16.0 (239) |
| 25 | 250 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 115706606 | | 6.345E-15 | | 47.0 (250) 38.3 (241) 14.7 (295) |
| 25 | 251 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 115707105 | | 2.249E-14 | | 83.2 (251) |
| 25 | 252 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 115707454 | | 2.307E-14 | | 70.0 (252) 13.4 (268) 4.50 (259) |
| 25 | 253 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 115707836 | | 4.488E-15 | | 43.0 (253) 26.6 (300) 19.8 (291) |
| 25 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 115708402 | | 3.354E-14 | | 89.8 (254) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 25 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 115710695 | | 5.196E-15 | | 36.0 (255) 26.5 (293) 23.2 (244) |
| 25 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 115710904 | | 4.059E-15 | | 74.4 (256) |
| 25 | 257 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 115711721 | | 4.719E-15 | | 45.3 (257) 24.8 (315) 14.2 (292) |
| 25 | 258 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 115712461 | | 4.051E-15 | | 41.9 (258) 32.5 (304) 25.7 (297) |
| 25 | 259 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 115713025 | | 4.495E-15 | | 41.6 (259) 28.8 (321) 19.2 (298) |
| 25 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 115713111 | | 4.040E-15 | | 72.7 (260) |
| 25 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 115713502 | | 4.055E-15 | | 42.6 (261) 32.8 (320) 24.6 (305) |
| 25 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 115713609 | | 4.040E-15 | | 39.8 (262) 33.1 (308) 27.1 (303) |
| 25 | 263 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 115713694 | | 4.823E-15 | | 44.5 (263) 24.1 (301) 16.7 (251) |
| 25 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 115713721 | | 4.038E-15 | | 71.9 (264) 17.1 (314) 11.1 (306) |
| 25 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 115713819 | | 4.332E-15 | | 53.6 (265) 24.4 (302) 15.3 (307) |
| 25 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 115713957 | | 4.043E-15 | | 40.5 (266) 33.1 (319) 26.4 (310) |
| 25 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 115714022 | | 4.038E-15 | | 38.7 (267) 33.2 (312) 28.0 (309) |
| 25 | 268 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 115714227 | | 3.225E-14 | | 79.2 (268) |
| 25 | 269 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 115714254 | | 4.043E-15 | | 59.5 (269) 23.8 (306) 16.7 (314) |
| 25 | 270 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 115715206 | | 5.453E-14 | | 93.2 (270) |
| 25 | 271 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 115715217 | | 6.274E-14 | | 94.8 (271) |
| 25 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 115715476 | | 3.554E-14 | | 84.8 (272) |
| 25 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 115716996 | | 4.989E-13 | | 95.1 (273) |
| 25 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 115717079 | | 5.012E-13 | | 100. (274) |
| 25 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 115717092 | | 5.973E-13 | | 67.7 (275) 32.3 (277) |
| 25 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 115717476 | | 1.090E-12 | | 100. (276) |
| 25 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 115717593 | | 8.559E-13 | | 68.0 (277) 32.0 (275) |
| 25 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 115717651 | | 1.528E-12 | | 55.2 (278) 44.8 (281) |
| 25 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 115717661 | | 1.556E-12 | | 100. (279) |
| 25 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 115717952 | | 1.534E-12 | | 100. (280) |
| 25 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 115717960 | | 1.571E-12 | | 55.2 (281) 44.8 (278) |
| 25 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 115835329 | | 4.105E-15 | | 100. (282) |
| 25 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 115837504 | | 4.119E-15 | | 67.7 (283) 32.3 (239) |
| 25 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 115839841 | | 3.977E-15 | | 40.6 (284) 40.2 (248) 15.6 (242) |
| 25 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 115841161 | | 3.977E-15 | | 45.4 (245) 34.3 (285) 20.3 (288) |
| 25 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 115842849 | | 3.978E-15 | | 100. (286) |
| 25 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3S_1$ | | 115843899 | | 3.982E-15 | | 63.5 (287) 24.8 (284) 10.6 (248) |
| 25 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 115848801 | | 3.975E-15 | | 49.6 (285) 48.5 (288) 1.96 (245) |
| 25 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 115849401 | | 4.075E-15 | | 56.1 (289) 21.2 (247) 20.7 (293) |
| 25 | 290 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 115849701 | | 4.092E-15 | | 100. (290) |
| 25 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 115851313 | | 4.066E-15 | | 48.1 (291) 45.6 (253) 6.27 (300) |
| 25 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 115853500 | | 4.059E-15 | | 66.8 (292) 31.7 (257) 1.53 (315) |
| 25 | 293 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 115853723 | | 4.061E-15 | | 49.6 (255) 41.0 (293) 9.43 (289) |
| 25 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 115853909 | | 4.065E-15 | | 100. (294) |
| 25 | 295 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 115855217 | | 3.992E-15 | | 70.1 (295) 29.9 (250) |
| 25 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 115855941 | | 4.084E-15 | | 41.2 (296) 33.3 (301) 25.5 (256) |
| 25 | 297 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 115856773 | | 4.084E-15 | | 63.5 (297) 36.5 (258) |
| 25 | 298 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 115857902 | | 4.081E-15 | | 50.9 (259) 36.0 (298) 13.1 (321) |
| 25 | 299 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 115857997 | | 4.081E-15 | | 100. (299) |
| 25 | 300 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 115858036 | | 4.040E-15 | | 63.5 (300) 29.7 (291) 6.77 (253) |
| 25 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 115858114 | | 4.081E-15 | | 45.9 (263) 29.6 (301) 24.5 (296) |
| 25 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 115858301 | | 4.091E-15 | | 37.7 (302) 35.3 (307) 27.0 (260) |
| 25 | 303 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 115858730 | | 4.090E-15 | | 71.2 (303) 23.2 (262) 5.52 (308) |
| 25 | 304 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 115858818 | | 4.083E-15 | | 67.5 (304) 21.7 (258) 10.8 (297) |
| 25 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 115859058 | | 4.090E-15 | | 57.2 (261) 22.1 (305) 20.6 (320) |
| 25 | 306 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^3H_5$ | | 115859250 | | 4.091E-15 | | 38.1 (306) 34.0 (314) 27.9 (264) |
| 25 | 307 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^1G_4$ | | 115859451 | | 4.090E-15 | | 42.3 (265) 30.9 (307) 26.8 (302) |
| 25 | 308 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 115859507 | | 4.084E-15 | | 61.4 (308) 36.9 (262) 1.67 (303) |
| 25 | 309 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 115859531 | | 4.090E-15 | | 70.4 (309) 23.6 (267) 6.04 (312) |
| 25 | 310 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 115859634 | | 4.093E-15 | | 59.4 (266) 20.9 (310) 19.7 (319) |
| 25 | 311 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 115859805 | | 4.077E-15 | | 100. (311) |
| 25 | 312 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 115859839 | | 4.074E-15 | | 60.7 (312) 37.7 (267) 1.61 (309) |
| 25 | 313 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 115859856 | | 4.084E-15 | | 100. (313) |
| 25 | 314 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 115859919 | | 4.093E-15 | | 40.3 (269) 32.5 (314) 27.2 (306) |
| 25 | 315 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 115860089 | | 4.056E-15 | | 67.7 (315) 16.5 (257) 15.8 (292) |
| 25 | 316 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 115860127 | | 4.074E-15 | | 100. (316) |
| 25 | 317 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 115860530 | | 4.088E-15 | | 100. (317) |
| 25 | 318 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 115860582 | | 4.087E-15 | | 100. (318) |
| 25 | 319 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 115860818 | | 4.088E-15 | | 52.7 (310) 47.3 (319) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 25 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^1F_3$ | | 115861052 | | 4.087E-15 | | 53.2 (305) 46.8 (320) |
| 25 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 115861292 | | 4.079E-15 | | 54.7 (321) 42.5 (298) 2.80 (259) |
| 26 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | 0 | | | 100. (1) |
| 26 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 53527760 | 53527200 | 53525401 | 4.834E-09 | 4.875E-09 | 100. (2) |
| 26 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 53761280 | 53760943 | 53759081 | 2.812E-09 | 2.813E-09 | 100. (3) |
| 26 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 53777570 | 53777233 | 53775393 | 2.256E-14 | 2.259E-14 | 91.3 (4) |
| 26 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 53781230 | 53780739 | 53778969 | 2.337E-03 | 2.254E-03 | 100. (5) |
| 26 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 53896600 | 53896319 | 53894467 | 1.261E-10 | 1.261E-10 | 100. (6) |
| 26 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 54042490 | 54041881 | 54040245 | 2.192E-15 | 2.191E-15 | 91.3 (7) |
| 26 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 63421700 | 63421204 | 63419461 | 3.342E-13 | 3.344E-13 | 100. (8) |
| 26 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 63486100 | 63485627 | 63483898 | 1.118E-13 | 1.118E-13 | 100. (9) |
| 26 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 63489000 | 63488017 | 63486393 | 3.488E-13 | 3.488E-13 | 100. (10) |
| 26 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 63490700 | 63490320 | 63488601 | 4.561E-14 | 4.565E-14 | 90.4 (11) |
| 26 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 63526300 | 63525930 | 63524204 | 1.153E-13 | 1.153E-13 | 100. (12) |
| 26 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 63560700 | 63560232 | 63558542 | 3.875E-14 | 3.874E-14 | 65.7 (13) 34.3 (17) |
| 26 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 63561300 | 63560870 | 63559174 | 3.869E-14 | 3.868E-14 | 100. (14) |
| 26 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 63565800 | 63565245 | 63563600 | 7.597E-15 | 7.591E-15 | 90.4 (15) |
| 26 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 63574200 | 63573781 | 63572086 | 3.915E-14 | 3.913E-14 | 100. (16) |
| 26 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 63576500 | 63576038 | 63574354 | 3.938E-14 | 3.937E-14 | 65.7 (17) 34.3 (13) |
| 26 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 66846900 | 66847270 | 66845577 | 4.871E-13 | 4.879E-13 | 100. (18) |
| 26 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 66873900 | 66873773 | 66872077 | 1.909E-13 | 1.910E-13 | 100. (19) |
| 26 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 66875000 | 66874357 | 66872697 | 5.057E-13 | 5.058E-13 | 100. (20) |
| 26 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 66875900 | 66875732 | 66874040 | 9.365E-14 | 9.371E-14 | 90.1 (21) |
| 26 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 66890900 | 66890783 | 66889089 | 1.957E-13 | 1.958E-13 | 100. (22) |
| 26 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | 66905400 | 66904958 | 66903275 | 9.013E-14 | 9.011E-14 | 67.4 (23) 32.6 (28) |
| 26 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | 66905700 | 66905140 | 66903456 | 8.992E-14 | 8.990E-14 | 100. (24) |
| 26 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 66907600 | 66906848 | 66905185 | 1.809E-14 | 1.807E-14 | 90.1 (25) |
| 26 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | 66911100 | 66910590 | 66908906 | 9.105E-14 | 9.106E-14 | 100. (26) |
| 26 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 66911488 | 66909809 | 1.844E-13 | 1.843E-13 | 56.8 (27) 43.2 (31) |
| 26 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | 66912100 | 66911713 | 66910032 | 9.178E-14 | 9.174E-14 | 67.4 (28) 32.6 (23) |
| 26 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 66911759 | 66910080 | 1.844E-13 | 1.843E-13 | 100. (29) |
| 26 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 66914494 | 66912814 | 1.851E-13 | 1.850E-13 | 100. (30) |
| 26 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 66914706 | 66913029 | 1.852E-13 | 1.851E-13 | 56.8 (31) 43.2 (27) |
| 26 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 68423800 | 68423916 | 68422232 | 7.708E-13 | 7.675E-13 | 100. (32) |
| 26 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 68437270 | 68437318 | 68435632 | 3.268E-13 | 3.257E-13 | 100. (33) |
| 26 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 68438100 | 68437521 | 68435859 | 7.860E-13 | 7.938E-13 | 100. (34) |
| 26 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 68438600 | 68438315 | 68436632 | 1.714E-13 | 1.711E-13 | 90.0 (35) |
| 26 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 68446300 | 68446024 | 68444339 | 3.342E-13 | 3.330E-13 | 100. (36) |
| 26 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | | 68453209 | 68451529 | 1.734E-13 | 1.733E-13 | 68.0 (37) 32.0 (42) |
| 26 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | | 68453284 | 68451603 | 1.732E-13 | 1.728E-13 | 100. (38) |
| 26 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p\ ^1P_1$ | 68454800 | 68454125 | 68452461 | 3.534E-14 | 3.525E-14 | 90.0 (39) |
| 26 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d\ ^3D_3$ | | 68456075 | 68454394 | 1.755E-13 | 1.752E-13 | 100. (40) |
| 26 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f\ ^3F_3$ | | 68456575 | 68454897 | 3.561E-13 | 3.561E-13 | 57.0 (41) 43.0 (47) |
| 26 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d\ ^1D_2$ | | 68456687 | 68455008 | 1.765E-13 | 1.766E-13 | 68.0 (42) 32.0 (37) |
| 26 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f\ ^3F_2$ | | 68456713 | 68455034 | 3.561E-13 | 3.560E-13 | 100. (43) |
| 26 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f\ ^3F_4$ | | 68458113 | 68456434 | 3.575E-13 | 3.575E-13 | 100. (44) |
| 26 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g\ ^3G_4$ | | 68458135 | 68456457 | 5.994E-13 | 5.993E-13 | 55.2 (45) 44.8 (49) |
| 26 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g\ ^3G_3$ | | 68458216 | 68456538 | 5.995E-13 | 5.994E-13 | 100. (46) |
| 26 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f\ ^1F_3$ | | 68458225 | 68456546 | 3.578E-13 | 3.577E-13 | 57.0 (47) 43.0 (41) |
| 26 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g\ ^3G_5$ | | 68459057 | 68457379 | 6.005E-13 | 6.004E-13 | 100. (48) |
| 26 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g\ ^1G_4$ | | 68459122 | 68457444 | 6.006E-13 | 6.005E-13 | 55.2 (49) 44.8 (45) |
| 26 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s\ ^3S_1$ | | 69277232 | 69275513 | 1.198E-12 | 1.177E-12 | 100. (50) |
| 26 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p\ ^3P_0$ | | 69284928 | 69283210 | 5.293E-13 | 5.233E-13 | 100. (51) |
| 26 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s\ ^1S_0$ | | 69285023 | 69283338 | 1.173E-12 | 1.208E-12 | 100. (52) |
| 26 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p\ ^3P_1$ | | 69285503 | 69283789 | 2.858E-13 | 2.841E-13 | 89.9 (53) |
| 26 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p\ ^3P_2$ | | 69289964 | 69288247 | 5.401E-13 | 5.348E-13 | 100. (54) |
| 26 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d\ ^3D_2$ | | 69294087 | 69292382 | 2.966E-13 | 2.961E-13 | 68.4 (55) 31.6 (60) |
| 26 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d\ ^3D_1$ | | 69294125 | 69292420 | 2.970E-13 | 2.950E-13 | 100. (56) |
| 26 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p\ ^1P_1$ | | 69294615 | 69292922 | 6.089E-14 | 6.040E-14 | 89.9 (57) |
| 26 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d\ ^3D_3$ | | 69295740 | 69294035 | 3.011E-13 | 2.992E-13 | 100. (58) |
| 26 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f\ ^3F_3$ | | 69296029 | 69294338 | 6.084E-13 | 6.084E-13 | 57.1 (59) 42.9 (65) |
| 26 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d\ ^1D_2$ | | 69296106 | 69294401 | 3.008E-13 | 3.016E-13 | 68.4 (60) 31.6 (55) |
| 26 | 61 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f\ ^3F_2$ | | 69296108 | 69294417 | 6.083E-13 | 6.082E-13 | 100. (61) |
| 26 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f\ ^3F_4$ | | 69296918 | 69295227 | 6.108E-13 | 6.110E-13 | 100. (62) |
| 26 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g\ ^3G_4$ | | 69296923 | 69295242 | 1.028E-12 | 1.028E-12 | 55.2 (63) 44.8 (69) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 26 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 69296971 | 69295289 | 1.028E-12 | 1.028E-12 | 100. (64) |
| 26 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 69296984 | 69295293 | 6.115E-13 | 6.111E-13 | 57.1 (65) 42.9 (59) |
| 26 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 69297457 | 69295779 | 1.552E-12 | 1.552E-12 | 54.2 (66) 45.8 (71) |
| 26 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 69297458 | 69295776 | 1.030E-12 | 1.030E-12 | 100. (67) |
| 26 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 69297488 | 69295809 | 1.553E-12 | 1.552E-12 | 100. (68) |
| 26 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 69297495 | 69295813 | 1.030E-12 | 1.030E-12 | 55.2 (69) 44.8 (63) |
| 26 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 69297812 | 69296134 | 1.554E-12 | 1.554E-12 | 100. (70) |
| 26 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 69297838 | 69296160 | 1.554E-12 | 1.554E-12 | 54.2 (71) 45.8 (66) |
| 26 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 109258000 | 109259778 | | 9.289E-15 | | 79.8 (72) |
| 26 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 109291000 | 109287871 | | 3.614E-15 | | 100. (73) |
| 26 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 109329000 | 109326200 | | 3.616E-15 | | 96.2 (74) |
| 26 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 109453000 | 109452566 | | 3.658E-15 | | 100. (75) |
| 26 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 109551000 | 109547908 | | 1.953E-15 | | 89.6 (76) |
| 26 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 109631000 | 109629385 | | 1.808E-15 | | 100. (77) |
| 26 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | 109683000 | 109681287 | | 1.807E-15 | | 66.7 (78) 33.3 (80) |
| 26 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 109737000 | 109736961 | | 3.560E-15 | | 96.2 (79) |
| 26 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | 109846000 | 109847733 | | 1.813E-15 | | 66.7 (80) 33.3 (78) |
| 26 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | 110126000 | 110127710 | | 2.081E-15 | | 81.2 (81) |
| 26 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 119361736 | | 1.394E-14 | | 82.8 (82) |
| 26 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p^1P_1$ | | 119397518 | | 4.673E-15 | | 37.8 (83) 34.5 (106) 24.0 (91) |
| 26 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 119424317 | | 1.221E-14 | | 76.2 (84) |
| 26 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 119425987 | | 4.400E-15 | | 72.7 (85) |
| 26 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 119430791 | | 2.924E-15 | | 72.6 (86) |
| 26 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 119449806 | | 8.275E-15 | | 73.6 (87) |
| 26 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 119457901 | | 6.965E-15 | | 69.1 (88) 26.4 (85) 4.52 (114) |
| 26 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 119486909 | | 9.816E-15 | | 88.8 (89) |
| 26 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 119499264 | | 3.351E-15 | | 64.2 (90) 23.1 (97) 7.66 (111) |
| 26 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2p3s^3P_1$ | | 119510383 | | 5.281E-15 | | 46.1 (91) 30.1 (83) 20.5 (87) |
| 26 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 119532643 | | 3.346E-15 | | 35.8 (92) 23.7 (103) 14.9 (107) |
| 26 | 93 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 119543472 | | 3.485E-15 | | 78.4 (93) |
| 26 | 94 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 119557744 | | 3.142E-15 | | 82.0 (94) |
| 26 | 95 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 119558230 | | 1.195E-14 | | 86.4 (95) |
| 26 | 96 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 119572844 | | 1.079E-14 | | 78.5 (96) |
| 26 | 97 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 119574698 | | 9.746E-15 | | 62.1 (97) 13.2 (100) 12.7 (111) |
| 26 | 98 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 119588184 | | 3.388E-15 | | 61.4 (98) 17.8 (113) 9.76 (109) |
| 26 | 99 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 119596173 | | 3.370E-15 | | 74.1 (99) |
| 26 | 100 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 119624870 | | 9.628E-15 | | 59.9 (100) 16.6 (90) 14.1 (97) |
| 26 | 101 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 119629758 | | 3.171E-15 | | 65.6 (101) 15.1 (117) 13.7 (112) |
| 26 | 102 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d^1D_2$ | | 119632259 | | 3.538E-15 | | 34.9 (98) 24.7 (102) 20.7 (109) |
| 26 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3P_1$ | | 119651346 | | 2.831E-15 | | 51.5 (103) 32.5 (92) 13.3 (86) |
| 26 | 104 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 119675368 | | 3.244E-15 | | 86.4 (104) |
| 26 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p^3P_2$ | | 119685709 | | 3.167E-15 | | 64.9 (105) 14.0 (100) 12.3 (90) |
| 26 | 106 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 119686244 | | 4.187E-15 | | 61.0 (106) 25.5 (83) 10.5 (91) |
| 26 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p^3S_1$ | | 119692418 | | 2.972E-15 | | 67.6 (107) 13.2 (103) 11.9 (92) |
| 26 | 108 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d^3F_4$ | | 119723960 | | 3.558E-15 | | 100. (108) |
| 26 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d^3D_2$ | | 119733868 | | 3.307E-15 | | 43.1 (102) 35.0 (109) 16.6 (93) |
| 26 | 110 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d^3D_3$ | | 119760094 | | 3.174E-15 | | 71.0 (110) 23.0 (99) 5.99 (115) |
| 26 | 111 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^1D_2$ | | 119761956 | | 3.037E-15 | | 61.7 (111) 24.9 (105) 12.3 (100) |
| 26 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d^3P_1$ | | 119789848 | | 3.322E-15 | | 71.4 (112) 22.5 (101) 3.11 (87) |
| 26 | 113 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^3P_2$ | | 119790229 | | 3.320E-15 | | 57.2 (113) 31.8 (109) 5.81 (102) |
| 26 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d^3P_0$ | | 119794840 | | 3.384E-15 | | 96.2 (114) |
| 26 | 115 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d^1F_3$ | | 119845209 | | 2.993E-15 | | 83.8 (115) |
| 26 | 116 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p^1S_0$ | | 119854154 | | 3.015E-15 | | 78.7 (116) |
| 26 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d^1P_1$ | | 119865186 | | 3.245E-15 | | 80.2 (117) |
| 26 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s^3S_1$ | | 122872020 | | 1.556E-14 | | 80.5 (118) |
| 26 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s^3P_1$ | | 122884840 | | 4.516E-15 | | 42.5 (119) 29.7 (147) 26.4 (129) |
| 26 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s^3P_0$ | | 122888771 | | 4.847E-15 | | 68.6 (120) 31.4 (124) |
| 26 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s^1S_0$ | | 122890564 | | 1.121E-14 | | 71.5 (121) 15.5 (162) 13.0 (130) |
| 26 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p^3D_1$ | | 122899638 | | 3.489E-15 | | 72.5 (122) |
| 26 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p^3P_1$ | | 122904869 | | 1.682E-14 | | 73.8 (123) |
| 26 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p^3P_0$ | | 122917330 | | 8.496E-15 | | 67.1 (124) 31.3 (120) 1.66 (158) |
| 26 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p^3P_2$ | | 122921140 | | 1.395E-14 | | 85.0 (125) |
| 26 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p^3D_2$ | | 122928468 | | 3.973E-15 | | 47.3 (126) 20.5 (132) 19.0 (154) |
| 26 | 127 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d^3F_2$ | | 122943440 | | 3.642E-15 | | 73.8 (127) |
| 26 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p^3P_1$ | | 122943918 | | 3.910E-15 | | 37.3 (128) 20.4 (148) 19.2 (151) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 26 | 129 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p^1P_1$ | | 122944969 | | 8.753E-15 | | 48.3 (129) 26.8 (119) 21.7 (123) |
| 26 | 130 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p^3P_0$ | | 122952113 | | 4.068E-15 | | 65.7 (130) 24.2 (121) 10.1 (162) |
| 26 | 131 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d^3D_3$ | | 122954904 | | 3.105E-14 | | 94.9 (131) |
| 26 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d^3D_2$ | | 122956824 | | 1.684E-14 | | 67.0 (132) 17.2 (138) 7.18 (154) |
| 26 | 133 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d^3D_1$ | | 122958551 | | 1.599E-14 | | 82.9 (133) |
| 26 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d^3F_3$ | | 122965508 | | 3.930E-15 | | 48.9 (134) 19.0 (166) 17.9 (155) |
| 26 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d^3P_2$ | | 122973238 | | 3.813E-15 | | 35.6 (135) 29.7 (157) 18.3 (152) |
| 26 | 136 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d^3D_1$ | | 122978238 | | 3.505E-15 | | 56.0 (136) 22.3 (168) 15.4 (156) |
| 26 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f^3G_3$ | | 122979990 | | 3.410E-15 | | 72.6 (137) |
| 26 | 138 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d^1D_2$ | | 122981469 | | 1.828E-14 | | 78.5 (138) |
| 26 | 139 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f^3F_2$ | | 122984896 | | 3.545E-15 | | 48.5 (139) 28.6 (169) 19.1 (161) |
| 26 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f^3G_4$ | | 122985115 | | 3.407E-15 | | 41.5 (140) 30.9 (165) 27.5 (160) |
| 26 | 141 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f^3F_4$ | | 122986039 | | 1.383E-13 | | 100. (141) |
| 26 | 142 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f^3F_2$ | | 122986214 | | 4.106E-14 | | 94.5 (142) |
| 26 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f^3D_3$ | | 122987156 | | 3.570E-15 | | 47.1 (143) 30.5 (163) 17.4 (159) |
| 26 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f^3F_3$ | | 122987702 | | 2.085E-14 | | 76.8 (144) |
| 26 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f^1F_3$ | | 122991559 | | 1.417E-13 | | 91.2 (145) |
| 26 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s^3P_2$ | | 123069857 | | 3.525E-15 | | 97.9 (146) |
| 26 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s^1P_1$ | | 123084646 | | 3.663E-15 | | 68.4 (147) 26.0 (119) 5.65 (129) |
| 26 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p^1P_1$ | | 123085510 | | 3.155E-15 | | 41.6 (128) 41.2 (148) 15.7 (122) |
| 26 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p^3P_2$ | | 123092453 | | 3.188E-15 | | 41.9 (149) 37.9 (126) 20.1 (154) |
| 26 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p^3D_3$ | | 123097339 | | 3.203E-15 | | 98.3 (150) |
| 26 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p^3S_1$ | | 123104082 | | 3.229E-15 | | 66.1 (151) 19.8 (148) 11.2 (128) |
| 26 | 152 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d^1D_2$ | | 123121253 | | 3.425E-15 | | 53.1 (152) 24.0 (157) 20.6 (127) |
| 26 | 153 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d^3F_4$ | | 123121853 | | 3.506E-15 | | 100. (153) |
| 26 | 154 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p^1D_2$ | | 123123222 | | 3.178E-15 | | 53.5 (154) 43.2 (149) 1.81 (126) |
| 26 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d^3D_3$ | | 123129541 | | 3.394E-15 | | 54.3 (155) 39.4 (134) 6.32 (166) |
| 26 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d^3P_1$ | | 123139721 | | 3.415E-15 | | 67.4 (156) 29.5 (136) 1.94 (168) |
| 26 | 157 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d^3D_2$ | | 123140306 | | 3.414E-15 | | 51.6 (135) 37.4 (157) 8.70 (152) |
| 26 | 158 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d^3P_0$ | | 123141792 | | 3.445E-15 | | 98.4 (158) |
| 26 | 159 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f^1F_3$ | | 123146792 | | 3.452E-15 | | 38.7 (159) 34.2 (163) 27.1 (137) |
| 26 | 160 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^3F_4$ | | 123149980 | | 3.452E-15 | | 65.8 (160) 34.2 (140) |
| 26 | 161 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | | 123154160 | | 3.449E-15 | | 48.4 (139) 33.7 (161) 17.9 (169) |
| 26 | 162 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | | 123155320 | | 3.264E-15 | | 74.5 (162) |
| 26 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^3F_3$ | | 123155504 | | 3.452E-15 | | 49.4 (143) 26.1 (163) 24.5 (159) |
| 26 | 164 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | | 123156051 | | 3.450E-15 | | 100. (164) |
| 26 | 165 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^1G_4$ | | 123157432 | | 3.449E-15 | | 68.3 (165) 24.5 (140) 7.18 (160) |
| 26 | 166 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^1F_3$ | | 123157705 | | 3.305E-15 | | 70.6 (166) 23.8 (155) 5.53 (134) |
| 26 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | | 123162271 | | 3.451E-15 | | 100. (167) |
| 26 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | | 123166340 | | 3.401E-15 | | 72.7 (168) |
| 26 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | | 123166887 | | 3.445E-15 | | 52.5 (169) 46.0 (161) 1.48 (139) |
| 26 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | | 124475376 | | 1.400E-14 | | 76.8 (170) |
| 26 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s^3P_1$ | | 124479832 | | 4.372E-15 | | 49.5 (171) 28.1 (207) 19.4 (181) |
| 26 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | | 124480891 | | 4.695E-15 | | 72.6 (172) |
| 26 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | | 124483095 | | 9.803E-15 | | 66.2 (173) 18.8 (182) 15.0 (220) |
| 26 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | | 124487728 | | 3.756E-15 | | 71.6 (174) 13.3 (208) 8.24 (185) |
| 26 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | | 124492048 | | 2.384E-14 | | 70.4 (175) 20.3 (181) 2.80 (189) |
| 26 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | | 124499200 | | 1.072E-14 | | 72.5 (176) |
| 26 | 177 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | | 124499708 | | 1.434E-14 | | 80.9 (177) |
| 26 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | | 124502131 | | 4.057E-15 | | 44.0 (178) 23.7 (212) 15.7 (184) |
| 26 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | | 124509366 | | 3.701E-15 | | 72.7 (179) |
| 26 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | | 124510683 | | 4.177E-15 | | 38.4 (180) 21.4 (211) 16.7 (170) |
| 26 | 181 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p^1P_1$ | | 124513530 | | 1.125E-14 | | 51.0 (181) 24.0 (175) 19.0 (171) |
| 26 | 182 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | | 124515495 | | 4.786E-15 | | 54.0 (182) 32.2 (173) 13.8 (220) |
| 26 | 183 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | | 124517253 | | 2.825E-14 | | 90.0 (183) |
| 26 | 184 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | | 124517673 | | 2.147E-14 | | 70.1 (184) 15.7 (192) 4.00 (212) |
| 26 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | | 124518961 | | 2.216E-14 | | 87.5 (185) |
| 26 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | | 124520584 | | 3.941E-15 | | 43.7 (186) 23.9 (225) 19.0 (215) |
| 26 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | | 124525125 | | 4.111E-15 | | 37.5 (187) 28.7 (217) 17.8 (177) |
| 26 | 188 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | | 124526781 | | 3.452E-15 | | 73.9 (188) |
| 26 | 189 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | | 124526984 | | 3.757E-15 | | 49.5 (189) 24.9 (234) 15.0 (216) |
| 26 | 190 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | | 124529684 | | 3.451E-15 | | 41.9 (190) 32.0 (228) 26.1 (221) |
| 26 | 191 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | | 124529908 | | 4.944E-15 | | 31.7 (191) 31.7 (192) 20.8 (237) |
| 26 | 192 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | | 124530356 | | 8.687E-15 | | 48.4 (192) 13.9 (184) 13.2 (191) |
| 26 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | | 124530808 | | 3.451E-15 | | 72.4 (193) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 26 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | 124531263 | | | 3.791E-15 | | 47.3 (194) 27.0 (223) 15.9 (219) |
| 26 | 195 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | 124531377 | | | 3.486E-15 | | 42.6 (195) 32.2 (236) 24.2 (229) |
| 26 | 196 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | 124531642 | | | 9.014E-15 | | 62.5 (196) 21.4 (199) 10.5 (226) |
| 26 | 197 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | 124531779 | | | 3.447E-15 | | 39.6 (197) 33.0 (231) 27.4 (227) |
| 26 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | 124532109 | | | 4.511E-14 | | 94.2 (198) |
| 26 | 199 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | 124532621 | | | 5.458E-15 | | 37.5 (196) 35.4 (199) 16.3 (226) |
| 26 | 200 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^3F_3$ | 124532771 | | | 2.209E-14 | | 80.0 (200) |
| 26 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | 124535239 | | | 2.480E-13 | | 93.3 (201) |
| 26 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | 124535419 | | | 3.493E-13 | | 62.2 (202) 37.8 (205) |
| 26 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | 124535432 | | | 3.288E-13 | | 100. (203) |
| 26 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | 124536252 | | | 5.499E-13 | | 100. (204) |
| 26 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | 124536411 | | | 4.600E-13 | | 62.5 (205) 37.5 (202) |
| 26 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | 124657036 | | | 3.512E-15 | | 100. (206) |
| 26 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | 124662089 | | | 3.544E-15 | | 67.8 (207) 30.8 (171) 1.36 (181) |
| 26 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^1P_1$ | 124665287 | | | 3.316E-15 | | 41.5 (180) 39.4 (208) 15.5 (174) |
| 26 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^3P_2$ | 124667847 | | | 3.323E-15 | | 43.8 (178) 35.2 (209) 21.0 (212) |
| 26 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | 124671500 | | | 3.325E-15 | | 100. (210) |
| 26 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p^3S_1$ | 124673943 | | | 3.341E-15 | | 63.9 (211) 25.1 (208) 9.86 (180) |
| 26 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^1D_2$ | 124683006 | | | 3.320E-15 | | 49.3 (212) 48.9 (209) 1.78 (178) |
| 26 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^1D_2$ | 124683574 | | | 3.464E-15 | | 54.8 (213) 22.3 (217) 21.2 (179) |
| 26 | 214 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | 124684224 | | | 3.496E-15 | | 100. (214) |
| 26 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d^3D_3$ | 124687269 | | | 3.452E-15 | | 49.1 (215) 44.3 (186) 6.58 (225) |
| 26 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d^3P_1$ | 124691646 | | | 3.454E-15 | | 66.7 (216) 31.5 (189) 1.78 (234) |
| 26 | 217 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^3D_2$ | 124692138 | | | 3.454E-15 | | 50.6 (187) 39.5 (217) 9.98 (213) |
| 26 | 218 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d^3P_0$ | 124692540 | | | 3.467E-15 | | 100. (218) |
| 26 | 219 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f^1F_3$ | 124696001 | | | 3.480E-15 | | 40.0 (219) 34.1 (223) 25.9 (188) |
| 26 | 220 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p^1S_0$ | 124696595 | | | 3.358E-15 | | 71.2 (220) 27.3 (182) 1.52 (173) |
| 26 | 221 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f^3F_4$ | 124697629 | | | 3.479E-15 | | 63.7 (221) 36.3 (190) |
| 26 | 222 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f^3D_2$ | 124699601 | | | 3.478E-15 | | 50.4 (191) 35.2 (222) 14.4 (237) |
| 26 | 223 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f^3F_3$ | 124700177 | | | 3.479E-15 | | 46.7 (194) 28.2 (223) 25.1 (219) |
| 26 | 224 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f^3G_5$ | 124700189 | | | 3.476E-15 | | 100. (224) |
| 26 | 225 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d^1F_3$ | 124700260 | | | 3.408E-15 | | 65.1 (225) 28.6 (215) 6.22 (186) |
| 26 | 226 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g^3G_4$ | 124700416 | | | 3.493E-15 | | 38.2 (226) 34.5 (230) 27.3 (193) |
| 26 | 227 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g^3G_5$ | 124701278 | | | 3.493E-15 | | 71.1 (227) 22.9 (197) 5.98 (231) |
| 26 | 228 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f^1G_4$ | 124701424 | | | 3.476E-15 | | 67.9 (228) 21.9 (190) 10.2 (221) |
| 26 | 229 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g^3F_3$ | 124701729 | | | 3.492E-15 | | 56.8 (195) 22.4 (229) 20.8 (236) |
| 26 | 230 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g^1G_4$ | 124702551 | | | 3.492E-15 | | 42.8 (199) 31.3 (230) 25.9 (226) |
| 26 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g^1H_5$ | 124702741 | | | 3.489E-15 | | 61.1 (231) 37.5 (197) 1.46 (227) |
| 26 | 232 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f^3D_1$ | 124703284 | | | 3.476E-15 | | 100. (232) |
| 26 | 233 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g^3H_6$ | 124703524 | | | 3.489E-15 | | 100. (233) |
| 26 | 234 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d^1P_1$ | 124704312 | | | 3.448E-15 | | 68.9 (234) 15.8 (216) 15.3 (189) |
| 26 | 235 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g^3F_2$ | 124704528 | | | 3.488E-15 | | 100. (235) |
| 26 | 236 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g^3F_3$ | 124705443 | | | 3.488E-15 | | 53.1 (229) 46.9 (236) |
| 26 | 237 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f^1D_2$ | 124705987 | | | 3.474E-15 | | 54.1 (237) 43.6 (222) 2.36 (191) |
| 26 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s^3S_1$ | 125339601 | | | 1.126E-14 | | 70.4 (238) 10.7 (287) 8.66 (284) |
| 26 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s^3P_1$ | 125340832 | | | 4.221E-15 | | 53.0 (239) 28.1 (283) 15.1 (249) |
| 26 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s^3P_0$ | 125341304 | | | 4.418E-15 | | 77.8 (240) |
| 26 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s^1S_0$ | 125343392 | | | 8.345E-15 | | 59.8 (241) 24.5 (250) 15.7 (295) |
| 26 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p^3D_1$ | 125345517 | | | 3.940E-15 | | 70.7 (242) 11.2 (284) 8.03 (238) |
| 26 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p^3P_1$ | 125349460 | | | 2.470E-14 | | 67.5 (243) 22.2 (249) 4.43 (257) |
| 26 | 244 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p^3P_2$ | 125353440 | | | 1.216E-14 | | 74.1 (244) |
| 26 | 245 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p^3P_0$ | 125353623 | | | 1.408E-14 | | 78.0 (245) |
| 26 | 246 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p^3D_2$ | 125353699 | | | 3.979E-15 | | 44.1 (246) 26.4 (288) 13.5 (285) |
| 26 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d^3F_2$ | 125357702 | | | 3.722E-15 | | 72.4 (247) |
| 26 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p^3P_1$ | 125358996 | | | 4.446E-15 | | 37.4 (248) 21.9 (287) 21.7 (238) |
| 26 | 249 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p^1P_1$ | 125361804 | | | 1.274E-14 | | 48.6 (249) 27.3 (243) 14.6 (239) |
| 26 | 250 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p^3P_0$ | 125362211 | | | 5.539E-15 | | 45.5 (250) 39.6 (241) 14.9 (295) |
| 26 | 251 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d^3D_3$ | 125363686 | | | 1.798E-14 | | 81.9 (251) |
| 26 | 252 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d^3D_2$ | 125363854 | | | 1.971E-14 | | 71.0 (252) 13.3 (269) 4.81 (259) |
| 26 | 253 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d^3F_3$ | 125364166 | | | 3.796E-15 | | 43.1 (253) 27.3 (299) 20.0 (291) |
| 26 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d^3D_1$ | 125364782 | | | 3.107E-14 | | 90.6 (254) |
| 26 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d^3P_2$ | 125367129 | | | 4.470E-15 | | 35.9 (255) 26.3 (293) 23.8 (244) |
| 26 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f^3G_3$ | 125367298 | | | 3.470E-15 | | 74.5 (256) |
| 26 | 257 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d^3D_1$ | 125367951 | | | 4.054E-15 | | 44.7 (257) 25.0 (314) 14.2 (249) |
| 26 | 258 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f^3G_4$ | 125369033 | | | 3.462E-15 | | 41.8 (258) 32.5 (303) 25.6 (297) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 26 | 259 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 125369518 | | 3.865E-15 | | 41.2 (259) 28.7 (321) 19.1 (298) |
| 26 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 125369700 | | 3.455E-15 | | 72.8 (260) |
| 26 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 125370096 | | 3.465E-15 | | 42.5 (261) 32.9 (320) 24.7 (305) |
| 26 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 125370281 | | 3.454E-15 | | 39.8 (262) 33.1 (308) 27.1 (304) |
| 26 | 263 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 125370345 | | 4.185E-15 | | 44.0 (263) 23.7 (301) 17.9 (251) |
| 26 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 125370395 | | 3.454E-15 | | 71.9 (264) 17.2 (315) 10.9 (306) |
| 26 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 125370505 | | 3.617E-15 | | 54.9 (265) 25.1 (302) 15.5 (307) |
| 26 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 125370630 | | 3.457E-15 | | 40.4 (266) 33.1 (319) 26.5 (310) |
| 26 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 125370749 | | 3.454E-15 | | 38.8 (267) 33.2 (312) 28.0 (309) |
| 26 | 268 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 125370981 | | 3.457E-15 | | 59.5 (268) 23.9 (306) 16.5 (315) |
| 26 | 269 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 125371085 | | 2.918E-14 | | 79.7 (269) |
| 26 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 125372135 | | 5.791E-14 | | 96.1 (270) |
| 26 | 271 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 125372243 | | 6.723E-14 | | 96.3 (271) |
| 26 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 125372412 | | 3.348E-14 | | 84.7 (272) |
| 26 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 125374102 | | 4.101E-13 | | 94.1 (273) |
| 26 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 125374203 | | 4.644E-13 | | 100. (274) |
| 26 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 125374218 | | 5.446E-13 | | 66.7 (275) 33.3 (277) |
| 26 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 125374678 | | 9.357E-13 | | 100. (276) |
| 26 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 125374803 | | 7.608E-13 | | 66.9 (277) 33.1 (275) |
| 26 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 125374861 | | 1.317E-12 | | 55.1 (278) 44.9 (281) |
| 26 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 125374872 | | 1.347E-12 | | 100. (279) |
| 26 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 125375215 | | 1.321E-12 | | 100. (280) |
| 26 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 125375224 | | 1.357E-12 | | 55.1 (281) 44.9 (278) |
| 26 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 125515000 | | 3.512E-15 | | 100. (282) |
| 26 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 125517205 | | 3.522E-15 | | 67.6 (283) 32.4 (239) |
| 26 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 125519825 | | 3.402E-15 | | 42.6 (248) 36.7 (284) 15.1 (242) |
| 26 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 125521082 | | 3.402E-15 | | 46.0 (246) 32.6 (285) 21.4 (288) |
| 26 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 125523481 | | 3.402E-15 | | 100. (286) |
| 26 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3S_1$ | | 125524397 | | 3.406E-15 | | 61.3 (287) 28.9 (284) 8.20 (248) |
| 26 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 125529664 | | 3.400E-15 | | 51.2 (285) 47.2 (288) 1.66 (246) |
| 26 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 125530400 | | 3.486E-15 | | 55.3 (289) 21.8 (293) 21.4 (247) |
| 26 | 290 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 125530853 | | 3.501E-15 | | 100. (290) |
| 26 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 125532384 | | 3.479E-15 | | 46.8 (291) 46.4 (253) 6.82 (299) |
| 26 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 125534586 | | 3.473E-15 | | 66.5 (292) 31.9 (257) 1.60 (314) |
| 26 | 293 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 125534958 | | 3.475E-15 | | 49.7 (255) 39.8 (293) 10.4 (289) |
| 26 | 294 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 125535009 | | 3.478E-15 | | 100. (294) |
| 26 | 295 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 125536283 | | 3.414E-15 | | 69.7 (295) 30.3 (250) |
| 26 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 125537380 | | 3.495E-15 | | 40.5 (296) 34.0 (301) 25.4 (256) |
| 26 | 297 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 125538308 | | 3.495E-15 | | 62.3 (297) 37.7 (258) |
| 26 | 298 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 125539408 | | 3.493E-15 | | 51.1 (259) 36.0 (298) 12.9 (321) |
| 26 | 299 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 125539482 | | 3.457E-15 | | 62.6 (299) 31.0 (291) 6.37 (253) |
| 26 | 300 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 125539621 | | 3.493E-15 | | 100. (300) |
| 26 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 125539723 | | 3.493E-15 | | 45.7 (263) 29.0 (301) 25.3 (296) |
| 26 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 125539938 | | 3.501E-15 | | 38.2 (302) 34.9 (307) 26.9 (260) |
| 26 | 303 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 125540432 | | 3.495E-15 | | 67.4 (303) 20.5 (258) 12.1 (297) |
| 26 | 304 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 125540440 | | 3.501E-15 | | 70.7 (304) 24.6 (262) 4.67 (308) |
| 26 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 125540724 | | 3.500E-15 | | 57.3 (261) 22.4 (305) 20.2 (320) |
| 26 | 306 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^3H_5$ | | 125540988 | | 3.501E-15 | | 38.6 (306) 33.6 (315) 27.9 (264) |
| 26 | 307 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^1G_4$ | | 125541192 | | 3.501E-15 | | 42.2 (265) 31.4 (307) 26.4 (302) |
| 26 | 308 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 125541212 | | 3.496E-15 | | 62.2 (308) 35.6 (262) 2.23 (304) |
| 26 | 309 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 125541319 | | 3.501E-15 | | 69.5 (309) 25.8 (267) 4.71 (312) |
| 26 | 310 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 125541387 | | 3.503E-15 | | 59.4 (266) 21.1 (310) 19.5 (319) |
| 26 | 311 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 125541395 | | 3.490E-15 | | 100. (311) |
| 26 | 312 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 125541611 | | 3.490E-15 | | 62.1 (312) 35.4 (267) 2.49 (309) |
| 26 | 313 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 125541628 | | 3.496E-15 | | 100. (313) |
| 26 | 314 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 125541641 | | 3.471E-15 | | 67.4 (314) 16.4 (257) 16.2 (292) |
| 26 | 315 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 125541722 | | 3.503E-15 | | 40.2 (268) 33.0 (315) 26.8 (306) |
| 26 | 316 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 125541949 | | 3.490E-15 | | 100. (316) |
| 26 | 317 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 125542313 | | 3.498E-15 | | 100. (317) |
| 26 | 318 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 125542320 | | 3.499E-15 | | 100. (318) |
| 26 | 319 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 125542659 | | 3.499E-15 | | 52.5 (310) 47.5 (319) |
| 26 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^1F_3$ | | 125542861 | | 3.498E-15 | | 52.8 (305) 47.2 (320) |
| 26 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 125543047 | | 3.491E-15 | | 54.7 (321) 42.4 (298) 2.87 (259) |
| 27 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 27 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 57857380 | 57856745 | | 3.284E-09 | | 100. (2) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|-----------------------|
| 27 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 58102090 | 58101689 | | 2.647E-09 | | 100. (3) |
| 27 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 58119680 | 58119277 | | 1.693E-14 | | 90.1 (4) |
| 27 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 58122700 | 58122140 | | 3.010E-03 | | 100. (5) |
| 27 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 58261180 | 58260856 | | 9.438E-11 | | 100. (6) |
| 27 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 58411430 | 58410739 | | 1.902E-15 | | 90.1 (7) |
| 27 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 68560000 | 68558949 | | 2.854E-13 | | 100. (8) |
| 27 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 68627500 | 68626450 | | 9.541E-14 | | 100. (9) |
| 27 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 68630600 | 68628897 | | 2.976E-13 | | 100. (10) |
| 27 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 68632500 | 68631494 | | 3.617E-14 | | 89.2 (11) |
| 27 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 68674800 | 68673833 | | 9.863E-14 | | 100. (12) |
| 27 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 68710600 | 68709509 | | 3.309E-14 | | 65.1 (13) 34.9 (17) |
| 27 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 68711300 | 68710284 | | 3.306E-14 | | 100. (14) |
| 27 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 68715500 | 68714344 | | 6.595E-15 | | 89.2 (15) |
| 27 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 68726500 | 68725454 | | 3.348E-14 | | 100. (16) |
| 27 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 68728900 | 68727879 | | 3.365E-14 | | 65.1 (17) 34.9 (13) |
| 27 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 72266000 | 72265543 | | 4.160E-13 | | 100. (18) |
| 27 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 72294300 | 72293308 | | 1.630E-13 | | 100. (19) |
| 27 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 72295500 | 72293898 | | 4.315E-13 | | 100. (20) |
| 27 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 72296500 | 72295410 | | 7.513E-14 | | 88.8 (21) |
| 27 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 72314300 | 72313304 | | 1.674E-13 | | 100. (22) |
| 27 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | 72329400 | 72328050 | | 7.695E-14 | | 66.6 (23) 33.4 (28) |
| 27 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | 72329700 | 72328285 | | 7.683E-14 | | 100. (24) |
| 27 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 72331500 | 72329861 | | 1.570E-14 | | 88.8 (25) |
| 27 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | 72336100 | 72334689 | | 7.788E-14 | | 100. (26) |
| 27 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 72335626 | | 1.575E-13 | | 56.8 (27) 43.2 (31) |
| 27 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | 72337100 | 72335888 | | 7.839E-14 | | 66.6 (28) 33.4 (23) |
| 27 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 72335932 | | 1.575E-13 | | 100. (29) |
| 27 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 72339143 | | 1.582E-13 | | 100. (30) |
| 27 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 72339381 | | 1.583E-13 | | 56.8 (31) 43.2 (27) |
| 27 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 73972000 | 73971310 | | 6.588E-13 | | 100. (32) |
| 27 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 73985370 | 73985348 | | 2.792E-13 | | 100. (33) |
| 27 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 73987000 | 73985551 | | 6.703E-13 | | 100. (34) |
| 27 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 73987500 | 73986418 | | 1.381E-13 | | 88.7 (35) |
| 27 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 73996600 | 73995581 | | 2.859E-13 | | 100. (36) |
| 27 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | | 74003058 | | 1.481E-13 | | 67.2 (37) 32.8 (42) |
| 27 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | | 74003158 | | 1.480E-13 | | 100. (38) |
| 27 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p\ ^1P_1$ | 74005400 | 74003932 | | 3.067E-14 | | 88.7 (39) |
| 27 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d\ ^3D_3$ | | 74006437 | | 1.502E-13 | | 100. (40) |
| 27 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f\ ^3F_3$ | | 74006960 | | 3.042E-13 | | 57.0 (41) 43.0 (47) |
| 27 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d\ ^1D_2$ | | 74007090 | | 1.507E-13 | | 67.2 (42) 32.8 (37) |
| 27 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f\ ^3F_2$ | | 74007115 | | 3.042E-13 | | 100. (43) |
| 27 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f\ ^3F_4$ | | 74008759 | | 3.055E-13 | | 100. (44) |
| 27 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g\ ^3G_4$ | | 74008782 | | 5.122E-13 | | 55.2 (45) 44.8 (49) |
| 27 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g\ ^3G_3$ | | 74008874 | | 5.123E-13 | | 100. (46) |
| 27 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f\ ^1F_3$ | | 74008884 | | 3.058E-13 | | 57.0 (47) 43.0 (41) |
| 27 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g\ ^3G_5$ | | 74009861 | | 5.133E-13 | | 100. (48) |
| 27 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g\ ^1G_4$ | | 74009934 | | 5.133E-13 | | 55.2 (49) 44.8 (45) |
| 27 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s\ ^3S_1$ | | 74894495 | | 1.021E-12 | | 100. (50) |
| 27 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p\ ^3P_0$ | | 74902555 | | 4.512E-13 | | 100. (51) |
| 27 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s\ ^1S_0$ | | 74902650 | | 1.004E-12 | | 100. (52) |
| 27 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p\ ^3P_1$ | | 74903171 | | 2.307E-13 | | 88.6 (53) |
| 27 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p\ ^3P_2$ | | 74908475 | | 4.613E-13 | | 100. (54) |
| 27 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d\ ^3D_2$ | | 74912764 | | 2.532E-13 | | 67.5 (55) 32.5 (60) |
| 27 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d\ ^3D_1$ | | 74912817 | | 2.535E-13 | | 100. (56) |
| 27 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p\ ^1P_1$ | | 74913269 | | 5.284E-14 | | 88.6 (57) |
| 27 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d\ ^3D_3$ | | 74914714 | | 2.574E-13 | | 100. (58) |
| 27 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f\ ^3F_3$ | | 74915015 | | 5.197E-13 | | 57.0 (59) 43.0 (65) |
| 27 | 60 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d\ ^1D_2$ | | 74915103 | | 2.570E-13 | | 67.5 (60) 32.5 (55) |
| 27 | 61 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f\ ^3F_2$ | | 74915104 | | 5.196E-13 | | 100. (61) |
| 27 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f\ ^3F_4$ | | 74916056 | | 5.219E-13 | | 100. (62) |
| 27 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g\ ^3G_4$ | | 74916062 | | 8.785E-13 | | 55.2 (63) 44.8 (69) |
| 27 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g\ ^3G_3$ | | 74916115 | | 8.787E-13 | | 100. (64) |
| 27 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f\ ^1F_3$ | | 74916130 | | 5.225E-13 | | 57.0 (65) 43.0 (59) |
| 27 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h\ ^3H_5$ | | 74916686 | | 1.327E-12 | | 54.2 (66) 45.8 (71) |
| 27 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g\ ^3G_5$ | | 74916686 | | 8.804E-13 | | 100. (67) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 27 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 74916721 | | 1.327E-12 | | 100. (68) |
| 27 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 74916729 | | 8.805E-13 | | 55.2 (69) 44.8 (63) |
| 27 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 74917102 | | 1.328E-12 | | 100. (70) |
| 27 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 74917130 | | 1.328E-12 | | 54.2 (71) 45.8 (66) |
| 27 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 118012000 | 118012525 | | 7.913E-15 | | 79.7 (72) |
| 27 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 118044000 | 118039794 | | 3.103E-15 | | 100. (73) |
| 27 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 118086000 | 118082864 | | 3.104E-15 | | 95.5 (74) |
| 27 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 118233000 | 118231934 | | 3.144E-15 | | 100. (75) |
| 27 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 118322000 | 118316986 | | 1.698E-15 | | 88.0 (76) |
| 27 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 118418000 | 118415649 | | 1.554E-15 | | 100. (77) |
| 27 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | 118474000 | 118471547 | | 1.552E-15 | | 63.5 (78) 36.5 (80) |
| 27 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 118525000 | 118524782 | | 3.063E-15 | | 95.4 (79) |
| 27 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | 118659000 | 118661516 | | 1.559E-15 | | 63.5 (80) 36.5 (78) |
| 27 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | 118946000 | 118946514 | | 1.769E-15 | | 81.0 (81) |
| 27 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 128930809 | | 1.240E-14 | | 83.6 (82) |
| 27 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p^1P_1$ | | 128968261 | | 3.963E-15 | | 36.1 (83) 33.7 (105) 26.5 (91) |
| 27 | 84 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 128995191 | | 1.032E-14 | | 75.9 (84) |
| 27 | 85 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 128995914 | | 3.754E-15 | | 73.5 (85) |
| 27 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 129001214 | | 2.511E-15 | | 72.7 (86) |
| 27 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 129022487 | | 7.167E-15 | | 73.8 (87) |
| 27 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 129030169 | | 6.112E-15 | | 70.3 (88) 25.8 (85) 3.93 (114) |
| 27 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 129066068 | | 8.470E-15 | | 89.0 (89) |
| 27 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 129079646 | | 2.874E-15 | | 62.9 (90) 22.9 (97) 8.69 (110) |
| 27 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2p3s^3P_1$ | | 129092203 | | 4.754E-15 | | 42.5 (91) 34.0 (83) 20.7 (87) |
| 27 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^1P_1$ | | 129113764 | | 2.882E-15 | | 32.3 (92) 25.7 (103) 16.5 (107) |
| 27 | 93 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 129124132 | | 2.997E-15 | | 78.4 (93) |
| 27 | 94 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 129136089 | | 2.743E-15 | | 79.7 (94) |
| 27 | 95 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 129143850 | | 1.188E-14 | | 89.5 (95) |
| 27 | 96 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 129154635 | | 9.637E-15 | | 79.6 (96) |
| 27 | 97 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 129157090 | | 8.742E-15 | | 63.5 (97) 13.0 (100) 11.8 (110) |
| 27 | 98 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 129179790 | | 2.907E-15 | | 48.4 (98) 21.9 (113) 14.0 (109) |
| 27 | 99 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 129182603 | | 2.885E-15 | | 71.8 (99) 16.7 (111) 11.5 (115) |
| 27 | 100 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 129213908 | | 9.248E-15 | | 64.6 (100) 15.4 (90) 12.8 (97) |
| 27 | 101 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 129214750 | | 2.724E-15 | | 64.5 (101) 16.2 (117) 14.4 (112) |
| 27 | 102 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3d^1D_2$ | | 129225306 | | 3.053E-15 | | 48.5 (98) 18.8 (102) 17.3 (109) |
| 27 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^3P_1$ | | 129251994 | | 2.417E-15 | | 52.1 (103) 32.6 (92) 13.3 (86) |
| 27 | 104 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 129280086 | | 2.691E-15 | | 89.5 (104) |
| 27 | 105 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 129283117 | | 3.539E-15 | | 62.4 (105) 23.2 (83) 12.2 (91) |
| 27 | 106 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p^3P_2$ | | 129285508 | | 2.675E-15 | | 60.1 (106) 15.0 (90) 12.5 (110) |
| 27 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p^3S_1$ | | 129296355 | | 2.528E-15 | | 67.3 (107) 15.1 (92) 11.4 (103) |
| 27 | 108 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d^3F_4$ | | 129334811 | | 3.061E-15 | | 100. (108) |
| 27 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d^3D_2$ | | 129342962 | | 2.848E-15 | | 45.1 (102) 33.0 (109) 17.3 (93) |
| 27 | 110 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^1D_2$ | | 129369331 | | 2.543E-15 | | 60.0 (110) 29.6 (106) 9.35 (100) |
| 27 | 111 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d^3D_3$ | | 129370448 | | 2.737E-15 | | 68.3 (111) 25.1 (99) 6.59 (115) |
| 27 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d^3P_1$ | | 129400532 | | 2.844E-15 | | 70.7 (112) 23.8 (101) 2.66 (87) |
| 27 | 113 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^3P_2$ | | 129402077 | | 2.844E-15 | | 56.4 (113) 32.6 (109) 6.48 (102) |
| 27 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d^3P_0$ | | 129405704 | | 2.899E-15 | | 96.7 (114) |
| 27 | 115 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d^1F_3$ | | 129459374 | | 2.576E-15 | | 81.9 (115) |
| 27 | 116 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p^1S_0$ | | 129464938 | | 2.566E-15 | | 78.4 (116) |
| 27 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d^1P_1$ | | 129480410 | | 2.785E-15 | | 79.1 (117) |
| 27 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s^3S_1$ | | 132724074 | | 1.353E-14 | | 80.8 (118) |
| 27 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s^3P_1$ | | 132737213 | | 3.805E-15 | | 44.4 (119) 29.6 (147) 24.7 (129) |
| 27 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s^3P_0$ | | 132740673 | | 4.123E-15 | | 69.4 (120) 30.6 (124) |
| 27 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s^1S_0$ | | 132742947 | | 9.414E-15 | | 71.0 (121) 15.2 (161) 13.9 (130) |
| 27 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p^3D_1$ | | 132752128 | | 2.995E-15 | | 72.5 (122) |
| 27 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p^3P_1$ | | 132758242 | | 1.481E-14 | | 73.9 (123) |
| 27 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p^3P_0$ | | 132770796 | | 7.487E-15 | | 68.1 (124) 30.5 (120) 1.38 (158) |
| 27 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p^3P_2$ | | 132777350 | | 1.199E-14 | | 85.0 (125) |
| 27 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p^3D_2$ | | 132784746 | | 3.379E-15 | | 46.9 (126) 19.8 (154) 19.6 (132) |
| 27 | 127 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d^3F_2$ | | 132800007 | | 3.126E-15 | | 73.8 (127) |
| 27 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p^3P_1$ | | 132800328 | | 3.343E-15 | | 37.8 (128) 20.1 (151) 19.3 (148) |
| 27 | 129 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p^1P_1$ | | 132802013 | | 7.968E-15 | | 50.3 (129) 24.1 (119) 22.2 (123) |
| 27 | 130 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p^3P_0$ | | 132807467 | | 3.555E-15 | | 63.6 (130) 25.5 (121) 10.9 (161) |
| 27 | 131 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d^3D_3$ | | 132813337 | | 2.746E-14 | | 94.3 (131) |
| 27 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d^3D_2$ | | 132814374 | | 1.515E-14 | | 68.2 (132) 16.9 (138) 6.58 (154) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 27 | 133 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 132815890 | | 1.440E-14 | | 83.8 (133) |
| 27 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 132824056 | | 3.359E-15 | | 48.1 (134) 20.0 (165) 18.3 (155) |
| 27 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 132831950 | | 3.284E-15 | | 36.6 (135) 30.1 (157) 17.9 (152) |
| 27 | 136 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 132836256 | | 3.017E-15 | | 55.0 (136) 23.1 (168) 15.5 (156) |
| 27 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 132838736 | | 2.932E-15 | | 72.8 (137) |
| 27 | 138 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 132840854 | | 1.542E-14 | | 79.4 (138) |
| 27 | 139 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 132843884 | | 3.080E-15 | | 47.6 (139) 28.9 (169) 19.2 (162) |
| 27 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 132844485 | | 2.930E-15 | | 41.6 (140) 31.2 (166) 27.3 (160) |
| 27 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 132845571 | | 3.684E-14 | | 94.7 (141) |
| 27 | 142 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 132845920 | | 1.251E-13 | | 100. (142) |
| 27 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 132846600 | | 3.073E-15 | | 47.7 (143) 30.2 (163) 17.1 (159) |
| 27 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 132847150 | | 1.857E-14 | | 75.8 (144) |
| 27 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | | 132851516 | | 1.180E-13 | | 89.6 (145) |
| 27 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 132950006 | | 3.029E-15 | | 100. (146) |
| 27 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 132964592 | | 3.123E-15 | | 68.4 (147) 27.1 (119) 4.57 (129) |
| 27 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | | 132966925 | | 2.714E-15 | | 43.5 (128) 38.3 (148) 15.3 (122) |
| 27 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | | 132973450 | | 2.736E-15 | | 39.3 (126) 39.1 (149) 21.6 (154) |
| 27 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 132980993 | | 2.745E-15 | | 98.7 (150) |
| 27 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | | 132987125 | | 2.764E-15 | | 64.0 (151) 23.3 (148) 9.12 (128) |
| 27 | 152 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | | 133006337 | | 2.946E-15 | | 52.9 (152) 24.4 (157) 20.8 (127) |
| 27 | 153 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 133007492 | | 3.014E-15 | | 100. (153) |
| 27 | 154 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 133007785 | | 2.726E-15 | | 51.6 (154) 45.8 (149) 1.54 (126) |
| 27 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | | 133014923 | | 2.921E-15 | | 52.5 (155) 40.6 (134) 6.88 (165) |
| 27 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 133025133 | | 2.933E-15 | | 67.7 (156) 30.3 (136) 1.99 (168) |
| 27 | 157 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | | 133026281 | | 2.933E-15 | | 51.9 (135) 37.3 (157) 9.65 (152) |
| 27 | 158 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 133027256 | | 2.958E-15 | | 98.7 (158) |
| 27 | 159 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^1F_3$ | | 133033569 | | 2.971E-15 | | 38.3 (159) 34.9 (163) 26.8 (137) |
| 27 | 160 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 133037149 | | 2.971E-15 | | 64.8 (160) 35.2 (140) |
| 27 | 161 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | | 133040565 | | 2.791E-15 | | 73.9 (161) |
| 27 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 133041153 | | 2.968E-15 | | 49.0 (139) 33.6 (162) 17.4 (169) |
| 27 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^3F_3$ | | 133042909 | | 2.971E-15 | | 48.8 (143) 25.8 (163) 25.3 (159) |
| 27 | 164 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 133043595 | | 2.969E-15 | | 100. (164) |
| 27 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 133044497 | | 2.844E-15 | | 69.2 (165) 25.5 (155) 5.33 (134) |
| 27 | 166 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | | 133044796 | | 2.969E-15 | | 68.4 (166) 23.4 (140) 8.23 (160) |
| 27 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | | 133049632 | | 2.970E-15 | | 100. (167) |
| 27 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | | 133053524 | | 2.922E-15 | | 71.9 (168) 14.6 (156) 13.5 (136) |
| 27 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 133054821 | | 2.965E-15 | | 52.5 (169) 45.9 (162) 1.57 (139) |
| 27 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | | 134457245 | | 1.190E-14 | | 76.6 (170) |
| 27 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | | 134461652 | | 3.686E-15 | | 50.9 (171) 28.3 (207) 18.0 (181) |
| 27 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | | 134462502 | | 3.985E-15 | | 73.6 (172) |
| 27 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | | 134465032 | | 8.213E-15 | | 65.4 (173) 19.7 (182) 14.9 (219) |
| 27 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | | 134469689 | | 3.236E-15 | | 71.4 (174) 13.3 (208) 7.45 (185) |
| 27 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | | 134474603 | | 2.098E-14 | | 70.4 (175) 20.7 (181) 2.78 (188) |
| 27 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | | 134481812 | | 9.528E-15 | | 73.5 (176) |
| 27 | 177 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | | 134483704 | | 1.218E-14 | | 80.7 (177) |
| 27 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | | 134485943 | | 3.444E-15 | | 44.2 (178) 24.4 (212) 14.8 (184) |
| 27 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | | 134493352 | | 3.176E-15 | | 72.8 (179) |
| 27 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | | 134494565 | | 3.562E-15 | | 38.8 (180) 22.0 (211) 16.2 (170) |
| 27 | 181 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | | 134497851 | | 1.016E-14 | | 51.5 (181) 24.4 (175) 17.1 (171) |
| 27 | 182 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 134498815 | | 4.183E-15 | | 52.4 (182) 33.3 (173) 14.3 (219) |
| 27 | 183 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 134502362 | | 2.373E-14 | | 89.7 (183) |
| 27 | 184 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | | 134502378 | | 1.916E-14 | | 70.9 (184) 15.5 (192) 3.64 (212) |
| 27 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 134503579 | | 2.032E-14 | | 88.4 (185) |
| 27 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 134505511 | | 3.355E-15 | | 43.5 (186) 24.7 (223) 19.2 (215) |
| 27 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 134510151 | | 3.541E-15 | | 37.8 (187) 28.6 (217) 18.0 (177) |
| 27 | 188 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 134511632 | | 3.233E-15 | | 48.9 (188) 25.3 (234) 15.0 (216) |
| 27 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 134511818 | | 2.968E-15 | | 74.0 (189) |
| 27 | 190 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 134515052 | | 2.966E-15 | | 41.9 (190) 32.1 (227) 26.0 (221) |
| 27 | 191 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 134515121 | | 3.491E-15 | | 39.9 (191) 26.7 (237) 18.2 (222) |
| 27 | 192 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | | 134515859 | | 1.237E-14 | | 65.2 (192) 13.2 (184) 6.77 (178) |
| 27 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 134516201 | | 2.966E-15 | | 72.4 (193) |
| 27 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 134516694 | | 3.273E-15 | | 47.4 (194) 26.8 (224) 15.7 (220) |
| 27 | 195 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 134516780 | | 2.990E-15 | | 42.9 (195) 32.6 (236) 24.5 (229) |
| 27 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 134517330 | | 2.964E-15 | | 39.7 (196) 33.0 (231) 27.3 (228) |
| 27 | 197 | $2p_{1/2}5g_{9/2}(J=4)$ | $2s5f\ ^3F_4$ | | 134517358 | | 5.427E-15 | | 45.9 (197) 30.9 (199) 14.8 (226) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 27 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | | 134517730 | | 4.125E-14 | | 94.5 (198) |
| 27 | 199 | $2s_{1/2}5f_{7/2}(J=4)$ | $2p5g^3F_4$ | | 134518338 | | 6.347E-15 | | 54.1 (197) 26.1 (199) 11.9 (226) |
| 27 | 200 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^3F_3$ | | 134518428 | | 2.054E-14 | | 79.6 (200) |
| 27 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | | 134521194 | | 2.051E-13 | | 92.0 (201) |
| 27 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | | 134521403 | | 3.133E-13 | | 61.7 (202) 38.3 (205) |
| 27 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | | 134521419 | | 2.983E-13 | | 100. (203) |
| 27 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | | 134522388 | | 4.729E-13 | | 100. (204) |
| 27 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | | 134522557 | | 4.063E-13 | | 61.9 (205) 38.1 (202) |
| 27 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | | 134666898 | | 3.021E-15 | | 100. (206) |
| 27 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | | 134671968 | | 3.043E-15 | | 67.7 (207) 31.2 (171) 1.08 (181) |
| 27 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^1P_1$ | | 134675715 | | 2.854E-15 | | 43.5 (180) 35.9 (208) 14.9 (174) |
| 27 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^3P_2$ | | 134678136 | | 2.858E-15 | | 44.6 (178) 33.4 (209) 22.0 (212) |
| 27 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | | 134683194 | | 2.859E-15 | | 100. (210) |
| 27 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p^3S_1$ | | 134685382 | | 2.869E-15 | | 61.7 (211) 28.9 (208) 7.72 (180) |
| 27 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^1D_2$ | | 134695126 | | 2.856E-15 | | 50.6 (209) 47.9 (212) 1.50 (178) |
| 27 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^1D_2$ | | 134695936 | | 2.981E-15 | | 54.0 (213) 23.2 (217) 21.4 (179) |
| 27 | 214 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | | 134696889 | | 3.009E-15 | | 100. (214) |
| 27 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d^3D_3$ | | 134699766 | | 2.971E-15 | | 47.7 (215) 45.2 (186) 7.15 (223) |
| 27 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d^3P_1$ | | 134704157 | | 2.971E-15 | | 66.3 (216) 31.8 (188) 1.84 (234) |
| 27 | 217 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^3D_2$ | | 134704949 | | 2.971E-15 | | 50.6 (187) 38.4 (217) 11.0 (213) |
| 27 | 218 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d^3P_0$ | | 134705079 | | 2.982E-15 | | 100. (218) |
| 27 | 219 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p^1S_0$ | | 134709066 | | 2.883E-15 | | 70.8 (219) 28.0 (182) 1.24 (173) |
| 27 | 220 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f^1F_3$ | | 134709186 | | 2.995E-15 | | 39.4 (220) 34.8 (224) 25.8 (189) |
| 27 | 221 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f^3F_4$ | | 134711003 | | 2.995E-15 | | 62.5 (221) 37.5 (190) |
| 27 | 222 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f^3D_2$ | | 134712901 | | 2.993E-15 | | 50.6 (191) 35.2 (222) 14.1 (237) |
| 27 | 223 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d^1F_3$ | | 134713454 | | 2.933E-15 | | 64.1 (223) 30.1 (215) 5.87 (186) |
| 27 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f^3F_3$ | | 134713687 | | 2.995E-15 | | 46.4 (194) 27.7 (224) 25.9 (220) |
| 27 | 225 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f^3G_5$ | | 134713736 | | 2.992E-15 | | 100. (225) |
| 27 | 226 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g^3G_4$ | | 134713972 | | 3.007E-15 | | 38.7 (226) 34.1 (230) 27.2 (193) |
| 27 | 227 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f^1G_4$ | | 134714922 | | 2.993E-15 | | 67.8 (227) 20.7 (190) 11.5 (221) |
| 27 | 228 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g^3G_5$ | | 134714973 | | 3.007E-15 | | 70.7 (228) 24.2 (196) 5.07 (231) |
| 27 | 229 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g^3F_3$ | | 134715331 | | 3.006E-15 | | 56.9 (195) 22.7 (229) 20.4 (236) |
| 27 | 230 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g^3G_4$ | | 134716300 | | 3.006E-15 | | 42.6 (199) 31.9 (230) 25.5 (226) |
| 27 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g^1H_5$ | | 134716414 | | 3.004E-15 | | 61.9 (231) 36.1 (196) 1.99 (228) |
| 27 | 232 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f^3D_1$ | | 134716743 | | 2.992E-15 | | 100. (232) |
| 27 | 233 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g^3H_6$ | | 134717333 | | 3.004E-15 | | 100. (233) |
| 27 | 234 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d^1P_1$ | | 134717704 | | 2.966E-15 | | 68.5 (234) 16.2 (216) 15.3 (188) |
| 27 | 235 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g^3F_2$ | | 134718246 | | 3.003E-15 | | 100. (235) |
| 27 | 236 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g^1F_3$ | | 134719311 | | 3.003E-15 | | 52.8 (229) 47.2 (236) |
| 27 | 237 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f^1D_2$ | | 134719754 | | 2.990E-15 | | 54.1 (237) 43.5 (222) 2.43 (191) |
| 27 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s^3S_1$ | | 135391613 | | 9.294E-15 | | 69.1 (238) 10.4 (287) 9.32 (284) |
| 27 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s^3P_1$ | | 135392669 | | 3.566E-15 | | 54.2 (239) 28.4 (283) 13.9 (250) |
| 27 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s^3P_0$ | | 135393041 | | 3.746E-15 | | 78.9 (240) |
| 27 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s^1S_0$ | | 135395396 | | 6.971E-15 | | 58.6 (241) 25.5 (249) 15.9 (295) |
| 27 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p^3D_1$ | | 135397484 | | 3.431E-15 | | 69.8 (242) 10.8 (284) 9.87 (238) |
| 27 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p^3P_1$ | | 135401924 | | 2.168E-14 | | 67.4 (243) 22.5 (250) 4.38 (257) |
| 27 | 244 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p^3P_0$ | | 135406114 | | 1.270E-14 | | 79.1 (244) |
| 27 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p^3D_2$ | | 135406688 | | 3.378E-15 | | 44.4 (245) 26.9 (288) 13.7 (285) |
| 27 | 246 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p^3P_2$ | | 135406692 | | 1.010E-14 | | 73.1 (246) |
| 27 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d^3F_2$ | | 135410797 | | 3.205E-15 | | 72.3 (247) |
| 27 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p^3P_1$ | | 135412043 | | 3.791E-15 | | 37.7 (248) 22.3 (287) 21.2 (238) |
| 27 | 249 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p^3P_0$ | | 135414978 | | 4.862E-15 | | 44.1 (249) 40.9 (241) 15.0 (295) |
| 27 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p^1P_1$ | | 135415254 | | 1.130E-14 | | 48.8 (250) 28.1 (243) 13.3 (239) |
| 27 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d^3D_2$ | | 135417554 | | 1.686E-14 | | 71.1 (251) 13.1 (269) 5.10 (259) |
| 27 | 252 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d^3D_3$ | | 135417588 | | 1.437E-14 | | 80.5 (252) |
| 27 | 253 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d^3F_3$ | | 135417779 | | 3.233E-15 | | 43.2 (253) 27.8 (299) 20.3 (291) |
| 27 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d^3D_1$ | | 135418459 | | 2.897E-14 | | 91.4 (254) |
| 27 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d^3P_2$ | | 135420851 | | 3.868E-15 | | 35.9 (255) 26.1 (294) 24.3 (246) |
| 27 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f^3G_3$ | | 135420972 | | 2.985E-15 | | 74.5 (256) |
| 27 | 257 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d^3D_1$ | | 135421428 | | 3.505E-15 | | 44.1 (257) 25.1 (312) 15.1 (250) |
| 27 | 258 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f^3G_4$ | | 135422900 | | 2.975E-15 | | 41.8 (258) 32.6 (303) 25.5 (297) |
| 27 | 259 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f^3F_2$ | | 135423293 | | 3.345E-15 | | 40.8 (259) 28.7 (321) 19.1 (298) |
| 27 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g^3H_4$ | | 135423583 | | 2.971E-15 | | 72.8 (260) |
| 27 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g^3G_3$ | | 135423984 | | 2.979E-15 | | 42.4 (261) 32.9 (320) 24.7 (305) |
| 27 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g^3H_5$ | | 135424257 | | 2.971E-15 | | 39.8 (262) 33.1 (307) 27.0 (304) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 27 | 263 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 135424301 | | 3.662E-15 | | 43.4 (263) 23.3 (301) 19.3 (252) |
| 27 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 135424372 | | 2.972E-15 | | 71.9 (264) 17.3 (315) 10.8 (306) |
| 27 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 135424492 | | 3.066E-15 | | 55.8 (265) 25.5 (302) 15.7 (308) |
| 27 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 135424606 | | 2.974E-15 | | 40.4 (266) 33.1 (319) 26.5 (311) |
| 27 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 135424785 | | 2.972E-15 | | 38.8 (267) 33.2 (313) 28.0 (310) |
| 27 | 268 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 135425017 | | 2.974E-15 | | 59.6 (268) 24.0 (306) 16.4 (315) |
| 27 | 269 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 135425270 | | 2.652E-14 | | 80.1 (269) |
| 27 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 135426384 | | 5.378E-14 | | 96.4 (270) |
| 27 | 271 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 135426632 | | 7.930E-14 | | 98.2 (271) |
| 27 | 272 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 135426681 | | 3.176E-14 | | 84.5 (272) |
| 27 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 135428554 | | 3.411E-13 | | 93.1 (273) |
| 27 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 135428675 | | 4.300E-13 | | 100. (274) |
| 27 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 135428690 | | 4.962E-13 | | 65.8 (275) 34.2 (277) |
| 27 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 135429237 | | 8.068E-13 | | 100. (276) |
| 27 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 135429369 | | 6.763E-13 | | 66.0 (277) 34.0 (275) |
| 27 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 135429426 | | 1.140E-12 | | 55.1 (278) 44.9 (281) |
| 27 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 135429439 | | 1.169E-12 | | 100. (279) |
| 27 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 135429841 | | 1.143E-12 | | 100. (280) |
| 27 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 135429851 | | 1.177E-12 | | 55.1 (281) 44.9 (278) |
| 27 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 135594955 | | 3.022E-15 | | 100. (282) |
| 27 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 135597194 | | 3.028E-15 | | 67.5 (283) 32.5 (239) |
| 27 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 135600077 | | 2.928E-15 | | 44.5 (248) 33.0 (284) 14.5 (242) |
| 27 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 135601284 | | 2.928E-15 | | 46.5 (245) 31.2 (285) 22.3 (288) |
| 27 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 135604507 | | 2.928E-15 | | 100. (286) |
| 27 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3S_1$ | | 135605307 | | 2.931E-15 | | 58.9 (287) 32.7 (284) 6.23 (248) |
| 27 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 135610923 | | 2.926E-15 | | 52.6 (285) 46.0 (288) 1.41 (245) |
| 27 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 135611796 | | 3.000E-15 | | 54.3 (289) 23.0 (294) 21.6 (247) |
| 27 | 290 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 135612430 | | 3.013E-15 | | 100. (290) |
| 27 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 135613853 | | 2.995E-15 | | 47.1 (253) 45.5 (291) 7.41 (299) |
| 27 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 135616064 | | 2.989E-15 | | 66.1 (292) 32.2 (257) 1.68 (312) |
| 27 | 293 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 135616503 | | 2.994E-15 | | 100. (293) |
| 27 | 294 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 135616613 | | 2.991E-15 | | 49.9 (255) 38.6 (294) 11.5 (289) |
| 27 | 295 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 135617750 | | 2.938E-15 | | 69.3 (295) 30.7 (249) |
| 27 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 135619240 | | 3.008E-15 | | 39.9 (296) 34.7 (301) 25.4 (256) |
| 27 | 297 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 135620273 | | 3.008E-15 | | 61.0 (297) 39.0 (258) |
| 27 | 298 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 135621337 | | 3.007E-15 | | 51.2 (259) 36.1 (298) 12.7 (321) |
| 27 | 299 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 135621347 | | 2.975E-15 | | 61.8 (299) 32.3 (291) 5.94 (253) |
| 27 | 300 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 135621683 | | 3.007E-15 | | 100. (300) |
| 27 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 135621772 | | 3.007E-15 | | 45.5 (263) 28.4 (301) 26.0 (296) |
| 27 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 135622013 | | 3.014E-15 | | 38.7 (302) 34.5 (308) 26.9 (260) |
| 27 | 303 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 135622475 | | 3.008E-15 | | 67.3 (303) 19.2 (258) 13.5 (297) |
| 27 | 304 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 135622594 | | 3.014E-15 | | 70.0 (304) 26.3 (262) 3.72 (307) |
| 27 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 135622827 | | 3.013E-15 | | 57.4 (261) 22.8 (305) 19.9 (320) |
| 27 | 306 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^3H_5$ | | 135623173 | | 3.015E-15 | | 39.0 (306) 33.2 (315) 27.8 (264) |
| 27 | 307 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 135623353 | | 3.011E-15 | | 63.1 (307) 33.8 (262) 3.01 (304) |
| 27 | 308 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 135623379 | | 3.013E-15 | | 42.1 (265) 31.9 (308) 26.0 (302) |
| 27 | 309 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 135623407 | | 3.004E-15 | | 100. (309) |
| 27 | 310 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 135623557 | | 3.014E-15 | | 68.1 (310) 28.8 (267) 3.13 (313) |
| 27 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 135623586 | | 3.016E-15 | | 59.5 (266) 21.4 (311) 19.2 (319) |
| 27 | 312 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 135623620 | | 2.988E-15 | | 67.0 (312) 16.6 (292) 16.4 (257) |
| 27 | 313 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 135623829 | | 3.007E-15 | | 63.6 (313) 32.4 (267) 3.98 (310) |
| 27 | 314 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 135623845 | | 3.011E-15 | | 100. (314) |
| 27 | 315 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 135623979 | | 3.016E-15 | | 40.1 (268) 33.4 (315) 26.5 (306) |
| 27 | 316 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 135624221 | | 3.007E-15 | | 100. (316) |
| 27 | 317 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 135624481 | | 3.011E-15 | | 100. (317) |
| 27 | 318 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 135624556 | | 3.013E-15 | | 100. (318) |
| 27 | 319 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 135624953 | | 3.013E-15 | | 52.2 (311) 47.8 (319) |
| 27 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^1F_3$ | | 135625117 | | 3.012E-15 | | 52.5 (305) 47.5 (320) |
| 27 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 135625242 | | 3.005E-15 | | 54.7 (321) 42.3 (298) 2.94 (259) |
| 28 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 28 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 62359670 | 62358976 | | 2.262E-09 | | 100. (2) |
| 28 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 62615790 | 62615349 | | 2.494E-09 | | 100. (3) |
| 28 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 62634560 | 62634115 | | 1.295E-14 | | 88.9 (4) |
| 28 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 62637030 | 62636412 | | 3.351E-03 | | 100. (5) |
| 28 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 62801690 | 62801348 | | 7.118E-11 | | 100. (6) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|-----------------------|
| 28 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p^1P_1$ | 62956290 | 62955523 | | 1.662E-15 | | 88.9 (7) |
| 28 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s^3S_1$ | 73903000 | 73902451 | | 2.450E-13 | | 100. (8) |
| 28 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p^3P_0$ | 73973600 | 73973089 | | 8.189E-14 | | 100. (9) |
| 28 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s^1S_0$ | 73976800 | 73975583 | | 2.553E-13 | | 100. (10) |
| 28 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p^3P_1$ | 73978900 | 73978446 | | 2.900E-14 | | 87.9 (11) |
| 28 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 74028800 | 74028455 | | 8.488E-14 | | 100. (12) |
| 28 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 74066000 | 74065498 | | 2.842E-14 | | 64.5 (13) 35.5 (17) |
| 28 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d^3D_1$ | 74066900 | 74066424 | | 2.841E-14 | | 100. (14) |
| 28 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 74070700 | 74070165 | | 5.759E-15 | | 87.9 (15) |
| 28 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 74084600 | 74084140 | | 2.881E-14 | | 100. (16) |
| 28 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 74087200 | 74086740 | | 2.892E-14 | | 64.5 (17) 35.5 (13) |
| 28 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s^3S_1$ | 77900700 | 77901008 | | 3.572E-13 | | 100. (18) |
| 28 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 77930200 | 77930057 | | 1.399E-13 | | 100. (19) |
| 28 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 77931400 | 77930652 | | 3.702E-13 | | 100. (20) |
| 28 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 77932500 | 77932287 | | 6.086E-14 | | 87.6 (21) |
| 28 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 77953500 | 77953421 | | 1.441E-13 | | 100. (22) |
| 28 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 77969200 | 77968736 | | 6.608E-14 | | 65.9 (23) 34.1 (28) |
| 28 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d^3D_1$ | 77969600 | 77969029 | | 6.603E-14 | | 100. (24) |
| 28 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 77971200 | 77970471 | | 1.371E-14 | | 87.6 (25) |
| 28 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 77977100 | 77976508 | | 6.701E-14 | | 100. (26) |
| 28 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | | 77977485 | | 1.353E-13 | | 56.8 (27) 43.2 (31) |
| 28 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | 77978200 | 77977787 | | 6.735E-14 | | 65.9 (28) 34.1 (23) |
| 28 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | | 77977828 | | 1.354E-13 | | 100. (29) |
| 28 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | | 77981575 | | 1.360E-13 | | 100. (30) |
| 28 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | | 77981842 | | 1.361E-13 | | 56.8 (31) 43.2 (27) |
| 28 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 79741000 | 79741131 | | 5.660E-13 | | 100. (32) |
| 28 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 79755910 | 79755817 | | 2.398E-13 | | 100. (33) |
| 28 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 79756700 | 79756018 | | 5.747E-13 | | 100. (34) |
| 28 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 79757300 | 79756951 | | 1.124E-13 | | 87.4 (35) |
| 28 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 79768100 | 79767773 | | 2.461E-13 | | 100. (36) |
| 28 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | | 79775538 | | 1.272E-13 | | 66.5 (37) 33.5 (42) |
| 28 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | | 79775668 | | 1.272E-13 | | 100. (38) |
| 28 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 79777100 | 79776373 | | 2.678E-14 | | 87.4 (39) |
| 28 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | | 79779497 | | 1.292E-13 | | 100. (40) |
| 28 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 79780042 | | 2.614E-13 | | 56.9 (41) 43.1 (47) |
| 28 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 79780192 | | 1.294E-13 | | 66.5 (42) 33.5 (37) |
| 28 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 79780215 | | 2.614E-13 | | 100. (43) |
| 28 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 79782135 | | 2.626E-13 | | 100. (44) |
| 28 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 79782159 | | 4.403E-13 | | 55.2 (45) 44.8 (49) |
| 28 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 79782262 | | 4.404E-13 | | 100. (46) |
| 28 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 79782274 | | 2.629E-13 | | 56.9 (47) 43.1 (41) |
| 28 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 79783414 | | 4.413E-13 | | 100. (48) |
| 28 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 79783495 | | 4.413E-13 | | 55.2 (49) 44.8 (45) |
| 28 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 80737006 | | 8.753E-13 | | 100. (50) |
| 28 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 80745436 | | 3.870E-13 | | 100. (51) |
| 28 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 80745530 | | 8.639E-13 | | 100. (52) |
| 28 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 80746090 | | 1.880E-13 | | 87.3 (53) |
| 28 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 80752353 | | 3.963E-13 | | 100. (54) |
| 28 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 80756807 | | 2.173E-13 | | 66.8 (55) 33.2 (61) |
| 28 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 80756877 | | 2.177E-13 | | 100. (56) |
| 28 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 80757290 | | 4.612E-14 | | 87.3 (57) |
| 28 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 80759093 | | 2.213E-13 | | 100. (58) |
| 28 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 80759406 | | 4.466E-13 | | 57.0 (59) 43.0 (65) |
| 28 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 80759506 | | 4.465E-13 | | 100. (60) |
| 28 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 80759507 | | 2.209E-13 | | 66.8 (61) 33.2 (55) |
| 28 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 80760617 | | 4.486E-13 | | 100. (62) |
| 28 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 80760622 | | 7.551E-13 | | 55.2 (63) 44.8 (69) |
| 28 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 80760682 | | 7.553E-13 | | 100. (64) |
| 28 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 80760698 | | 4.491E-13 | | 57.0 (65) 43.0 (59) |
| 28 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 80761348 | | 1.141E-12 | | 54.2 (66) 45.8 (71) |
| 28 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 80761349 | | 7.568E-13 | | 100. (67) |
| 28 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 80761387 | | 1.141E-12 | | 100. (68) |
| 28 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 80761396 | | 7.570E-13 | | 55.2 (69) 44.8 (63) |
| 28 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 80761832 | | 1.142E-12 | | 100. (70) |
| 28 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 80761864 | | 1.142E-12 | | 54.2 (71) 45.8 (66) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|-----------------------------------|
| 28 | 72 | $2s^2_{1/2}(J=0)$ | $2s^2\ ^1S_0$ | 127111000 | 127111439 | | 6.766E-15 | | 79.5 (72) |
| 28 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p\ ^3P_0$ | 127143000 | 127137806 | | 2.679E-15 | | 100. (73) |
| 28 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p\ ^3P_1$ | 127190000 | 127185838 | | 2.679E-15 | | 94.7 (74) |
| 28 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p\ ^3P_2$ | 127362000 | 127360732 | | 2.717E-15 | | 100. (75) |
| 28 | 76 | $2p^2_{1/2}(J=0)$ | $2p^2\ ^3P_0$ | 127437000 | 127432546 | | 1.484E-15 | | 86.2 (76) |
| 28 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2\ ^3P_1$ | 127554000 | 127551333 | | 1.342E-15 | | 100. (77) |
| 28 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2\ ^3P_2$ | 127614000 | 127611105 | | 1.341E-15 | | 60.5 (78) 39.5 (80) |
| 28 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p\ ^1P_1$ | 127662000 | 127661842 | | 2.651E-15 | | 94.7 (79) |
| 28 | 80 | $2p^2_{3/2}(J=2)$ | $2p^2\ ^1D_2$ | 127827000 | 127828140 | | 1.348E-15 | | 60.5 (80) 39.5 (78) |
| 28 | 81 | $2p^2_{3/2}(J=0)$ | $2p^2\ ^1S_0$ | 128117000 | 128117679 | | 1.513E-15 | | 80.8 (81) |
| 28 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s\ ^3S_1$ | | 138879171 | | 1.107E-14 | | 84.4 (82) |
| 28 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p\ ^1P_1$ | | 138918224 | | 3.383E-15 | | 34.4 (83) 32.9 (104) 28.8 (91) |
| 28 | 84 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s\ ^3P_0$ | | 138945033 | | 3.221E-15 | | 74.2 (84) |
| 28 | 85 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | | 138945290 | | 8.757E-15 | | 75.6 (85) |
| 28 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p\ ^3D_1$ | | 138950841 | | 2.170E-15 | | 72.7 (86) |
| 28 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p\ ^3P_1$ | | 138974474 | | 6.225E-15 | | 73.8 (87) |
| 28 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | | 138981652 | | 5.387E-15 | | 71.4 (88) 25.2 (84) 3.41 (114) |
| 28 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | | 139025457 | | 7.347E-15 | | 89.2 (89) |
| 28 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | | 139040233 | | 2.477E-15 | | 61.6 (90) 22.5 (97) 9.73 (110) |
| 28 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2p3s\ ^3P_1$ | | 139054268 | | 4.312E-15 | | 38.9 (91) 37.8 (83) 21.0 (87) |
| 28 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^1P_1$ | | 139074787 | | 2.488E-15 | | 29.3 (92) 27.4 (103) 18.0 (107) |
| 28 | 93 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 139084944 | | 2.591E-15 | | 78.3 (93) |
| 28 | 94 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 139093702 | | 2.407E-15 | | 77.5 (94) |
| 28 | 95 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 139109766 | | 1.170E-14 | | 91.9 (95) |
| 28 | 96 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 139116600 | | 8.624E-15 | | 80.5 (96) |
| 28 | 97 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d\ ^3D_2$ | | 139119702 | | 7.871E-15 | | 64.9 (97) 12.9 (101) 11.1 (110) |
| 28 | 98 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 139149476 | | 2.484E-15 | | 69.7 (98) 17.6 (111) 12.8 (115) |
| 28 | 99 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 139150999 | | 2.511E-15 | | 34.7 (102) 26.1 (99) 18.7 (113) |
| 28 | 100 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 139179837 | | 2.353E-15 | | 63.5 (100) 17.3 (117) 14.9 (112) |
| 28 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 139183329 | | 8.931E-15 | | 68.8 (101) 14.1 (90) 11.9 (97) |
| 28 | 102 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 139201614 | | 2.644E-15 | | 62.6 (102) 13.3 (109) 13.1 (113) |
| 28 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^3P_1$ | | 139235345 | | 2.081E-15 | | 53.2 (103) 32.0 (92) 13.3 (86) |
| 28 | 104 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 139262405 | | 3.007E-15 | | 63.7 (104) 20.8 (83) 13.9 (91) |
| 28 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p\ ^3P_2$ | | 139267603 | | 2.271E-15 | | 55.5 (105) 17.7 (90) 16.1 (110) |
| 28 | 106 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 139268549 | | 2.264E-15 | | 91.9 (106) |
| 28 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^3S_1$ | | 139283843 | | 2.164E-15 | | 65.9 (107) 18.4 (92) 9.33 (103) |
| 28 | 108 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 139329507 | | 2.648E-15 | | 100. (108) |
| 28 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^1D_2$ | | 139335792 | | 2.466E-15 | | 46.6 (109) 31.7 (113) 17.9 (93) |
| 28 | 110 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 139360549 | | 2.155E-15 | | 58.6 (110) 34.3 (105) 7.12 (101) |
| 28 | 111 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^3D_3$ | | 139364417 | | 2.373E-15 | | 65.6 (111) 27.2 (98) 7.20 (115) |
| 28 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 139394784 | | 2.450E-15 | | 70.7 (112) 25.1 (100) 2.29 (87) |
| 28 | 113 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3D_2$ | | 139397711 | | 2.451E-15 | | 55.7 (99) 33.1 (113) 7.22 (109) |
| 28 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 139400122 | | 2.498E-15 | | 97.2 (114) |
| 28 | 115 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | | 139457304 | | 2.230E-15 | | 80.0 (115) |
| 28 | 116 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 139459215 | | 2.197E-15 | | 78.0 (116) |
| 28 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 139479480 | | 2.404E-15 | | 78.1 (117) |
| 28 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 142966804 | | 1.179E-14 | | 81.0 (118) |
| 28 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 142980237 | | 3.227E-15 | | 46.2 (119) 29.5 (147) 23.1 (129) |
| 28 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 142983205 | | 3.528E-15 | | 70.2 (120) 29.8 (124) |
| 28 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 142985976 | | 7.957E-15 | | 70.4 (121) 14.9 (161) 14.7 (130) |
| 28 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 142995253 | | 2.589E-15 | | 72.5 (122) |
| 28 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 143002285 | | 1.307E-14 | | 73.9 (123) |
| 28 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 143014901 | | 6.628E-15 | | 69.1 (124) 29.7 (120) 1.16 (158) |
| 28 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 143024638 | | 1.036E-14 | | 85.1 (125) |
| 28 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 143032059 | | 2.889E-15 | | 46.6 (126) 20.7 (153) 18.7 (132) |
| 28 | 127 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 143047603 | | 2.698E-15 | | 73.8 (127) |
| 28 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 143047704 | | 2.870E-15 | | 38.3 (128) 20.9 (151) 18.3 (148) |
| 28 | 129 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | | 143050037 | | 7.277E-15 | | 52.0 (129) 22.7 (123) 21.7 (119) |
| 28 | 130 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 143053429 | | 3.119E-15 | | 61.6 (130) 26.6 (121) 11.7 (161) |
| 28 | 131 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 143062953 | | 2.425E-14 | | 95.5 (131) |
| 28 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 143063003 | | 1.371E-14 | | 69.9 (132) 16.8 (138) 6.10 (153) |
| 28 | 133 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 143064289 | | 1.305E-14 | | 84.7 (133) |
| 28 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 143073746 | | 2.886E-15 | | 47.4 (134) 20.9 (165) 18.6 (155) |
| 28 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 143081769 | | 2.842E-15 | | 37.1 (135) 30.0 (157) 17.4 (152) |
| 28 | 136 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 143085262 | | 2.609E-15 | | 54.1 (136) 23.8 (168) 15.6 (156) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 28 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f^3G_3$ | | 143088628 | | 2.535E-15 | | 73.0 (137) |
| 28 | 138 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d^1D_2$ | | 143091366 | | 1.250E-14 | | 77.4 (138) |
| 28 | 139 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f^3F_2$ | | 143094028 | | 2.715E-15 | | 45.7 (139) 28.3 (169) 18.8 (162) |
| 28 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f^3G_4$ | | 143095062 | | 2.533E-15 | | 41.6 (140) 31.4 (166) 27.0 (160) |
| 28 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f^3F_2$ | | 143096127 | | 3.325E-14 | | 95.0 (141) |
| 28 | 142 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f^3F_4$ | | 143097056 | | 1.124E-13 | | 100. (142) |
| 28 | 143 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f^3D_3$ | | 143097247 | | 2.660E-15 | | 48.1 (143) 29.9 (163) 16.8 (159) |
| 28 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f^3F_3$ | | 143097795 | | 1.667E-14 | | 74.7 (144) |
| 28 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f^1F_3$ | | 143102736 | | 9.918E-14 | | 88.0 (145) |
| 28 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s^3P_2$ | | 143224190 | | 2.618E-15 | | 100. (146) |
| 28 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s^1P_1$ | | 143238616 | | 2.683E-15 | | 68.3 (147) 28.0 (119) 3.70 (129) |
| 28 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p^1P_1$ | | 143242317 | | 2.348E-15 | | 45.2 (128) 35.2 (148) 14.8 (122) |
| 28 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p^3P_2$ | | 143248459 | | 2.362E-15 | | 40.5 (126) 36.6 (149) 22.9 (153) |
| 28 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p^3D_3$ | | 143259089 | | 2.368E-15 | | 99.0 (150) |
| 28 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p^3S_1$ | | 143264651 | | 2.381E-15 | | 62.1 (151) 27.0 (148) 7.27 (128) |
| 28 | 152 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d^1D_2$ | | 143285878 | | 2.548E-15 | | 52.5 (152) 25.0 (157) 21.0 (127) |
| 28 | 153 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p^1D_2$ | | 143286812 | | 2.353E-15 | | 50.2 (153) 48.5 (149) 1.31 (126) |
| 28 | 154 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d^3F_4$ | | 143287691 | | 2.606E-15 | | 100. (154) |
| 28 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d^3D_3$ | | 143294757 | | 2.528E-15 | | 50.7 (155) 41.8 (134) 7.47 (165) |
| 28 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d^3P_1$ | | 143304983 | | 2.534E-15 | | 67.2 (156) 30.8 (136) 2.04 (168) |
| 28 | 157 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d^3D_2$ | | 143306791 | | 2.535E-15 | | 51.8 (135) 36.6 (157) 10.6 (152) |
| 28 | 158 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d^3P_0$ | | 143307160 | | 2.555E-15 | | 98.9 (158) |
| 28 | 159 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f^1F_3$ | | 143314899 | | 2.571E-15 | | 37.8 (159) 35.6 (163) 26.6 (137) |
| 28 | 160 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^3F_4$ | | 143318905 | | 2.571E-15 | | 63.7 (160) 36.3 (140) |
| 28 | 161 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | | 143320276 | | 2.402E-15 | | 73.4 (161) |
| 28 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | | 143322703 | | 2.569E-15 | | 49.4 (139) 33.6 (162) 17.0 (169) |
| 28 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^3F_3$ | | 143324931 | | 2.571E-15 | | 48.3 (143) 26.2 (159) 25.5 (163) |
| 28 | 164 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | | 143325748 | | 2.570E-15 | | 100. (164) |
| 28 | 165 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^1F_3$ | | 143325822 | | 2.461E-15 | | 67.7 (165) 27.2 (155) 5.08 (134) |
| 28 | 166 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^1G_4$ | | 143326735 | | 2.569E-15 | | 68.4 (166) 22.1 (140) 9.47 (160) |
| 28 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | | 143331546 | | 2.569E-15 | | 100. (167) |
| 28 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | | 143335270 | | 2.526E-15 | | 71.1 (168) 15.2 (156) 13.7 (136) |
| 28 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | | 143337370 | | 2.566E-15 | | 52.6 (169) 45.7 (162) 1.65 (139) |
| 28 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | | 144835017 | | 1.013E-14 | | 76.3 (170) |
| 28 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s^3P_1$ | | 144839345 | | 3.128E-15 | | 52.3 (171) 28.6 (207) 16.7 (182) |
| 28 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | | 144839974 | | 3.401E-15 | | 74.5 (172) |
| 28 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | | 144842848 | | 6.922E-15 | | 64.6 (173) 20.6 (181) 14.8 (219) |
| 28 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | | 144847519 | | 2.810E-15 | | 71.1 (174) 13.2 (208) 7.26 (170) |
| 28 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | | 144853066 | | 1.857E-14 | | 70.4 (175) 21.1 (182) 2.73 (188) |
| 28 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | | 144860315 | | 8.516E-15 | | 74.5 (176) |
| 28 | 177 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | | 144863810 | | 1.040E-14 | | 80.5 (177) |
| 28 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | | 144865822 | | 2.940E-15 | | 44.3 (178) 24.9 (212) 13.9 (183) |
| 28 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | | 144873402 | | 2.742E-15 | | 72.8 (179) |
| 28 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | | 144874480 | | 3.052E-15 | | 39.2 (180) 22.6 (211) 15.7 (170) |
| 28 | 181 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | | 144877999 | | 3.675E-15 | | 50.9 (181) 34.3 (173) 14.7 (219) |
| 28 | 182 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p^1P_1$ | | 144878248 | | 9.224E-15 | | 52.3 (182) 25.1 (175) 15.6 (171) |
| 28 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | | 144883198 | | 1.720E-14 | | 71.5 (183) 15.4 (192) 3.32 (212) |
| 28 | 184 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | | 144883646 | | 1.999E-14 | | 89.3 (184) |
| 28 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | | 144884305 | | 1.876E-14 | | 89.3 (185) |
| 28 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | | 144886561 | | 2.873E-15 | | 43.4 (186) 25.4 (223) 19.5 (215) |
| 28 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | | 144891292 | | 3.065E-15 | | 38.1 (187) 28.6 (218) 18.1 (177) |
| 28 | 188 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | | 144892325 | | 2.797E-15 | | 48.4 (188) 25.7 (233) 15.1 (216) |
| 28 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | | 144892976 | | 2.565E-15 | | 74.1 (189) |
| 28 | 190 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | | 144896424 | | 2.860E-15 | | 41.6 (190) 28.2 (237) 19.1 (222) |
| 28 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | | 144896574 | | 2.563E-15 | | 41.8 (191) 32.2 (227) 25.9 (221) |
| 28 | 192 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | | 144897553 | | 1.372E-14 | | 71.1 (192) 12.6 (183) 6.53 (178) |
| 28 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | | 144897746 | | 2.564E-15 | | 72.5 (193) |
| 28 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | | 144898280 | | 2.841E-15 | | 47.4 (194) 26.6 (224) 15.4 (220) |
| 28 | 195 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | | 144898334 | | 2.581E-15 | | 42.8 (195) 32.7 (236) 24.5 (229) |
| 28 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | | 144899054 | | 2.563E-15 | | 39.7 (196) 33.0 (231) 27.3 (228) |
| 28 | 197 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | | 144899206 | | 3.634E-15 | | 40.2 (197) 29.8 (200) 19.0 (226) |
| 28 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | | 144899528 | | 3.796E-14 | | 94.9 (198) |
| 28 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^3F_3$ | | 144900264 | | 1.920E-14 | | 79.2 (199) |
| 28 | 200 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | | 144900305 | | 8.343E-15 | | 70.2 (200) 16.9 (197) 7.71 (226) |
| 28 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | | 144903359 | | 1.717E-13 | | 90.8 (201) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 28 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | 144903598 | | | 2.817E-13 | | 61.2 (202) 38.8 (205) |
| 28 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | 144903619 | | | 2.709E-13 | | 100. (203) |
| 28 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | 144904755 | | | 4.088E-13 | | 100. (204) |
| 28 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | 144904936 | | | 3.594E-13 | | 61.4 (205) 38.6 (202) |
| 28 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | 145076016 | | | 2.614E-15 | | 100. (206) |
| 28 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | 145081116 | | | 2.629E-15 | | 68.2 (207) 31.8 (171) |
| 28 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^1P_1$ | 145085370 | | | 2.469E-15 | | 45.2 (180) 32.6 (208) 14.4 (174) |
| 28 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^3P_2$ | 145087677 | | | 2.472E-15 | | 45.2 (178) 31.8 (209) 23.0 (212) |
| 28 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | 145094351 | | | 2.473E-15 | | 100. (210) |
| 28 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p^3S_1$ | 145096317 | | | 2.479E-15 | | 59.3 (211) 32.4 (208) 5.96 (180) |
| 28 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^1D_2$ | 145106714 | | | 2.470E-15 | | 52.2 (209) 46.6 (212) 1.27 (178) |
| 28 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^1D_2$ | 145107772 | | | 2.579E-15 | | 53.1 (213) 24.3 (218) 21.5 (179) |
| 28 | 214 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | 145109082 | | | 2.604E-15 | | 100. (214) |
| 28 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d^3D_3$ | 145111736 | | | 2.572E-15 | | 46.2 (215) 46.0 (186) 7.77 (223) |
| 28 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d^3P_1$ | 145116136 | | | 2.569E-15 | | 66.0 (216) 32.1 (188) 1.91 (233) |
| 28 | 217 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d^3P_0$ | 145117087 | | | 2.578E-15 | | 100. (217) |
| 28 | 218 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^3D_2$ | 145117278 | | | 2.571E-15 | | 50.7 (187) 37.3 (218) 12.0 (213) |
| 28 | 219 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p^1S_0$ | 145121019 | | | 2.490E-15 | | 70.4 (219) 28.6 (181) 1.02 (173) |
| 28 | 220 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f^1F_3$ | 145121898 | | | 2.592E-15 | | 38.8 (220) 35.5 (224) 25.7 (189) |
| 28 | 221 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f^3F_4$ | 145123919 | | | 2.592E-15 | | 61.1 (221) 38.9 (191) |
| 28 | 222 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f^3D_2$ | 145125731 | | | 2.591E-15 | | 50.8 (190) 35.3 (222) 13.9 (237) |
| 28 | 223 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d^1F_3$ | 145126163 | | | 2.539E-15 | | 63.0 (223) 31.5 (215) 5.48 (186) |
| 28 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f^3F_3$ | 145126755 | | | 2.592E-15 | | 46.2 (194) 27.2 (224) 26.6 (220) |
| 28 | 225 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f^3G_5$ | 145126842 | | | 2.590E-15 | | 100. (225) |
| 28 | 226 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g^3G_4$ | 145127086 | | | 2.602E-15 | | 39.2 (226) 33.7 (230) 27.1 (193) |
| 28 | 227 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f^3G_4$ | 145127961 | | | 2.590E-15 | | 67.7 (227) 19.3 (191) 13.0 (221) |
| 28 | 228 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g^3G_5$ | 145128241 | | | 2.602E-15 | | 70.0 (228) 26.0 (196) 4.05 (231) |
| 28 | 229 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g^3F_3$ | 145128493 | | | 2.602E-15 | | 57.0 (195) 23.0 (229) 20.0 (236) |
| 28 | 230 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g^1G_4$ | 145129627 | | | 2.602E-15 | | 42.4 (197) 32.4 (230) 25.2 (226) |
| 28 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g^1H_5$ | 145129648 | | | 2.600E-15 | | 62.9 (231) 34.3 (196) 2.76 (228) |
| 28 | 232 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f^3D_1$ | 145129731 | | | 2.590E-15 | | 100. (232) |
| 28 | 233 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d^1P_1$ | 145130626 | | | 2.566E-15 | | 68.0 (233) 16.6 (216) 15.4 (188) |
| 28 | 234 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g^3H_6$ | 145130719 | | | 2.600E-15 | | 100. (234) |
| 28 | 235 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g^3F_2$ | 145131524 | | | 2.599E-15 | | 100. (235) |
| 28 | 236 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g^1F_3$ | 145132758 | | | 2.599E-15 | | 52.5 (229) 47.5 (236) |
| 28 | 237 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f^1D_2$ | 145133081 | | | 2.589E-15 | | 54.2 (237) 43.3 (222) 2.51 (190) |
| 28 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s^3S_1$ | 145842335 | | | 7.633E-15 | | 67.5 (238) 10.1 (284) 10.1 (287) |
| 28 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s^3P_1$ | 145843188 | | | 3.032E-15 | | 55.4 (239) 28.8 (283) 12.8 (250) |
| 28 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s^3P_0$ | 145843456 | | | 3.193E-15 | | 80.1 (240) |
| 28 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s^1S_0$ | 145846099 | | | 5.853E-15 | | 57.4 (241) 26.6 (249) 16.1 (295) |
| 28 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p^3D_1$ | 145848149 | | | 3.024E-15 | | 68.6 (242) 12.2 (238) 10.3 (284) |
| 28 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p^3P_1$ | 145853117 | | | 1.916E-14 | | 67.3 (243) 22.8 (250) 4.32 (257) |
| 28 | 244 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p^3P_0$ | 145857322 | | | 1.153E-14 | | 80.3 (244) |
| 28 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p^3D_2$ | 145858474 | | | 2.885E-15 | | 44.8 (245) 27.4 (288) 13.9 (285) |
| 28 | 246 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p^3P_2$ | 145858781 | | | 8.381E-15 | | 71.8 (246) 13.8 (255) 7.76 (289) |
| 28 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d^3F_2$ | 145862692 | | | 2.781E-15 | | 72.0 (247) 12.6 (289) 7.54 (294) |
| 28 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p^3P_1$ | 145863871 | | | 3.248E-15 | | 38.2 (248) 22.7 (287) 20.6 (238) |
| 28 | 249 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p^3P_0$ | 145866444 | | | 4.299E-15 | | 42.7 (249) 42.2 (241) 15.1 (295) |
| 28 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p^1P_1$ | 145867531 | | | 1.001E-14 | | 48.7 (250) 28.9 (243) 12.0 (239) |
| 28 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d^3D_2$ | 145870100 | | | 1.441E-14 | | 70.9 (251) 12.9 (269) 5.42 (259) |
| 28 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d^3F_3$ | 145870221 | | | 2.770E-15 | | 43.3 (252) 28.4 (298) 20.5 (291) |
| 28 | 253 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d^3D_3$ | 145870365 | | | 1.149E-14 | | 78.8 (253) |
| 28 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d^3D_1$ | 145870981 | | | 2.719E-14 | | 92.2 (254) |
| 28 | 255 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d^3P_2$ | 145873405 | | | 3.367E-15 | | 35.8 (255) 26.0 (294) 24.9 (246) |
| 28 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f^3G_3$ | 145873474 | | | 2.582E-15 | | 74.6 (256) |
| 28 | 257 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d^3D_1$ | 145873695 | | | 3.051E-15 | | 43.6 (257) 25.2 (310) 16.0 (250) |
| 28 | 258 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f^3G_4$ | 145875614 | | | 2.572E-15 | | 41.8 (258) 32.7 (303) 25.5 (297) |
| 28 | 259 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f^3F_2$ | 145875899 | | | 2.914E-15 | | 40.3 (259) 28.5 (321) 19.0 (299) |
| 28 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g^3H_4$ | 145876311 | | | 2.569E-15 | | 72.8 (260) |
| 28 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g^3G_3$ | 145876717 | | | 2.575E-15 | | 42.3 (261) 33.0 (320) 24.7 (305) |
| 28 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g^3H_5$ | 145877089 | | | 2.569E-15 | | 39.8 (262) 33.2 (308) 27.0 (304) |
| 28 | 263 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f^3D_3$ | 145877116 | | | 3.230E-15 | | 42.6 (263) 22.8 (301) 20.9 (253) |
| 28 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h^1I_5$ | 145877205 | | | 2.570E-15 | | 71.9 (264) 17.4 (315) 10.7 (306) |
| 28 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g^3F_4$ | 145877332 | | | 2.628E-15 | | 56.3 (265) 25.7 (302) 15.7 (309) |
| 28 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h^3H_4$ | 145877439 | | | 2.571E-15 | | 40.3 (266) 33.1 (319) 26.5 (311) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 28 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 145877686 | | 2.570E-15 | | 38.8 (267) 33.3 (313) 28.0 (312) |
| 28 | 268 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 145877917 | | 2.571E-15 | | 59.6 (268) 24.1 (306) 16.3 (315) |
| 28 | 269 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 145878332 | | 2.425E-14 | | 80.4 (269) |
| 28 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 145879519 | | 5.027E-14 | | 96.7 (270) |
| 28 | 271 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 145879836 | | 3.034E-14 | | 84.3 (271) |
| 28 | 272 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 145879930 | | 8.999E-14 | | 98.7 (272) |
| 28 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 145881912 | | 2.869E-13 | | 92.0 (273) |
| 28 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 145882054 | | 3.979E-13 | | 100. (274) |
| 28 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 145882067 | | 4.521E-13 | | 65.0 (275) 35.0 (277) |
| 28 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 145882713 | | 6.985E-13 | | 100. (276) |
| 28 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 145882851 | | 6.014E-13 | | 65.2 (277) 34.8 (275) |
| 28 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 145882909 | | 9.901E-13 | | 55.0 (278) 45.0 (281) |
| 28 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 145882923 | | 1.018E-12 | | 100. (279) |
| 28 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 145883390 | | 9.926E-13 | | 100. (280) |
| 28 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 145883402 | | 1.024E-12 | | 55.0 (281) 45.0 (278) |
| 28 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 146076986 | | 2.615E-15 | | 100. (282) |
| 28 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 146079263 | | 2.619E-15 | | 67.4 (283) 32.6 (239) |
| 28 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 146082389 | | 2.534E-15 | | 46.0 (248) 29.8 (284) 13.9 (242) |
| 28 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 146083559 | | 2.533E-15 | | 46.9 (245) 29.9 (285) 23.2 (288) |
| 28 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 146087727 | | 2.533E-15 | | 100. (286) |
| 28 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3S_1$ | | 146088424 | | 2.536E-15 | | 56.5 (287) 36.0 (284) 4.70 (248) |
| 28 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 146094380 | | 2.532E-15 | | 53.8 (285) 45.0 (288) 1.19 (245) |
| 28 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 146095394 | | 2.596E-15 | | 53.7 (289) 24.4 (294) 21.9 (247) |
| 28 | 290 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 146096241 | | 2.608E-15 | | 100. (290) |
| 28 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 146097525 | | 2.592E-15 | | 47.8 (252) 44.1 (291) 8.06 (298) |
| 28 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 146099740 | | 2.587E-15 | | 65.8 (292) 32.4 (257) 1.77 (310) |
| 28 | 293 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 146100195 | | 2.591E-15 | | 100. (293) |
| 28 | 294 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 146100495 | | 2.589E-15 | | 50.1 (255) 37.2 (294) 12.7 (289) |
| 28 | 295 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 146101416 | | 2.542E-15 | | 69.1 (295) 30.9 (249) |
| 28 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 146103333 | | 2.604E-15 | | 39.2 (296) 35.4 (301) 25.3 (256) |
| 28 | 297 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 146104479 | | 2.604E-15 | | 59.5 (297) 40.5 (258) |
| 28 | 298 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 146105438 | | 2.575E-15 | | 60.9 (298) 33.6 (291) 5.49 (252) |
| 28 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 146105499 | | 2.602E-15 | | 51.3 (259) 36.1 (299) 12.6 (321) |
| 28 | 300 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 146105995 | | 2.603E-15 | | 100. (300) |
| 28 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 146106072 | | 2.602E-15 | | 45.4 (263) 27.8 (301) 26.8 (296) |
| 28 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 146106339 | | 2.609E-15 | | 39.1 (302) 34.0 (309) 26.8 (260) |
| 28 | 303 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 146106760 | | 2.604E-15 | | 67.1 (303) 17.7 (258) 15.2 (297) |
| 28 | 304 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 146107006 | | 2.609E-15 | | 68.9 (304) 28.4 (262) 2.70 (308) |
| 28 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 146107181 | | 2.608E-15 | | 57.4 (261) 23.1 (305) 19.5 (320) |
| 28 | 306 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 146107619 | | 2.610E-15 | | 39.3 (306) 32.9 (315) 27.8 (264) |
| 28 | 307 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 146107655 | | 2.601E-15 | | 100. (307) |
| 28 | 308 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 146107748 | | 2.607E-15 | | 64.1 (308) 31.7 (262) 4.14 (304) |
| 28 | 309 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^1G_4$ | | 146107829 | | 2.608E-15 | | 42.0 (265) 32.4 (309) 25.6 (302) |
| 28 | 310 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 146107832 | | 2.586E-15 | | 66.7 (310) 17.0 (292) 16.3 (257) |
| 28 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 146108047 | | 2.611E-15 | | 59.5 (266) 21.6 (311) 18.9 (319) |
| 28 | 312 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 146108061 | | 2.609E-15 | | 65.5 (312) 33.1 (267) 1.44 (313) |
| 28 | 313 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 146108311 | | 2.605E-15 | | 65.3 (313) 28.1 (267) 6.61 (312) |
| 28 | 314 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 146108323 | | 2.607E-15 | | 100. (314) |
| 28 | 315 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 146108507 | | 2.611E-15 | | 40.1 (268) 33.8 (315) 26.2 (306) |
| 28 | 316 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 146108761 | | 2.604E-15 | | 100. (316) |
| 28 | 317 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 146108901 | | 2.607E-15 | | 100. (317) |
| 28 | 318 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 146109055 | | 2.609E-15 | | 100. (318) |
| 28 | 319 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 146109517 | | 2.609E-15 | | 51.9 (311) 48.1 (319) |
| 28 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^1F_3$ | | 146109636 | | 2.607E-15 | | 52.2 (305) 47.8 (320) |
| 28 | 321 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 146109689 | | 2.601E-15 | | 54.8 (321) 42.2 (299) 3.00 (259) |
| 29 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 29 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 67035380 | 67034666 | | 1.579E-09 | | 100. (2) |
| 29 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 67303150 | 67302716 | | 2.351E-09 | | 100. (3) |
| 29 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 67322950 | 67322508 | | 1.008E-14 | | 87.6 (4) |
| 29 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 67324970 | 67324336 | | 3.180E-03 | | 100. (5) |
| 29 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 67519170 | 67518845 | | 5.409E-11 | | 100. (6) |
| 29 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 67678080 | 67677297 | | 1.460E-15 | | 87.6 (7) |
| 29 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 79453200 | 79452707 | | 2.114E-13 | | 100. (8) |
| 29 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 79527000 | 79526546 | | 7.067E-14 | | 100. (9) |
| 29 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 79530300 | 79529075 | | 2.201E-13 | | 100. (10) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|-----------------------|
| 29 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p^3P_1$ | 79532500 | 79532173 | | 2.350E-14 | | 86.6 (11) |
| 29 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 79591200 | 79590877 | | 7.345E-14 | | 100. (12) |
| 29 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 79629700 | 79629276 | | 2.455E-14 | | 64.0 (13) 36.0 (17) |
| 29 | 14 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 79630800 | 79630371 | | 2.455E-14 | | 100. (14) |
| 29 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 79634300 | 79633789 | | 5.056E-15 | | 86.6 (15) |
| 29 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 79651400 | 79650939 | | 2.492E-14 | | 100. (16) |
| 29 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 79654200 | 79653723 | | 2.499E-14 | | 64.0 (17) 36.0 (13) |
| 29 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s^3S_1$ | 83754400 | 83754729 | | 3.082E-13 | | 100. (18) |
| 29 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 83785300 | 83785088 | | 1.208E-13 | | 100. (19) |
| 29 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 83786500 | 83785682 | | 3.192E-13 | | 100. (20) |
| 29 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 83787700 | 83787427 | | 4.979E-14 | | 86.3 (21) |
| 29 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 83812400 | 83812233 | | 1.247E-13 | | 100. (22) |
| 29 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 83828600 | 83828113 | | 5.706E-14 | | 65.3 (23) 34.7 (28) |
| 29 | 24 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 83829100 | 83828471 | | 5.706E-14 | | 100. (24) |
| 29 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 83830600 | 83829780 | | 1.203E-14 | | 86.3 (25) |
| 29 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 83837800 | 83837155 | | 5.797E-14 | | 100. (26) |
| 29 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | | 83838171 | | 1.170E-13 | | 56.8 (27) 43.2 (31) |
| 29 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | 83838900 | 83838517 | | 5.818E-14 | | 65.3 (28) 34.7 (23) |
| 29 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | | 83838554 | | 1.170E-13 | | 100. (29) |
| 29 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | | 83842903 | | 1.175E-13 | | 100. (30) |
| 29 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | | 83843199 | | 1.176E-13 | | 56.8 (31) 43.2 (27) |
| 29 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 85734300 | 85734470 | | 4.887E-13 | | 100. (32) |
| 29 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | | 85749817 | | 2.071E-13 | | 100. (33) |
| 29 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 85750700 | 85750013 | | 4.953E-13 | | 100. (34) |
| 29 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 85751300 | 85751005 | | 9.232E-14 | | 86.1 (35) |
| 29 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 85763900 | 85763706 | | 2.130E-13 | | 100. (36) |
| 29 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | | 85771759 | | 1.098E-13 | | 65.8 (37) 34.2 (42) |
| 29 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | | 85771920 | | 1.099E-13 | | 100. (38) |
| 29 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 85773200 | 85772557 | | 2.350E-14 | | 86.1 (39) |
| 29 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | | 85776367 | | 1.118E-13 | | 100. (40) |
| 29 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 85776933 | | 2.258E-13 | | 56.9 (41) 43.1 (47) |
| 29 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 85777105 | | 1.118E-13 | | 65.8 (42) 34.2 (37) |
| 29 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 85777127 | | 2.259E-13 | | 100. (43) |
| 29 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 85779354 | | 2.270E-13 | | 100. (44) |
| 29 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 85779380 | | 3.806E-13 | | 55.2 (45) 44.8 (49) |
| 29 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 85779495 | | 3.807E-13 | | 100. (46) |
| 29 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 85779509 | | 2.272E-13 | | 56.9 (47) 43.1 (41) |
| 29 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 85780831 | | 3.815E-13 | | 100. (48) |
| 29 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 85780922 | | 3.815E-13 | | 55.2 (49) 44.8 (45) |
| 29 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 86805867 | | 7.539E-13 | | 100. (50) |
| 29 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 86814675 | | 3.336E-13 | | 100. (51) |
| 29 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 86814767 | | 7.473E-13 | | 100. (52) |
| 29 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 86815360 | | 1.546E-13 | | 86.0 (53) |
| 29 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 86822710 | | 3.423E-13 | | 100. (54) |
| 29 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 86827329 | | 1.876E-13 | | 66.1 (55) 33.9 (61) |
| 29 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 86827417 | | 1.880E-13 | | 100. (56) |
| 29 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 86827792 | | 4.048E-14 | | 86.0 (57) |
| 29 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 86829989 | | 1.913E-13 | | 100. (58) |
| 29 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 86830315 | | 3.858E-13 | | 57.0 (59) 43.0 (65) |
| 29 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 86830427 | | 3.857E-13 | | 100. (60) |
| 29 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 86830430 | | 1.909E-13 | | 66.1 (61) 33.9 (55) |
| 29 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 86831716 | | 3.878E-13 | | 100. (62) |
| 29 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 86831722 | | 6.527E-13 | | 55.2 (63) 44.8 (69) |
| 29 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 86831788 | | 6.528E-13 | | 100. (64) |
| 29 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 86831807 | | 3.882E-13 | | 57.0 (65) 43.0 (59) |
| 29 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 86832562 | | 9.860E-13 | | 54.2 (66) 45.8 (71) |
| 29 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 86832562 | | 6.542E-13 | | 100. (67) |
| 29 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 86832605 | | 9.861E-13 | | 100. (68) |
| 29 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 86832615 | | 6.543E-13 | | 55.2 (69) 44.8 (63) |
| 29 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 86833120 | | 9.873E-13 | | 100. (70) |
| 29 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 86833157 | | 9.873E-13 | | 54.2 (71) 45.8 (66) |
| 29 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 136557000 | 136558087 | | 5.808E-15 | | 79.4 (72) |
| 29 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 136591000 | 136583492 | | 2.325E-15 | | 100. (73) |
| 29 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 136644000 | 136636680 | | 2.325E-15 | | 93.9 (74) |
| 29 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 136838000 | 136840817 | | 2.360E-15 | | 100. (75) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 29 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2\ ^3P_0$ | 136904000 | 136896100 | | 1.304E-15 | | 84.4 (76) |
| 29 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2\ ^3P_1$ | 137042000 | 137038302 | | 1.166E-15 | | 100. (77) |
| 29 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2\ ^3P_2$ | 137106000 | 137101821 | | 1.164E-15 | | 57.8 (78) 42.2 (80) |
| 29 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p\ ^1P_1$ | 137152000 | 137150023 | | 2.306E-15 | | 93.9 (79) |
| 29 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2\ ^1D_2$ | 137348000 | 137349742 | | 1.172E-15 | | 57.8 (80) 42.2 (78) |
| 29 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2\ ^1S_0$ | 137639000 | 137643427 | | 1.301E-15 | | 80.5 (81) |
| 29 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s\ ^3S_1$ | | 149208619 | | 9.903E-15 | | 84.3 (82) |
| 29 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2s3p\ ^1P_1$ | | 149249206 | | 2.905E-15 | | 32.7 (83) 32.2 (104) 31.0 (91) |
| 29 | 84 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s\ ^3P_0$ | | 149275153 | | 2.779E-15 | | 74.8 (84) |
| 29 | 85 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | | 149276416 | | 7.469E-15 | | 75.3 (85) |
| 29 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p\ ^3D_1$ | | 149281477 | | 1.885E-15 | | 72.7 (86) |
| 29 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p\ ^3P_1$ | | 149307566 | | 5.423E-15 | | 72.8 (87) |
| 29 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | | 149314152 | | 4.767E-15 | | 72.5 (88) |
| 29 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | | 149366963 | | 6.407E-15 | | 89.4 (89) |
| 29 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | | 149382907 | | 2.143E-15 | | 60.4 (90) 22.1 (97) 10.8 (110) |
| 29 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2p3s\ ^3P_1$ | | 149398415 | | 3.934E-15 | | 41.4 (83) 35.3 (91) 21.4 (87) |
| 29 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | | 149417636 | | 2.155E-15 | | 28.9 (92) 26.9 (103) 19.2 (107) |
| 29 | 93 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 149427806 | | 2.252E-15 | | 77.4 (93) |
| 29 | 94 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 149432366 | | 2.122E-15 | | 75.4 (94) |
| 29 | 95 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 149457916 | | 1.140E-14 | | 93.7 (95) |
| 29 | 96 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 149460635 | | 7.737E-15 | | 81.4 (96) |
| 29 | 97 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d\ ^3D_2$ | | 149464431 | | 7.114E-15 | | 66.0 (97) 12.9 (101) 10.4 (110) |
| 29 | 98 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 149498698 | | 2.150E-15 | | 67.7 (98) 18.3 (111) 14.0 (116) |
| 29 | 99 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 149503435 | | 2.184E-15 | | 29.6 (99) 23.3 (102) 22.8 (113) |
| 29 | 100 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 149526902 | | 2.043E-15 | | 62.6 (100) 18.4 (117) 15.4 (112) |
| 29 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 149534980 | | 8.616E-15 | | 72.3 (101) |
| 29 | 102 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 149563578 | | 2.298E-15 | | 74.9 (102) |
| 29 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^1P_1$ | | 149603383 | | 1.804E-15 | | 53.9 (92) 30.5 (103) 13.0 (86) |
| 29 | 104 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 149626268 | | 2.570E-15 | | 64.8 (104) 18.4 (83) 15.6 (91) |
| 29 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p\ ^3P_2$ | | 149634172 | | 1.939E-15 | | 51.2 (105) 20.4 (90) 19.5 (110) |
| 29 | 106 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 149642895 | | 1.928E-15 | | 93.7 (106) |
| 29 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^3S_1$ | | 149657129 | | 1.865E-15 | | 64.4 (107) 22.1 (103) 7.47 (92) |
| 29 | 108 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 149710241 | | 2.302E-15 | | 100. (108) |
| 29 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^1D_2$ | | 149714506 | | 2.145E-15 | | 47.6 (109) 30.8 (113) 18.4 (93) |
| 29 | 110 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 149737758 | | 1.847E-15 | | 56.5 (110) 38.2 (105) 5.36 (101) |
| 29 | 111 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^3D_3$ | | 149744172 | | 2.068E-15 | | 63.0 (111) 29.2 (98) 7.83 (116) |
| 29 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 149774773 | | 2.122E-15 | | 70.0 (112) 26.1 (100) 1.96 (87) |
| 29 | 113 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3D_2$ | | 149779322 | | 2.125E-15 | | 55.2 (99) 33.3 (113) 8.02 (109) |
| 29 | 114 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 149780269 | | 2.165E-15 | | 97.5 (114) |
| 29 | 115 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 149839188 | | 1.893E-15 | | 77.5 (115) |
| 29 | 116 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 149841195 | | 1.940E-15 | | 78.1 (116) |
| 29 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 149864594 | | 2.087E-15 | | 77.1 (117) |
| 29 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 153602084 | | 1.030E-14 | | 81.1 (118) |
| 29 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 153615782 | | 2.755E-15 | | 47.8 (119) 29.5 (147) 21.6 (129) |
| 29 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 153618241 | | 3.035E-15 | | 71.0 (120) 29.0 (124) |
| 29 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 153621523 | | 6.765E-15 | | 69.8 (121) 15.5 (130) 14.7 (160) |
| 29 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 153630887 | | 2.251E-15 | | 72.4 (122) |
| 29 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 153638875 | | 1.156E-14 | | 73.9 (123) |
| 29 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 153651526 | | 5.894E-15 | | 70.7 (124) 29.3 (120) |
| 29 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 153664918 | | 9.002E-15 | | 85.1 (125) |
| 29 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 153672321 | | 2.482E-15 | | 46.4 (126) 21.4 (153) 17.8 (131) |
| 29 | 127 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 153687963 | | 2.474E-15 | | 38.8 (127) 21.6 (151) 17.5 (148) |
| 29 | 128 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 153688141 | | 2.340E-15 | | 73.8 (128) |
| 29 | 129 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | | 153690958 | | 6.669E-15 | | 53.6 (129) 23.3 (123) 19.6 (119) |
| 29 | 130 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 153691876 | | 2.749E-15 | | 59.8 (130) 27.7 (121) 12.5 (160) |
| 29 | 131 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 153704623 | | 1.247E-14 | | 70.8 (131) 16.7 (138) 5.61 (153) |
| 29 | 132 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 153705661 | | 1.188E-14 | | 85.5 (132) |
| 29 | 133 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 153705675 | | 2.141E-14 | | 95.5 (133) |
| 29 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 153716502 | | 2.491E-15 | | 46.8 (134) 21.7 (164) 18.8 (155) |
| 29 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 153724619 | | 2.469E-15 | | 37.6 (135) 30.0 (158) 16.9 (152) |
| 29 | 136 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 153727168 | | 2.268E-15 | | 53.3 (136) 24.4 (168) 15.7 (156) |
| 29 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 153731587 | | 2.203E-15 | | 73.1 (137) |
| 29 | 138 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 153734919 | | 9.574E-15 | | 75.3 (138) |
| 29 | 139 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 153737258 | | 2.443E-15 | | 43.0 (139) 27.2 (169) 18.0 (162) |
| 29 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 153738771 | | 2.201E-15 | | 41.6 (140) 31.6 (166) 26.8 (161) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 29 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f^3F_2$ | 153739802 | | | 3.018E-14 | | 95.3 (141) |
| 29 | 142 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f^3D_3$ | 153741022 | | | 2.313E-15 | | 48.5 (142) 29.7 (163) 16.5 (159) |
| 29 | 143 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f^3F_4$ | 153741374 | | | 1.004E-13 | | 100. (143) |
| 29 | 144 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f^3F_3$ | 153741557 | | | 1.507E-14 | | 73.7 (144) |
| 29 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f^1F_3$ | 153747144 | | | 8.423E-14 | | 86.4 (145) |
| 29 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s^3P_2$ | 153894558 | | | 2.276E-15 | | 100. (146) |
| 29 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s^1P_1$ | 153908865 | | | 2.320E-15 | | 68.3 (147) 28.7 (119) 3.01 (129) |
| 29 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p^1P_1$ | 153913827 | | | 2.041E-15 | | 46.7 (127) 32.2 (148) 14.2 (122) |
| 29 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p^3P_2$ | 153919635 | | | 2.051E-15 | | 41.5 (126) 34.5 (149) 24.0 (153) |
| 29 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p^3D_3$ | 153933810 | | | 2.054E-15 | | 100. (150) |
| 29 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p^3S_1$ | 153938856 | | | 2.063E-15 | | 60.0 (151) 30.6 (148) 5.69 (127) |
| 29 | 152 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d^1D_2$ | 153962059 | | | 2.215E-15 | | 51.9 (152) 25.8 (158) 21.2 (128) |
| 29 | 153 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p^1D_2$ | 153962480 | | | 2.043E-15 | | 50.3 (149) 48.6 (153) 1.11 (126) |
| 29 | 154 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d^3F_4$ | 153964644 | | | 2.265E-15 | | 100. (154) |
| 29 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d^3D_3$ | 153971231 | | | 2.199E-15 | | 49.0 (155) 42.9 (134) 8.11 (164) |
| 29 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d^3P_1$ | 153981456 | | | 2.201E-15 | | 66.7 (156) 31.2 (136) 2.09 (168) |
| 29 | 157 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d^3P_0$ | 153983693 | | | 2.218E-15 | | 100. (157) |
| 29 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d^3D_2$ | 153984033 | | | 2.203E-15 | | 52.2 (135) 36.1 (158) 11.7 (152) |
| 29 | 159 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f^1F_3$ | 153992977 | | | 2.236E-15 | | 37.3 (159) 36.3 (163) 26.4 (137) |
| 29 | 160 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | 153996641 | | | 2.080E-15 | | 72.9 (160) |
| 29 | 161 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^3F_4$ | 153997442 | | | 2.236E-15 | | 62.3 (161) 37.7 (140) |
| 29 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | 154001005 | | | 2.234E-15 | | 49.8 (139) 33.6 (162) 16.6 (169) |
| 29 | 163 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^3F_3$ | 154003770 | | | 2.236E-15 | | 47.8 (142) 27.0 (159) 25.2 (163) |
| 29 | 164 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^1F_3$ | 154003871 | | | 2.141E-15 | | 66.3 (164) 28.9 (155) 4.80 (134) |
| 29 | 165 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | 154004714 | | | 2.235E-15 | | 100. (165) |
| 29 | 166 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^1G_4$ | 154005450 | | | 2.235E-15 | | 68.4 (166) 20.7 (140) 10.9 (161) |
| 29 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | 154010213 | | | 2.235E-15 | | 100. (167) |
| 29 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | 154013774 | | | 2.194E-15 | | 70.5 (168) 15.7 (156) 13.8 (136) |
| 29 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | 154016734 | | | 2.232E-15 | | 52.7 (169) 45.6 (162) 1.74 (139) |
| 29 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | 155610591 | | | 8.616E-15 | | 75.8 (170) |
| 29 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s^3P_1$ | 155614807 | | | 2.671E-15 | | 53.5 (171) 28.9 (207) 15.4 (182) |
| 29 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | 155615211 | | | 2.919E-15 | | 75.5 (172) |
| 29 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | 155618446 | | | 5.867E-15 | | 63.7 (173) 21.4 (181) 14.8 (219) |
| 29 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | 155623123 | | | 2.458E-15 | | 70.6 (174) 13.1 (208) 8.54 (170) |
| 29 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | 155629338 | | | 1.653E-14 | | 70.4 (175) 21.5 (182) 2.67 (188) |
| 29 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | 155636608 | | | 7.653E-15 | | 75.4 (176) |
| 29 | 177 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | 155641947 | | | 8.916E-15 | | 80.3 (177) |
| 29 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | 155643690 | | | 2.523E-15 | | 44.5 (178) 25.5 (212) 13.1 (209) |
| 29 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | 155651439 | | | 2.381E-15 | | 72.8 (179) |
| 29 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | 155652351 | | | 2.625E-15 | | 39.7 (180) 23.1 (211) 15.1 (170) |
| 29 | 181 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | 155654950 | | | 3.244E-15 | | 49.6 (181) 35.4 (173) 15.1 (219) |
| 29 | 182 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p^1P_1$ | 155656644 | | | 8.403E-15 | | 53.1 (182) 25.7 (175) 14.1 (171) |
| 29 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | 155662056 | | | 1.553E-14 | | 72.1 (183) 15.4 (192) 3.02 (212) |
| 29 | 184 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | 155663026 | | | 1.691E-14 | | 88.9 (184) |
| 29 | 185 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | 155663058 | | | 1.741E-14 | | 90.1 (185) |
| 29 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | 155665660 | | | 2.473E-15 | | 43.4 (186) 26.0 (223) 19.7 (215) |
| 29 | 187 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | 155670476 | | | 2.665E-15 | | 38.3 (187) 28.6 (218) 18.2 (177) |
| 29 | 188 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | 155670986 | | | 2.432E-15 | | 48.0 (188) 26.1 (233) 15.1 (216) |
| 29 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | 155672183 | | | 2.229E-15 | | 74.2 (189) |
| 29 | 190 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | 155675762 | | | 2.435E-15 | | 42.3 (190) 29.0 (237) 19.5 (222) |
| 29 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | 155676177 | | | 2.226E-15 | | 41.8 (191) 32.3 (227) 25.8 (221) |
| 29 | 192 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | 155677342 | | | 1.369E-14 | | 74.2 (192) |
| 29 | 193 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | 155677373 | | | 2.228E-15 | | 72.6 (193) |
| 29 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | 155677950 | | | 2.480E-15 | | 47.5 (194) 26.4 (224) 15.2 (220) |
| 29 | 195 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | 155677971 | | | 2.240E-15 | | 42.7 (195) 32.8 (236) 24.6 (229) |
| 29 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | 155678880 | | | 2.227E-15 | | 39.7 (196) 33.1 (231) 27.2 (228) |
| 29 | 197 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | 155679116 | | | 2.724E-15 | | 46.7 (197) 22.0 (226) 18.4 (200) |
| 29 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | 155679428 | | | 3.514E-14 | | 95.3 (198) |
| 29 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^3F_3$ | 155680204 | | | 1.803E-14 | | 78.7 (199) |
| 29 | 200 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | 155680450 | | | 1.146E-14 | | 81.6 (200) |
| 29 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | 155683660 | | | 1.454E-13 | | 89.5 (201) |
| 29 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | 155683931 | | | 2.537E-13 | | 60.7 (202) 39.3 (205) |
| 29 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | 155683956 | | | 2.461E-13 | | 100. (203) |
| 29 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | 155685281 | | | 3.550E-13 | | 100. (204) |
| 29 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | 155685473 | | | 3.186E-13 | | 60.9 (205) 39.1 (202) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 29 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 155886568 | | 2.273E-15 | | 100. (206) |
| 29 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 155891713 | | 2.283E-15 | | 68.0 (207) 32.0 (171) |
| 29 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^1P_1$ | | 155896432 | | 2.148E-15 | | 46.5 (180) 29.6 (208) 13.8 (174) |
| 29 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^3P_2$ | | 155898649 | | 2.149E-15 | | 45.7 (178) 30.4 (209) 23.9 (212) |
| 29 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 155907168 | | 2.150E-15 | | 100. (210) |
| 29 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^3S_1$ | | 155908939 | | 2.154E-15 | | 57.1 (211) 35.6 (208) 4.56 (180) |
| 29 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | | 155919966 | | 2.148E-15 | | 53.5 (209) 45.4 (212) 1.08 (178) |
| 29 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | | 155921278 | | 2.243E-15 | | 52.5 (213) 25.7 (218) 21.8 (179) |
| 29 | 214 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 155923005 | | 2.265E-15 | | 100. (214) |
| 29 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | | 155925377 | | 2.237E-15 | | 46.8 (186) 44.7 (215) 8.44 (223) |
| 29 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 155929778 | | 2.234E-15 | | 65.6 (216) 32.4 (188) 1.99 (233) |
| 29 | 217 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 155930761 | | 2.242E-15 | | 100. (217) |
| 29 | 218 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^1D_2$ | | 155931328 | | 2.236E-15 | | 50.8 (187) 36.0 (218) 13.2 (213) |
| 29 | 219 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 155934648 | | 2.162E-15 | | 70.7 (219) 29.3 (181) |
| 29 | 220 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | | 155936338 | | 2.255E-15 | | 38.2 (220) 36.2 (224) 25.6 (189) |
| 29 | 221 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 155938578 | | 2.255E-15 | | 59.6 (221) 40.4 (191) |
| 29 | 222 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 155940289 | | 2.254E-15 | | 51.0 (190) 35.3 (222) 13.7 (237) |
| 29 | 223 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 155940588 | | 2.208E-15 | | 62.0 (223) 33.0 (215) 5.07 (186) |
| 29 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | | 155941586 | | 2.255E-15 | | 45.9 (194) 27.4 (220) 26.6 (224) |
| 29 | 225 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 155941708 | | 2.253E-15 | | 100. (225) |
| 29 | 226 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | | 155941962 | | 2.264E-15 | | 39.7 (226) 33.3 (232) 27.0 (193) |
| 29 | 227 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 155942746 | | 2.254E-15 | | 67.5 (227) 17.8 (191) 14.7 (221) |
| 29 | 228 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 155943286 | | 2.264E-15 | | 68.9 (228) 28.1 (196) 2.95 (231) |
| 29 | 229 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^3F_3$ | | 155943418 | | 2.263E-15 | | 57.0 (195) 23.3 (229) 19.6 (236) |
| 29 | 230 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 155944448 | | 2.253E-15 | | 100. (230) |
| 29 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 155944650 | | 2.262E-15 | | 64.0 (231) 32.1 (196) 3.87 (228) |
| 29 | 232 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^1G_4$ | | 155944738 | | 2.263E-15 | | 42.3 (197) 32.9 (232) 24.8 (226) |
| 29 | 233 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 155945280 | | 2.231E-15 | | 67.6 (233) 17.1 (216) 15.3 (188) |
| 29 | 234 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 155945887 | | 2.262E-15 | | 100. (234) |
| 29 | 235 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 155946564 | | 2.261E-15 | | 100. (235) |
| 29 | 236 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^1F_3$ | | 155947987 | | 2.261E-15 | | 52.2 (229) 47.8 (236) |
| 29 | 237 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 155948171 | | 2.252E-15 | | 54.2 (237) 43.2 (222) 2.59 (190) |
| 29 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 156693677 | | 6.224E-15 | | 65.3 (238) 10.9 (284) 9.75 (287) |
| 29 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 156694302 | | 2.594E-15 | | 56.4 (239) 29.1 (283) 11.7 (250) |
| 29 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 156694462 | | 2.738E-15 | | 81.2 (240) |
| 29 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 156697413 | | 4.939E-15 | | 56.1 (241) 27.6 (249) 16.3 (295) |
| 29 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 156699433 | | 2.699E-15 | | 66.8 (242) 15.0 (238) 9.72 (284) |
| 29 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 156704956 | | 1.705E-14 | | 67.2 (243) 23.2 (250) 4.22 (255) |
| 29 | 244 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 156709167 | | 1.052E-14 | | 81.3 (244) |
| 29 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 156710981 | | 2.479E-15 | | 45.1 (245) 27.8 (288) 14.2 (285) |
| 29 | 246 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 156711626 | | 6.945E-15 | | 70.2 (246) 13.9 (256) 8.53 (289) |
| 29 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 156715315 | | 2.433E-15 | | 71.4 (247) 12.1 (289) 7.97 (294) |
| 29 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 156716400 | | 2.794E-15 | | 38.6 (248) 23.1 (287) 20.0 (238) |
| 29 | 249 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 156718522 | | 3.825E-15 | | 43.6 (241) 41.4 (249) 15.0 (295) |
| 29 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 156720558 | | 8.831E-15 | | 48.5 (250) 29.7 (243) 10.9 (239) |
| 29 | 251 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 156723417 | | 1.232E-14 | | 70.7 (251) 12.8 (269) 5.77 (259) |
| 29 | 252 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 156723420 | | 2.387E-15 | | 43.4 (252) 28.8 (298) 20.6 (291) |
| 29 | 253 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 156723939 | | 9.190E-15 | | 76.9 (253) |
| 29 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 156724272 | | 2.564E-14 | | 92.9 (254) |
| 29 | 255 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 156726679 | | 2.673E-15 | | 43.4 (255) 25.4 (307) 17.2 (250) |
| 29 | 256 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 156726720 | | 2.945E-15 | | 35.7 (256) 25.8 (294) 25.4 (246) |
| 29 | 257 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 156726734 | | 2.246E-15 | | 74.6 (257) |
| 29 | 258 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 156729105 | | 2.234E-15 | | 41.8 (258) 32.8 (303) 25.4 (297) |
| 29 | 259 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 156729263 | | 2.554E-15 | | 39.8 (259) 28.4 (320) 18.9 (299) |
| 29 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 156729816 | | 2.233E-15 | | 72.8 (260) |
| 29 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 156730226 | | 2.237E-15 | | 42.2 (261) 33.0 (321) 24.8 (305) |
| 29 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 156730710 | | 2.233E-15 | | 39.9 (262) 33.2 (309) 27.0 (304) |
| 29 | 263 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 156730721 | | 2.872E-15 | | 41.8 (263) 22.7 (253) 22.2 (301) |
| 29 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 156730826 | | 2.234E-15 | | 71.9 (264) 17.5 (315) 10.6 (308) |
| 29 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 156730959 | | 2.270E-15 | | 56.7 (265) 25.9 (302) 15.7 (310) |
| 29 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 156731060 | | 2.235E-15 | | 40.3 (266) 33.2 (319) 26.5 (311) |
| 29 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 156731383 | | 2.234E-15 | | 38.8 (267) 33.3 (313) 27.9 (312) |
| 29 | 268 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 156731613 | | 2.235E-15 | | 59.6 (268) 24.2 (308) 16.2 (315) |
| 29 | 269 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 156732198 | | 2.228E-14 | | 80.6 (269) |
| 29 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 156733465 | | 4.723E-14 | | 97.0 (270) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 29 | 271 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f^3F_3$ | | 156733806 | | 2.915E-14 | | 83.9 (271) |
| 29 | 272 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f^3F_4$ | | 156734061 | | 9.830E-14 | | 100. (272) |
| 29 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f^1F_3$ | | 156736099 | | 2.441E-13 | | 90.9 (273) |
| 29 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g^3G_3$ | | 156736264 | | 3.677E-13 | | 100. (274) |
| 29 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g^3G_4$ | | 156736277 | | 4.115E-13 | | 64.3 (275) 35.7 (277) |
| 29 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g^3G_5$ | | 156737032 | | 6.072E-13 | | 100. (276) |
| 29 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g^1G_4$ | | 156737179 | | 5.354E-13 | | 64.4 (277) 35.6 (275) |
| 29 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h^3H_5$ | | 156737235 | | 8.632E-13 | | 55.0 (278) 45.0 (281) |
| 29 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h^3H_4$ | | 156737251 | | 8.896E-13 | | 100. (279) |
| 29 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h^3H_6$ | | 156737792 | | 8.652E-13 | | 100. (280) |
| 29 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h^1H_5$ | | 156737805 | | 8.938E-13 | | 55.0 (281) 45.0 (278) |
| 29 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s^3P_2$ | | 156963284 | | 2.275E-15 | | 100. (282) |
| 29 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s^1P_1$ | | 156965601 | | 2.278E-15 | | 67.3 (283) 32.7 (239) |
| 29 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p^1P_1$ | | 156968953 | | 2.204E-15 | | 47.1 (248) 27.1 (284) 13.4 (242) |
| 29 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p^3P_2$ | | 156970098 | | 2.204E-15 | | 47.3 (245) 28.7 (285) 24.0 (288) |
| 29 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p^3D_3$ | | 156975343 | | 2.203E-15 | | 100. (286) |
| 29 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p^3S_1$ | | 156975951 | | 2.206E-15 | | 54.3 (287) 38.8 (284) 3.54 (248) |
| 29 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p^1D_2$ | | 156982233 | | 2.203E-15 | | 55.0 (285) 44.0 (288) 1.01 (245) |
| 29 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d^1D_2$ | | 156983393 | | 2.258E-15 | | 52.3 (289) 25.7 (294) 22.0 (247) |
| 29 | 290 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d^3F_4$ | | 156984488 | | 2.268E-15 | | 100. (290) |
| 29 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d^3D_3$ | | 156985598 | | 2.254E-15 | | 48.5 (252) 42.7 (291) 8.77 (298) |
| 29 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d^3P_1$ | | 156987813 | | 2.251E-15 | | 65.4 (292) 32.7 (255) 1.86 (307) |
| 29 | 293 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d^3P_0$ | | 156988286 | | 2.254E-15 | | 100. (293) |
| 29 | 294 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d^3D_2$ | | 156988809 | | 2.252E-15 | | 50.2 (256) 35.8 (294) 14.0 (289) |
| 29 | 295 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p^1S_0$ | | 156989480 | | 2.212E-15 | | 68.8 (295) 31.2 (249) |
| 29 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f^1F_3$ | | 156991864 | | 2.265E-15 | | 38.6 (296) 36.1 (301) 25.3 (257) |
| 29 | 297 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f^3F_4$ | | 156993130 | | 2.265E-15 | | 57.8 (297) 42.2 (258) |
| 29 | 298 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d^1F_3$ | | 156993958 | | 2.239E-15 | | 59.9 (298) 35.0 (291) 5.03 (252) |
| 29 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f^3D_2$ | | 156994098 | | 2.264E-15 | | 51.3 (259) 36.2 (299) 12.5 (320) |
| 29 | 300 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f^3G_5$ | | 156994762 | | 2.264E-15 | | 100. (300) |
| 29 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f^3F_3$ | | 156994829 | | 2.264E-15 | | 45.2 (263) 27.6 (296) 27.2 (301) |
| 29 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g^3G_4$ | | 156995121 | | 2.270E-15 | | 39.6 (302) 33.6 (310) 26.8 (260) |
| 29 | 303 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f^1G_4$ | | 156995492 | | 2.265E-15 | | 66.8 (303) 17.0 (297) 16.1 (258) |
| 29 | 304 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g^3G_5$ | | 156995884 | | 2.269E-15 | | 67.3 (304) 31.1 (262) 1.64 (309) |
| 29 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g^3F_3$ | | 156995993 | | 2.269E-15 | | 57.4 (261) 23.4 (305) 19.2 (321) |
| 29 | 306 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f^3D_1$ | | 156996340 | | 2.263E-15 | | 100. (306) |
| 29 | 307 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d^1P_1$ | | 156996481 | | 2.250E-15 | | 66.5 (307) 17.4 (292) 16.1 (255) |
| 29 | 308 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h^3H_5$ | | 156996534 | | 2.271E-15 | | 39.7 (308) 32.6 (315) 27.8 (264) |
| 29 | 309 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g^1H_5$ | | 156996601 | | 2.268E-15 | | 65.2 (309) 29.0 (262) 5.77 (304) |
| 29 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g^3G_4$ | | 156996748 | | 2.269E-15 | | 41.9 (265) 32.9 (310) 25.2 (302) |
| 29 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h^3G_4$ | | 156996977 | | 2.271E-15 | | 59.5 (266) 21.9 (311) 18.6 (319) |
| 29 | 312 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h^3H_6$ | | 156997035 | | 2.270E-15 | | 60.8 (312) 39.2 (267) |
| 29 | 313 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h^1I_6$ | | 156997264 | | 2.267E-15 | | 66.6 (313) 22.0 (267) 11.4 (312) |
| 29 | 314 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g^3H_6$ | | 156997267 | | 2.268E-15 | | 100. (314) |
| 29 | 315 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h^1H_5$ | | 156997510 | | 2.271E-15 | | 40.0 (268) 34.1 (315) 25.9 (308) |
| 29 | 316 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h^3I_7$ | | 156997775 | | 2.267E-15 | | 100. (316) |
| 29 | 317 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g^3F_2$ | | 156997778 | | 2.268E-15 | | 100. (317) |
| 29 | 318 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h^3G_3$ | | 156998022 | | 2.270E-15 | | 100. (318) |
| 29 | 319 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h^1G_4$ | | 156998558 | | 2.270E-15 | | 51.7 (311) 48.3 (319) |
| 29 | 320 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f^1D_2$ | | 156998593 | | 2.263E-15 | | 54.9 (320) 42.1 (299) 3.06 (259) |
| 29 | 321 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g^1F_3$ | | 156998623 | | 2.268E-15 | | 51.9 (305) 48.1 (321) |
| 30 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2^1S_0$ | 0 | 0 | 0 | | | 100. (1) |
| 30 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s^3S_1$ | 71886300 | 71884381 | 71882079 | 1.116E-09 | 1.124E-09 | 100. (2) |
| 30 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p^3P_0$ | 72166200 | 72164351 | 72162008 | 2.218E-09 | 2.218E-09 | 100. (3) |
| 30 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p^3P_1$ | 72186600 | 72184995 | 72182687 | 7.979E-15 | 7.986E-15 | 86.4 (4) |
| 30 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s^1S_0$ | 72188400 | 72186487 | 72184197 | 2.694E-03 | 2.737E-03 | 100. (5) |
| 30 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p^3P_2$ | 72415600 | 72414176 | 72411849 | 4.141E-11 | 4.141E-11 | 100. (6) |
| 30 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p^1P_1$ | 72579000 | 72576915 | 72574805 | 1.289E-15 | 1.289E-15 | 86.4 (7) |
| 30 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s^3S_1$ | 85212700 | 85210482 | 85208263 | 1.833E-13 | 1.833E-13 | 100. (8) |
| 30 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p^3P_0$ | 85289800 | 85287583 | 85285376 | 6.129E-14 | 6.129E-14 | 100. (9) |
| 30 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s^1S_0$ | 85293200 | 85290138 | 85288023 | 1.907E-13 | 1.907E-13 | 100. (10) |
| 30 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p^3P_1$ | 85295600 | 85293430 | 85291237 | 1.925E-14 | 1.926E-14 | 85.4 (11) |
| 30 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 85364000 | 85361942 | 85359741 | 6.390E-14 | 6.389E-14 | 100. (12) |
| 30 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 85403900 | 85401688 | 85399521 | 2.131E-14 | 2.130E-14 | 63.6 (13) 36.4 (17) |
| 30 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d^3D_1$ | 85405200 | 85402966 | 85400795 | 2.132E-14 | 2.131E-14 | 100. (14) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|-----------------------|
| 30 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 85408300 | 85406067 | 85403942 | 4.462E-15 | 4.458E-15 | 85.4 (15) |
| 30 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 85428900 | 85426721 | 85424549 | 2.167E-14 | 2.166E-14 | 100. (16) |
| 30 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 85431900 | 85429699 | 85427538 | 2.171E-14 | 2.170E-14 | 63.6 (17) 36.4 (13) |
| 30 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s^3S_1$ | 89828600 | 89827530 | 89825360 | 2.673E-13 | 2.675E-13 | 100. (18) |
| 30 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 89860800 | 89859223 | 89857050 | 1.048E-13 | 1.048E-13 | 100. (19) |
| 30 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 89862000 | 89859812 | 89857671 | 2.766E-13 | 2.767E-13 | 100. (20) |
| 30 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 89863300 | 89861650 | 89859483 | 4.112E-14 | 4.112E-14 | 85.0 (21) |
| 30 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 89892100 | 89890595 | 89888424 | 1.084E-13 | 1.084E-13 | 100. (22) |
| 30 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 89908900 | 89907038 | 89904878 | 4.952E-14 | 4.950E-14 | 64.8 (23) 35.2 (28) |
| 30 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d^3D_1$ | 89909400 | 89907468 | 89905308 | 4.955E-14 | 4.953E-14 | 100. (24) |
| 30 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 89910900 | 89908645 | 89906504 | 1.061E-14 | 1.060E-14 | 85.0 (25) |
| 30 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 89918900 | 89917497 | 89915337 | 5.041E-14 | 5.040E-14 | 100. (26) |
| 30 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | | 89918554 | 89916399 | 1.016E-13 | 1.016E-13 | 56.8 (27) 43.2 (31) |
| 30 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | 89920800 | 89918948 | 89916790 | 5.052E-14 | 5.050E-14 | 64.8 (28) 35.2 (23) |
| 30 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | | 89918979 | 89916823 | 1.016E-13 | 1.016E-13 | 100. (29) |
| 30 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | | 89923999 | 89921843 | 1.021E-13 | 1.021E-13 | 100. (30) |
| 30 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | | 89924327 | 89922172 | 1.022E-13 | 1.022E-13 | 56.8 (31) 43.2 (27) |
| 30 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 91953400 | 91952173 | 91950014 | 4.240E-13 | 4.210E-13 | 100. (32) |
| 30 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 91969900 | 91968192 | 91966029 | 1.798E-13 | 1.788E-13 | 100. (33) |
| 30 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 91970500 | 91968383 | 91966243 | 4.290E-13 | 4.343E-13 | 100. (34) |
| 30 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 91971200 | 91969424 | 91967265 | 7.651E-14 | 7.636E-14 | 84.9 (35) |
| 30 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 91985900 | 91984242 | 91982081 | 1.853E-13 | 1.843E-13 | 100. (36) |
| 30 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | 91994500 | 91992582 | 91990425 | 9.526E-14 | 9.520E-14 | 65.2 (37) 34.8 (42) |
| 30 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | 91994800 | 91992779 | 91990622 | 9.547E-14 | 9.522E-14 | 100. (38) |
| 30 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 91994500 | 91993350 | 91991208 | 2.073E-14 | 2.068E-14 | 84.9 (39) |
| 30 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | 91995600 | 91997914 | 91995757 | 9.723E-14 | 9.697E-14 | 100. (40) |
| 30 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 91998503 | 91996348 | 1.961E-13 | 1.961E-13 | 56.9 (41) 43.1 (47) |
| 30 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | 92000500 | 91998699 | 91996543 | 9.706E-14 | 9.714E-14 | 65.2 (42) 34.8 (37) |
| 30 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 91998719 | 91996563 | 1.961E-13 | 1.961E-13 | 100. (43) |
| 30 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 92001290 | 91999134 | 1.972E-13 | 1.972E-13 | 100. (44) |
| 30 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 92001317 | 91999163 | 3.306E-13 | 3.306E-13 | 55.2 (45) 44.8 (49) |
| 30 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 92001444 | 91999290 | 3.307E-13 | 3.307E-13 | 100. (46) |
| 30 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 92001461 | 91999307 | 1.974E-13 | 1.973E-13 | 56.9 (47) 43.1 (41) |
| 30 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 92002986 | 92000832 | 3.315E-13 | 3.314E-13 | 100. (48) |
| 30 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 92003088 | 92000933 | 3.315E-13 | 3.315E-13 | 55.2 (49) 44.8 (45) |
| 30 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 93101935 | 93099728 | 6.525E-13 | 6.456E-13 | 100. (50) |
| 30 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 93111128 | 93108923 | 2.891E-13 | 2.874E-13 | 100. (51) |
| 30 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 93111215 | 93109042 | 6.496E-13 | 6.607E-13 | 100. (52) |
| 30 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 93111838 | 93109638 | 1.283E-13 | 1.279E-13 | 84.8 (53) |
| 30 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 93120412 | 93118207 | 2.972E-13 | 2.959E-13 | 100. (54) |
| 30 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 93125195 | 93123007 | 1.627E-13 | 1.626E-13 | 65.5 (55) 34.5 (61) |
| 30 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 93125303 | 93123114 | 1.631E-13 | 1.625E-13 | 100. (56) |
| 30 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 93125641 | 93123459 | 3.570E-14 | 3.545E-14 | 84.8 (57) |
| 30 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 93128275 | 93126086 | 1.662E-13 | 1.657E-13 | 100. (58) |
| 30 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 93128612 | 93126442 | 3.350E-13 | 3.350E-13 | 57.0 (59) 43.0 (65) |
| 30 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 93128737 | 93126566 | 3.350E-13 | 3.349E-13 | 100. (60) |
| 30 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 93128741 | 93126554 | 1.658E-13 | 1.659E-13 | 65.5 (61) 34.5 (55) |
| 30 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 93130225 | 93128054 | 3.369E-13 | 3.370E-13 | 100. (62) |
| 30 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 93130231 | 93128072 | 5.670E-13 | 5.669E-13 | 55.2 (63) 44.8 (69) |
| 30 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 93130305 | 93128145 | 5.671E-13 | 5.669E-13 | 100. (64) |
| 30 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 93130325 | 93128155 | 3.372E-13 | 3.370E-13 | 57.0 (65) 43.0 (59) |
| 30 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 93131197 | 93129043 | 8.567E-13 | 8.566E-13 | 54.3 (66) 45.7 (71) |
| 30 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 93131197 | 93129038 | 5.684E-13 | 5.684E-13 | 100. (67) |
| 30 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 93131245 | 93129090 | 8.568E-13 | 8.567E-13 | 100. (68) |
| 30 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 93131256 | 93129097 | 5.685E-13 | 5.684E-13 | 55.2 (69) 44.8 (63) |
| 30 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 93131840 | 93129686 | 8.579E-13 | 8.578E-13 | 100. (70) |
| 30 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 93131881 | 93129725 | 8.579E-13 | 8.578E-13 | 54.3 (71) 45.7 (66) |
| 30 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 146350000 | 146353609 | | 5.003E-15 | | 79.2 (72) |
| 30 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 146390000 | 146377996 | | 2.028E-15 | | 100. (73) |
| 30 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 146445000 | 146436504 | | 2.027E-15 | | 93.0 (74) |
| 30 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 146676000 | 146673614 | | 2.061E-15 | | 100. (75) |
| 30 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 146721000 | 146708711 | | 1.152E-15 | | 82.5 (76) |
| 30 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 146885000 | 146877967 | | 1.017E-15 | | 100. (77) |
| 30 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | 146952000 | 146945112 | | 1.016E-15 | | 55.4 (78) 44.6 (80) |
| 30 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 146995000 | 146990785 | | 2.015E-15 | | 93.0 (79) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 30 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2\ ^1D_2$ | 147224000 | 147228017 | | 1.024E-15 | | 55.4 (80) 44.6 (78) |
| 30 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2\ ^1S_0$ | 147526000 | 147525547 | | 1.125E-15 | | 80.2 (81) |
| 30 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s\ ^3S_1$ | | 159920495 | | 8.874E-15 | | 84.7 (82) |
| 30 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s\ ^3P_1$ | | 159962543 | | 2.509E-15 | | 33.1 (83) 31.5 (104) 31.1 (91) |
| 30 | 84 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s\ ^3P_0$ | | 159987620 | | 2.410E-15 | | 75.5 (84) |
| 30 | 85 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | | 159989919 | | 6.399E-15 | | 74.9 (85) |
| 30 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p\ ^3D_1$ | | 159994458 | | 1.647E-15 | | 72.6 (86) |
| 30 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p\ ^3P_1$ | | 160023105 | | 4.738E-15 | | 72.4 (87) |
| 30 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | | 160029016 | | 4.235E-15 | | 73.4 (88) |
| 30 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | | 160092022 | | 5.614E-15 | | 89.6 (89) |
| 30 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | | 160109086 | | 1.862E-15 | | 59.3 (90) 21.6 (97) 11.8 (110) |
| 30 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p\ ^1P_1$ | | 160126033 | | 3.606E-15 | | 44.7 (91) 31.9 (83) 21.9 (87) |
| 30 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | | 160143766 | | 1.873E-15 | | 30.2 (92) 24.8 (103) 20.3 (107) |
| 30 | 93 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 160153399 | | 1.879E-15 | | 73.3 (93) |
| 30 | 94 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 160154137 | | 1.966E-15 | | 77.3 (94) |
| 30 | 95 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 160188176 | | 6.962E-15 | | 82.2 (95) |
| 30 | 96 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 160189789 | | 1.098E-14 | | 95.0 (96) |
| 30 | 97 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d\ ^3D_2$ | | 160192712 | | 6.456E-15 | | 67.0 (97) 12.9 (101) 9.75 (110) |
| 30 | 98 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 160231706 | | 1.870E-15 | | 65.8 (98) 18.9 (111) 15.3 (116) |
| 30 | 99 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 160238623 | | 1.908E-15 | | 32.2 (99) 25.8 (114) 16.8 (109) |
| 30 | 100 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 160257362 | | 1.783E-15 | | 61.7 (100) 19.4 (117) 15.8 (112) |
| 30 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 160270280 | | 8.266E-15 | | 75.2 (101) |
| 30 | 102 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 160312766 | | 2.005E-15 | | 82.9 (102) |
| 30 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^1P_1$ | | 160357657 | | 1.573E-15 | | 55.2 (92) 29.0 (103) 12.8 (86) |
| 30 | 104 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 160376403 | | 2.208E-15 | | 66.2 (104) 17.5 (83) 16.3 (91) |
| 30 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p\ ^3P_2$ | | 160386915 | | 1.667E-15 | | 47.4 (105) 23.0 (90) 22.3 (110) |
| 30 | 106 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 160404810 | | 1.658E-15 | | 95.0 (106) |
| 30 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^3S_1$ | | 160417979 | | 1.616E-15 | | 62.7 (107) 25.8 (103) 5.83 (92) |
| 30 | 108 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 160478742 | | 2.012E-15 | | 100. (108) |
| 30 | 109 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^1D_2$ | | 160480792 | | 1.874E-15 | | 48.2 (109) 30.4 (114) 18.9 (94) |
| 30 | 110 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 160502636 | | 1.596E-15 | | 54.4 (110) 41.6 (105) 4.06 (101) |
| 30 | 111 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^3D_3$ | | 160511421 | | 1.811E-15 | | 60.5 (111) 31.0 (98) 8.49 (116) |
| 30 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 160542210 | | 1.848E-15 | | 69.3 (112) 27.0 (100) 2.00 (117) |
| 30 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 160547862 | | 1.886E-15 | | 97.9 (113) |
| 30 | 114 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3D_2$ | | 160548646 | | 1.852E-15 | | 54.8 (99) 33.3 (114) 8.88 (109) |
| 30 | 115 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 160606597 | | 1.641E-15 | | 77.0 (115) |
| 30 | 116 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | | 160612793 | | 1.696E-15 | | 76.2 (116) |
| 30 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 160637487 | | 1.820E-15 | | 76.2 (117) |
| 30 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 164631324 | | 9.002E-15 | | 81.2 (118) |
| 30 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 164645251 | | 2.365E-15 | | 49.8 (119) 29.9 (147) 20.4 (130) |
| 30 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 164647186 | | 2.623E-15 | | 71.8 (120) 28.2 (124) |
| 30 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 164651002 | | 5.781E-15 | | 69.2 (121) 16.3 (129) 14.5 (160) |
| 30 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 164660433 | | 1.970E-15 | | 72.1 (122) 15.6 (148) 6.40 (118) |
| 30 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 164669425 | | 1.026E-14 | | 73.8 (123) |
| 30 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 164682080 | | 5.264E-15 | | 71.6 (124) 28.4 (120) |
| 30 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 164699636 | | 7.861E-15 | | 85.2 (125) |
| 30 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 164706966 | | 2.143E-15 | | 46.3 (126) 22.1 (152) 16.9 (131) |
| 30 | 127 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 164722547 | | 2.140E-15 | | 39.3 (127) 22.3 (151) 16.8 (148) |
| 30 | 128 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 164723056 | | 2.041E-15 | | 73.8 (128) |
| 30 | 129 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 164724216 | | 2.432E-15 | | 58.2 (129) 28.7 (121) 13.1 (160) |
| 30 | 130 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | | 164726234 | | 6.130E-15 | | 54.9 (130) 23.9 (123) 17.6 (119) |
| 30 | 131 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 164740683 | | 1.141E-14 | | 72.3 (131) |
| 30 | 132 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 164741454 | | 1.087E-14 | | 86.4 (132) |
| 30 | 133 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 164742966 | | 1.891E-14 | | 95.4 (133) |
| 30 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 164753769 | | 2.161E-15 | | 46.3 (134) 22.5 (163) 19.1 (155) |
| 30 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 164761954 | | 2.155E-15 | | 38.1 (135) 30.0 (158) 16.5 (153) |
| 30 | 136 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 164763413 | | 1.979E-15 | | 52.7 (136) 25.0 (168) 15.8 (156) |
| 30 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 164769059 | | 1.923E-15 | | 73.3 (137) |
| 30 | 138 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 164772961 | | 6.812E-15 | | 70.9 (138) 7.95 (139) 5.51 (126) |
| 30 | 139 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 164775039 | | 2.276E-15 | | 39.4 (139) 25.4 (169) 16.7 (162) |
| 30 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 164777066 | | 1.922E-15 | | 41.6 (140) 31.7 (166) 26.7 (161) |
| 30 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 164778056 | | 2.754E-14 | | 95.6 (141) |
| 30 | 142 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 164779377 | | 2.021E-15 | | 48.9 (142) 29.5 (159) 16.3 (164) |
| 30 | 143 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 164779896 | | 1.372E-14 | | 72.8 (143) |
| 30 | 144 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 164780342 | | 8.953E-14 | | 100. (144) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 30 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f^1F_3$ | | 164786207 | | 7.225E-14 | | 84.9 (145) |
| 30 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s^3P_2$ | | 164962794 | | 1.988E-15 | | 100. (146) |
| 30 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s^1P_1$ | | 164977021 | | 2.018E-15 | | 68.2 (147) 29.4 (119) 2.46 (130) |
| 30 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p^1P_1$ | | 164983136 | | 1.784E-15 | | 47.8 (127) 29.5 (148) 13.7 (122) |
| 30 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p^3P_2$ | | 164988664 | | 1.789E-15 | | 42.4 (126) 32.7 (149) 24.9 (152) |
| 30 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p^3D_3$ | | 165006873 | | 1.792E-15 | | 100. (150) |
| 30 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p^3S_1$ | | 165011463 | | 1.798E-15 | | 57.9 (151) 33.7 (148) 4.41 (127) |
| 30 | 152 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p^1D_2$ | | 165036507 | | 1.783E-15 | | 52.4 (149) 47.6 (152) |
| 30 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d^1D_2$ | | 165036601 | | 1.935E-15 | | 51.6 (153) 26.9 (158) 21.5 (128) |
| 30 | 154 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d^3F_4$ | | 165040081 | | 1.978E-15 | | 100. (154) |
| 30 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d^3D_3$ | | 165046062 | | 1.922E-15 | | 47.3 (155) 44.0 (134) 8.79 (163) |
| 30 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d^3P_1$ | | 165056274 | | 1.921E-15 | | 66.2 (156) 31.6 (136) 2.16 (168) |
| 30 | 157 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d^3P_0$ | | 165058573 | | 1.936E-15 | | 100. (157) |
| 30 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d^3D_2$ | | 165059740 | | 1.924E-15 | | 52.1 (135) 35.0 (158) 12.8 (153) |
| 30 | 159 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f^3F_3$ | | 165069536 | | 1.954E-15 | | 37.0 (159) 36.8 (164) 26.3 (137) |
| 30 | 160 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | | 165071382 | | 1.811E-15 | | 72.4 (160) |
| 30 | 161 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^3F_4$ | | 165074492 | | 1.954E-15 | | 60.7 (161) 39.3 (140) |
| 30 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | | 165077790 | | 1.953E-15 | | 50.1 (139) 33.6 (162) 16.3 (169) |
| 30 | 163 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^1F_3$ | | 165080381 | | 1.871E-15 | | 65.0 (163) 30.5 (155) 4.48 (134) |
| 30 | 164 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^1F_3$ | | 165081164 | | 1.954E-15 | | 47.4 (142) 27.8 (164) 24.8 (159) |
| 30 | 165 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | | 165082229 | | 1.953E-15 | | 100. (165) |
| 30 | 166 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^1G_4$ | | 165082681 | | 1.953E-15 | | 68.3 (166) 19.1 (140) 12.7 (161) |
| 30 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | | 165087363 | | 1.953E-15 | | 100. (167) |
| 30 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | | 165090766 | | 1.916E-15 | | 69.9 (168) 16.2 (156) 14.0 (136) |
| 30 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | | 165094651 | | 1.951E-15 | | 52.8 (169) 45.4 (162) 1.82 (139) |
| 30 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | | 166785399 | | 7.311E-15 | | 75.1 (170) |
| 30 | 171 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s^3P_1$ | | 166789466 | | 2.295E-15 | | 54.7 (171) 29.2 (207) 14.2 (182) |
| 30 | 172 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | | 166789637 | | 2.518E-15 | | 76.5 (172) |
| 30 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | | 166793260 | | 4.996E-15 | | 62.9 (173) 22.3 (181) 14.9 (219) |
| 30 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | | 166797928 | | 2.168E-15 | | 69.9 (174) 13.0 (208) 10.0 (170) |
| 30 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | | 166804858 | | 1.479E-14 | | 70.3 (175) 22.0 (182) 2.59 (187) |
| 30 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | | 166812131 | | 6.916E-15 | | 76.4 (176) |
| 30 | 177 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | | 166819568 | | 7.669E-15 | | 79.2 (177) |
| 30 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | | 166820988 | | 2.177E-15 | | 44.8 (178) 26.0 (212) 13.4 (209) |
| 30 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | | 166828904 | | 2.079E-15 | | 72.8 (179) |
| 30 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | | 166829623 | | 2.268E-15 | | 40.2 (180) 23.6 (211) 14.5 (208) |
| 30 | 181 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | | 166831099 | | 2.878E-15 | | 48.3 (181) 36.4 (173) 15.3 (219) |
| 30 | 182 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p^1P_1$ | | 166834497 | | 7.675E-15 | | 53.7 (182) 26.4 (175) 12.8 (171) |
| 30 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | | 166840406 | | 1.411E-14 | | 72.7 (183) |
| 30 | 184 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | | 166841293 | | 1.626E-14 | | 90.9 (184) |
| 30 | 185 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | | 166841965 | | 1.434E-14 | | 88.5 (185) |
| 30 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | | 166844256 | | 2.140E-15 | | 43.4 (186) 26.6 (223) 19.9 (215) |
| 30 | 187 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | | 166849057 | | 2.124E-15 | | 47.7 (187) 26.4 (233) 15.1 (216) |
| 30 | 188 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | | 166849149 | | 2.328E-15 | | 38.5 (188) 28.6 (218) 18.3 (177) |
| 30 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | | 166850885 | | 1.946E-15 | | 74.2 (189) |
| 30 | 190 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | | 166854589 | | 2.104E-15 | | 42.6 (190) 29.4 (237) 19.8 (222) |
| 30 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | | 166855313 | | 1.943E-15 | | 41.8 (191) 32.4 (227) 25.8 (221) |
| 30 | 192 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | | 166856531 | | 1.945E-15 | | 72.6 (192) |
| 30 | 193 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | | 166856681 | | 1.318E-14 | | 76.2 (193) |
| 30 | 194 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | | 166857138 | | 1.954E-15 | | 42.6 (194) 32.8 (236) 24.6 (228) |
| 30 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | | 166857155 | | 2.175E-15 | | 47.4 (195) 26.3 (224) 15.0 (220) |
| 30 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | | 166858259 | | 1.945E-15 | | 39.8 (196) 33.1 (231) 27.2 (229) |
| 30 | 197 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | | 166858552 | | 2.193E-15 | | 50.8 (197) 23.8 (226) 14.0 (232) |
| 30 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | | 166858890 | | 3.271E-14 | | 96.6 (198) |
| 30 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^3F_3$ | | 166859705 | | 1.703E-14 | | 78.2 (199) |
| 30 | 200 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | | 166860223 | | 1.559E-14 | | 88.6 (200) |
| 30 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | | 166863562 | | 1.246E-13 | | 88.2 (201) |
| 30 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | | 166863866 | | 2.289E-13 | | 60.3 (202) 39.7 (205) |
| 30 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | | 166863897 | | 2.238E-13 | | 100. (203) |
| 30 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | | 166865430 | | 3.098E-13 | | 100. (204) |
| 30 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | | 166865635 | | 2.828E-13 | | 60.4 (205) 39.6 (202) |
| 30 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | | 167100264 | | 1.987E-15 | | 100. (206) |
| 30 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | | 167105464 | | 1.993E-15 | | 67.9 (207) 32.1 (171) |
| 30 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^1P_1$ | | 167110610 | | 1.877E-15 | | 47.5 (180) 27.1 (208) 13.3 (174) |
| 30 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^3P_2$ | | 167112759 | | 1.878E-15 | | 46.2 (178) 29.1 (209) 24.7 (212) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 30 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | 167123371 | | 1.878E-15 | | | 100. (210) |
| 30 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^3S_1$ | 167124975 | | 1.880E-15 | | | 54.9 (211) 38.3 (208) 3.49 (180) |
| 30 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | 167136609 | | 1.876E-15 | | | 55.2 (209) 44.8 (212) |
| 30 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | 167138177 | | 1.960E-15 | | | 51.3 (213) 26.9 (218) 21.9 (179) |
| 30 | 214 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | 167140387 | | 1.979E-15 | | | 100. (214) |
| 30 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | 167142415 | | 1.955E-15 | | | 47.6 (186) 43.2 (215) 9.16 (223) |
| 30 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | 167146809 | | 1.952E-15 | | | 65.2 (216) 32.7 (187) 2.07 (233) |
| 30 | 217 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | 167147828 | | 1.958E-15 | | | 100. (217) |
| 30 | 218 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | 167148833 | | 1.954E-15 | | | 50.8 (188) 34.7 (218) 14.5 (213) |
| 30 | 219 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | 167151678 | | 1.887E-15 | | | 70.3 (219) 29.7 (181) |
| 30 | 220 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^1F_3$ | 167154241 | | 1.971E-15 | | | 37.6 (220) 36.9 (224) 25.5 (189) |
| 30 | 221 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | 167156713 | | 1.971E-15 | | | 57.8 (221) 42.2 (191) |
| 30 | 222 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | 167158309 | | 1.970E-15 | | | 51.1 (190) 35.4 (222) 13.5 (237) |
| 30 | 223 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | 167158463 | | 1.930E-15 | | | 60.9 (223) 34.5 (215) 4.65 (186) |
| 30 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^3F_3$ | 167159915 | | 1.971E-15 | | | 45.7 (195) 28.2 (220) 26.1 (224) |
| 30 | 225 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | 167160071 | | 1.970E-15 | | | 100. (225) |
| 30 | 226 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | 167160336 | | 1.979E-15 | | | 40.2 (226) 32.9 (232) 26.9 (192) |
| 30 | 227 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | 167161012 | | 1.970E-15 | | | 67.2 (227) 16.6 (221) 16.2 (191) |
| 30 | 228 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^3F_3$ | 167161842 | | 1.978E-15 | | | 57.1 (194) 23.6 (228) 19.3 (236) |
| 30 | 229 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | 167161843 | | 1.979E-15 | | | 67.3 (229) 30.8 (196) 1.81 (231) |
| 30 | 230 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | 167162630 | | 1.969E-15 | | | 100. (230) |
| 30 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | 167163155 | | 1.977E-15 | | | 65.1 (231) 29.4 (196) 5.50 (229) |
| 30 | 232 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | 167163368 | | 1.978E-15 | | | 42.1 (197) 33.4 (232) 24.5 (226) |
| 30 | 233 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | 167163398 | | 1.950E-15 | | | 67.2 (233) 17.5 (216) 15.3 (187) |
| 30 | 234 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | 167164573 | | 1.977E-15 | | | 100. (234) |
| 30 | 235 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | 167165102 | | 1.977E-15 | | | 100. (235) |
| 30 | 236 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^1F_3$ | 167166737 | | 1.977E-15 | | | 51.9 (228) 48.1 (236) |
| 30 | 237 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | 167166760 | | 1.969E-15 | | | 54.3 (237) 43.1 (222) 2.66 (190) |
| 30 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | 167947075 | | 5.034E-15 | | | 62.5 (238) 11.9 (284) 11.2 (242) |
| 30 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | 167947446 | | 2.232E-15 | | | 57.4 (239) 29.5 (283) 10.6 (250) |
| 30 | 240 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | 167947501 | | 2.360E-15 | | | 82.3 (240) |
| 30 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | 167950779 | | 4.185E-15 | | | 54.8 (241) 28.7 (249) 16.6 (295) |
| 30 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | 167952780 | | 2.446E-15 | | | 64.4 (242) 18.6 (238) 8.96 (284) |
| 30 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | 167958886 | | 1.528E-14 | | | 67.2 (243) 23.6 (250) 4.12 (255) |
| 30 | 244 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | 167963089 | | 9.668E-15 | | | 82.4 (244) |
| 30 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | 167965655 | | 2.141E-15 | | | 45.5 (245) 28.3 (288) 14.4 (285) |
| 30 | 246 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | 167966682 | | 5.715E-15 | | | 68.2 (246) 14.1 (257) 9.51 (289) |
| 30 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | 167970113 | | 2.149E-15 | | | 70.5 (247) 11.3 (289) 8.51 (294) |
| 30 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | 167971080 | | 2.414E-15 | | | 39.0 (248) 23.4 (287) 19.4 (238) |
| 30 | 249 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | 167972656 | | 3.423E-15 | | | 45.0 (241) 40.1 (249) 14.9 (295) |
| 30 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | 167975793 | | 7.727E-15 | | | 47.5 (250) 30.1 (243) 9.68 (239) |
| 30 | 251 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | 167978824 | | 2.068E-15 | | | 43.5 (251) 29.3 (298) 20.8 (291) |
| 30 | 252 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | 167978961 | | 1.051E-14 | | | 70.2 (252) 12.8 (269) 6.17 (259) |
| 30 | 253 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | 167979766 | | 7.322E-15 | | | 74.7 (253) |
| 30 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | 167979791 | | 2.432E-14 | | | 93.6 (254) |
| 30 | 255 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | 167981830 | | 2.359E-15 | | | 42.6 (255) 25.1 (307) 18.4 (250) |
| 30 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | 167982201 | | 1.966E-15 | | | 74.7 (256) |
| 30 | 257 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | 167982246 | | 2.589E-15 | | | 35.5 (257) 26.0 (246) 25.6 (294) |
| 30 | 258 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | 167984820 | | 1.950E-15 | | | 41.8 (258) 32.8 (303) 25.4 (297) |
| 30 | 259 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | 167984838 | | 2.252E-15 | | | 39.3 (259) 28.1 (319) 18.7 (299) |
| 30 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | 167985545 | | 1.950E-15 | | | 72.8 (260) |
| 30 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | 167985962 | | 1.953E-15 | | | 42.2 (261) 33.0 (321) 24.8 (305) |
| 30 | 262 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | 167986568 | | 2.576E-15 | | | 40.7 (262) 24.8 (253) 21.6 (301) |
| 30 | 263 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | 167986569 | | 1.950E-15 | | | 39.9 (263) 33.2 (308) 26.9 (304) |
| 30 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | 167986685 | | 1.951E-15 | | | 71.9 (264) 17.6 (315) 10.5 (309) |
| 30 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | 167986823 | | 1.974E-15 | | | 57.0 (265) 26.1 (302) 15.7 (310) |
| 30 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | 167986921 | | 1.952E-15 | | | 40.3 (266) 33.2 (320) 26.5 (311) |
| 30 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | 167987326 | | 1.951E-15 | | | 38.8 (267) 33.3 (314) 27.9 (312) |
| 30 | 268 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | 167987556 | | 1.952E-15 | | | 59.6 (268) 24.3 (309) 16.1 (315) |
| 30 | 269 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | 167988329 | | 2.059E-14 | | | 80.7 (269) |
| 30 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | 167989685 | | 4.461E-14 | | | 97.2 (270) |
| 30 | 271 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | 167990049 | | 2.818E-14 | | | 83.4 (271) |
| 30 | 272 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | 167990489 | | 1.046E-13 | | | 100. (272) |
| 30 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | 167992581 | | 2.099E-13 | | | 89.7 (273) |
| 30 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | 167992770 | | 3.394E-13 | | | 100. (274) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 30 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 167992783 | | 3.746E-13 | | 63.6 (275) 36.4 (277) |
| 30 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 167993661 | | 5.300E-13 | | 100. (276) |
| 30 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 167993815 | | 4.768E-13 | | 63.7 (277) 36.3 (275) |
| 30 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 167993869 | | 7.553E-13 | | 54.9 (278) 45.1 (281) |
| 30 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 167993888 | | 7.799E-13 | | 100. (279) |
| 30 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 167994510 | | 7.570E-13 | | 100. (280) |
| 30 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 167994525 | | 7.831E-13 | | 54.9 (281) 45.1 (278) |
| 30 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 168255569 | | 1.988E-15 | | 100. (282) |
| 30 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 168257927 | | 1.991E-15 | | 67.2 (283) 32.8 (239) |
| 30 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 168261490 | | 1.926E-15 | | 47.9 (284) 24.8 (284) 14.4 (287) |
| 30 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^3P_2$ | | 168262621 | | 1.926E-15 | | 47.6 (245) 27.6 (285) 24.8 (288) |
| 30 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 168269085 | | 1.926E-15 | | 100. (286) |
| 30 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^1S_1$ | | 168269615 | | 1.928E-15 | | 52.3 (287) 41.2 (284) 3.79 (242) |
| 30 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^1D_2$ | | 168276215 | | 1.925E-15 | | 56.5 (285) 43.5 (288) |
| 30 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 168277523 | | 1.973E-15 | | 50.9 (289) 27.1 (294) 22.0 (247) |
| 30 | 290 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 168278904 | | 1.983E-15 | | 100. (290) |
| 30 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 168279803 | | 1.970E-15 | | 49.2 (251) 41.3 (291) 9.52 (298) |
| 30 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 168282013 | | 1.967E-15 | | 65.1 (292) 33.0 (255) 1.96 (307) |
| 30 | 293 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^1P_0$ | | 168282503 | | 1.971E-15 | | 100. (293) |
| 30 | 294 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 168283289 | | 1.969E-15 | | 50.4 (257) 34.3 (294) 15.3 (289) |
| 30 | 295 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 168283669 | | 1.933E-15 | | 68.6 (295) 31.4 (249) |
| 30 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^1F_3$ | | 168286564 | | 1.980E-15 | | 37.9 (296) 36.9 (301) 25.2 (256) |
| 30 | 297 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^3F_4$ | | 168287957 | | 1.980E-15 | | 55.9 (297) 44.1 (258) |
| 30 | 298 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 168288640 | | 1.957E-15 | | 59.0 (298) 36.4 (291) 4.56 (251) |
| 30 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 168288867 | | 1.979E-15 | | 51.4 (259) 36.3 (299) 12.3 (319) |
| 30 | 300 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 168289719 | | 1.979E-15 | | 100. (300) |
| 30 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^3F_3$ | | 168289777 | | 1.979E-15 | | 45.1 (262) 28.3 (296) 26.6 (301) |
| 30 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 168290093 | | 1.984E-15 | | 40.0 (302) 33.2 (310) 26.7 (260) |
| 30 | 303 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^1G_4$ | | 168290406 | | 1.980E-15 | | 66.4 (303) 19.1 (297) 14.5 (258) |
| 30 | 304 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 168290957 | | 1.984E-15 | | 65.4 (304) 34.6 (263) |
| 30 | 305 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 168290997 | | 1.984E-15 | | 57.4 (261) 23.8 (305) 18.8 (321) |
| 30 | 306 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 168291197 | | 1.978E-15 | | 100. (306) |
| 30 | 307 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 168291300 | | 1.967E-15 | | 66.2 (307) 17.8 (292) 16.0 (255) |
| 30 | 308 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 168291650 | | 1.983E-15 | | 66.1 (308) 25.7 (263) 8.17 (304) |
| 30 | 309 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^3H_5$ | | 168291651 | | 1.985E-15 | | 40.0 (309) 32.3 (315) 27.7 (264) |
| 30 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^1G_4$ | | 168291871 | | 1.984E-15 | | 41.8 (265) 33.4 (310) 24.9 (302) |
| 30 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 168292112 | | 1.986E-15 | | 59.5 (266) 22.2 (311) 18.3 (320) |
| 30 | 312 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 168292212 | | 1.985E-15 | | 52.8 (312) 47.2 (267) |
| 30 | 313 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 168292413 | | 1.983E-15 | | 100. (313) |
| 30 | 314 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 168292426 | | 1.983E-15 | | 66.1 (314) 19.6 (312) 14.2 (267) |
| 30 | 315 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 168292726 | | 1.986E-15 | | 39.9 (268) 34.5 (315) 25.6 (309) |
| 30 | 316 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 168292847 | | 1.983E-15 | | 100. (316) |
| 30 | 317 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 168292998 | | 1.983E-15 | | 100. (317) |
| 30 | 318 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 168293194 | | 1.984E-15 | | 100. (318) |
| 30 | 319 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 168293689 | | 1.978E-15 | | 54.9 (319) 42.0 (299) 3.12 (259) |
| 30 | 320 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 168293812 | | 1.984E-15 | | 51.4 (311) 48.6 (320) |
| 30 | 321 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^1F_3$ | | 168293815 | | 1.983E-15 | | 51.6 (305) 48.4 (321) |
| 31 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 31 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 76911150 | 76909013 | | 7.972E-10 | | 100. (2) |
| 31 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 77202880 | 77201170 | | 2.093E-09 | | 100. (3) |
| 31 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 77224190 | 77222470 | | 6.406E-15 | | 85.2 (4) |
| 31 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 77225860 | 77223766 | | 2.168E-03 | | 100. (5) |
| 31 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 77490090 | 77488545 | | 3.193E-11 | | 100. (6) |
| 31 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 77657700 | 77655589 | | 1.144E-15 | | 85.2 (7) |
| 31 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 91177480 | 91176921 | | 1.595E-13 | | 100. (8) |
| 31 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 91257860 | 91257354 | | 5.341E-14 | | 100. (9) |
| 31 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 91261400 | 91259923 | | 1.660E-13 | | 100. (10) |
| 31 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 91263800 | 91263365 | | 1.592E-14 | | 84.2 (11) |
| 31 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 91343230 | 91342887 | | 5.585E-14 | | 100. (12) |
| 31 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 91384440 | 91383969 | | 1.858E-14 | | 63.3 (13) 36.7 (17) |
| 31 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 91385930 | 91385449 | | 1.861E-14 | | 100. (14) |
| 31 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 91388810 | 91388239 | | 3.955E-15 | | 84.2 (15) |
| 31 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 91413210 | 91412746 | | 1.893E-14 | | 100. (16) |
| 31 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 91416400 | 91415928 | | 1.894E-14 | | 63.3 (17) 36.7 (13) |
| 31 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 96120300 | 96120631 | | 2.327E-13 | | 100. (18) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 31 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | 96153900 | 96153685 | | 9.135E-14 | | 100. (19) |
| 31 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | 96155100 | 96154266 | | 2.407E-13 | | 100. (20) |
| 31 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | 96156500 | 96156178 | | 3.426E-14 | | 83.8 (21) |
| 31 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | 96189900 | 96189768 | | 9.474E-14 | | 100. (22) |
| 31 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | 96207300 | 96206769 | | 4.317E-14 | | 64.3 (23) 35.7 (28) |
| 31 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d^3D_1$ | 96207900 | 96207279 | | 4.323E-14 | | 100. (24) |
| 31 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | 96209200 | 96208327 | | 9.404E-15 | | 83.8 (25) |
| 31 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | 96219400 | 96218805 | | 4.404E-14 | | 100. (26) |
| 31 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | | 96219900 | | 8.864E-14 | | 56.8 (27) 43.2 (31) |
| 31 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | 96220800 | 96220347 | | 4.408E-14 | | 64.3 (28) 35.7 (23) |
| 31 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | | 96220371 | | 8.866E-14 | | 100. (29) |
| 31 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | | 96226137 | | 8.914E-14 | | 100. (30) |
| 31 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | | 96226500 | | 8.920E-14 | | 56.8 (31) 43.2 (27) |
| 31 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 98395400 | 98395490 | | 3.694E-13 | | 100. (32) |
| 31 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | | 98412193 | | 1.568E-13 | | 100. (33) |
| 31 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 98413100 | 98412377 | | 3.733E-13 | | 100. (34) |
| 31 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 98413800 | 98413458 | | 6.396E-14 | | 83.7 (35) |
| 31 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 98430900 | 98430653 | | 1.619E-13 | | 100. (36) |
| 31 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | | 98439276 | | 8.304E-14 | | 64.7 (37) 35.3 (42) |
| 31 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | | 98439513 | | 8.330E-14 | | 100. (38) |
| 31 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 98440800 | 98440018 | | 1.836E-14 | | 83.7 (39) |
| 31 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | | 98445415 | | 8.495E-14 | | 100. (40) |
| 31 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 98446025 | | 1.711E-13 | | 56.9 (41) 43.1 (47) |
| 31 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 98446248 | | 8.467E-14 | | 64.7 (42) 35.3 (37) |
| 31 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 98446264 | | 1.711E-13 | | 100. (43) |
| 31 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 98449217 | | 1.721E-13 | | 100. (44) |
| 31 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 98449246 | | 2.886E-13 | | 55.2 (45) 44.8 (49) |
| 31 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 98449387 | | 2.887E-13 | | 100. (46) |
| 31 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 98449407 | | 1.723E-13 | | 56.9 (47) 43.1 (41) |
| 31 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 98451158 | | 2.894E-13 | | 100. (48) |
| 31 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 98451270 | | 2.894E-13 | | 55.2 (49) 44.8 (45) |
| 31 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 99626473 | | 5.672E-13 | | 100. (50) |
| 31 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 99636058 | | 2.517E-13 | | 100. (51) |
| 31 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 99636140 | | 5.670E-13 | | 100. (52) |
| 31 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 99636785 | | 1.074E-13 | | 83.6 (53) |
| 31 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 99646735 | | 2.593E-13 | | 100. (54) |
| 31 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 99651680 | | 1.418E-13 | | 64.9 (55) 35.1 (61) |
| 31 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 99651811 | | 1.422E-13 | | 100. (56) |
| 31 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 99652112 | | 3.162E-14 | | 83.6 (57) |
| 31 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 99655226 | | 1.451E-13 | | 100. (58) |
| 31 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 99655576 | | 2.923E-13 | | 57.0 (59) 43.0 (65) |
| 31 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 99655714 | | 2.923E-13 | | 100. (60) |
| 31 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 99655721 | | 1.447E-13 | | 64.9 (61) 35.1 (55) |
| 31 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 99657423 | | 2.940E-13 | | 100. (62) |
| 31 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 99657429 | | 4.949E-13 | | 55.2 (63) 44.8 (69) |
| 31 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 99657511 | | 4.950E-13 | | 100. (64) |
| 31 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 99657534 | | 2.943E-13 | | 57.0 (65) 43.0 (59) |
| 31 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 99658536 | | 7.479E-13 | | 54.3 (66) 45.7 (71) |
| 31 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 99658536 | | 4.962E-13 | | 100. (67) |
| 31 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 99658589 | | 7.480E-13 | | 100. (68) |
| 31 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 99658601 | | 4.963E-13 | | 55.2 (69) 44.8 (63) |
| 31 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 99659272 | | 7.490E-13 | | 100. (70) |
| 31 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 99659316 | | 7.490E-13 | | 54.3 (71) 45.7 (66) |
| 31 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 156500000 | 156499821 | | 4.325E-15 | | 78.9 (72) |
| 31 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 156530000 | 156523155 | | 1.776E-15 | | 100. (73) |
| 31 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 156600000 | 156587119 | | 1.775E-15 | | 92.1 (74) |
| 31 | 75 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 156860000 | 156861256 | | 1.807E-15 | | 100. (75) |
| 31 | 76 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 156880000 | 156872157 | | 1.022E-15 | | 80.7 (76) |
| 31 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 157080000 | 157072472 | | 8.918E-16 | | 100. (77) |
| 31 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | 157150000 | 157143123 | | 8.905E-16 | | 53.3 (78) 46.7 (80) |
| 31 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 157190000 | 157186286 | | 1.769E-15 | | 92.1 (79) |
| 31 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | 157460000 | 157465396 | | 8.980E-16 | | 53.3 (80) 46.7 (78) |
| 31 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | 157760000 | 157766557 | | 9.779E-16 | | 79.7 (81) |
| 31 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 171016869 | | 7.960E-15 | | 85.1 (82) |
| 31 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 171060314 | | 2.179E-15 | | 34.9 (83) 31.0 (104) 29.5 (91) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 31 | 84 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s\ ^3P_0$ | 171084521 | | | 2.099E-15 | | 76.2 (84) |
| 31 | 85 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s\ ^1S_0$ | 171087879 | | | 5.508E-15 | | 74.5 (85) |
| 31 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p\ ^3D_1$ | 171091872 | | | 1.447E-15 | | 72.5 (86) |
| 31 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p\ ^3P_1$ | 171123162 | | | 4.152E-15 | | 71.9 (87) 17.7 (83) 7.31 (91) |
| 31 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | 171128322 | | | 3.775E-15 | | 74.4 (88) |
| 31 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | 171202807 | | | 4.941E-15 | | 89.9 (89) |
| 31 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | 171220940 | | | 1.624E-15 | | 58.3 (90) 21.1 (96) 12.8 (110) |
| 31 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p\ ^1P_1$ | 171239261 | | | 3.318E-15 | | 47.8 (91) 28.6 (83) 22.4 (87) |
| 31 | 92 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | 171255382 | | | 1.632E-15 | | 31.4 (92) 23.0 (103) 21.3 (107) |
| 31 | 93 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | 171258870 | | | 1.669E-15 | | 71.3 (93) 20.1 (85) 8.54 (115) |
| 31 | 94 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | 171266123 | | | 1.724E-15 | | 77.1 (94) |
| 31 | 95 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | 171301401 | | | 6.284E-15 | | 83.0 (95) |
| 31 | 96 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d\ ^3D_2$ | 171306721 | | | 5.882E-15 | | 67.9 (96) 13.0 (101) 9.17 (110) |
| 31 | 97 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | 171307606 | | | 1.047E-14 | | 96.1 (97) |
| 31 | 98 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | 171350698 | | | 1.634E-15 | | 64.1 (98) 19.5 (111) 16.4 (116) |
| 31 | 99 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | 171359007 | | | 1.675E-15 | | 34.0 (99) 27.8 (114) 17.4 (108) |
| 31 | 100 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | 171373389 | | | 1.563E-15 | | 60.8 (100) 20.4 (117) 16.1 (112) |
| 31 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | 171391409 | | | 7.867E-15 | | 77.5 (101) |
| 31 | 102 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | 171451341 | | | 1.757E-15 | | 89.0 (102) |
| 31 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^1P_1$ | 171500508 | | | 1.379E-15 | | 55.7 (92) 27.0 (103) 12.4 (86) |
| 31 | 104 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | 171515249 | | | 1.909E-15 | | 66.8 (104) 19.0 (83) 14.2 (91) |
| 31 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p\ ^3P_2$ | 171528280 | | | 1.444E-15 | | 44.0 (105) 25.4 (90) 24.7 (110) |
| 31 | 106 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | 171556743 | | | 1.437E-15 | | 96.1 (106) |
| 31 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^3S_1$ | 171568904 | | | 1.408E-15 | | 60.6 (107) 29.2 (103) 4.48 (92) |
| 31 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^1D_2$ | 171637112 | | | 1.645E-15 | | 48.4 (108) 30.2 (114) 19.2 (94) |
| 31 | 109 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | 171637519 | | | 1.765E-15 | | 100. (109) |
| 31 | 110 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | 171657627 | | | 1.390E-15 | | 52.4 (110) 44.5 (105) 3.10 (101) |
| 31 | 111 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^3D_3$ | 171668642 | | | 1.592E-15 | | 58.0 (111) 32.8 (98) 9.18 (116) |
| 31 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | 171699575 | | | 1.618E-15 | | 68.7 (112) 27.8 (100) 2.06 (117) |
| 31 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | 171705383 | | | 1.651E-15 | | 98.2 (113) |
| 31 | 114 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3D_2$ | 171708191 | | | 1.623E-15 | | 54.5 (99) 33.1 (114) 9.82 (108) |
| 31 | 115 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | 171763946 | | | 1.429E-15 | | 76.5 (115) |
| 31 | 116 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | 171774606 | | | 1.489E-15 | | 74.4 (116) |
| 31 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | 171800671 | | | 1.595E-15 | | 75.3 (117) |
| 31 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | 176056677 | | | 7.869E-15 | | 81.1 (118) |
| 31 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | 176070800 | | | 2.043E-15 | | 51.1 (119) 29.9 (147) 19.0 (130) |
| 31 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | 176072201 | | | 2.278E-15 | | 72.5 (120) |
| 31 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | 176076566 | | | 4.965E-15 | | 68.6 (121) 17.0 (127) 14.4 (159) |
| 31 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | 176086053 | | | 1.734E-15 | | 71.8 (122) 15.6 (148) 7.28 (118) |
| 31 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | 176096091 | | | 9.127E-15 | | 73.7 (123) |
| 31 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | 176108723 | | | 4.721E-15 | | 72.4 (124) |
| 31 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | 176130988 | | | 6.896E-15 | | 85.2 (125) |
| 31 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | 176138196 | | | 1.858E-15 | | 46.3 (126) 22.8 (152) 16.1 (131) |
| 31 | 127 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | 176152611 | | | 2.159E-15 | | 56.7 (127) 29.6 (121) 13.7 (159) |
| 31 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | 176153660 | | | 1.859E-15 | | 39.8 (128) 22.9 (151) 16.1 (148) |
| 31 | 129 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | 176154549 | | | 1.787E-15 | | 73.8 (129) |
| 31 | 130 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | 176158069 | | | 5.648E-15 | | 56.1 (130) 24.5 (123) 15.8 (119) |
| 31 | 131 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | 176173379 | | | 1.049E-14 | | 73.0 (131) |
| 31 | 132 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | 176173865 | | | 9.992E-15 | | 87.1 (132) |
| 31 | 133 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | 176177034 | | | 1.674E-14 | | 95.4 (133) |
| 31 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | 176187760 | | | 1.882E-15 | | 45.9 (134) 23.2 (163) 19.3 (155) |
| 31 | 135 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | 176195986 | | | 1.887E-15 | | 38.5 (135) 30.1 (158) 16.1 (153) |
| 31 | 136 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | 176196199 | | | 1.735E-15 | | 52.1 (136) 25.5 (168) 15.8 (156) |
| 31 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | 176203257 | | | 1.687E-15 | | 73.4 (137) |
| 31 | 138 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | 176207676 | | | 4.577E-15 | | 63.1 (138) 13.0 (139) 8.32 (169) |
| 31 | 139 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | 176209604 | | | 2.235E-15 | | 34.2 (139) 22.4 (169) 17.7 (138) |
| 31 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | 176212163 | | | 1.685E-15 | | 41.6 (140) 31.9 (166) 26.5 (161) |
| 31 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | 176213095 | | | 2.525E-14 | | 95.8 (141) |
| 31 | 142 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | 176214531 | | | 1.773E-15 | | 49.2 (142) 29.4 (160) 16.1 (164) |
| 31 | 143 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | 176215015 | | | 1.255E-14 | | 71.9 (143) 16.8 (145) 5.00 (134) |
| 31 | 144 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | 176216169 | | | 7.975E-14 | | 100. (144) |
| 31 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | 176222133 | | | 6.256E-14 | | 83.4 (145) |
| 31 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | 176431356 | | | 1.744E-15 | | 100. (146) |
| 31 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | 176445543 | | | 1.765E-15 | | 68.1 (147) 29.9 (119) 2.02 (130) |
| 31 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | 176452710 | | | 1.565E-15 | | 48.7 (128) 27.1 (148) 13.2 (122) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 31 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | 176458010 | | 1.569E-15 | | | 43.2 (126) 31.1 (149) 25.7 (152) |
| 31 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | 176480779 | | 1.570E-15 | | | 100. (150) |
| 31 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | 176484972 | | 1.574E-15 | | | 56.3 (151) 36.9 (148) 3.44 (128) |
| 31 | 152 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | 176511388 | | 1.564E-15 | | | 53.8 (149) 46.2 (152) |
| 31 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | 176511998 | | 1.698E-15 | | | 50.5 (153) 27.9 (158) 21.6 (129) |
| 31 | 154 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | 176516514 | | 1.736E-15 | | | 100. (154) |
| 31 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | 176521752 | | 1.687E-15 | | | 45.6 (155) 44.9 (134) 9.51 (163) |
| 31 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | 176531936 | | 1.685E-15 | | | 65.8 (156) 32.0 (136) 2.23 (168) |
| 31 | 157 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | 176534306 | | 1.698E-15 | | | 100. (157) |
| 31 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | 176536426 | | 1.688E-15 | | | 52.0 (135) 33.9 (158) 14.0 (153) |
| 31 | 159 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | 176546998 | | 1.585E-15 | | | 71.9 (159) 26.3 (127) 1.75 (121) |
| 31 | 160 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^3F_3$ | 176547087 | | 1.716E-15 | | | 37.7 (160) 36.2 (164) 26.1 (137) |
| 31 | 161 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | 176552565 | | 1.716E-15 | | | 58.9 (161) 41.1 (140) |
| 31 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | 176555570 | | 1.714E-15 | | | 50.4 (139) 33.7 (162) 15.9 (169) |
| 31 | 163 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | 176557863 | | 1.642E-15 | | | 63.7 (163) 32.2 (155) 4.14 (134) |
| 31 | 164 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^1F_3$ | 176559630 | | 1.715E-15 | | | 47.0 (142) 28.6 (164) 24.4 (160) |
| 31 | 165 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | 176560810 | | 1.715E-15 | | | 100. (165) |
| 31 | 166 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | 176560947 | | 1.715E-15 | | | 68.0 (166) 17.3 (140) 14.7 (161) |
| 31 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | 176565509 | | 1.714E-15 | | | 100. (167) |
| 31 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | 176568759 | | 1.681E-15 | | | 69.3 (168) 16.7 (156) 14.0 (136) |
| 31 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | 176573639 | | 1.713E-15 | | | 52.9 (169) 45.2 (162) 1.91 (139) |
| 31 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | 178361623 | | 6.183E-15 | | | 74.2 (170) |
| 31 | 171 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | 178365444 | | 2.182E-15 | | | 77.4 (171) |
| 31 | 172 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | 178365508 | | 1.982E-15 | | | 55.8 (172) 29.4 (207) 13.1 (182) |
| 31 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | 178369475 | | 4.275E-15 | | | 62.0 (173) 23.1 (181) 14.9 (219) |
| 31 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | 178374130 | | 1.928E-15 | | | 68.9 (174) 12.7 (208) 11.8 (170) |
| 31 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | 178381811 | | 1.330E-14 | | | 70.3 (175) 22.4 (182) 2.50 (187) |
| 31 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | 178389070 | | 6.280E-15 | | | 77.4 (176) |
| 31 | 177 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | 178398879 | | 6.615E-15 | | | 78.8 (177) |
| 31 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | 178399926 | | 1.887E-15 | | | 45.0 (178) 26.5 (212) 13.6 (209) |
| 31 | 179 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | 178408009 | | 1.825E-15 | | | 72.7 (179) |
| 31 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | 178408505 | | 1.967E-15 | | | 40.7 (180) 24.0 (211) 14.1 (208) |
| 31 | 181 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | 178408639 | | 2.564E-15 | | | 47.1 (181) 37.4 (173) 15.5 (219) |
| 31 | 182 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | 178414016 | | 7.021E-15 | | | 54.2 (182) 27.0 (175) 11.6 (172) |
| 31 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | 178420453 | | 1.287E-14 | | | 73.1 (183) |
| 31 | 184 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | 178421217 | | 1.525E-14 | | | 91.6 (184) |
| 31 | 185 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | 178422672 | | 1.220E-14 | | | 88.1 (185) |
| 31 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | 178424565 | | 1.861E-15 | | | 43.4 (186) 27.1 (222) 20.1 (215) |
| 31 | 187 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | 178428752 | | 1.864E-15 | | | 47.8 (187) 26.9 (231) 15.3 (216) |
| 31 | 188 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | 178429530 | | 2.041E-15 | | | 38.3 (188) 28.3 (218) 18.1 (177) |
| 31 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | 178431300 | | 1.707E-15 | | | 74.3 (189) |
| 31 | 190 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | 178435122 | | 1.834E-15 | | | 42.7 (190) 29.8 (236) 20.0 (223) |
| 31 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | 178436199 | | 1.704E-15 | | | 41.8 (191) 32.5 (227) 25.7 (221) |
| 31 | 192 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | 178437440 | | 1.706E-15 | | | 72.6 (192) |
| 31 | 193 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | 178437780 | | 1.248E-14 | | | 77.5 (193) |
| 31 | 194 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | 178438057 | | 1.713E-15 | | | 42.5 (194) 32.9 (237) 24.7 (228) |
| 31 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | 178438115 | | 1.916E-15 | | | 47.4 (195) 26.1 (220) 14.8 (224) |
| 31 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | 178439412 | | 1.706E-15 | | | 39.8 (196) 33.1 (232) 27.1 (229) |
| 31 | 197 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | 178439746 | | 1.841E-15 | | | 53.2 (197) 24.8 (226) 14.6 (233) |
| 31 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | 178440125 | | 3.059E-14 | | | 96.8 (198) |
| 31 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | 178440980 | | 1.616E-14 | | | 77.6 (199) |
| 31 | 200 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | 178441826 | | 2.011E-14 | | | 92.6 (200) |
| 31 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | 178445277 | | 1.078E-13 | | | 86.9 (201) |
| 31 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | 178445614 | | 2.068E-13 | | | 59.9 (202) 40.1 (205) |
| 31 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | 178445652 | | 2.035E-13 | | | 100. (203) |
| 31 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | 178447418 | | 2.715E-13 | | | 100. (204) |
| 31 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | 178447634 | | 2.516E-13 | | | 60.0 (205) 40.0 (202) |
| 31 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | 178719598 | | 1.744E-15 | | | 100. (206) |
| 31 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | 178724863 | | 1.748E-15 | | | 67.7 (207) 32.3 (172) |
| 31 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^1P_1$ | 178730403 | | 1.648E-15 | | | 48.3 (180) 24.9 (208) 14.0 (211) |
| 31 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^3P_2$ | 178732503 | | 1.648E-15 | | | 46.6 (178) 28.0 (209) 25.4 (212) |
| 31 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | 178745472 | | 1.648E-15 | | | 100. (210) |
| 31 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^3S_1$ | 178746933 | | 1.649E-15 | | | 53.0 (211) 40.6 (208) 3.78 (174) |
| 31 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | 178759153 | | 1.647E-15 | | | 56.2 (209) 43.8 (212) |
| 31 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | 178760982 | | 1.721E-15 | | | 50.0 (213) 28.1 (218) 21.9 (179) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 31 | 214 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 178763750 | | 1.737E-15 | | 100. (214) |
| 31 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | | 178765360 | | 1.717E-15 | | 48.4 (186) 41.7 (215) 9.92 (222) |
| 31 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 178769742 | | 1.713E-15 | | 64.9 (216) 33.0 (187) 2.17 (231) |
| 31 | 217 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 178770799 | | 1.719E-15 | | 100. (217) |
| 31 | 218 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | | 178772310 | | 1.715E-15 | | 50.9 (188) 33.3 (218) 15.8 (213) |
| 31 | 219 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 178774622 | | 1.655E-15 | | 69.9 (219) 30.1 (181) |
| 31 | 220 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^3F_3$ | | 178778122 | | 1.731E-15 | | 37.6 (220) 37.0 (224) 25.4 (189) |
| 31 | 221 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^3F_4$ | | 178780838 | | 1.730E-15 | | 55.9 (221) 44.1 (191) |
| 31 | 222 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 178782306 | | 1.695E-15 | | 59.8 (222) 35.9 (215) 4.22 (186) |
| 31 | 223 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 178782308 | | 1.730E-15 | | 51.2 (190) 35.5 (223) 13.3 (236) |
| 31 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^1F_3$ | | 178784264 | | 1.730E-15 | | 45.5 (195) 28.9 (224) 25.5 (220) |
| 31 | 225 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 178784451 | | 1.729E-15 | | 100. (225) |
| 31 | 226 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | | 178784727 | | 1.737E-15 | | 40.6 (226) 32.6 (233) 26.9 (192) |
| 31 | 227 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^1G_4$ | | 178785282 | | 1.730E-15 | | 66.7 (227) 18.8 (221) 14.5 (191) |
| 31 | 228 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^3F_3$ | | 178786284 | | 1.737E-15 | | 57.1 (194) 24.0 (228) 18.9 (237) |
| 31 | 229 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 178786430 | | 1.737E-15 | | 65.5 (229) 34.5 (196) |
| 31 | 230 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 178786792 | | 1.729E-15 | | 100. (230) |
| 31 | 231 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 178787498 | | 1.711E-15 | | 66.9 (231) 17.9 (216) 15.2 (187) |
| 31 | 232 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 178787690 | | 1.736E-15 | | 66.1 (232) 26.0 (196) 7.91 (229) |
| 31 | 233 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^1G_4$ | | 178788041 | | 1.737E-15 | | 42.0 (197) 33.9 (233) 24.1 (226) |
| 31 | 234 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 178789300 | | 1.736E-15 | | 100. (234) |
| 31 | 235 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 178789659 | | 1.736E-15 | | 100. (235) |
| 31 | 236 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 178791368 | | 1.728E-15 | | 54.4 (236) 42.9 (223) 2.73 (190) |
| 31 | 237 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^1F_3$ | | 178791528 | | 1.736E-15 | | 51.5 (228) 48.5 (237) |
| 31 | 238 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 179604721 | | 4.040E-15 | | 59.0 (238) 14.5 (242) 13.1 (284) |
| 31 | 239 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 179604773 | | 2.044E-15 | | 83.4 (239) |
| 31 | 240 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 179604823 | | 1.932E-15 | | 58.3 (240) 29.8 (283) 9.67 (250) |
| 31 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 179608398 | | 3.561E-15 | | 53.4 (241) 29.8 (249) 16.9 (295) |
| 31 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 179610405 | | 2.254E-15 | | 61.2 (242) 23.0 (238) 8.06 (284) |
| 31 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 179617108 | | 1.378E-14 | | 67.1 (243) 24.0 (250) 3.99 (255) |
| 31 | 244 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 179621292 | | 8.934E-15 | | 83.5 (244) |
| 31 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 179624711 | | 1.858E-15 | | 45.8 (245) 28.7 (288) 14.6 (285) |
| 31 | 246 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 179626153 | | 4.652E-15 | | 65.4 (246) 14.2 (257) 10.8 (289) |
| 31 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 179629310 | | 1.923E-15 | | 69.0 (247) 10.3 (289) 9.21 (294) |
| 31 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 179630124 | | 2.094E-15 | | 39.5 (248) 23.8 (287) 18.6 (238) |
| 31 | 249 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 179631053 | | 3.082E-15 | | 46.4 (241) 38.8 (249) 14.8 (295) |
| 31 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 179635443 | | 6.686E-15 | | 46.6 (250) 30.7 (243) 8.65 (240) |
| 31 | 251 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 179638654 | | 1.802E-15 | | 43.6 (251) 29.6 (298) 21.0 (291) |
| 31 | 252 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 179638945 | | 8.950E-15 | | 69.6 (252) 12.8 (269) 6.60 (258) |
| 31 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 179639749 | | 2.315E-14 | | 94.2 (253) |
| 31 | 254 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 179640059 | | 5.807E-15 | | 72.0 (254) 15.6 (262) 6.97 (301) |
| 31 | 255 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 179641367 | | 2.098E-15 | | 41.6 (255) 24.8 (307) 19.9 (250) |
| 31 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 179642096 | | 1.732E-15 | | 73.7 (256) |
| 31 | 257 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 179642201 | | 2.287E-15 | | 35.4 (257) 26.6 (246) 25.4 (294) |
| 31 | 258 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 179644841 | | 1.997E-15 | | 38.8 (258) 27.9 (319) 18.5 (299) |
| 31 | 259 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 179644983 | | 1.710E-15 | | 41.8 (259) 32.9 (303) 25.4 (297) |
| 31 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 179645722 | | 1.710E-15 | | 72.8 (260) |
| 31 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 179646143 | | 1.712E-15 | | 42.1 (261) 33.1 (320) 24.8 (304) |
| 31 | 262 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 179646882 | | 2.332E-15 | | 39.5 (262) 27.2 (254) 20.9 (296) |
| 31 | 263 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 179646889 | | 1.710E-15 | | 39.9 (263) 33.2 (308) 26.9 (306) |
| 31 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 179647005 | | 1.711E-15 | | 71.9 (264) 17.6 (316) 10.4 (309) |
| 31 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 179647147 | | 1.727E-15 | | 57.8 (265) 26.4 (302) 15.8 (310) |
| 31 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 179647241 | | 1.712E-15 | | 40.3 (266) 33.2 (321) 26.6 (311) |
| 31 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 179647739 | | 1.711E-15 | | 38.8 (267) 33.3 (314) 27.9 (312) |
| 31 | 268 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 179647969 | | 1.712E-15 | | 59.7 (268) 24.3 (309) 16.0 (316) |
| 31 | 269 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 179648939 | | 1.912E-14 | | 80.7 (269) |
| 31 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 179650391 | | 4.231E-14 | | 97.5 (270) |
| 31 | 271 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 179650781 | | 2.736E-14 | | 82.8 (271) |
| 31 | 272 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 179651429 | | 1.083E-13 | | 100. (272) |
| 31 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 179653572 | | 1.823E-13 | | 88.5 (273) |
| 31 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 179653786 | | 3.129E-13 | | 100. (274) |
| 31 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 179653798 | | 3.408E-13 | | 63.0 (275) 37.0 (277) |
| 31 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 179654813 | | 4.644E-13 | | 100. (276) |
| 31 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 179654975 | | 4.252E-13 | | 63.0 (277) 37.0 (275) |
| 31 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 179655027 | | 6.631E-13 | | 54.9 (278) 45.1 (281) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 31 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h^3H_4$ | | 179655048 | | 6.860E-13 | | 100. (279) |
| 31 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h^3H_6$ | | 179655762 | | 6.644E-13 | | 100. (280) |
| 31 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h^1H_5$ | | 179655778 | | 6.884E-13 | | 54.9 (281) 45.1 (278) |
| 31 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s^3P_2$ | | 179956347 | | 1.746E-15 | | 100. (282) |
| 31 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s^1P_1$ | | 179958747 | | 1.748E-15 | | 67.2 (283) 32.8 (240) |
| 31 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p^1P_1$ | | 179962510 | | 1.691E-15 | | 48.5 (248) 22.9 (284) 16.2 (287) |
| 31 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p^3P_2$ | | 179963635 | | 1.691E-15 | | 47.9 (245) 26.7 (285) 25.4 (288) |
| 31 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p^3D_3$ | | 179971471 | | 1.690E-15 | | 100. (286) |
| 31 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p^3S_1$ | | 179971930 | | 1.693E-15 | | 50.5 (287) 43.2 (284) 4.22 (242) |
| 31 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p^1D_2$ | | 179978842 | | 1.690E-15 | | 57.3 (285) 42.7 (288) |
| 31 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d^1D_2$ | | 179980301 | | 1.732E-15 | | 49.5 (289) 28.5 (294) 22.0 (247) |
| 31 | 290 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d^3F_4$ | | 179982013 | | 1.741E-15 | | 100. (290) |
| 31 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d^1D_3$ | | 179982659 | | 1.730E-15 | | 49.8 (251) 39.9 (291) 10.3 (298) |
| 31 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d^3P_1$ | | 179984856 | | 1.727E-15 | | 64.7 (292) 33.2 (255) 2.07 (307) |
| 31 | 293 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d^3P_0$ | | 179985366 | | 1.731E-15 | | 100. (293) |
| 31 | 294 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d^1D_2$ | | 179986456 | | 1.729E-15 | | 50.4 (257) 32.9 (294) 16.7 (289) |
| 31 | 295 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p^1S_0$ | | 179986499 | | 1.698E-15 | | 68.4 (295) 31.6 (249) |
| 31 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f^3F_3$ | | 179989956 | | 1.738E-15 | | 37.6 (296) 37.3 (301) 25.2 (256) |
| 31 | 297 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f^3F_4$ | | 179991481 | | 1.738E-15 | | 53.2 (297) 45.4 (259) 1.42 (303) |
| 31 | 298 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d^1F_3$ | | 179992007 | | 1.718E-15 | | 58.0 (298) 37.9 (291) 4.10 (251) |
| 31 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f^3D_2$ | | 179992328 | | 1.738E-15 | | 51.4 (258) 36.3 (299) 12.2 (319) |
| 31 | 300 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f^3G_5$ | | 179993387 | | 1.738E-15 | | 100. (300) |
| 31 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f^1F_3$ | | 179993439 | | 1.738E-15 | | 44.9 (262) 29.1 (301) 26.0 (296) |
| 31 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g^3G_4$ | | 179993779 | | 1.742E-15 | | 40.5 (302) 32.9 (310) 26.7 (260) |
| 31 | 303 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f^1G_4$ | | 179994025 | | 1.738E-15 | | 65.7 (303) 21.5 (297) 12.8 (259) |
| 31 | 304 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g^3F_3$ | | 179994715 | | 1.742E-15 | | 57.4 (261) 24.1 (304) 18.5 (320) |
| 31 | 305 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f^3D_1$ | | 179994746 | | 1.737E-15 | | 100. (305) |
| 31 | 306 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g^3G_5$ | | 179994750 | | 1.742E-15 | | 61.5 (306) 38.5 (263) |
| 31 | 307 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d^1P_1$ | | 179994810 | | 1.727E-15 | | 66.0 (307) 18.2 (292) 15.8 (255) |
| 31 | 308 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g^1H_5$ | | 179995419 | | 1.741E-15 | | 66.7 (308) 21.6 (263) 11.7 (306) |
| 31 | 309 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h^3H_5$ | | 179995496 | | 1.743E-15 | | 40.3 (309) 32.0 (316) 27.7 (264) |
| 31 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g^1G_4$ | | 179995723 | | 1.742E-15 | | 41.7 (265) 33.8 (310) 24.5 (302) |
| 31 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h^3G_4$ | | 179995976 | | 1.743E-15 | | 59.5 (266) 22.5 (311) 18.1 (321) |
| 31 | 312 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h^3H_6$ | | 179996109 | | 1.743E-15 | | 54.7 (267) 40.6 (312) 4.64 (314) |
| 31 | 313 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g^3H_6$ | | 179996284 | | 1.741E-15 | | 100. (313) |
| 31 | 314 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h^1I_6$ | | 179996330 | | 1.742E-15 | | 62.1 (314) 31.5 (312) 6.42 (267) |
| 31 | 315 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g^3F_2$ | | 179996631 | | 1.741E-15 | | 100. (315) |
| 31 | 316 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h^1H_5$ | | 179996680 | | 1.743E-15 | | 39.9 (268) 34.8 (316) 25.3 (309) |
| 31 | 317 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h^1I_7$ | | 179996956 | | 1.742E-15 | | 100. (317) |
| 31 | 318 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h^3G_3$ | | 179997094 | | 1.743E-15 | | 100. (318) |
| 31 | 319 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f^1D_2$ | | 179997501 | | 1.737E-15 | | 55.0 (319) 41.9 (299) 3.18 (258) |
| 31 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g^1F_3$ | | 179997735 | | 1.741E-15 | | 51.3 (304) 48.7 (320) |
| 31 | 321 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h^1G_4$ | | 179997802 | | 1.743E-15 | | 51.1 (311) 48.9 (321) |
| 32 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2^1S_0$ | 0 | 0 | | | | 100. (1) |
| 32 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s^3S_1$ | 82118000 | 82109244 | | 5.756E-10 | | 100. (2) |
| 32 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p^3P_0$ | 82414220 | 82413855 | | 1.977E-09 | | 100. (3) |
| 32 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p^3P_1$ | 82444310 | 82435595 | | 5.213E-15 | | 84.0 (4) |
| 32 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s^1S_0$ | 82437350 | 82436861 | | 1.711E-03 | | 100. (5) |
| 32 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p^3P_2$ | 82742690 | 82742924 | | 2.480E-11 | | 100. (6) |
| 32 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p^1P_1$ | 82914880 | 82914309 | | 1.019E-15 | | 84.0 (7) |
| 32 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s^3S_1$ | 97353380 | 97352930 | | 1.395E-13 | | 100. (8) |
| 32 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p^3P_0$ | 97437160 | 97436761 | | 4.674E-14 | | 100. (9) |
| 32 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s^1S_0$ | 97440830 | 97439335 | | 1.450E-13 | | 100. (10) |
| 32 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p^3P_1$ | 97443200 | 97442878 | | 1.329E-14 | | 83.0 (11) |
| 32 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p^3P_2$ | 97534920 | 97534705 | | 4.903E-14 | | 100. (12) |
| 32 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d^3D_2$ | 97577460 | 97577112 | | 1.627E-14 | | 62.9 (13) 37.1 (17) |
| 32 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d^3D_1$ | 97579170 | 97578810 | | 1.631E-14 | | 100. (14) |
| 32 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p^1P_1$ | 97581770 | 97581301 | | 3.520E-15 | | 83.0 (15) |
| 32 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d^3D_3$ | 97610380 | 97610035 | | 1.661E-14 | | 100. (16) |
| 32 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d^1D_2$ | 97613790 | 97613431 | | 1.661E-14 | | 62.9 (17) 37.1 (13) |
| 32 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s^3S_1$ | | 102635004 | | 2.035E-13 | | 100. (18) |
| 32 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p^3P_0$ | | 102669446 | | 7.998E-14 | | 100. (19) |
| 32 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s^1S_0$ | | 102670014 | | 2.103E-13 | | 100. (20) |
| 32 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p^3P_1$ | | 102671979 | | 2.880E-14 | | 82.7 (21) |
| 32 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p^3P_2$ | | 102710760 | | 8.316E-14 | | 100. (22) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 32 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d^3D_2$ | | 102728314 | | 3.780E-14 | | 63.9 (23) 36.1 (28) |
| 32 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d^3D_1$ | | 102728911 | | 3.789E-14 | | 100. (24) |
| 32 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p^1P_1$ | | 102729835 | | 8.366E-15 | | 82.7 (25) |
| 32 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d^3D_3$ | | 102742097 | | 3.864E-14 | | 100. (26) |
| 32 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | | 102743232 | | 7.769E-14 | | 56.8 (27) 43.2 (31) |
| 32 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | | 102743735 | | 3.863E-14 | | 63.9 (28) 36.1 (23) |
| 32 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | | 102743751 | | 7.772E-14 | | 100. (29) |
| 32 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | | 102750343 | | 7.817E-14 | | 100. (30) |
| 32 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | | 102750742 | | 7.822E-14 | | 56.8 (31) 43.2 (27) |
| 32 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | | 105065417 | | 3.231E-13 | | 100. (32) |
| 32 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | | 105082818 | | 1.373E-13 | | 100. (33) |
| 32 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | | 105082994 | | 3.261E-13 | | 100. (34) |
| 32 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | | 105084103 | | 5.391E-14 | | 82.6 (35) |
| 32 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | | 105103953 | | 1.421E-13 | | 100. (36) |
| 32 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | | 105112858 | | 7.271E-14 | | 64.3 (37) 35.7 (42) |
| 32 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | | 105113138 | | 7.300E-14 | | 100. (38) |
| 32 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | | 105113580 | | 1.633E-14 | | 82.6 (39) |
| 32 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | | 105119889 | | 7.454E-14 | | 100. (40) |
| 32 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 105120522 | | 1.500E-13 | | 56.9 (41) 43.1 (47) |
| 32 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 105120772 | | 7.419E-14 | | 64.3 (42) 35.7 (37) |
| 32 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 105120785 | | 1.500E-13 | | 100. (43) |
| 32 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 105124162 | | 1.509E-13 | | 100. (44) |
| 32 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 105124192 | | 2.531E-13 | | 55.2 (45) 44.8 (49) |
| 32 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 105124347 | | 2.531E-13 | | 100. (46) |
| 32 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 105124371 | | 1.511E-13 | | 56.9 (47) 43.1 (41) |
| 32 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 105126372 | | 2.538E-13 | | 100. (48) |
| 32 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 105126496 | | 2.538E-13 | | 55.2 (49) 44.8 (45) |
| 32 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 106380489 | | 4.952E-13 | | 100. (50) |
| 32 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 106390473 | | 2.201E-13 | | 100. (51) |
| 32 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 106390551 | | 4.970E-13 | | 100. (52) |
| 32 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 106391213 | | 9.062E-14 | | 82.5 (53) |
| 32 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 106402697 | | 2.272E-13 | | 100. (54) |
| 32 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 106407804 | | 1.242E-13 | | 64.5 (55) 35.5 (61) |
| 32 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 106407959 | | 1.246E-13 | | 100. (56) |
| 32 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 106408225 | | 2.812E-14 | | 82.5 (57) |
| 32 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 106411866 | | 1.272E-13 | | 100. (58) |
| 32 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 106412228 | | 2.561E-13 | | 57.0 (59) 43.0 (65) |
| 32 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 106412379 | | 2.561E-13 | | 100. (60) |
| 32 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 106412391 | | 1.268E-13 | | 64.5 (61) 35.5 (55) |
| 32 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 106414334 | | 2.578E-13 | | 100. (62) |
| 32 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 106414341 | | 4.338E-13 | | 55.2 (63) 44.8 (69) |
| 32 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 106414430 | | 4.339E-13 | | 100. (64) |
| 32 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 106414456 | | 2.580E-13 | | 57.0 (65) 43.0 (59) |
| 32 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 106415602 | | 6.559E-13 | | 54.3 (66) 45.7 (71) |
| 32 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 106415603 | | 4.351E-13 | | 100. (67) |
| 32 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 106415661 | | 6.559E-13 | | 100. (68) |
| 32 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 106415674 | | 4.352E-13 | | 55.2 (69) 44.8 (63) |
| 32 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 106416442 | | 6.568E-13 | | 100. (70) |
| 32 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 106416490 | | 6.569E-13 | | 54.3 (71) 45.7 (66) |
| 32 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | | 166998092 | | 3.753E-15 | | 78.7 (72) |
| 32 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | | 167020344 | | 1.563E-15 | | 100. (73) |
| 32 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | | 167089874 | | 1.561E-15 | | 91.2 (74) |
| 32 | 75 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | | 167387753 | | 9.098E-16 | | 78.8 (75) |
| 32 | 76 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | | 167405430 | | 1.592E-15 | | 100. (76) |
| 32 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | | 167623495 | | 7.851E-16 | | 100. (77) |
| 32 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^3P_2$ | | 167697538 | | 7.839E-16 | | 51.4 (78) 48.6 (80) |
| 32 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | | 167738242 | | 1.560E-15 | | 91.1 (79) |
| 32 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^1D_2$ | | 168063861 | | 7.911E-16 | | 51.4 (80) 48.6 (78) |
| 32 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | | 168368517 | | 8.542E-16 | | 79.3 (81) |
| 32 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 182499344 | | 7.141E-15 | | 85.5 (82) |
| 32 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 182544115 | | 1.902E-15 | | 36.6 (83) 30.5 (104) 28.0 (91) |
| 32 | 84 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 182567459 | | 1.837E-15 | | 76.8 (84) |
| 32 | 85 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 182571902 | | 4.761E-15 | | 74.1 (85) |
| 32 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 182575314 | | 1.277E-15 | | 72.3 (86) |
| 32 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 182609338 | | 3.649E-15 | | 71.3 (87) 17.6 (83) 7.92 (91) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 32 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p\ ^3P_0$ | 182613677 | | | 3.377E-15 | | 75.2 (88) |
| 32 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p\ ^3P_2$ | 182701017 | | | 4.368E-15 | | 89.1 (89) |
| 32 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p\ ^3D_2$ | 182720157 | | | 1.421E-15 | | 57.4 (90) 20.5 (96) 13.8 (110) |
| 32 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p\ ^1P_1$ | 182739776 | | | 3.058E-15 | | 51.0 (91) 25.8 (83) 23.2 (87) |
| 32 | 92 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | 182750370 | | | 1.488E-15 | | 69.4 (92) 21.2 (85) 9.36 (115) |
| 32 | 93 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | 182754199 | | | 1.428E-15 | | 32.4 (93) 22.2 (107) 21.6 (103) |
| 32 | 94 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | 182765451 | | | 1.519E-15 | | 77.0 (94) |
| 32 | 95 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | 182802013 | | | 5.690E-15 | | 83.7 (95) |
| 32 | 96 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d\ ^3D_2$ | 182808160 | | | 5.380E-15 | | 68.8 (96) 13.2 (101) 8.62 (110) |
| 32 | 97 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | 182813120 | | | 9.895E-15 | | 96.9 (97) |
| 32 | 98 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | 182857388 | | | 1.435E-15 | | 62.6 (98) 19.9 (111) 17.5 (116) |
| 32 | 99 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | 182866533 | | | 1.476E-15 | | 35.4 (99) 29.2 (114) 17.6 (108) |
| 32 | 100 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | 182876676 | | | 1.376E-15 | | 59.9 (100) 21.3 (117) 16.3 (112) |
| 32 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | 182900091 | | | 7.424E-15 | | 80.1 (101) |
| 32 | 102 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | 182981002 | | | 1.547E-15 | | 92.0 (102) |
| 32 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^1P_1$ | 183033829 | | | 1.214E-15 | | 56.0 (93) 25.1 (103) 12.0 (86) |
| 32 | 104 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | 183044760 | | | 1.661E-15 | | 67.2 (104) 20.5 (83) 12.3 (91) |
| 32 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p\ ^3P_2$ | 183060218 | | | 1.258E-15 | | 41.0 (105) 27.5 (90) 26.6 (110) |
| 32 | 106 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | 183100679 | | | 1.254E-15 | | 96.9 (106) |
| 32 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^3S_1$ | 183111917 | | | 1.234E-15 | | 58.6 (107) 32.4 (103) 3.41 (93) |
| 32 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^1D_2$ | 183185453 | | | 1.449E-15 | | 48.4 (108) 30.4 (114) 19.6 (94) |
| 32 | 109 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | 183188599 | | | 1.556E-15 | | 100. (109) |
| 32 | 110 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | 183204700 | | | 1.218E-15 | | 50.6 (110) 47.0 (105) 2.38 (101) |
| 32 | 111 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^3D_3$ | 183217840 | | | 1.406E-15 | | 55.6 (111) 34.5 (98) 9.89 (116) |
| 32 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | 183248871 | | | 1.422E-15 | | 68.2 (112) 28.5 (100) 2.12 (117) |
| 32 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | 183254841 | | | 1.452E-15 | | 98.4 (113) |
| 32 | 114 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3D_2$ | 183259994 | | | 1.428E-15 | | 54.2 (99) 32.7 (114) 10.8 (108) |
| 32 | 115 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | 183313256 | | | 1.252E-15 | | 76.0 (115) |
| 32 | 116 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | 183328671 | | | 1.313E-15 | | 72.5 (116) |
| 32 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | 183356177 | | | 1.404E-15 | | 74.5 (117) |
| 32 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | 187879819 | | | 6.873E-15 | | 81.0 (118) |
| 32 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | 187894097 | | | 1.773E-15 | | 52.4 (119) 30.0 (147) 17.6 (130) |
| 32 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | 187894958 | | | 1.987E-15 | | 73.3 (120) |
| 32 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | 187899896 | | | 4.285E-15 | | 68.0 (121) 17.7 (127) 14.2 (159) |
| 32 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | 187909415 | | | 1.534E-15 | | 71.4 (122) 15.6 (148) 8.24 (118) |
| 32 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | 187920550 | | | 8.144E-15 | | 73.5 (123) |
| 32 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | 187933133 | | | 4.252E-15 | | 73.2 (124) |
| 32 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | 187960693 | | | 6.076E-15 | | 85.3 (125) |
| 32 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | 187967716 | | | 1.619E-15 | | 46.3 (126) 23.5 (152) 15.2 (131) |
| 32 | 127 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | 187978738 | | | 1.924E-15 | | 55.3 (127) 30.5 (121) 14.2 (159) |
| 32 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | 187983013 | | | 1.621E-15 | | 40.3 (128) 23.4 (151) 15.6 (148) |
| 32 | 129 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | 187984327 | | | 1.573E-15 | | 73.8 (129) |
| 32 | 130 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | 187988187 | | | 5.216E-15 | | 57.2 (130) 25.1 (123) 14.2 (119) |
| 32 | 131 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | 188004430 | | | 9.691E-15 | | 73.6 (131) |
| 32 | 132 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | 188004613 | | | 9.222E-15 | | 87.9 (132) |
| 32 | 133 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | 188009609 | | | 1.486E-14 | | 94.5 (133) |
| 32 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | 188020194 | | | 1.646E-15 | | 45.6 (134) 23.9 (163) 19.5 (155) |
| 32 | 135 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | 188027235 | | | 1.526E-15 | | 51.7 (135) 26.0 (168) 15.9 (156) |
| 32 | 136 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | 188028438 | | | 1.659E-15 | | 39.3 (136) 30.4 (158) 15.9 (153) |
| 32 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | 188035899 | | | 1.485E-15 | | 73.5 (137) |
| 32 | 138 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | 188040770 | | | 3.058E-15 | | 52.5 (138) 19.8 (139) 12.9 (169) |
| 32 | 139 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | 188042700 | | | 2.344E-15 | | 28.7 (138) 27.1 (139) 18.0 (169) |
| 32 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | 188045783 | | | 1.484E-15 | | 41.6 (140) 32.0 (165) 26.4 (161) |
| 32 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | 188046646 | | | 2.326E-14 | | 96.1 (141) |
| 32 | 142 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | 188048207 | | | 1.562E-15 | | 49.5 (142) 29.2 (160) 15.9 (164) |
| 32 | 143 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | 188048644 | | | 1.155E-14 | | 71.1 (143) 18.2 (145) 4.74 (134) |
| 32 | 144 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | 188050590 | | | 7.106E-14 | | 100. (144) |
| 32 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | 188056658 | | | 5.465E-14 | | 82.0 (145) |
| 32 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | 188302228 | | | 1.537E-15 | | 100. (146) |
| 32 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | 188316408 | | | 1.552E-15 | | 68.0 (147) 30.3 (119) 1.67 (130) |
| 32 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | 188324535 | | | 1.379E-15 | | 49.4 (128) 25.0 (148) 12.9 (151) |
| 32 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | 188329654 | | | 1.382E-15 | | 43.8 (126) 29.7 (149) 26.5 (152) |
| 32 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | 188357542 | | | 1.383E-15 | | 100. (150) |
| 32 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | 188361393 | | | 1.385E-15 | | 54.3 (151) 39.3 (148) 3.76 (122) |
| 32 | 152 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | 188389141 | | | 1.378E-15 | | 55.0 (149) 45.0 (152) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 32 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | 188390268 | | 1.496E-15 | | | 49.4 (153) 28.9 (158) 21.6 (129) |
| 32 | 154 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | 188395971 | | 1.530E-15 | | | 100. (154) |
| 32 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | 188400317 | | 1.488E-15 | | | 45.9 (134) 43.9 (155) 10.3 (163) |
| 32 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | 188410462 | | 1.484E-15 | | | 65.4 (156) 32.3 (135) 2.31 (168) |
| 32 | 157 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | 188412907 | | 1.495E-15 | | | 100. (157) |
| 32 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | 188416125 | | 1.488E-15 | | | 52.0 (136) 32.8 (158) 15.3 (153) |
| 32 | 159 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | 188425506 | | 1.394E-15 | | | 71.5 (159) 27.0 (127) 1.48 (121) |
| 32 | 160 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^3F_3$ | 188427662 | | 1.513E-15 | | | 38.3 (160) 35.7 (164) 26.0 (137) |
| 32 | 161 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | 188433686 | | 1.512E-15 | | | 56.9 (161) 43.1 (140) |
| 32 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | 188436376 | | 1.511E-15 | | | 50.6 (139) 33.8 (162) 15.6 (169) |
| 32 | 163 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | 188438348 | | 1.448E-15 | | | 62.4 (163) 33.8 (155) 3.79 (134) |
| 32 | 164 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^1F_3$ | 188441203 | | 1.512E-15 | | | 46.7 (142) 29.4 (164) 23.9 (160) |
| 32 | 165 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | 188442288 | | 1.512E-15 | | | 67.6 (165) 17.0 (161) 15.4 (140) |
| 32 | 166 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | 188442494 | | 1.512E-15 | | | 100. (166) |
| 32 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | 188446682 | | 1.511E-15 | | | 100. (167) |
| 32 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | 188449784 | | 1.481E-15 | | | 68.8 (168) 17.2 (156) 14.1 (135) |
| 32 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | 188455734 | | 1.510E-15 | | | 53.0 (169) 45.0 (162) 2.00 (139) |
| 32 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | 190340964 | | 5.203E-15 | | | 73.0 (170) |
| 32 | 171 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | 190344317 | | 1.899E-15 | | | 78.3 (171) |
| 32 | 172 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | 190344627 | | 1.721E-15 | | | 56.8 (172) 29.7 (207) 12.0 (182) |
| 32 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | 190348792 | | 3.674E-15 | | | 61.1 (173) 23.9 (179) 15.1 (219) |
| 32 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | 190353428 | | 1.729E-15 | | | 67.7 (174) 13.8 (170) 12.5 (208) |
| 32 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | 190361902 | | 1.202E-14 | | | 70.2 (175) 22.9 (182) 2.40 (187) |
| 32 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | 190369141 | | 5.727E-15 | | | 78.3 (176) |
| 32 | 177 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | 190381602 | | 5.712E-15 | | | 78.3 (177) |
| 32 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | 190382218 | | 1.644E-15 | | | 45.3 (178) 27.0 (212) 13.8 (209) |
| 32 | 179 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | 190389272 | | 2.295E-15 | | | 45.9 (179) 38.4 (173) 15.7 (219) |
| 32 | 180 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | 190390471 | | 1.611E-15 | | | 72.4 (180) |
| 32 | 181 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | 190390716 | | 1.713E-15 | | | 41.2 (181) 24.5 (211) 13.8 (208) |
| 32 | 182 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | 190396926 | | 6.425E-15 | | | 54.7 (182) 27.6 (175) 10.4 (172) |
| 32 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | 190403922 | | 1.180E-14 | | | 74.2 (183) |
| 32 | 184 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | 190404553 | | 1.437E-14 | | | 92.3 (184) |
| 32 | 185 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | 190406877 | | 1.040E-14 | | | 87.6 (185) |
| 32 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | 190408308 | | 1.625E-15 | | | 43.5 (186) 27.6 (222) 20.3 (215) |
| 32 | 187 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | 190411785 | | 1.642E-15 | | | 47.4 (187) 27.1 (231) 15.2 (216) |
| 32 | 188 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | 190413337 | | 1.797E-15 | | | 38.4 (188) 28.3 (218) 18.1 (177) |
| 32 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | 190415148 | | 1.504E-15 | | | 74.3 (189) |
| 32 | 190 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | 190419086 | | 1.608E-15 | | | 42.7 (190) 30.0 (236) 20.1 (223) |
| 32 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | 190420560 | | 1.500E-15 | | | 41.8 (191) 32.6 (227) 25.6 (221) |
| 32 | 192 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | 190421824 | | 1.502E-15 | | | 72.7 (192) |
| 32 | 193 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | 190422368 | | 1.175E-14 | | | 77.8 (193) |
| 32 | 194 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | 190422449 | | 1.507E-15 | | | 42.4 (194) 32.9 (237) 24.7 (228) |
| 32 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | 190422552 | | 1.695E-15 | | | 47.3 (195) 26.0 (220) 14.6 (224) |
| 32 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | 190424066 | | 1.502E-15 | | | 39.8 (196) 33.1 (232) 27.1 (230) |
| 32 | 197 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | 190424427 | | 1.581E-15 | | | 54.6 (197) 25.4 (226) 14.9 (233) |
| 32 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | 190424864 | | 2.873E-14 | | | 97.1 (198) |
| 32 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | 190425758 | | 1.541E-14 | | | 77.1 (199) |
| 32 | 200 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | 190426988 | | 2.467E-14 | | | 95.8 (200) |
| 32 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | 190430538 | | 9.420E-14 | | | 85.6 (201) |
| 32 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | 190430909 | | 1.870E-13 | | | 59.6 (202) 40.4 (205) |
| 32 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | 190430955 | | 1.852E-13 | | | 100. (203) |
| 32 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | 190432977 | | 2.388E-13 | | | 100. (204) |
| 32 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | 190433207 | | 2.242E-13 | | | 59.7 (205) 40.3 (202) |
| 32 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | 190746576 | | 1.537E-15 | | | 100. (206) |
| 32 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | 190751914 | | 1.540E-15 | | | 67.6 (207) 32.4 (172) |
| 32 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^1P_1$ | 190757819 | | 1.452E-15 | | | 48.8 (181) 23.1 (208) 15.7 (211) |
| 32 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^3P_2$ | 190759886 | | 1.453E-15 | | | 47.0 (178) 27.0 (209) 26.0 (212) |
| 32 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | 190775495 | | 1.453E-15 | | | 100. (210) |
| 32 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^3S_1$ | 190776835 | | 1.453E-15 | | | 51.2 (211) 42.5 (208) 4.18 (174) |
| 32 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^1D_2$ | 190789625 | | 1.452E-15 | | | 57.1 (209) 42.9 (212) |
| 32 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | 190791717 | | 1.517E-15 | | | 48.6 (213) 29.4 (218) 22.0 (180) |
| 32 | 214 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | 190795122 | | 1.532E-15 | | | 100. (214) |
| 32 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | 190796240 | | 1.514E-15 | | | 49.1 (186) 40.2 (215) 10.7 (222) |
| 32 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | 190800603 | | 1.510E-15 | | | 64.5 (216) 33.2 (187) 2.27 (231) |
| 32 | 217 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | 190801701 | | 1.515E-15 | | | 100. (217) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 32 | 218 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | 190803795 | | 1.512E-15 | | | 50.9 (188) 31.9 (218) 17.2 (213) |
| 32 | 219 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | 190805503 | | 1.458E-15 | | | 69.6 (219) 30.4 (179) |
| 32 | 220 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^3F_3$ | 190810015 | | 1.526E-15 | | | 38.3 (220) 36.4 (224) 25.3 (189) |
| 32 | 221 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^3F_4$ | 190812985 | | 1.526E-15 | | | 53.1 (221) 45.5 (191) 1.39 (227) |
| 32 | 222 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | 190814149 | | 1.494E-15 | | | 58.8 (222) 37.5 (215) 3.79 (186) |
| 32 | 223 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | 190814320 | | 1.525E-15 | | | 51.3 (190) 35.5 (223) 13.2 (236) |
| 32 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^1F_3$ | 190816667 | | 1.525E-15 | | | 45.3 (195) 29.7 (224) 25.0 (220) |
| 32 | 225 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | 190816883 | | 1.525E-15 | | | 100. (225) |
| 32 | 226 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | 190817172 | | 1.532E-15 | | | 41.0 (226) 32.2 (233) 26.8 (192) |
| 32 | 227 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^1G_4$ | 190817593 | | 1.525E-15 | | | 66.0 (227) 21.3 (221) 12.7 (191) |
| 32 | 228 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^3F_3$ | 190818781 | | 1.532E-15 | | | 57.1 (194) 24.3 (228) 18.6 (237) |
| 32 | 229 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | 190818968 | | 1.524E-15 | | | 100. (229) |
| 32 | 230 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | 190819078 | | 1.532E-15 | | | 61.6 (230) 38.4 (196) |
| 32 | 231 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | 190819612 | | 1.509E-15 | | | 66.6 (231) 18.3 (216) 15.1 (187) |
| 32 | 232 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | 190820293 | | 1.531E-15 | | | 66.8 (232) 21.8 (196) 11.4 (230) |
| 32 | 233 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | 190820793 | | 1.532E-15 | | | 41.9 (197) 34.3 (233) 23.8 (226) |
| 32 | 234 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | 190822104 | | 1.531E-15 | | | 100. (234) |
| 32 | 235 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | 190822271 | | 1.531E-15 | | | 100. (235) |
| 32 | 236 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | 190824031 | | 1.524E-15 | | | 54.4 (236) 42.8 (223) 2.80 (190) |
| 32 | 237 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^1F_3$ | 190824399 | | 1.531E-15 | | | 51.2 (228) 48.8 (237) |
| 32 | 238 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | 191667984 | | 1.779E-15 | | | 84.4 (238) |
| 32 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | 191668141 | | 1.680E-15 | | | 59.2 (239) 30.1 (283) 8.76 (250) |
| 32 | 240 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | 191668316 | | 3.221E-15 | | | 54.6 (240) 18.6 (242) 14.3 (284) |
| 32 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | 191671981 | | 3.042E-15 | | | 51.9 (241) 30.9 (249) 17.2 (294) |
| 32 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | 191674029 | | 2.119E-15 | | | 57.3 (242) 28.2 (240) 7.03 (284) |
| 32 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | 191681340 | | 1.250E-14 | | | 67.0 (243) 24.5 (250) 3.86 (255) |
| 32 | 244 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | 191685496 | | 8.300E-15 | | | 84.5 (244) |
| 32 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | 191689866 | | 1.620E-15 | | | 46.1 (245) 29.0 (285) 14.7 (288) |
| 32 | 246 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | 191691755 | | 3.714E-15 | | | 61.5 (246) 14.2 (257) 12.4 (289) |
| 32 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | 191694634 | | 1.751E-15 | | | 66.4 (247) 12.0 (246) 10.1 (295) |
| 32 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | 191695253 | | 1.823E-15 | | | 40.0 (248) 24.1 (287) 17.9 (240) |
| 32 | 249 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | 191695424 | | 2.790E-15 | | | 47.9 (241) 37.5 (249) 14.6 (294) |
| 32 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | 191701236 | | 5.697E-15 | | | 45.2 (250) 31.3 (243) 7.69 (239) |
| 32 | 251 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | 191704630 | | 1.577E-15 | | | 43.7 (251) 30.0 (298) 21.1 (291) |
| 32 | 252 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | 191705093 | | 7.596E-15 | | | 68.8 (252) 12.8 (269) 7.09 (258) |
| 32 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | 191705873 | | 2.207E-14 | | | 94.7 (253) |
| 32 | 254 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | 191706540 | | 4.547E-15 | | | 67.9 (254) 16.9 (262) 8.50 (301) |
| 32 | 255 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | 191707011 | | 1.884E-15 | | | 40.5 (255) 24.4 (305) 21.7 (250) |
| 32 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | 191708143 | | 1.540E-15 | | | 73.0 (256) |
| 32 | 257 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | 191708309 | | 2.028E-15 | | | 35.2 (257) 27.2 (246) 25.2 (295) |
| 32 | 258 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | 191710994 | | 1.781E-15 | | | 38.2 (258) 27.6 (319) 18.3 (299) |
| 32 | 259 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | 191711317 | | 1.505E-15 | | | 41.8 (259) 32.9 (303) 25.3 (297) |
| 32 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | 191712069 | | 1.506E-15 | | | 72.9 (260) |
| 32 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | 191712496 | | 1.508E-15 | | | 42.1 (261) 33.1 (320) 24.8 (306) |
| 32 | 262 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | 191713389 | | 2.131E-15 | | | 38.1 (262) 29.9 (254) 20.1 (296) |
| 32 | 263 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | 191713394 | | 1.506E-15 | | | 39.9 (263) 33.2 (308) 26.9 (307) |
| 32 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | 191713510 | | 1.507E-15 | | | 71.9 (264) 17.7 (316) 10.4 (309) |
| 32 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | 191713655 | | 1.517E-15 | | | 57.8 (265) 26.5 (302) 15.7 (310) |
| 32 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | 191713746 | | 1.508E-15 | | | 40.2 (266) 33.2 (321) 26.6 (311) |
| 32 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | 191714347 | | 1.507E-15 | | | 38.8 (267) 33.3 (314) 27.9 (312) |
| 32 | 268 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | 191714577 | | 1.508E-15 | | | 59.7 (268) 24.4 (309) 15.9 (316) |
| 32 | 269 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | 191715762 | | 1.784E-14 | | | 80.6 (269) |
| 32 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | 191717317 | | 4.030E-14 | | | 97.7 (270) |
| 32 | 271 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | 191717733 | | 2.666E-14 | | | 82.2 (271) |
| 32 | 272 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | 191718612 | | 1.099E-13 | | | 100. (272) |
| 32 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | 191720807 | | 1.597E-13 | | | 87.3 (273) |
| 32 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | 191721047 | | 2.881E-13 | | | 100. (274) |
| 32 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | 191721057 | | 3.100E-13 | | | 62.4 (275) 37.6 (277) |
| 32 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | 191722224 | | 4.084E-13 | | | 100. (276) |
| 32 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | 191722393 | | 3.796E-13 | | | 62.5 (277) 37.5 (275) |
| 32 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | 191722445 | | 5.841E-13 | | | 54.9 (278) 45.1 (281) |
| 32 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | 191722467 | | 6.054E-13 | | | 100. (279) |
| 32 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | 191723283 | | 5.852E-13 | | | 100. (280) |
| 32 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | 191723300 | | 6.072E-13 | | | 54.9 (281) 45.1 (278) |
| 32 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | 192067637 | | 1.539E-15 | | | 100. (282) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 32 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 192070078 | | 1.541E-15 | | 67.1 (283) 32.9 (239) |
| 32 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 192074032 | | 1.491E-15 | | 48.9 (248) 21.3 (284) 17.7 (287) |
| 32 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^1D_2$ | | 192075158 | | 1.490E-15 | | 48.1 (245) 26.1 (285) 25.8 (288) |
| 32 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 192084530 | | 1.490E-15 | | 100. (286) |
| 32 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3S_1$ | | 192084923 | | 1.493E-15 | | 49.0 (287) 44.9 (284) 4.59 (242) |
| 32 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^3P_2$ | | 192092144 | | 1.490E-15 | | 58.1 (288) 41.9 (285) |
| 32 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 192093756 | | 1.526E-15 | | 48.0 (289) 29.9 (295) 22.1 (247) |
| 32 | 290 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 192095846 | | 1.535E-15 | | 100. (290) |
| 32 | 291 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 192096193 | | 1.525E-15 | | 50.4 (251) 38.4 (291) 11.2 (298) |
| 32 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 192098375 | | 1.523E-15 | | 64.3 (292) 33.5 (255) 2.18 (305) |
| 32 | 293 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 192098903 | | 1.526E-15 | | 100. (293) |
| 32 | 294 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 192099998 | | 1.498E-15 | | 68.2 (294) 31.8 (249) |
| 32 | 295 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 192100345 | | 1.524E-15 | | 50.5 (257) 31.4 (295) 18.2 (289) |
| 32 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^3F_3$ | | 192104073 | | 1.532E-15 | | 38.2 (296) 36.7 (301) 25.1 (256) |
| 32 | 297 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^3F_4$ | | 192105735 | | 1.532E-15 | | 50.6 (297) 47.2 (259) 2.24 (303) |
| 32 | 298 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 192106093 | | 1.514E-15 | | 57.0 (298) 39.3 (291) 3.64 (251) |
| 32 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 192106514 | | 1.532E-15 | | 51.5 (258) 36.4 (299) 12.1 (319) |
| 32 | 300 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 192107804 | | 1.532E-15 | | 100. (300) |
| 32 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^1F_3$ | | 192107852 | | 1.532E-15 | | 44.8 (262) 29.8 (301) 25.4 (296) |
| 32 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 192108215 | | 1.536E-15 | | 40.9 (302) 32.5 (310) 26.6 (260) |
| 32 | 303 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^1G_4$ | | 192108386 | | 1.533E-15 | | 64.9 (303) 24.1 (297) 11.0 (259) |
| 32 | 304 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 192109021 | | 1.531E-15 | | 100. (304) |
| 32 | 305 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 192109043 | | 1.523E-15 | | 65.7 (305) 18.6 (292) 15.7 (255) |
| 32 | 306 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 192109183 | | 1.536E-15 | | 57.4 (261) 24.4 (306) 18.2 (320) |
| 32 | 307 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 192109291 | | 1.536E-15 | | 56.6 (307) 43.4 (263) |
| 32 | 308 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 192109947 | | 1.536E-15 | | 66.6 (308) 16.8 (263) 16.6 (307) |
| 32 | 309 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^3H_5$ | | 192110104 | | 1.537E-15 | | 40.6 (309) 31.7 (316) 27.7 (264) |
| 32 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^1G_4$ | | 192110339 | | 1.536E-15 | | 41.6 (265) 34.2 (310) 24.2 (302) |
| 32 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 192110603 | | 1.537E-15 | | 59.5 (266) 22.7 (311) 17.8 (321) |
| 32 | 312 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^3H_6$ | | 192110758 | | 1.537E-15 | | 59.7 (267) 28.2 (312) 12.1 (314) |
| 32 | 313 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 192110915 | | 1.535E-15 | | 100. (313) |
| 32 | 314 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^1I_6$ | | 192111013 | | 1.537E-15 | | 54.6 (314) 43.9 (312) 1.50 (267) |
| 32 | 315 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 192111164 | | 1.535E-15 | | 100. (315) |
| 32 | 316 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 192111408 | | 1.537E-15 | | 39.8 (268) 35.1 (316) 25.1 (309) |
| 32 | 317 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 192111680 | | 1.536E-15 | | 100. (317) |
| 32 | 318 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 192111759 | | 1.537E-15 | | 100. (318) |
| 32 | 319 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 192112062 | | 1.531E-15 | | 55.0 (319) 41.7 (299) 3.24 (258) |
| 32 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^1F_3$ | | 192112420 | | 1.535E-15 | | 50.9 (306) 49.1 (320) |
| 32 | 321 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 192112568 | | 1.537E-15 | | 50.9 (311) 49.1 (321) |
| 33 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 33 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 87498590 | 87485900 | | 4.198E-10 | | 100. (2) |
| 33 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 87818560 | 87803245 | | 1.867E-09 | | 100. (3) |
| 33 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 87841400 | 87825192 | | 4.293E-15 | | 82.9 (4) |
| 33 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 87837590 | 87826611 | | 1.340E-03 | | 100. (5) |
| 33 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 88180530 | 88178466 | | 1.939E-11 | | 100. (6) |
| 33 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 88357310 | 88354234 | | 9.110E-16 | | 82.9 (7) |
| 33 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 103745200 | 103739591 | | 1.224E-13 | | 100. (8) |
| 33 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 103833400 | 103826894 | | 4.108E-14 | | 100. (9) |
| 33 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 103834800 | 103829462 | | 1.272E-13 | | 100. (10) |
| 33 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 103839000 | 103833051 | | 1.120E-14 | | 81.9 (11) |
| 33 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 103942800 | 103938573 | | 4.323E-14 | | 100. (12) |
| 33 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | | 103982296 | | 1.431E-14 | | 62.6 (13) 37.4 (17) |
| 33 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | | 103984230 | | 1.435E-14 | | 100. (14) |
| 33 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 103989900 | 103986432 | | 3.144E-15 | | 81.9 (15) |
| 33 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 104033700 | 104019794 | | 1.463E-14 | | 100. (16) |
| 33 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 104037400 | 104023413 | | 1.462E-14 | | 62.6 (17) 37.4 (13) |
| 33 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 109374900 | 109371807 | | 1.786E-13 | | 100. (18) |
| 33 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 109411700 | 109407665 | | 7.031E-14 | | 100. (19) |
| 33 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 109411200 | 109408217 | | 1.845E-13 | | 100. (20) |
| 33 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 109414000 | 109410213 | | 2.440E-14 | | 81.6 (21) |
| 33 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 109457100 | 109454769 | | 7.330E-14 | | 100. (22) |
| 33 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | | 109472872 | | 3.323E-14 | | 63.5 (23) 36.5 (28) |
| 33 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | | 109473564 | | 3.334E-14 | | 100. (24) |
| 33 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 109477100 | 109474369 | | 7.469E-15 | | 81.6 (25) |
| 33 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | | 109488583 | | 3.405E-14 | | 100. (26) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 33 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f^3F_3$ | | 109489757 | | 6.838E-14 | | 56.8 (27) 43.2 (31) |
| 33 | 28 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d^1D_2$ | | 109490321 | | 3.399E-14 | | 63.5 (28) 36.5 (23) |
| 33 | 29 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f^3F_2$ | | 109490329 | | 6.840E-14 | | 100. (29) |
| 33 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f^3F_4$ | | 109497833 | | 6.883E-14 | | 100. (30) |
| 33 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^3F_3$ | | 109498271 | | 6.887E-14 | | 56.8 (31) 43.2 (27) |
| 33 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 111965800 | 111963142 | | 2.837E-13 | | 100. (32) |
| 33 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 111984400 | 111981256 | | 1.207E-13 | | 100. (33) |
| 33 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 111983800 | 111981420 | | 2.861E-13 | | 100. (34) |
| 33 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 111985500 | 111982548 | | 4.579E-14 | | 81.5 (35) |
| 33 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 112007600 | 112005350 | | 1.253E-13 | | 100. (36) |
| 33 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | | 112014535 | | 6.392E-14 | | 63.9 (37) 36.1 (42) |
| 33 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | | 112014862 | | 6.423E-14 | | 100. (38) |
| 33 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 112017700 | 112015244 | | 1.457E-14 | | 81.5 (39) |
| 33 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | | 112022552 | | 6.569E-14 | | 100. (40) |
| 33 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 112023206 | | 1.320E-13 | | 56.9 (41) 43.1 (47) |
| 33 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 112023488 | | 6.528E-14 | | 63.9 (42) 36.1 (37) |
| 33 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 112023496 | | 1.320E-13 | | 100. (43) |
| 33 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 112027341 | | 1.329E-13 | | 100. (44) |
| 33 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 112027373 | | 2.228E-13 | | 55.2 (45) 44.8 (49) |
| 33 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 112027543 | | 2.228E-13 | | 100. (46) |
| 33 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 112027569 | | 1.330E-13 | | 56.9 (47) 43.1 (41) |
| 33 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 112029848 | | 2.235E-13 | | 100. (48) |
| 33 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 112029983 | | 2.235E-13 | | 55.2 (49) 44.8 (45) |
| 33 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 113365185 | | 4.340E-13 | | 100. (50) |
| 33 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 113375577 | | 1.933E-13 | | 100. (51) |
| 33 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 113375648 | | 4.373E-13 | | 100. (52) |
| 33 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 113376320 | | 7.706E-14 | | 81.4 (53) |
| 33 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 113389511 | | 2.000E-13 | | 100. (54) |
| 33 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 113394779 | | 1.091E-13 | | 64.1 (55) 35.9 (61) |
| 33 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 113394960 | | 1.095E-13 | | 100. (56) |
| 33 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 113395192 | | 2.510E-14 | | 81.4 (57) |
| 33 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 113399411 | | 1.120E-13 | | 100. (58) |
| 33 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 113399784 | | 2.254E-13 | | 57.0 (59) 43.0 (65) |
| 33 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 113399952 | | 2.254E-13 | | 100. (60) |
| 33 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 113399966 | | 1.116E-13 | | 64.1 (61) 35.9 (55) |
| 33 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 113402177 | | 2.269E-13 | | 100. (62) |
| 33 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 113402184 | | 3.819E-13 | | 55.2 (63) 44.8 (69) |
| 33 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 113402282 | | 3.820E-13 | | 100. (64) |
| 33 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 113402310 | | 2.272E-13 | | 57.0 (65) 43.0 (59) |
| 33 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 113403616 | | 5.775E-13 | | 54.3 (66) 45.7 (71) |
| 33 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 113403617 | | 3.831E-13 | | 100. (67) |
| 33 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 113403681 | | 5.776E-13 | | 100. (68) |
| 33 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 113403695 | | 3.832E-13 | | 55.2 (69) 44.8 (63) |
| 33 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 113404569 | | 5.784E-13 | | 100. (70) |
| 33 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 113404623 | | 5.785E-13 | | 54.3 (71) 45.7 (66) |
| 33 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | | 177850115 | | 3.268E-15 | | 78.4 (72) |
| 33 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | | 177871254 | | 1.380E-15 | | 100. (73) |
| 33 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | | 177946434 | | 1.379E-15 | | 90.2 (74) |
| 33 | 75 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | | 178257133 | | 8.130E-16 | | 77.0 (75) |
| 33 | 76 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | | 178308150 | | 1.407E-15 | | 100. (76) |
| 33 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | | 178533049 | | 6.939E-16 | | 100. (77) |
| 33 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^1D_2$ | | 178610378 | | 6.928E-16 | | 50.3 (78) 49.7 (80) |
| 33 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | | 178648696 | | 1.381E-15 | | 90.2 (79) |
| 33 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^3P_2$ | | 179025744 | | 6.998E-16 | | 50.3 (80) 49.7 (78) |
| 33 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | | 179333826 | | 7.496E-16 | | 78.8 (81) |
| 33 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 194369857 | | 6.403E-15 | | 85.7 (82) |
| 33 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 194415889 | | 1.668E-15 | | 38.1 (83) 30.0 (104) 26.6 (91) |
| 33 | 84 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 194438383 | | 1.614E-15 | | 77.4 (84) |
| 33 | 85 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 194443936 | | 4.133E-15 | | 73.7 (85) |
| 33 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 194446726 | | 1.132E-15 | | 72.1 (86) 18.3 (103) 5.91 (82) |
| 33 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 194483573 | | 3.218E-15 | | 70.6 (87) 17.6 (83) 8.54 (91) |
| 33 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 194487027 | | 3.031E-15 | | 76.1 (88) |
| 33 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 194588698 | | 3.877E-15 | | 89.4 (89) |
| 33 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 194608777 | | 1.248E-15 | | 56.6 (90) 19.9 (96) 14.8 (110) |
| 33 | 91 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p^1P_1$ | | 194629606 | | 2.825E-15 | | 53.3 (91) 23.8 (87) 23.0 (83) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 33 | 92 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p\ ^3P_0$ | | 194629837 | | 1.331E-15 | | 67.7 (92) 22.2 (85) 10.1 (115) |
| 33 | 93 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p\ ^3P_1$ | | 194642283 | | 1.253E-15 | | 33.4 (93) 22.9 (107) 20.3 (103) |
| 33 | 94 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d\ ^3F_2$ | | 194654166 | | 1.343E-15 | | 76.8 (94) |
| 33 | 95 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d\ ^3D_1$ | | 194692060 | | 5.167E-15 | | 84.4 (95) |
| 33 | 96 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d\ ^3D_2$ | | 194699078 | | 4.939E-15 | | 69.5 (96) 13.4 (101) 8.12 (110) |
| 33 | 97 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d\ ^3D_3$ | | 194708419 | | 9.283E-15 | | 97.5 (97) |
| 33 | 98 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d\ ^3F_3$ | | 194753843 | | 1.265E-15 | | 61.1 (98) 20.3 (111) 18.6 (116) |
| 33 | 99 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 194763438 | | 1.304E-15 | | 36.6 (99) 30.1 (114) 17.5 (108) |
| 33 | 100 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d\ ^3D_1$ | | 194769265 | | 1.215E-15 | | 59.0 (100) 22.1 (117) 16.4 (112) |
| 33 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 194798410 | | 6.950E-15 | | 81.1 (101) |
| 33 | 102 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 194903862 | | 1.367E-15 | | 94.0 (102) |
| 33 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^1P_1$ | | 194959885 | | 1.073E-15 | | 56.2 (93) 23.3 (103) 11.7 (86) |
| 33 | 104 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 194967237 | | 1.452E-15 | | 67.6 (104) 21.9 (83) 10.6 (91) |
| 33 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p\ ^3P_2$ | | 194985027 | | 1.103E-15 | | 38.4 (105) 29.5 (90) 28.2 (110) |
| 33 | 106 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 195038966 | | 1.101E-15 | | 97.5 (106) |
| 33 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^3S_1$ | | 195049380 | | 1.087E-15 | | 56.5 (107) 35.2 (103) 3.58 (86) |
| 33 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^1D_2$ | | 195128169 | | 1.282E-15 | | 48.2 (108) 30.7 (114) 19.9 (94) |
| 33 | 109 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 195134380 | | 1.377E-15 | | 100. (109) |
| 33 | 110 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 195146194 | | 1.074E-15 | | 49.2 (105) 49.0 (110) 1.85 (101) |
| 33 | 111 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^3D_3$ | | 195161378 | | 1.246E-15 | | 53.3 (111) 36.1 (98) 10.6 (116) |
| 33 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 195192469 | | 1.256E-15 | | 67.7 (112) 29.1 (100) 2.19 (117) |
| 33 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 195198609 | | 1.282E-15 | | 98.6 (113) |
| 33 | 114 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3D_2$ | | 195206457 | | 1.262E-15 | | 54.5 (99) 32.4 (114) 12.0 (108) |
| 33 | 115 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 195256910 | | 1.102E-15 | | 75.5 (115) |
| 33 | 116 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | | 195277390 | | 1.162E-15 | | 70.8 (116) 26.4 (111) 2.82 (98) |
| 33 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^3P_1$ | | 195306404 | | 1.241E-15 | | 74.4 (117) |
| 33 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 200102768 | | 5.994E-15 | | 80.8 (118) |
| 33 | 119 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 200117159 | | 1.547E-15 | | 53.5 (119) 30.1 (147) 16.4 (130) |
| 33 | 120 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 200117480 | | 1.740E-15 | | 74.1 (120) |
| 33 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 200123013 | | 3.713E-15 | | 67.4 (121) 18.4 (127) 14.2 (159) |
| 33 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 200132541 | | 1.365E-15 | | 70.9 (122) 15.6 (148) 9.29 (118) |
| 33 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 200144827 | | 7.290E-15 | | 73.2 (123) |
| 33 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 200157333 | | 3.844E-15 | | 74.0 (124) |
| 33 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 200190814 | | 5.373E-15 | | 85.4 (125) |
| 33 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 200197589 | | 1.415E-15 | | 46.3 (126) 24.1 (152) 14.4 (132) |
| 33 | 127 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 200204621 | | 1.721E-15 | | 54.0 (127) 31.3 (121) 14.7 (159) |
| 33 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 200212674 | | 1.419E-15 | | 40.8 (128) 24.0 (151) 15.1 (148) |
| 33 | 129 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 200214453 | | 1.390E-15 | | 73.8 (129) |
| 33 | 130 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | | 200218661 | | 4.826E-15 | | 58.1 (130) 25.7 (123) 12.7 (119) |
| 33 | 131 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 200235763 | | 8.545E-15 | | 88.6 (131) |
| 33 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 200235898 | | 8.997E-15 | | 74.1 (132) |
| 33 | 133 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 200242769 | | 1.321E-14 | | 94.5 (133) |
| 33 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 200253144 | | 1.446E-15 | | 45.3 (134) 24.6 (163) 19.7 (155) |
| 33 | 135 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 200258585 | | 1.348E-15 | | 51.7 (135) 26.7 (168) 16.1 (156) |
| 33 | 136 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 200261384 | | 1.464E-15 | | 39.7 (136) 30.5 (158) 15.6 (153) |
| 33 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 200269057 | | 1.313E-15 | | 73.6 (137) |
| 33 | 138 | $2p_{1/2}4f_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 200274303 | | 2.159E-15 | | 40.4 (138) 26.5 (139) 17.5 (169) |
| 33 | 139 | $2s_{1/2}4d_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 200276419 | | 2.586E-15 | | 40.6 (138) 20.1 (139) 13.6 (169) |
| 33 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 200280009 | | 1.312E-15 | | 41.6 (140) 32.1 (165) 26.2 (161) |
| 33 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 200280787 | | 2.150E-14 | | 96.3 (141) |
| 33 | 142 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 200282484 | | 1.381E-15 | | 49.8 (142) 29.1 (160) 15.7 (164) |
| 33 | 143 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 200282859 | | 1.069E-14 | | 70.3 (143) 19.5 (145) 4.48 (134) |
| 33 | 144 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 200285689 | | 6.337E-14 | | 100. (144) |
| 33 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | | 200291863 | | 4.812E-14 | | 80.6 (145) |
| 33 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 200577755 | | 1.360E-15 | | 100. (146) |
| 33 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 200591960 | | 1.370E-15 | | 67.9 (147) 30.7 (119) 1.38 (130) |
| 33 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | | 200600966 | | 1.220E-15 | | 49.8 (128) 23.1 (148) 14.6 (151) |
| 33 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^3P_2$ | | 200605944 | | 1.222E-15 | | 44.4 (126) 28.5 (149) 27.1 (152) |
| 33 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 200639550 | | 1.222E-15 | | 100. (150) |
| 33 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | | 200643106 | | 1.224E-15 | | 52.4 (151) 41.4 (148) 4.17 (122) |
| 33 | 152 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^1D_2$ | | 200672150 | | 1.219E-15 | | 56.0 (149) 44.0 (152) |
| 33 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | | 200673795 | | 1.323E-15 | | 48.3 (153) 30.1 (158) 21.7 (129) |
| 33 | 154 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 200680854 | | 1.354E-15 | | 100. (154) |
| 33 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | | 200684145 | | 1.317E-15 | | 46.7 (134) 42.2 (155) 11.1 (163) |
| 33 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 200694239 | | 1.312E-15 | | 65.0 (156) 32.6 (135) 2.40 (168) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 33 | 157 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 200696767 | | 1.322E-15 | | 100. (157) |
| 33 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | | 200701240 | | 1.316E-15 | | 51.9 (136) 31.6 (158) 16.6 (153) |
| 33 | 159 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | | 200709296 | | 1.231E-15 | | 71.2 (159) 27.6 (127) 1.26 (121) |
| 33 | 160 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^3F_3$ | | 200713659 | | 1.339E-15 | | 39.0 (160) 35.2 (164) 25.8 (137) |
| 33 | 161 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^3F_4$ | | 200720253 | | 1.338E-15 | | 54.7 (161) 45.3 (140) |
| 33 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 200722609 | | 1.338E-15 | | 50.8 (139) 33.9 (162) 15.3 (169) |
| 33 | 163 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | | 200724239 | | 1.281E-15 | | 61.1 (163) 35.5 (155) 3.43 (134) |
| 33 | 164 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^1F_3$ | | 200728290 | | 1.338E-15 | | 46.4 (142) 30.1 (164) 23.5 (160) |
| 33 | 165 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^1G_4$ | | 200729114 | | 1.338E-15 | | 66.9 (165) 19.6 (161) 13.4 (140) |
| 33 | 166 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | | 200729687 | | 1.338E-15 | | 100. (166) |
| 33 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | | 200733282 | | 1.337E-15 | | 100. (167) |
| 33 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | | 200736241 | | 1.310E-15 | | 68.3 (168) 17.6 (156) 14.1 (135) |
| 33 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 200743343 | | 1.337E-15 | | 53.1 (169) 44.8 (162) 2.08 (139) |
| 33 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | | 202725467 | | 4.353E-15 | | 71.4 (170) 8.84 (208) 8.77 (174) |
| 33 | 171 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | | 202728336 | | 1.659E-15 | | 79.3 (171) |
| 33 | 172 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | | 202728872 | | 1.502E-15 | | 57.8 (172) 30.0 (207) 11.0 (182) |
| 33 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | | 202733262 | | 3.169E-15 | | 60.1 (173) 24.7 (179) 15.2 (219) |
| 33 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | | 202737877 | | 1.564E-15 | | 66.2 (174) 16.2 (170) 12.1 (208) |
| 33 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | | 202747184 | | 1.092E-14 | | 70.8 (175) 23.6 (182) 2.31 (187) |
| 33 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | | 202754369 | | 5.254E-15 | | 79.3 (176) |
| 33 | 177 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | | 202769809 | | 4.930E-15 | | 77.6 (177) |
| 33 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | | 202769936 | | 1.438E-15 | | 45.6 (178) 27.4 (209) 14.1 (212) |
| 33 | 179 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 202775052 | | 2.063E-15 | | 44.8 (179) 39.4 (173) 15.8 (219) |
| 33 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | | 202778327 | | 1.497E-15 | | 41.7 (180) 24.8 (211) 13.5 (208) |
| 33 | 181 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | | 202778362 | | 1.430E-15 | | 72.1 (181) 13.7 (213) 6.59 (218) |
| 33 | 182 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | | 202785306 | | 5.875E-15 | | 55.0 (182) 28.2 (175) 9.37 (172) |
| 33 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | | 202792887 | | 1.087E-14 | | 74.4 (183) |
| 33 | 184 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 202793379 | | 1.358E-14 | | 92.9 (184) |
| 33 | 185 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 202796660 | | 8.879E-15 | | 87.1 (185) |
| 33 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 202797560 | | 1.426E-15 | | 43.5 (186) 28.1 (222) 20.4 (215) |
| 33 | 187 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 202800231 | | 1.454E-15 | | 47.0 (187) 27.2 (230) 15.2 (216) |
| 33 | 188 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 202802649 | | 1.588E-15 | | 38.6 (188) 28.3 (218) 18.1 (177) |
| 33 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 202804506 | | 1.330E-15 | | 74.4 (189) |
| 33 | 190 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 202808555 | | 1.417E-15 | | 42.7 (190) 30.2 (236) 20.2 (223) |
| 33 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 202810475 | | 1.326E-15 | | 41.8 (191) 32.6 (227) 25.6 (221) |
| 33 | 192 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 202811760 | | 1.328E-15 | | 72.7 (192) |
| 33 | 193 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 202812395 | | 1.332E-15 | | 42.3 (193) 32.9 (237) 24.7 (229) |
| 33 | 194 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | | 202812527 | | 1.105E-14 | | 77.9 (194) |
| 33 | 195 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 202812547 | | 1.507E-15 | | 47.1 (195) 25.8 (220) 14.4 (224) |
| 33 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 202814299 | | 1.328E-15 | | 39.8 (196) 33.1 (232) 27.0 (231) |
| 33 | 197 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 202814682 | | 1.376E-15 | | 55.5 (197) 25.8 (226) 15.1 (233) |
| 33 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 202815187 | | 2.710E-14 | | 97.3 (198) |
| 33 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | | 202816120 | | 1.476E-14 | | 76.5 (199) |
| 33 | 200 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 202817786 | | 2.887E-14 | | 97.9 (200) |
| 33 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | | 202821428 | | 8.303E-14 | | 84.3 (201) |
| 33 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 202821834 | | 1.693E-13 | | 59.3 (202) 40.7 (205) |
| 33 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 202821887 | | 1.685E-13 | | 100. (203) |
| 33 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 202824193 | | 2.109E-13 | | 100. (204) |
| 33 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | | 202824437 | | 2.002E-13 | | 59.4 (205) 40.6 (202) |
| 33 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 203183574 | | 1.360E-15 | | 100. (206) |
| 33 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 203188995 | | 1.362E-15 | | 67.5 (207) 32.5 (172) |
| 33 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^1P_1$ | | 203195240 | | 1.285E-15 | | 49.2 (180) 21.5 (208) 17.2 (211) |
| 33 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^1D_2$ | | 203197286 | | 1.286E-15 | | 47.3 (178) 26.6 (209) 26.1 (212) |
| 33 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 203215841 | | 1.285E-15 | | 100. (210) |
| 33 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^3S_1$ | | 203217077 | | 1.286E-15 | | 49.7 (211) 44.2 (208) 4.54 (174) |
| 33 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^3P_2$ | | 203230422 | | 1.285E-15 | | 57.9 (212) 42.1 (209) |
| 33 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | | 203232779 | | 1.342E-15 | | 47.3 (213) 30.8 (218) 22.0 (181) |
| 33 | 214 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 203236910 | | 1.356E-15 | | 100. (214) |
| 33 | 215 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | | 203237451 | | 1.340E-15 | | 49.7 (186) 38.7 (215) 11.6 (222) |
| 33 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 203241789 | | 1.336E-15 | | 64.1 (216) 33.5 (187) 2.38 (230) |
| 33 | 217 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 203242933 | | 1.340E-15 | | 100. (217) |
| 33 | 218 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | | 203245693 | | 1.338E-15 | | 50.9 (188) 30.6 (218) 18.6 (213) |
| 33 | 219 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 203246720 | | 1.289E-15 | | 69.3 (219) 30.7 (179) |
| 33 | 220 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^3F_3$ | | 203252323 | | 1.351E-15 | | 38.9 (220) 35.8 (224) 25.3 (189) |
| 33 | 221 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^3F_4$ | | 203255556 | | 1.350E-15 | | 50.5 (221) 47.3 (191) 2.23 (227) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 33 | 222 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 203256398 | | 1.322E-15 | | 57.7 (222) 39.0 (215) 3.37 (186) |
| 33 | 223 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 203256748 | | 1.350E-15 | | 51.4 (190) 35.6 (223) 13.0 (236) |
| 33 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^1F_3$ | | 203259530 | | 1.350E-15 | | 45.2 (195) 30.4 (224) 24.5 (220) |
| 33 | 225 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 203259774 | | 1.350E-15 | | 100. (225) |
| 33 | 226 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | | 203260078 | | 1.356E-15 | | 41.4 (226) 31.9 (233) 26.7 (192) |
| 33 | 227 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^1G_4$ | | 203260354 | | 1.350E-15 | | 65.1 (227) 24.0 (221) 10.9 (191) |
| 33 | 228 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 203261561 | | 1.349E-15 | | 100. (228) |
| 33 | 229 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^3F_3$ | | 203261738 | | 1.356E-15 | | 57.2 (193) 24.6 (229) 18.3 (237) |
| 33 | 230 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 203262144 | | 1.335E-15 | | 66.3 (230) 18.8 (216) 15.0 (187) |
| 33 | 231 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 203262191 | | 1.356E-15 | | 56.7 (231) 43.3 (196) |
| 33 | 232 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 203263379 | | 1.355E-15 | | 66.7 (232) 16.9 (196) 16.4 (231) |
| 33 | 233 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^3G_4$ | | 203264034 | | 1.356E-15 | | 41.8 (197) 34.7 (233) 23.5 (226) |
| 33 | 234 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 203265345 | | 1.355E-15 | | 100. (234) |
| 33 | 235 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 203265396 | | 1.355E-15 | | 100. (235) |
| 33 | 236 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 203267157 | | 1.349E-15 | | 54.5 (236) 42.6 (223) 2.87 (190) |
| 33 | 237 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^1F_3$ | | 203267759 | | 1.355E-15 | | 50.9 (229) 49.1 (237) |
| 33 | 238 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 204139200 | | 1.555E-15 | | 85.4 (238) |
| 33 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 204139460 | | 1.469E-15 | | 59.9 (239) 30.4 (283) 7.93 (250) |
| 33 | 240 | $2s_{1/2}6s_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 204139911 | | 2.561E-15 | | 49.4 (240) 23.4 (242) 15.6 (284) |
| 33 | 241 | $2s_{1/2}6s_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 204143591 | | 2.606E-15 | | 50.4 (241) 32.0 (247) 17.6 (294) |
| 33 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 204145732 | | 2.034E-15 | | 52.6 (242) 34.3 (240) 5.90 (284) |
| 33 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 204153648 | | 1.140E-14 | | 67.0 (243) 24.9 (250) 3.71 (254) |
| 33 | 244 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 204157766 | | 7.749E-15 | | 85.5 (244) |
| 33 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 204163196 | | 1.420E-15 | | 46.5 (245) 29.4 (285) 14.9 (288) |
| 33 | 246 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 204165547 | | 2.889E-15 | | 55.7 (246) 14.5 (289) 13.9 (257) |
| 33 | 247 | $2p_{1/2}6p_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 204167841 | | 2.541E-15 | | 49.4 (241) 36.2 (247) 14.3 (294) |
| 33 | 248 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 204168181 | | 1.637E-15 | | 61.4 (248) 17.2 (246) 11.2 (295) |
| 33 | 249 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 204168543 | | 1.593E-15 | | 40.5 (249) 24.4 (287) 17.1 (240) |
| 33 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 204175245 | | 4.762E-15 | | 43.3 (250) 31.6 (243) 7.87 (254) |
| 33 | 251 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 204178831 | | 1.386E-15 | | 43.8 (251) 30.3 (298) 21.2 (290) |
| 33 | 252 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 204179486 | | 6.431E-15 | | 69.2 (252) 13.1 (269) 7.80 (258) |
| 33 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 204180245 | | 2.114E-14 | | 95.2 (253) |
| 33 | 254 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 204180848 | | 1.712E-15 | | 39.2 (254) 24.0 (250) 23.7 (304) |
| 33 | 255 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 204181278 | | 3.432E-15 | | 62.1 (255) 18.3 (263) 11.2 (301) |
| 33 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 204182433 | | 1.399E-15 | | 70.8 (256) 12.9 (296) 11.3 (301) |
| 33 | 257 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 204182649 | | 1.807E-15 | | 34.9 (257) 27.8 (246) 25.0 (295) |
| 33 | 258 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 204185379 | | 1.597E-15 | | 37.6 (258) 27.2 (319) 18.1 (299) |
| 33 | 259 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 204185901 | | 1.330E-15 | | 41.8 (259) 32.9 (303) 25.3 (297) |
| 33 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 204186667 | | 1.331E-15 | | 72.9 (260) |
| 33 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 204187100 | | 1.333E-15 | | 42.0 (261) 33.1 (320) 24.8 (306) |
| 33 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 204188164 | | 1.331E-15 | | 39.9 (262) 33.2 (308) 26.9 (307) |
| 33 | 263 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 204188175 | | 1.969E-15 | | 36.4 (263) 33.0 (255) 19.2 (296) |
| 33 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 204188281 | | 1.333E-15 | | 71.9 (264) 17.7 (316) 10.3 (309) |
| 33 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 204188429 | | 1.339E-15 | | 57.8 (265) 26.5 (302) 15.6 (310) |
| 33 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 204188518 | | 1.333E-15 | | 40.2 (266) 33.2 (321) 26.6 (311) |
| 33 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^1I_6$ | | 204189231 | | 1.333E-15 | | 38.8 (312) 33.3 (267) 27.9 (315) |
| 33 | 268 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 204189462 | | 1.333E-15 | | 59.7 (268) 24.4 (309) 15.9 (316) |
| 33 | 269 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 204190878 | | 1.673E-14 | | 80.5 (269) |
| 33 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 204192543 | | 3.851E-14 | | 97.9 (270) |
| 33 | 271 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 204192986 | | 2.608E-14 | | 81.4 (271) |
| 33 | 272 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 204194123 | | 1.095E-13 | | 100. (272) |
| 33 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 204196368 | | 1.410E-13 | | 86.0 (273) |
| 33 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 204196635 | | 2.649E-13 | | 100. (274) |
| 33 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 204196643 | | 2.819E-13 | | 61.9 (275) 38.1 (277) |
| 33 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 204197977 | | 3.605E-13 | | 100. (276) |
| 33 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 204198155 | | 3.394E-13 | | 61.9 (277) 38.1 (275) |
| 33 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 204198204 | | 5.161E-13 | | 54.9 (278) 45.1 (281) |
| 33 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 204198230 | | 5.358E-13 | | 100. (279) |
| 33 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 204199156 | | 5.170E-13 | | 100. (280) |
| 33 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 204199175 | | 5.373E-13 | | 54.9 (281) 45.1 (278) |
| 33 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 204591832 | | 1.362E-15 | | 100. (282) |
| 33 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 204594311 | | 1.364E-15 | | 67.1 (283) 32.9 (239) |
| 33 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^1P_1$ | | 204598449 | | 1.320E-15 | | 49.3 (249) 19.9 (284) 19.0 (287) |
| 33 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^1D_2$ | | 204599582 | | 1.319E-15 | | 48.3 (245) 26.6 (285) 25.1 (288) |
| 33 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 204610665 | | 1.319E-15 | | 100. (286) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 33 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^3S_1$ | | 204610995 | | 1.321E-15 | | 47.6 (287) 46.3 (284) 4.92 (242) |
| 33 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^3P_2$ | | 204618525 | | 1.319E-15 | | 58.8 (288) 41.2 (285) |
| 33 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 204620290 | | 1.351E-15 | | 46.6 (289) 31.3 (295) 22.1 (248) |
| 33 | 290 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 204622810 | | 1.350E-15 | | 51.0 (251) 36.9 (290) 12.1 (298) |
| 33 | 291 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 204622811 | | 1.358E-15 | | 100. (291) |
| 33 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 204624968 | | 1.348E-15 | | 64.0 (292) 33.7 (254) 2.29 (304) |
| 33 | 293 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 204625516 | | 1.351E-15 | | 100. (293) |
| 33 | 294 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 204626563 | | 1.326E-15 | | 68.1 (294) 31.9 (247) |
| 33 | 295 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 204627362 | | 1.349E-15 | | 50.5 (257) 29.9 (295) 19.6 (289) |
| 33 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^3F_3$ | | 204631321 | | 1.356E-15 | | 38.9 (296) 36.0 (301) 25.1 (256) |
| 33 | 297 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^3F_4$ | | 204633123 | | 1.356E-15 | | 48.9 (259) 47.8 (297) 3.30 (303) |
| 33 | 298 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 204633303 | | 1.340E-15 | | 56.0 (298) 40.8 (290) 3.19 (251) |
| 33 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 204633832 | | 1.356E-15 | | 51.5 (258) 36.5 (299) 12.0 (319) |
| 33 | 300 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 204635375 | | 1.356E-15 | | 100. (300) |
| 33 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^1F_3$ | | 204635422 | | 1.356E-15 | | 44.7 (263) 30.5 (301) 24.8 (296) |
| 33 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 204635807 | | 1.360E-15 | | 41.2 (302) 32.2 (310) 26.6 (260) |
| 33 | 303 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^1G_4$ | | 204635899 | | 1.357E-15 | | 63.8 (303) 26.9 (297) 9.31 (259) |
| 33 | 304 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 204636405 | | 1.348E-15 | | 65.5 (304) 19.0 (292) 15.5 (254) |
| 33 | 305 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 204636429 | | 1.356E-15 | | 100. (305) |
| 33 | 306 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 204636810 | | 1.359E-15 | | 57.4 (261) 24.8 (306) 17.8 (320) |
| 33 | 307 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^3G_5$ | | 204636987 | | 1.359E-15 | | 49.9 (307) 48.5 (262) 1.64 (308) |
| 33 | 308 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^1H_5$ | | 204637646 | | 1.359E-15 | | 65.1 (308) 23.3 (307) 11.6 (262) |
| 33 | 309 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^3H_5$ | | 204637883 | | 1.361E-15 | | 40.9 (309) 31.5 (316) 27.6 (264) |
| 33 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^1G_4$ | | 204638129 | | 1.359E-15 | | 41.5 (265) 34.6 (310) 23.9 (302) |
| 33 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 204638404 | | 1.361E-15 | | 59.4 (266) 23.0 (311) 17.6 (321) |
| 33 | 312 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 204638565 | | 1.361E-15 | | 61.1 (312) 20.0 (267) 18.8 (315) |
| 33 | 313 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 204638715 | | 1.359E-15 | | 100. (313) |
| 33 | 314 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 204638856 | | 1.359E-15 | | 100. (314) |
| 33 | 315 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 204638887 | | 1.361E-15 | | 53.4 (315) 46.6 (267) |
| 33 | 316 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 204639320 | | 1.361E-15 | | 39.8 (268) 35.3 (316) 24.9 (309) |
| 33 | 317 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 204639583 | | 1.360E-15 | | 100. (317) |
| 33 | 318 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 204639598 | | 1.360E-15 | | 100. (318) |
| 33 | 319 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 204639782 | | 1.356E-15 | | 55.1 (319) 41.6 (299) 3.29 (258) |
| 33 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^1F_3$ | | 204640279 | | 1.359E-15 | | 50.6 (306) 49.4 (320) |
| 33 | 321 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 204640518 | | 1.360E-15 | | 50.6 (311) 49.4 (321) |
| 34 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 34 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 93052920 | 93039890 | | 3.090E-10 | | 100. (2) |
| 34 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 93386400 | 93370266 | | 1.765E-09 | | 100. (3) |
| 34 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 93409410 | 93392168 | | 3.574E-15 | | 81.8 (4) |
| 34 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 93405000 | 93393930 | | 1.042E-03 | | 100. (5) |
| 34 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 93796560 | 93796415 | | 1.526E-11 | | 100. (6) |
| 34 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 93977800 | 93976615 | | 8.175E-16 | | 81.8 (7) |
| 34 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 110342500 | 110338082 | | 1.077E-13 | | 100. (8) |
| 34 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 110434400 | 110428932 | | 3.624E-14 | | 100. (9) |
| 34 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 110435500 | 110431480 | | 1.119E-13 | | 100. (10) |
| 34 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 110439900 | 110435061 | | 9.509E-15 | | 80.9 (11) |
| 34 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 110556100 | 110555770 | | 3.827E-14 | | 100. (12) |
| 34 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | | 110600796 | | 1.263E-14 | | 62.4 (13) 37.6 (17) |
| 34 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 110614590 | 110602984 | | 1.268E-14 | | 100. (14) |
| 34 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 110606500 | 110604912 | | 2.817E-15 | | 80.9 (15) |
| 34 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 110654500 | 110643326 | | 1.294E-14 | | 100. (16) |
| 34 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 110658400 | 110647180 | | 1.292E-14 | | 62.4 (17) 37.6 (13) |
| 34 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 116333800 | 116332296 | | 1.574E-13 | | 100. (18) |
| 34 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 116372100 | 116369599 | | 6.205E-14 | | 100. (19) |
| 34 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 116371400 | 116370132 | | 1.624E-13 | | 100. (20) |
| 34 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 116374300 | 116372134 | | 2.083E-14 | | 80.6 (21) |
| 34 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 116423400 | 116423093 | | 6.487E-14 | | 100. (22) |
| 34 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | | 116441742 | | 2.933E-14 | | 63.2 (23) 36.8 (29) |
| 34 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | | 116442536 | | 2.945E-14 | | 100. (24) |
| 34 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 116444000 | 116443227 | | 6.690E-15 | | 80.6 (25) |
| 34 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | | 116459573 | | 3.012E-14 | | 100. (26) |
| 34 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 116460786 | | 6.042E-14 | | 56.8 (27) 43.2 (31) |
| 34 | 28 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 116461413 | | 6.044E-14 | | 100. (28) |
| 34 | 29 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | | 116461417 | | 3.003E-14 | | 63.2 (29) 36.8 (23) |
| 34 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 116469921 | | 6.084E-14 | | 100. (30) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 34 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f^1F_3$ | | 116470400 | | 6.088E-14 | | 56.8 (31) 43.2 (27) |
| 34 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s^3S_1$ | 119090700 | 119089952 | | 2.500E-13 | | 100. (32) |
| 34 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p^3P_0$ | 119110100 | 119108793 | | 1.066E-13 | | 100. (33) |
| 34 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s^1S_0$ | 119109500 | 119108944 | | 2.519E-13 | | 100. (34) |
| 34 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 119111300 | 119110078 | | 3.918E-14 | | 80.4 (35) |
| 34 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 119136400 | 119136152 | | 1.108E-13 | | 100. (36) |
| 34 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | | 119145614 | | 5.640E-14 | | 63.5 (37) 36.5 (42) |
| 34 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | | 119145993 | | 5.674E-14 | | 100. (38) |
| 34 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 119146800 | 119146318 | | 1.305E-14 | | 80.4 (39) |
| 34 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | | 119154717 | | 5.810E-14 | | 100. (40) |
| 34 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 119155393 | | 1.166E-13 | | 56.9 (41) 43.1 (47) |
| 34 | 42 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 119155708 | | 5.766E-14 | | 63.5 (42) 36.5 (37) |
| 34 | 43 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 119155712 | | 1.166E-13 | | 100. (43) |
| 34 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 119160070 | | 1.174E-13 | | 100. (44) |
| 34 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 119160103 | | 1.969E-13 | | 55.2 (45) 44.8 (49) |
| 34 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 119160290 | | 1.970E-13 | | 100. (46) |
| 34 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 119160320 | | 1.175E-13 | | 56.9 (47) 43.1 (41) |
| 34 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 119162904 | | 1.975E-13 | | 100. (48) |
| 34 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 119163051 | | 1.976E-13 | | 55.2 (49) 44.8 (45) |
| 34 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 120581863 | | 3.817E-13 | | 100. (50) |
| 34 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 120592669 | | 1.704E-13 | | 100. (51) |
| 34 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 120592733 | | 3.862E-13 | | 100. (52) |
| 34 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 120593409 | | 6.600E-14 | | 80.4 (53) |
| 34 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 120608491 | | 1.767E-13 | | 100. (54) |
| 34 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 120613917 | | 9.629E-14 | | 63.7 (55) 36.3 (61) |
| 34 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 120614128 | | 9.671E-14 | | 100. (56) |
| 34 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 120614329 | | 2.248E-14 | | 80.4 (57) |
| 34 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 120619177 | | 9.900E-14 | | 100. (58) |
| 34 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 120619563 | | 1.991E-13 | | 56.9 (59) 43.1 (65) |
| 34 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 120619747 | | 1.991E-13 | | 100. (60) |
| 34 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 120619765 | | 9.864E-14 | | 63.7 (61) 36.3 (55) |
| 34 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 120622270 | | 2.006E-13 | | 100. (62) |
| 34 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 120622276 | | 3.376E-13 | | 55.3 (63) 44.7 (69) |
| 34 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 120622384 | | 3.376E-13 | | 100. (64) |
| 34 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 120622416 | | 2.008E-13 | | 56.9 (65) 43.1 (59) |
| 34 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 120623897 | | 5.105E-13 | | 54.3 (66) 45.7 (71) |
| 34 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 120623897 | | 3.387E-13 | | 100. (67) |
| 34 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 120623967 | | 5.106E-13 | | 100. (68) |
| 34 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 120623983 | | 3.387E-13 | | 55.3 (69) 44.7 (63) |
| 34 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 120624975 | | 5.114E-13 | | 100. (70) |
| 34 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 120625034 | | 5.114E-13 | | 54.3 (71) 45.7 (66) |
| 34 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | | 189057725 | | 2.855E-15 | | 78.1 (72) |
| 34 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | | 189077737 | | 1.223E-15 | | 100. (73) |
| 34 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | | 189158627 | | 1.222E-15 | | 89.2 (74) |
| 34 | 75 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | | 189482112 | | 7.288E-16 | | 75.3 (75) |
| 34 | 76 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | | 189571605 | | 1.249E-15 | | 100. (76) |
| 34 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | | 189803327 | | 6.156E-16 | | 100. (77) |
| 34 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^1D_2$ | | 189883838 | | 6.146E-16 | | 51.8 (78) 48.2 (80) |
| 34 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | | 189919860 | | 1.227E-15 | | 89.2 (79) |
| 34 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^3P_2$ | | 190353568 | | 6.213E-16 | | 51.8 (80) 48.2 (78) |
| 34 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | | 190665067 | | 6.608E-16 | | 78.3 (81) |
| 34 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 206630519 | | 5.737E-15 | | 85.8 (82) |
| 34 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 206677750 | | 1.470E-15 | | 39.5 (83) 29.6 (104) 25.3 (92) |
| 34 | 84 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 206699412 | | 1.423E-15 | | 78.0 (84) |
| 34 | 85 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 206706099 | | 3.602E-15 | | 73.3 (85) |
| 34 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 206708228 | | 1.008E-15 | | 71.8 (86) 18.3 (103) 6.54 (82) |
| 34 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 206747978 | | 2.847E-15 | | 70.6 (87) 17.7 (83) 9.28 (92) |
| 34 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 206750490 | | 2.730E-15 | | 76.9 (88) |
| 34 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 206868071 | | 3.454E-15 | | 89.6 (89) |
| 34 | 90 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 206889016 | | 1.100E-15 | | 55.9 (90) 19.2 (96) 15.7 (110) |
| 34 | 91 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 206899386 | | 1.194E-15 | | 66.0 (91) 23.1 (85) 10.9 (115) |
| 34 | 92 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p^1P_1$ | | 206910967 | | 2.612E-15 | | 55.3 (92) 24.3 (87) 20.4 (83) |
| 34 | 93 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^3P_1$ | | 206921870 | | 1.103E-15 | | 34.2 (93) 23.6 (107) 19.3 (103) |
| 34 | 94 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 206934491 | | 1.192E-15 | | 76.6 (94) |
| 34 | 95 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 206973766 | | 4.706E-15 | | 85.1 (95) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 34 | 96 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 206981695 | | 4.551E-15 | | 70.2 (96) 13.6 (101) 7.64 (110) |
| 34 | 97 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 206995770 | | 8.658E-15 | | 98.0 (97) |
| 34 | 98 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 207042312 | | 1.119E-15 | | 59.8 (98) 20.6 (111) 19.6 (116) |
| 34 | 99 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d^3P_2$ | | 207052085 | | 1.157E-15 | | 37.5 (99) 30.8 (114) 17.3 (108) |
| 34 | 100 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 207053380 | | 1.078E-15 | | 58.1 (100) 22.8 (117) 16.5 (112) |
| 34 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 207088625 | | 6.465E-15 | | 81.8 (101) |
| 34 | 102 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 207222277 | | 1.213E-15 | | 96.2 (102) |
| 34 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p^1P_1$ | | 207281148 | | 9.518E-16 | | 56.3 (93) 21.7 (103) 11.4 (86) |
| 34 | 104 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 207285159 | | 1.277E-15 | | 67.8 (104) 23.1 (83) 9.08 (92) |
| 34 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p^3P_2$ | | 207305183 | | 9.725E-16 | | 36.2 (105) 31.2 (90) 29.4 (110) |
| 34 | 106 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p^3D_3$ | | 207374153 | | 9.723E-16 | | 98.0 (106) |
| 34 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p^3S_1$ | | 207383841 | | 9.610E-16 | | 54.6 (107) 37.7 (103) 4.01 (86) |
| 34 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d^1D_2$ | | 207467809 | | 1.138E-15 | | 48.2 (108) 31.5 (114) 20.3 (94) |
| 34 | 109 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d^3F_4$ | | 207477455 | | 1.223E-15 | | 100. (109) |
| 34 | 110 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p^1D_2$ | | 207484646 | | 9.507E-16 | | 51.1 (105) 47.5 (110) 1.45 (101) |
| 34 | 111 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d^3D_3$ | | 207501818 | | 1.108E-15 | | 51.1 (111) 37.5 (98) 11.4 (116) |
| 34 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d^3P_1$ | | 207532930 | | 1.113E-15 | | 67.8 (112) 29.9 (100) 2.28 (117) |
| 34 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d^3P_0$ | | 207539251 | | 1.136E-15 | | 98.8 (113) |
| 34 | 114 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d^1D_2$ | | 207550177 | | 1.120E-15 | | 54.8 (99) 32.0 (114) 13.3 (108) |
| 34 | 115 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p^1S_0$ | | 207597480 | | 9.736E-16 | | 75.0 (115) |
| 34 | 116 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d^1F_3$ | | 207623359 | | 1.032E-15 | | 69.0 (116) 28.3 (111) 2.66 (98) |
| 34 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d^1P_1$ | | 207653945 | | 1.101E-15 | | 73.5 (117) |
| 34 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s^3S_1$ | | 212727723 | | 5.217E-15 | | 80.4 (118) |
| 34 | 119 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s^3P_0$ | | 212741965 | | 1.530E-15 | | 74.8 (119) |
| 34 | 120 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s^3P_1$ | | 212742183 | | 1.356E-15 | | 54.6 (120) 30.2 (147) 15.2 (130) |
| 34 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s^1S_0$ | | 212748117 | | 3.231E-15 | | 66.8 (121) 19.1 (127) 14.1 (159) |
| 34 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p^3D_1$ | | 212757634 | | 1.221E-15 | | 70.2 (122) 15.6 (148) 10.4 (118) |
| 34 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p^3P_1$ | | 212771120 | | 6.545E-15 | | 73.0 (123) |
| 34 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p^3P_0$ | | 212783528 | | 3.488E-15 | | 74.7 (124) |
| 34 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p^3P_2$ | | 212823594 | | 4.768E-15 | | 85.6 (125) |
| 34 | 126 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p^3D_2$ | | 212830056 | | 1.243E-15 | | 46.4 (126) 24.6 (149) 13.6 (132) |
| 34 | 127 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p^3P_0$ | | 212832464 | | 1.544E-15 | | 52.8 (127) 32.1 (121) 15.1 (159) |
| 34 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p^3P_1$ | | 212844888 | | 1.246E-15 | | 41.3 (128) 24.4 (151) 14.7 (148) |
| 34 | 129 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d^3F_2$ | | 212847169 | | 1.233E-15 | | 73.7 (129) |
| 34 | 130 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p^1P_1$ | | 212851742 | | 4.471E-15 | | 58.9 (130) 26.3 (123) 11.4 (120) |
| 34 | 131 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d^3D_1$ | | 212869559 | | 7.943E-15 | | 89.3 (131) |
| 34 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d^3D_2$ | | 212870029 | | 8.387E-15 | | 74.5 (132) |
| 34 | 133 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d^3D_3$ | | 212878771 | | 1.179E-14 | | 94.5 (133) |
| 34 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d^3F_3$ | | 212888866 | | 1.275E-15 | | 45.1 (134) 25.1 (163) 19.8 (155) |
| 34 | 135 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d^3D_1$ | | 212892495 | | 1.195E-15 | | 51.3 (135) 27.1 (168) 16.1 (156) |
| 34 | 136 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d^3P_2$ | | 212897081 | | 1.295E-15 | | 40.0 (136) 30.5 (158) 15.4 (153) |
| 34 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f^3G_3$ | | 212904986 | | 1.165E-15 | | 73.7 (137) |
| 34 | 138 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f^3F_2$ | | 212910537 | | 1.645E-15 | | 31.9 (138) 30.6 (139) 21.4 (169) |
| 34 | 139 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d^1D_2$ | | 212913010 | | 2.883E-15 | | 50.0 (139) 14.4 (138) 12.8 (132) |
| 34 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f^3G_4$ | | 212917099 | | 1.164E-15 | | 41.7 (140) 32.2 (165) 26.1 (161) |
| 34 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f^3F_2$ | | 212917773 | | 1.995E-14 | | 97.5 (141) |
| 34 | 142 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f^3D_3$ | | 212919624 | | 1.225E-15 | | 50.0 (142) 29.0 (160) 15.6 (164) |
| 34 | 143 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f^3F_3$ | | 212919914 | | 9.929E-15 | | 69.5 (143) 20.8 (145) 4.23 (134) |
| 34 | 144 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f^3F_4$ | | 212923726 | | 5.659E-14 | | 100. (144) |
| 34 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f^1F_3$ | | 212930008 | | 4.268E-14 | | 79.3 (145) |
| 34 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s^3P_2$ | | 213260477 | | 1.208E-15 | | 100. (146) |
| 34 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s^1P_1$ | | 213274737 | | 1.215E-15 | | 67.8 (147) 31.0 (120) 1.15 (130) |
| 34 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p^1P_1$ | | 213284552 | | 1.084E-15 | | 50.2 (128) 21.6 (148) 16.2 (151) |
| 34 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p^1D_2$ | | 213289421 | | 1.084E-15 | | 44.9 (126) 27.7 (149) 27.4 (152) |
| 34 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p^3D_3$ | | 213329386 | | 1.085E-15 | | 100. (150) |
| 34 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p^3S_1$ | | 213332690 | | 1.086E-15 | | 50.8 (151) 43.1 (148) 4.52 (122) |
| 34 | 152 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p^3P_2$ | | 213362998 | | 1.082E-15 | | 57.0 (152) 43.0 (149) |
| 34 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d^1D_2$ | | 213365161 | | 1.175E-15 | | 47.1 (153) 31.2 (158) 21.7 (129) |
| 34 | 154 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d^3F_4$ | | 213373757 | | 1.202E-15 | | 100. (154) |
| 34 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d^3D_3$ | | 213375818 | | 1.170E-15 | | 47.5 (134) 40.5 (155) 11.9 (163) |
| 34 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d^3P_1$ | | 213385851 | | 1.165E-15 | | 64.6 (156) 32.9 (135) 2.49 (168) |
| 34 | 157 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d^3P_0$ | | 213388468 | | 1.174E-15 | | 100. (157) |
| 34 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d^3D_2$ | | 213394371 | | 1.169E-15 | | 51.8 (136) 30.3 (158) 17.9 (153) |
| 34 | 159 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p^1S_0$ | | 213400946 | | 1.091E-15 | | 70.8 (159) 28.1 (127) 1.07 (121) |
| 34 | 160 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f^3F_3$ | | 213407677 | | 1.189E-15 | | 39.6 (160) 34.7 (164) 25.7 (137) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 34 | 161 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f^3F_4$ | 213414854 | | 1.189E-15 | | | 51.3 (161) 46.9 (140) 1.79 (165) |
| 34 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f^3D_2$ | 213416864 | | 1.188E-15 | | | 50.9 (138) 34.0 (162) 15.0 (169) |
| 34 | 163 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d^1F_3$ | 213418131 | | 1.138E-15 | | | 59.8 (163) 37.1 (155) 3.07 (134) |
| 34 | 164 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f^1F_3$ | 213423493 | | 1.189E-15 | | | 46.1 (142) 30.8 (164) 23.1 (160) |
| 34 | 165 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^1G_4$ | 213424035 | | 1.189E-15 | | | 66.0 (165) 22.6 (161) 11.4 (140) |
| 34 | 166 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | 213424991 | | 1.189E-15 | | | 100. (166) |
| 34 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | 213427907 | | 1.188E-15 | | | 100. (167) |
| 34 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | 213430726 | | 1.163E-15 | | | 67.9 (168) 18.1 (156) 14.0 (135) |
| 34 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | 213439069 | | 1.187E-15 | | | 53.2 (169) 44.6 (162) 2.16 (138) |
| 34 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | 215517356 | | 3.620E-15 | | | 69.4 (170) 10.7 (174) 9.47 (208) |
| 34 | 171 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | 215519707 | | 1.456E-15 | | | 80.2 (171) |
| 34 | 172 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s^3P_1$ | 215520473 | | 1.317E-15 | | | 58.6 (172) 30.3 (207) 10.1 (182) |
| 34 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | 215525118 | | 2.744E-15 | | | 59.2 (173) 25.5 (179) 15.3 (219) |
| 34 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | 215529716 | | 1.429E-15 | | | 64.3 (174) 19.0 (170) 11.6 (208) |
| 34 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | 215539890 | | 9.958E-15 | | | 70.6 (175) 24.1 (182) 2.20 (187) |
| 34 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | 215547011 | | 4.839E-15 | | | 80.2 (176) |
| 34 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | 215565329 | | 1.263E-15 | | | 45.9 (177) 27.8 (209) 14.3 (212) |
| 34 | 178 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | 215565752 | | 4.244E-15 | | | 76.7 (178) |
| 34 | 179 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | 215568212 | | 1.862E-15 | | | 43.8 (179) 40.4 (173) 15.8 (219) |
| 34 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | 215573593 | | 1.314E-15 | | | 42.2 (180) 25.2 (211) 13.2 (208) |
| 34 | 181 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | 215573939 | | 1.277E-15 | | | 71.6 (181) 13.4 (213) 6.80 (218) |
| 34 | 182 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p^1P_1$ | 215581410 | | 5.361E-15 | | | 55.2 (182) 28.7 (175) 8.41 (172) |
| 34 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | 215589602 | | 1.005E-14 | | | 74.5 (183) |
| 34 | 184 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | 215589946 | | 1.288E-14 | | | 93.5 (184) |
| 34 | 185 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | 215594281 | | 7.591E-15 | | | 86.6 (185) |
| 34 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | 215594582 | | 1.256E-15 | | | 43.6 (186) 28.5 (222) 20.6 (214) |
| 34 | 187 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | 215596343 | | 1.292E-15 | | | 46.6 (187) 27.3 (229) 15.2 (216) |
| 34 | 188 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | 215599725 | | 1.407E-15 | | | 38.7 (188) 28.3 (218) 18.0 (178) |
| 34 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | 215601635 | | 1.181E-15 | | | 74.4 (189) |
| 34 | 190 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | 215605790 | | 1.255E-15 | | | 42.7 (190) 30.3 (236) 20.3 (223) |
| 34 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | 215608206 | | 1.176E-15 | | | 41.8 (191) 32.7 (227) 25.5 (221) |
| 34 | 192 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | 215609514 | | 1.178E-15 | | | 72.7 (192) |
| 34 | 193 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | 215610158 | | 1.181E-15 | | | 42.3 (193) 33.0 (237) 24.7 (230) |
| 34 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | 215610364 | | 1.344E-15 | | | 47.0 (194) 25.7 (220) 14.3 (224) |
| 34 | 195 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | 215610516 | | 1.039E-14 | | | 78.0 (195) |
| 34 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | 215612379 | | 1.178E-15 | | | 39.8 (196) 33.2 (232) 27.0 (231) |
| 34 | 197 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | 215612780 | | 1.209E-15 | | | 56.1 (197) 26.1 (226) 15.2 (233) |
| 34 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | 215613353 | | 2.564E-14 | | | 97.5 (198) |
| 34 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^3F_3$ | 215614326 | | 1.418E-14 | | | 75.8 (199) |
| 34 | 200 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | 215616480 | | 3.233E-14 | | | 98.5 (200) |
| 34 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | 215620210 | | 7.375E-14 | | | 83.0 (201) |
| 34 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | 215620650 | | 1.535E-13 | | | 59.0 (202) 41.0 (205) |
| 34 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | 215620713 | | 1.534E-13 | | | 100. (203) |
| 34 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | 215623330 | | 1.869E-13 | | | 100. (204) |
| 34 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | 215623587 | | 1.791E-13 | | | 59.1 (205) 40.9 (202) |
| 34 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | 216033169 | | 1.209E-15 | | | 100. (206) |
| 34 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | 216038678 | | 1.210E-15 | | | 67.4 (207) 32.6 (172) |
| 34 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^1P_1$ | 216045242 | | 1.142E-15 | | | 49.5 (180) 20.2 (208) 18.5 (211) |
| 34 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^1D_2$ | 216047276 | | 1.142E-15 | | | 47.5 (177) 27.1 (209) 25.3 (212) |
| 34 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | 216069103 | | 1.142E-15 | | | 100. (210) |
| 34 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p^3S_1$ | 216070249 | | 1.142E-15 | | | 48.4 (211) 45.5 (208) 4.85 (174) |
| 34 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^3P_2$ | 216084140 | | 1.141E-15 | | | 58.6 (212) 41.4 (209) |
| 34 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^1D_2$ | 216086761 | | 1.192E-15 | | | 45.9 (213) 32.1 (218) 22.0 (181) |
| 34 | 214 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d^3D_3$ | 216091586 | | 1.190E-15 | | | 50.3 (186) 37.2 (214) 12.5 (222) |
| 34 | 215 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | 216091715 | | 1.204E-15 | | | 100. (215) |
| 34 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d^3P_1$ | 216095895 | | 1.186E-15 | | | 63.7 (216) 33.8 (187) 2.49 (229) |
| 34 | 217 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d^3P_0$ | 216097087 | | 1.190E-15 | | | 100. (217) |
| 34 | 218 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^3D_2$ | 216100605 | | 1.189E-15 | | | 50.8 (188) 29.2 (218) 20.0 (213) |
| 34 | 219 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p^1S_0$ | 216100864 | | 1.145E-15 | | | 69.1 (219) 30.9 (179) |
| 34 | 220 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f^3F_3$ | 216107647 | | 1.200E-15 | | | 39.6 (220) 35.2 (224) 25.2 (189) |
| 34 | 221 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f^3F_4$ | 216111151 | | 1.200E-15 | | | 49.1 (191) 47.6 (221) 3.32 (227) |
| 34 | 222 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d^1F_3$ | 216111655 | | 1.175E-15 | | | 56.6 (222) 40.5 (214) 2.96 (186) |
| 34 | 223 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f^3D_2$ | 216112194 | | 1.199E-15 | | | 51.4 (190) 35.7 (223) 12.9 (236) |
| 34 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f^1F_3$ | 216115460 | | 1.200E-15 | | | 45.0 (194) 31.1 (224) 24.0 (220) |
| 34 | 225 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f^3G_5$ | 216115729 | | 1.199E-15 | | | 100. (225) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 34 | 226 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | | 216116048 | | 1.205E-15 | | 41.8 (226) 31.6 (233) 26.7 (192) |
| 34 | 227 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^1G_4$ | | 216116172 | | 1.199E-15 | | 64.0 (227) 26.9 (221) 9.15 (191) |
| 34 | 228 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f\ ^3D_1$ | | 216117174 | | 1.199E-15 | | 100. (228) |
| 34 | 229 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 216117696 | | 1.186E-15 | | 66.0 (229) 19.2 (216) 14.8 (187) |
| 34 | 230 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^3F_3$ | | 216117762 | | 1.204E-15 | | 57.2 (193) 24.9 (230) 17.9 (237) |
| 34 | 231 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^3G_5$ | | 216118365 | | 1.204E-15 | | 50.1 (231) 48.4 (196) 1.53 (232) |
| 34 | 232 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^1H_5$ | | 216119561 | | 1.204E-15 | | 65.3 (232) 22.9 (231) 11.8 (196) |
| 34 | 233 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^1G_4$ | | 216120368 | | 1.204E-15 | | 41.7 (197) 35.1 (233) 23.2 (226) |
| 34 | 234 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g\ ^3F_2$ | | 216121484 | | 1.204E-15 | | 100. (234) |
| 34 | 235 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g\ ^3H_6$ | | 216121780 | | 1.204E-15 | | 100. (235) |
| 34 | 236 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f\ ^1D_2$ | | 216123349 | | 1.199E-15 | | 54.6 (236) 42.5 (223) 2.93 (190) |
| 34 | 237 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g\ ^1F_3$ | | 216124212 | | 1.204E-15 | | 50.6 (230) 49.4 (237) |
| 34 | 238 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s\ ^3P_0$ | | 217020665 | | 1.365E-15 | | 86.4 (238) |
| 34 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s\ ^3P_1$ | | 217021027 | | 1.290E-15 | | 60.7 (239) 30.7 (283) 7.16 (250) |
| 34 | 240 | $2p_{1/2}6p_{1/2}(J=1)$ | $2s6s\ ^3S_1$ | | 217021739 | | 2.045E-15 | | 43.7 (240) 28.9 (242) 16.9 (287) |
| 34 | 241 | $2p_{1/2}6p_{1/2}(J=0)$ | $2s6s\ ^1S_0$ | | 217025472 | | 2.242E-15 | | 48.8 (241) 33.2 (247) 18.0 (294) |
| 34 | 242 | $2p_{1/2}6p_{1/2}(J=1)$ | $2p6p\ ^3D_1$ | | 217027774 | | 1.996E-15 | | 47.3 (242) 40.9 (240) 4.88 (249) |
| 34 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p\ ^3P_1$ | | 217036277 | | 1.046E-14 | | 67.0 (243) 25.3 (250) 3.55 (254) |
| 34 | 244 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p\ ^3P_0$ | | 217040348 | | 7.265E-15 | | 86.5 (244) |
| 34 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p\ ^3D_2$ | | 217046959 | | 1.249E-15 | | 46.8 (245) 29.7 (285) 15.1 (288) |
| 34 | 246 | $2s_{1/2}6p_{3/2}(J=2)$ | $2s6p\ ^3P_2$ | | 217049761 | | 2.191E-15 | | 47.5 (246) 21.1 (248) 17.0 (289) |
| 34 | 247 | $2s_{1/2}6s_{1/2}(J=0)$ | $2p6p\ ^3P_0$ | | 217050550 | | 2.326E-15 | | 51.0 (241) 34.9 (247) 14.0 (294) |
| 34 | 248 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d\ ^3F_2$ | | 217052237 | | 1.589E-15 | | 54.0 (248) 24.8 (246) 12.4 (295) |
| 34 | 249 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p\ ^3P_1$ | | 217052251 | | 1.396E-15 | | 41.0 (249) 24.7 (284) 16.2 (240) |
| 34 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p\ ^1P_1$ | | 217059720 | | 3.895E-15 | | 40.8 (250) 31.7 (243) 9.68 (254) |
| 34 | 251 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d\ ^3F_3$ | | 217063520 | | 1.223E-15 | | 43.9 (251) 30.6 (297) 21.3 (290) |
| 34 | 252 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d\ ^3D_2$ | | 217064379 | | 5.433E-15 | | 67.9 (252) 13.1 (269) 8.40 (258) |
| 34 | 253 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d\ ^3D_1$ | | 217065119 | | 2.030E-14 | | 95.7 (253) |
| 34 | 254 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d\ ^3D_1$ | | 217065142 | | 1.577E-15 | | 37.6 (254) 27.0 (250) 22.9 (304) |
| 34 | 255 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d\ ^3D_3$ | | 217066493 | | 2.304E-15 | | 49.5 (255) 18.0 (263) 16.8 (301) |
| 34 | 256 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f\ ^3G_3$ | | 217067264 | | 1.372E-15 | | 60.8 (256) 16.2 (296) 14.2 (255) |
| 34 | 257 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d\ ^3P_2$ | | 217067483 | | 1.616E-15 | | 34.7 (257) 28.5 (246) 24.9 (295) |
| 34 | 258 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f\ ^3F_2$ | | 217070258 | | 1.441E-15 | | 36.9 (258) 26.8 (318) 17.8 (299) |
| 34 | 259 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f\ ^3G_4$ | | 217071001 | | 1.180E-15 | | 41.8 (259) 33.0 (303) 25.3 (298) |
| 34 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g\ ^3H_4$ | | 217071780 | | 1.181E-15 | | 72.9 (260) |
| 34 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g\ ^3G_3$ | | 217072218 | | 1.182E-15 | | 42.0 (261) 33.1 (320) 24.9 (306) |
| 34 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g\ ^3H_5$ | | 217073468 | | 1.181E-15 | | 39.9 (262) 33.2 (308) 26.9 (307) |
| 34 | 263 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f\ ^3D_3$ | | 217073509 | | 1.839E-15 | | 36.5 (255) 34.6 (263) 18.2 (296) |
| 34 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h\ ^3I_5$ | | 217073585 | | 1.183E-15 | | 71.9 (264) 17.8 (316) 10.3 (309) |
| 34 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g\ ^3F_4$ | | 217073735 | | 1.187E-15 | | 57.9 (265) 26.6 (302) 15.6 (310) |
| 34 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h\ ^3H_4$ | | 217073823 | | 1.183E-15 | | 40.2 (266) 33.2 (321) 26.6 (311) |
| 34 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h\ ^3I_6$ | | 217074660 | | 1.183E-15 | | 38.8 (267) 33.3 (312) 27.9 (315) |
| 34 | 268 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h\ ^3G_5$ | | 217074890 | | 1.183E-15 | | 59.7 (268) 24.5 (309) 15.8 (316) |
| 34 | 269 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d\ ^1D_2$ | | 217076551 | | 1.575E-14 | | 80.4 (269) |
| 34 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f\ ^3F_2$ | | 217078332 | | 3.690E-14 | | 98.1 (270) |
| 34 | 271 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f\ ^3F_3$ | | 217078801 | | 2.556E-14 | | 81.4 (271) |
| 34 | 272 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f\ ^3F_4$ | | 217080225 | | 1.073E-13 | | 100. (272) |
| 34 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f\ ^1F_3$ | | 217082519 | | 1.255E-13 | | 84.8 (273) |
| 34 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g\ ^3G_3$ | | 217082813 | | 2.434E-13 | | 100. (274) |
| 34 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g\ ^3G_4$ | | 217082820 | | 2.564E-13 | | 61.4 (275) 38.6 (277) |
| 34 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g\ ^3G_5$ | | 217084338 | | 3.192E-13 | | 100. (276) |
| 34 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g\ ^1G_4$ | | 217084524 | | 3.039E-13 | | 61.5 (277) 38.5 (275) |
| 34 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h\ ^3H_5$ | | 217084571 | | 4.573E-13 | | 54.8 (278) 45.2 (281) |
| 34 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h\ ^3H_4$ | | 217084599 | | 4.757E-13 | | 100. (279) |
| 34 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h\ ^3H_6$ | | 217085648 | | 4.582E-13 | | 100. (280) |
| 34 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h\ ^1H_5$ | | 217085668 | | 4.768E-13 | | 54.8 (281) 45.2 (278) |
| 34 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s\ ^3P_2$ | | 217531517 | | 1.210E-15 | | 100. (282) |
| 34 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s\ ^1P_1$ | | 217534031 | | 1.212E-15 | | 67.0 (283) 33.0 (239) |
| 34 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p\ ^3S_1$ | | 217538347 | | 1.172E-15 | | 49.5 (249) 20.2 (284) 18.8 (287) |
| 34 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p\ ^1D_2$ | | 217539494 | | 1.172E-15 | | 48.5 (245) 27.1 (285) 24.4 (288) |
| 34 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p\ ^3D_3$ | | 217552477 | | 1.171E-15 | | 100. (286) |
| 34 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p\ ^1P_1$ | | 217552742 | | 1.174E-15 | | 47.9 (287) 46.8 (284) 5.26 (242) |
| 34 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p\ ^3P_2$ | | 217560583 | | 1.171E-15 | | 59.4 (288) 40.6 (285) |
| 34 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d\ ^1D_2$ | | 217562503 | | 1.200E-15 | | 45.2 (289) 32.8 (295) 22.1 (248) |
| 34 | 290 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d\ ^3D_3$ | | 217565107 | | 1.199E-15 | | 51.5 (251) 35.5 (290) 13.0 (297) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 34 | 291 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d\ ^3F_4$ | | 217565510 | | 1.207E-15 | | 100. (291) |
| 34 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d\ ^3P_1$ | | 217567236 | | 1.198E-15 | | 63.6 (292) 34.0 (254) 2.41 (304) |
| 34 | 293 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d\ ^3P_0$ | | 217567802 | | 1.201E-15 | | 100. (293) |
| 34 | 294 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p\ ^1S_0$ | | 217568787 | | 1.179E-15 | | 67.9 (294) 32.1 (247) |
| 34 | 295 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 217570111 | | 1.199E-15 | | 50.4 (257) 28.5 (295) 21.1 (289) |
| 34 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^3F_3$ | | 217574304 | | 1.205E-15 | | 39.5 (296) 35.4 (301) 25.0 (256) |
| 34 | 297 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 217576242 | | 1.191E-15 | | 55.0 (297) 42.3 (290) 2.77 (251) |
| 34 | 298 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^3F_4$ | | 217576248 | | 1.205E-15 | | 50.6 (259) 44.8 (298) 4.61 (303) |
| 34 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 217576886 | | 1.205E-15 | | 51.5 (258) 36.6 (299) 11.9 (318) |
| 34 | 300 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 217578706 | | 1.205E-15 | | 100. (300) |
| 34 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^1F_3$ | | 217578756 | | 1.205E-15 | | 44.6 (263) 31.2 (301) 24.3 (296) |
| 34 | 302 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^1G_4$ | | 217579160 | | 1.208E-15 | | 41.6 (302) 31.9 (310) 26.5 (260) |
| 34 | 303 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^1G_4$ | | 217579168 | | 1.205E-15 | | 62.4 (303) 30.0 (298) 7.62 (259) |
| 34 | 304 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 217579499 | | 1.198E-15 | | 65.3 (304) 19.4 (292) 15.3 (254) |
| 34 | 305 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 217579573 | | 1.205E-15 | | 100. (305) |
| 34 | 306 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 217580201 | | 1.208E-15 | | 57.4 (261) 25.1 (306) 17.5 (320) |
| 34 | 307 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^3G_5$ | | 217580436 | | 1.208E-15 | | 53.3 (262) 41.9 (307) 4.77 (308) |
| 34 | 308 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^1H_5$ | | 217581127 | | 1.208E-15 | | 62.0 (308) 31.3 (307) 6.75 (262) |
| 34 | 309 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^1H_5$ | | 217581440 | | 1.209E-15 | | 41.1 (309) 31.3 (316) 27.6 (264) |
| 34 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^1G_4$ | | 217581700 | | 1.208E-15 | | 41.4 (265) 35.0 (310) 23.6 (302) |
| 34 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 217581986 | | 1.209E-15 | | 59.4 (266) 23.3 (311) 17.3 (321) |
| 34 | 312 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 217582136 | | 1.209E-15 | | 60.7 (267) 26.5 (312) 12.7 (315) |
| 34 | 313 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 217582288 | | 1.208E-15 | | 100. (313) |
| 34 | 314 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 217582313 | | 1.207E-15 | | 100. (314) |
| 34 | 315 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 217582555 | | 1.209E-15 | | 59.7 (315) 40.3 (312) |
| 34 | 316 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 217583024 | | 1.209E-15 | | 39.7 (268) 35.6 (316) 24.7 (309) |
| 34 | 317 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 217583218 | | 1.209E-15 | | 100. (317) |
| 34 | 318 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 217583266 | | 1.204E-15 | | 55.2 (318) 41.5 (299) 3.34 (258) |
| 34 | 319 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 217583267 | | 1.209E-15 | | 100. (319) |
| 34 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^1F_3$ | | 217583918 | | 1.207E-15 | | 50.3 (306) 49.7 (320) |
| 34 | 321 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 217584258 | | 1.209E-15 | | 50.3 (311) 49.7 (321) |
| 35 | 1 | $1s_{1/2}^2(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 35 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 98785120 | 98772008 | | 2.297E-10 | | 100. (2) |
| 35 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 99132150 | 99115713 | | 1.668E-09 | | 100. (3) |
| 35 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 99155410 | 99137309 | | 3.006E-15 | | 80.8 (4) |
| 35 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 99150500 | 99139625 | | 7.978E-04 | | 100. (5) |
| 35 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 99595470 | 99597906 | | 1.208E-11 | | 100. (6) |
| 35 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 99781210 | 99782597 | | 7.358E-16 | | 80.8 (7) |
| 35 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 117152100 | 117149459 | | 9.514E-14 | | 100. (8) |
| 35 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 117247800 | 117243932 | | 3.208E-14 | | 100. (9) |
| 35 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 117248600 | 117246450 | | 9.881E-14 | | 100. (10) |
| 35 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 117253200 | 117249961 | | 8.135E-15 | | 79.9 (11) |
| 35 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 117385200 | 117387454 | | 3.400E-14 | | 100. (12) |
| 35 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | | 117433770 | | 1.119E-14 | | 62.1 (13) 37.9 (17) |
| 35 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | | 117436233 | | 1.124E-14 | | 100. (14) |
| 35 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 117437000 | 117437901 | | 2.532E-15 | | 79.9 (15) |
| 35 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | | 117481820 | | 1.149E-14 | | 100. (16) |
| 35 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | | 117485918 | | 1.145E-14 | | 62.1 (17) 37.9 (13) |
| 35 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 123516800 | 123517606 | | 1.390E-13 | | 100. (18) |
| 35 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 123556700 | 123556384 | | 5.495E-14 | | 100. (19) |
| 35 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 123555800 | 123556893 | | 1.434E-13 | | 100. (20) |
| 35 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 123558800 | 123558877 | | 1.790E-14 | | 79.6 (21) |
| 35 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 123614600 | 123616907 | | 5.761E-14 | | 100. (22) |
| 35 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | | 123636097 | | 2.598E-14 | | 62.9 (23) 37.1 (29) |
| 35 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | | 123637002 | | 2.610E-14 | | 100. (24) |
| 35 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 123635800 | 123637587 | | 6.010E-15 | | 79.6 (25) |
| 35 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | | 123656257 | | 2.674E-14 | | 100. (26) |
| 35 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 123657508 | | 5.357E-14 | | 56.8 (27) 43.2 (31) |
| 35 | 28 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 123658193 | | 5.359E-14 | | 100. (28) |
| 35 | 29 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | | 123658209 | | 2.662E-14 | | 62.9 (29) 37.1 (23) |
| 35 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 123667803 | | 5.397E-14 | | 100. (30) |
| 35 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 123668327 | | 5.401E-14 | | 56.8 (31) 43.2 (27) |
| 35 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 126445300 | 126447011 | | 2.209E-13 | | 100. (32) |
| 35 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | 126465400 | 126466592 | | 9.438E-14 | | 100. (33) |
| 35 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 126464800 | 126466728 | | 2.225E-13 | | 100. (34) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 35 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p^3P_1$ | 126466600 | 126467855 | | 3.374E-14 | | 79.5 (35) |
| 35 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p^3P_2$ | 126495200 | 126497544 | | 9.843E-14 | | 100. (36) |
| 35 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d^3D_2$ | | 126507282 | | 4.995E-14 | | 63.2 (37) 36.8 (43) |
| 35 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d^3D_1$ | | 126507717 | | 5.029E-14 | | 100. (38) |
| 35 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 126505900 | 126507986 | | 1.172E-14 | | 79.5 (39) |
| 35 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | | 126517576 | | 5.158E-14 | | 100. (40) |
| 35 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 126518273 | | 1.034E-13 | | 56.9 (41) 43.1 (47) |
| 35 | 42 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 126518622 | | 1.034E-13 | | 100. (42) |
| 35 | 43 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 126518625 | | 5.111E-14 | | 63.2 (43) 36.8 (37) |
| 35 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 126523545 | | 1.042E-13 | | 100. (44) |
| 35 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 126523580 | | 1.747E-13 | | 55.3 (45) 44.7 (49) |
| 35 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 126523784 | | 1.747E-13 | | 100. (46) |
| 35 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 126523817 | | 1.043E-13 | | 56.9 (47) 43.1 (41) |
| 35 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 126526734 | | 1.753E-13 | | 100. (48) |
| 35 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 126526897 | | 1.753E-13 | | 55.3 (49) 44.7 (45) |
| 35 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 128031697 | | 3.368E-13 | | 100. (50) |
| 35 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 128042927 | | 1.507E-13 | | 100. (51) |
| 35 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 128042982 | | 3.420E-13 | | 100. (52) |
| 35 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 128043654 | | 5.690E-14 | | 79.4 (53) |
| 35 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 128060825 | | 1.567E-13 | | 100. (54) |
| 35 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 128066409 | | 8.527E-14 | | 63.3 (55) 36.7 (61) |
| 35 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 128066652 | | 8.568E-14 | | 100. (56) |
| 35 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 128066823 | | 2.019E-14 | | 79.4 (57) |
| 35 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 128072358 | | 8.783E-14 | | 100. (58) |
| 35 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 128072756 | | 1.765E-13 | | 56.9 (59) 43.1 (65) |
| 35 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 128072957 | | 1.765E-13 | | 100. (60) |
| 35 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 128072979 | | 8.747E-14 | | 63.3 (61) 36.7 (55) |
| 35 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 128075807 | | 1.779E-13 | | 100. (62) |
| 35 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 128075814 | | 2.994E-13 | | 55.3 (63) 44.7 (69) |
| 35 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 128075932 | | 2.995E-13 | | 100. (64) |
| 35 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 128075966 | | 1.781E-13 | | 56.9 (65) 43.1 (59) |
| 35 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 128077640 | | 4.529E-13 | | 54.3 (66) 45.7 (71) |
| 35 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 128077640 | | 3.005E-13 | | 100. (67) |
| 35 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 128077717 | | 4.530E-13 | | 100. (68) |
| 35 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 128077734 | | 3.005E-13 | | 55.3 (69) 44.7 (63) |
| 35 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 128078855 | | 4.538E-13 | | 100. (70) |
| 35 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 128078919 | | 4.538E-13 | | 54.3 (71) 45.7 (66) |
| 35 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | | 200622542 | | 2.503E-15 | | 77.8 (72) |
| 35 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | | 200641407 | | 1.088E-15 | | 100. (73) |
| 35 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | | 200728046 | | 1.087E-15 | | 88.3 (74) |
| 35 | 75 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | | 201064266 | | 6.552E-16 | | 73.6 (75) |
| 35 | 76 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | | 201197762 | | 1.113E-15 | | 100. (76) |
| 35 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | | 201436287 | | 5.479E-16 | | 100. (77) |
| 35 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^1D_2$ | | 201519886 | | 5.471E-16 | | 53.1 (78) 46.9 (80) |
| 35 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | | 201553724 | | 1.093E-15 | | 88.3 (79) |
| 35 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^3P_2$ | | 202049634 | | 5.535E-16 | | 53.1 (80) 46.9 (78) |
| 35 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | | 202364591 | | 5.849E-16 | | 77.7 (81) |
| 35 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 219283207 | | 5.133E-15 | | 85.9 (82) |
| 35 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 219331572 | | 1.300E-15 | | 41.2 (83) 29.6 (104) 24.3 (92) |
| 35 | 84 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 219352426 | | 1.259E-15 | | 78.6 (84) |
| 35 | 85 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 219360275 | | 3.151E-15 | | 72.9 (85) |
| 35 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 219361691 | | 9.012E-16 | | 71.5 (86) 18.3 (103) 7.20 (82) |
| 35 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 219404427 | | 2.526E-15 | | 69.7 (87) 17.6 (83) 9.92 (92) |
| 35 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 219405949 | | 2.465E-15 | | 77.6 (88) |
| 35 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 219541121 | | 3.088E-15 | | 89.8 (89) |
| 35 | 90 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 219560890 | | 1.074E-15 | | 64.4 (90) 24.0 (85) 11.6 (115) |
| 35 | 91 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 219562850 | | 9.719E-16 | | 55.3 (91) 18.5 (96) 16.6 (110) |
| 35 | 92 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p^1P_1$ | | 219585847 | | 2.416E-15 | | 57.1 (92) 24.9 (87) 18.0 (83) |
| 35 | 93 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^3P_1$ | | 219594957 | | 9.746E-16 | | 35.1 (93) 24.2 (107) 18.3 (103) |
| 35 | 94 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 219608403 | | 1.062E-15 | | 76.5 (94) |
| 35 | 95 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 219649121 | | 4.297E-15 | | 85.7 (95) |
| 35 | 96 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 219658000 | | 4.207E-15 | | 70.7 (96) 13.9 (101) 7.19 (110) |
| 35 | 97 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 219677203 | | 8.035E-15 | | 98.3 (97) |
| 35 | 98 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 219724801 | | 9.937E-16 | | 58.6 (98) 20.9 (111) 20.5 (116) |
| 35 | 99 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 219731002 | | 9.589E-16 | | 57.9 (99) 23.7 (117) 16.8 (112) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 35 | 100 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d\ ^3P_2$ | | 219734558 | | 1.029E-15 | | 38.3 (100) 31.2 (114) 17.1 (108) |
| 35 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d\ ^1D_2$ | | 219772770 | | 5.984E-15 | | 82.4 (101) |
| 35 | 102 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s\ ^3P_2$ | | 219938409 | | 1.081E-15 | | 97.0 (102) |
| 35 | 103 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^1P_1$ | | 219999857 | | 8.474E-16 | | 56.2 (93) 20.4 (103) 12.4 (107) |
| 35 | 104 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s\ ^1P_1$ | | 220000765 | | 1.128E-15 | | 68.0 (104) 24.2 (83) 7.80 (92) |
| 35 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p\ ^3P_2$ | | 220022921 | | 8.615E-16 | | 34.3 (105) 32.8 (91) 30.4 (110) |
| 35 | 106 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | | 220108557 | | 8.622E-16 | | 98.3 (106) |
| 35 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^3S_1$ | | 220117611 | | 8.535E-16 | | 52.9 (107) 39.8 (103) 4.40 (86) |
| 35 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^1D_2$ | | 220206691 | | 1.013E-15 | | 47.5 (108) 32.1 (114) 20.4 (94) |
| 35 | 109 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | | 220220183 | | 1.090E-15 | | 100. (109) |
| 35 | 110 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | | 220222368 | | 8.453E-16 | | 52.6 (105) 46.2 (110) 1.15 (101) |
| 35 | 111 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^3D_3$ | | 220241485 | | 9.886E-16 | | 48.9 (111) 38.9 (98) 12.2 (116) |
| 35 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | | 220272585 | | 9.899E-16 | | 67.2 (112) 30.4 (99) 2.36 (117) |
| 35 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | | 220279101 | | 1.011E-15 | | 99.0 (113) |
| 35 | 114 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3D_2$ | | 220293525 | | 9.978E-16 | | 54.4 (100) 31.1 (114) 14.5 (108) |
| 35 | 115 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | | 220337306 | | 8.639E-16 | | 74.5 (115) |
| 35 | 116 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | | 220368944 | | 9.203E-16 | | 67.3 (116) 30.2 (111) 2.47 (98) |
| 35 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | | 220401162 | | 9.805E-16 | | 72.8 (117) |
| 35 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | | 225756638 | | 4.527E-15 | | 79.9 (118) |
| 35 | 119 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | | 225770368 | | 1.349E-15 | | 75.6 (119) |
| 35 | 120 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | | 225771120 | | 1.194E-15 | | 55.5 (120) 30.3 (147) 14.1 (130) |
| 35 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | | 225777170 | | 2.822E-15 | | 66.2 (121) 19.7 (126) 14.1 (159) |
| 35 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | | 225786646 | | 1.098E-15 | | 69.5 (122) 15.5 (148) 11.7 (118) |
| 35 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | | 225801391 | | 5.894E-15 | | 72.7 (123) |
| 35 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | | 225813677 | | 3.176E-15 | | 75.5 (124) |
| 35 | 125 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | | 225861038 | | 4.242E-15 | | 84.8 (125) |
| 35 | 126 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | | 225864226 | | 1.390E-15 | | 51.7 (126) 32.8 (121) 15.4 (159) |
| 35 | 127 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | | 225867112 | | 1.095E-15 | | 46.6 (127) 25.2 (149) 13.2 (152) |
| 35 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | | 225881657 | | 1.098E-15 | | 41.8 (128) 24.9 (151) 14.3 (148) |
| 35 | 129 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | | 225884474 | | 1.098E-15 | | 73.6 (129) |
| 35 | 130 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | | 225889442 | | 4.144E-15 | | 59.7 (130) 26.9 (123) 10.2 (120) |
| 35 | 131 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | | 225908009 | | 7.407E-15 | | 90.0 (131) |
| 35 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | | 225908827 | | 7.849E-15 | | 74.8 (132) |
| 35 | 133 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | | 225919634 | | 1.054E-14 | | 94.4 (133) |
| 35 | 134 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | | 225929368 | | 1.127E-15 | | 44.9 (134) 25.7 (163) 20.0 (155) |
| 35 | 135 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | | 225930962 | | 1.063E-15 | | 50.9 (135) 27.4 (168) 16.1 (156) |
| 35 | 136 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | | 225937537 | | 1.150E-15 | | 40.3 (136) 30.6 (158) 15.1 (153) |
| 35 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | | 225945697 | | 1.037E-15 | | 73.7 (137) |
| 35 | 138 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | | 225951501 | | 1.329E-15 | | 35.8 (138) 24.3 (169) 23.3 (139) |
| 35 | 139 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | | 225954475 | | 3.157E-15 | | 57.2 (139) 13.6 (132) 10.5 (138) |
| 35 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | | 225959069 | | 1.036E-15 | | 41.7 (140) 32.3 (165) 26.0 (161) |
| 35 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | | 225959622 | | 1.858E-14 | | 97.7 (141) |
| 35 | 142 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | | 225961640 | | 1.091E-15 | | 50.2 (142) 29.0 (160) 15.4 (164) |
| 35 | 143 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | | 225961829 | | 9.264E-15 | | 68.9 (143) 22.0 (145) 3.99 (134) |
| 35 | 144 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | | 225966725 | | 5.062E-14 | | 100. (144) |
| 35 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | | 225973118 | | 3.810E-14 | | 78.1 (145) |
| 35 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | | 226352702 | | 1.076E-15 | | 100. (146) |
| 35 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | | 226367042 | | 1.081E-15 | | 68.4 (147) 31.6 (120) |
| 35 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | | 226377605 | | 9.654E-16 | | 50.4 (128) 20.3 (148) 17.5 (151) |
| 35 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^1D_2$ | | 226382394 | | 9.658E-16 | | 45.4 (127) 28.1 (149) 26.5 (152) |
| 35 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | | 226429399 | | 9.662E-16 | | 100. (150) |
| 35 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | | 226432486 | | 9.665E-16 | | 49.4 (151) 44.5 (148) 4.83 (122) |
| 35 | 152 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^3P_2$ | | 226464033 | | 9.639E-16 | | 57.8 (152) 42.2 (149) |
| 35 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | | 226466710 | | 1.047E-15 | | 45.8 (153) 32.4 (158) 21.7 (129) |
| 35 | 154 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | | 226477043 | | 1.072E-15 | | 100. (154) |
| 35 | 155 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | | 226477683 | | 1.043E-15 | | 48.3 (134) 38.9 (155) 12.8 (163) |
| 35 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | | 226487647 | | 1.038E-15 | | 64.2 (156) 33.2 (135) 2.59 (168) |
| 35 | 157 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | | 226490361 | | 1.045E-15 | | 100. (157) |
| 35 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | | 226497882 | | 1.042E-15 | | 51.6 (136) 29.1 (158) 19.3 (153) |
| 35 | 159 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | | 226502808 | | 9.711E-16 | | 71.2 (159) 28.8 (126) |
| 35 | 160 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^3F_3$ | | 226512077 | | 1.060E-15 | | 40.2 (160) 34.2 (164) 25.6 (137) |
| 35 | 161 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^3F_4$ | | 226519849 | | 1.060E-15 | | 48.9 (140) 48.2 (161) 2.93 (165) |
| 35 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | | 226521505 | | 1.059E-15 | | 51.1 (138) 34.1 (162) 14.8 (169) |
| 35 | 163 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | | 226522392 | | 1.014E-15 | | 58.5 (163) 38.7 (155) 2.72 (134) |
| 35 | 164 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^1F_3$ | | 226529182 | | 1.060E-15 | | 45.8 (142) 31.5 (164) 22.7 (160) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 35 | 165 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f^1G_4$ | 226529425 | | 1.060E-15 | | | 64.8 (165) 25.8 (161) 9.43 (140) |
| 35 | 166 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f^3G_5$ | 226530776 | | 1.060E-15 | | | 100. (166) |
| 35 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f^3D_1$ | 226532918 | | 1.059E-15 | | | 100. (167) |
| 35 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d^1P_1$ | 226535602 | | 1.036E-15 | | | 67.5 (168) 18.5 (156) 14.0 (135) |
| 35 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f^1D_2$ | 226545278 | | 1.058E-15 | | | 53.4 (169) 44.4 (162) 2.25 (138) |
| 35 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s^3S_1$ | 228718613 | | 2.991E-15 | | | 67.0 (170) 13.0 (174) 10.2 (211) |
| 35 | 171 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s^3P_0$ | 228720419 | | 1.282E-15 | | | 81.2 (171) |
| 35 | 172 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s^3P_1$ | 228721409 | | 1.160E-15 | | | 59.9 (172) 30.8 (207) 9.27 (182) |
| 35 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s^1S_0$ | 228726345 | | 2.383E-15 | | | 58.1 (173) 26.3 (178) 15.5 (218) |
| 35 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p^3D_1$ | 228730935 | | 1.320E-15 | | | 62.0 (174) 22.3 (170) 11.1 (211) |
| 35 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p^3P_1$ | 228742009 | | 9.117E-15 | | | 70.5 (175) 24.6 (182) 2.08 (187) |
| 35 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p^3P_0$ | 228749053 | | 4.475E-15 | | | 81.1 (176) |
| 35 | 177 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p^3D_2$ | 228770404 | | 1.114E-15 | | | 46.2 (177) 28.2 (209) 14.4 (212) |
| 35 | 178 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p^3P_0$ | 228770742 | | 1.687E-15 | | | 42.7 (178) 41.5 (173) 15.8 (218) |
| 35 | 179 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p^3P_2$ | 228771439 | | 3.634E-15 | | | 75.6 (179) |
| 35 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p^3P_1$ | 228778520 | | 1.157E-15 | | | 42.7 (180) 25.6 (208) 13.0 (211) |
| 35 | 181 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d^3F_2$ | 228779211 | | 1.148E-15 | | | 70.8 (181) 12.9 (213) 7.05 (219) |
| 35 | 182 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p^1P_1$ | 228787253 | | 4.874E-15 | | | 55.3 (182) 29.2 (175) 7.54 (172) |
| 35 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d^3D_2$ | 228796081 | | 9.318E-15 | | | 74.6 (183) |
| 35 | 184 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d^3D_1$ | 228796269 | | 1.225E-14 | | | 94.0 (184) |
| 35 | 185 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d^3F_3$ | 228801385 | | 1.111E-15 | | | 43.6 (185) 28.9 (222) 20.7 (214) |
| 35 | 186 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d^3D_3$ | 228801756 | | 6.487E-15 | | | 85.9 (186) |
| 35 | 187 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d^3D_1$ | 228802127 | | 1.153E-15 | | | 46.2 (187) 27.4 (229) 15.1 (216) |
| 35 | 188 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d^3P_2$ | 228806574 | | 1.251E-15 | | | 38.9 (188) 28.4 (219) 18.0 (179) |
| 35 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f^3G_3$ | 228808544 | | 1.053E-15 | | | 74.5 (189) |
| 35 | 190 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f^3F_2$ | 228812801 | | 1.114E-15 | | | 42.7 (190) 30.5 (236) 20.4 (223) |
| 35 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f^3G_4$ | 228815768 | | 1.047E-15 | | | 41.8 (191) 32.8 (226) 25.5 (221) |
| 35 | 192 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g^3H_4$ | 228817096 | | 1.049E-15 | | | 72.7 (192) |
| 35 | 193 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g^3G_3$ | 228817750 | | 1.051E-15 | | | 42.2 (193) 33.0 (237) 24.8 (230) |
| 35 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f^3D_3$ | 228818016 | | 1.204E-15 | | | 46.8 (194) 25.5 (220) 14.1 (224) |
| 35 | 195 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d^1D_2$ | 228818357 | | 9.788E-15 | | | 77.9 (195) |
| 35 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g^3H_5$ | 228820319 | | 1.049E-15 | | | 39.8 (196) 33.2 (232) 27.0 (231) |
| 35 | 197 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g^3F_4$ | 228820734 | | 1.070E-15 | | | 56.5 (197) 26.3 (227) 15.3 (233) |
| 35 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f^3F_2$ | 228821382 | | 2.434E-14 | | | 97.7 (198) |
| 35 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f^3F_3$ | 228822394 | | 1.367E-14 | | | 75.2 (199) |
| 35 | 200 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f^3F_4$ | 228825092 | | 3.503E-14 | | | 98.9 (200) |
| 35 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f^1F_3$ | 228828906 | | 6.597E-14 | | | 81.8 (201) |
| 35 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g^3G_4$ | 228829381 | | 1.393E-13 | | | 58.7 (202) 41.3 (205) |
| 35 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g^3G_3$ | 228829453 | | 1.397E-13 | | | 100. (203) |
| 35 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g^3G_5$ | 228832413 | | 1.662E-13 | | | 100. (204) |
| 35 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g^1G_4$ | 228832685 | | 1.605E-13 | | | 58.8 (205) 41.2 (202) |
| 35 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s^3P_2$ | 229297694 | | 1.077E-15 | | | 100. (206) |
| 35 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s^1P_1$ | 229303298 | | 1.078E-15 | | | 67.3 (207) 32.7 (172) |
| 35 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p^3S_1$ | 229310162 | | 1.018E-15 | | | 49.7 (180) 19.6 (208) 19.2 (211) |
| 35 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p^1D_2$ | 229312193 | | 1.018E-15 | | | 47.8 (177) 27.6 (209) 24.6 (212) |
| 35 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p^3D_3$ | 229337639 | | 1.017E-15 | | | 100. (210) |
| 35 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p^1P_1$ | 229338708 | | 1.017E-15 | | | 47.2 (208) 46.7 (211) 5.12 (174) |
| 35 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p^3P_2$ | 229353135 | | 1.017E-15 | | | 59.2 (212) 40.8 (209) |
| 35 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d^1D_2$ | 229356020 | | 1.062E-15 | | | 44.6 (213) 33.5 (219) 22.0 (181) |
| 35 | 214 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d^3D_3$ | 229361004 | | 1.061E-15 | | | 50.9 (185) 35.7 (214) 13.4 (222) |
| 35 | 215 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d^3F_4$ | 229361900 | | 1.073E-15 | | | 100. (215) |
| 35 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d^3P_1$ | 229365280 | | 1.057E-15 | | | 63.4 (216) 34.0 (187) 2.60 (229) |
| 35 | 217 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d^3P_0$ | 229366524 | | 1.061E-15 | | | 100. (217) |
| 35 | 218 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p^1S_0$ | 229370296 | | 1.020E-15 | | | 68.9 (218) 31.1 (178) |
| 35 | 219 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d^3D_2$ | 229370900 | | 1.060E-15 | | | 50.7 (188) 27.8 (219) 21.4 (213) |
| 35 | 220 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f^3F_3$ | 229378354 | | 1.069E-15 | | | 40.2 (220) 34.7 (224) 25.1 (189) |
| 35 | 221 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f^3F_4$ | 229382130 | | 1.069E-15 | | | 50.8 (191) 44.6 (221) 4.66 (226) |
| 35 | 222 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d^1F_3$ | 229382287 | | 1.047E-15 | | | 55.5 (222) 42.0 (214) 2.57 (185) |
| 35 | 223 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f^3D_2$ | 229383021 | | 1.069E-15 | | | 51.4 (190) 35.8 (223) 12.7 (236) |
| 35 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f^3F_3$ | 229386823 | | 1.069E-15 | | | 44.8 (194) 31.7 (224) 23.5 (220) |
| 35 | 225 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f^3G_5$ | 229387116 | | 1.069E-15 | | | 100. (225) |
| 35 | 226 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f^1G_4$ | 229387417 | | 1.069E-15 | | | 62.6 (226) 30.0 (221) 7.46 (191) |
| 35 | 227 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g^3G_4$ | 229387452 | | 1.074E-15 | | | 42.1 (227) 31.3 (233) 26.6 (192) |
| 35 | 228 | $2p_{3/2}5f_{5/2}(J=1)$ | $2p5f^3D_1$ | 229388170 | | 1.069E-15 | | | 100. (228) |
| 35 | 229 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d^1P_1$ | 229388633 | | 1.057E-15 | | | 65.7 (229) 19.6 (216) 14.7 (187) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 35 | 230 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g^3F_3$ | | 229389220 | | 1.074E-15 | | 57.2 (193) 25.2 (230) 17.6 (237) |
| 35 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g^3G_5$ | | 229389960 | | 1.074E-15 | | 53.1 (196) 42.5 (231) 4.42 (232) |
| 35 | 232 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g^1H_5$ | | 229391217 | | 1.074E-15 | | 62.4 (232) 30.5 (231) 7.09 (196) |
| 35 | 233 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g^1G_4$ | | 229392168 | | 1.074E-15 | | 41.6 (197) 35.5 (233) 23.0 (227) |
| 35 | 234 | $2p_{3/2}5g_{7/2}(J=2)$ | $2p5g^3F_2$ | | 229393057 | | 1.073E-15 | | 100. (234) |
| 35 | 235 | $2p_{3/2}5g_{9/2}(J=6)$ | $2p5g^3H_6$ | | 229393625 | | 1.073E-15 | | 100. (235) |
| 35 | 236 | $2p_{3/2}5f_{7/2}(J=2)$ | $2p5f^1D_2$ | | 229394974 | | 1.068E-15 | | 54.7 (236) 42.3 (223) 3.00 (190) |
| 35 | 237 | $2p_{3/2}5g_{9/2}(J=3)$ | $2p5g^1F_3$ | | 229396129 | | 1.073E-15 | | 50.3 (230) 49.7 (237) |
| 35 | 238 | $2p_{1/2}6s_{1/2}(J=0)$ | $2p6s^3P_0$ | | 230314377 | | 1.202E-15 | | 87.3 (238) |
| 35 | 239 | $2p_{1/2}6s_{1/2}(J=1)$ | $2p6s^3P_1$ | | 230314836 | | 1.138E-15 | | 61.3 (239) 30.9 (283) 6.46 (250) |
| 35 | 240 | $2p_{1/2}6p_{1/2}(J=1)$ | $2s6s^3S_1$ | | 230315787 | | 1.648E-15 | | 37.3 (240) 34.3 (242) 18.0 (287) |
| 35 | 241 | $2p_{1/2}6p_{1/2}(J=0)$ | $2s6s^1S_0$ | | 230319623 | | 1.935E-15 | | 47.2 (241) 34.3 (246) 18.5 (294) |
| 35 | 242 | $2s_{1/2}6s_{1/2}(J=1)$ | $2p6p^3D_1$ | | 230322167 | | 1.999E-15 | | 47.9 (240) 41.7 (242) 5.08 (248) |
| 35 | 243 | $2s_{1/2}6p_{1/2}(J=1)$ | $2s6p^3P_1$ | | 230331235 | | 9.646E-15 | | 66.9 (243) 25.7 (250) 3.39 (253) |
| 35 | 244 | $2s_{1/2}6p_{1/2}(J=0)$ | $2s6p^3P_0$ | | 230335250 | | 6.841E-15 | | 87.4 (244) |
| 35 | 245 | $2p_{1/2}6p_{3/2}(J=2)$ | $2p6p^3D_2$ | | 230343164 | | 1.104E-15 | | 47.0 (245) 30.0 (285) 15.2 (288) |
| 35 | 246 | $2s_{1/2}6s_{1/2}(J=0)$ | $2p6p^3P_0$ | | 230345557 | | 2.141E-15 | | 52.7 (241) 33.6 (246) 13.7 (294) |
| 35 | 247 | $2p_{1/2}6d_{3/2}(J=2)$ | $2s6p^3P_2$ | | 230346376 | | 1.647E-15 | | 37.2 (247) 31.5 (249) 19.7 (289) |
| 35 | 248 | $2p_{1/2}6p_{3/2}(J=1)$ | $2p6p^3P_1$ | | 230348388 | | 1.228E-15 | | 41.5 (248) 25.0 (284) 15.4 (240) |
| 35 | 249 | $2p_{1/2}6d_{3/2}(J=2)$ | $2p6d^3F_2$ | | 230348847 | | 1.611E-15 | | 44.0 (249) 34.7 (247) 13.6 (295) |
| 35 | 250 | $2s_{1/2}6p_{3/2}(J=1)$ | $2s6p^1P_1$ | | 230356668 | | 3.112E-15 | | 37.5 (250) 31.5 (243) 12.0 (253) |
| 35 | 251 | $2p_{1/2}6d_{5/2}(J=3)$ | $2p6d^3F_3$ | | 230360709 | | 1.084E-15 | | 44.0 (251) 30.8 (297) 21.4 (290) |
| 35 | 252 | $2s_{1/2}6d_{3/2}(J=2)$ | $2s6d^3D_2$ | | 230361791 | | 4.573E-15 | | 66.3 (252) 13.1 (269) 9.09 (258) |
| 35 | 253 | $2p_{1/2}6d_{3/2}(J=1)$ | $2p6d^3D_1$ | | 230361918 | | 1.481E-15 | | 35.6 (253) 30.8 (250) 21.7 (304) |
| 35 | 254 | $2s_{1/2}6d_{3/2}(J=1)$ | $2s6d^3D_1$ | | 230362518 | | 1.952E-14 | | 96.1 (254) |
| 35 | 255 | $2p_{1/2}6f_{5/2}(J=3)$ | $2p6f^3G_3$ | | 230364073 | | 1.349E-15 | | 42.8 (255) 23.4 (301) 22.5 (256) |
| 35 | 256 | $2s_{1/2}6d_{5/2}(J=3)$ | $2s6d^3D_3$ | | 230364775 | | 1.664E-15 | | 37.5 (256) 31.7 (255) 19.4 (296) |
| 35 | 257 | $2p_{1/2}6d_{5/2}(J=2)$ | $2p6d^3P_2$ | | 230364824 | | 1.451E-15 | | 34.4 (257) 29.1 (247) 24.7 (295) |
| 35 | 258 | $2p_{1/2}6f_{5/2}(J=2)$ | $2p6f^3F_2$ | | 230367644 | | 1.307E-15 | | 36.2 (258) 26.3 (316) 17.5 (299) |
| 35 | 259 | $2p_{1/2}6f_{7/2}(J=4)$ | $2p6f^3G_4$ | | 230368630 | | 1.051E-15 | | 41.7 (259) 33.0 (302) 25.3 (298) |
| 35 | 260 | $2p_{1/2}6g_{7/2}(J=4)$ | $2p6g^3H_4$ | | 230369422 | | 1.052E-15 | | 72.9 (260) |
| 35 | 261 | $2p_{1/2}6g_{7/2}(J=3)$ | $2p6g^3G_3$ | | 230369865 | | 1.052E-15 | | 42.0 (261) 33.1 (320) 24.9 (306) |
| 35 | 262 | $2p_{1/2}6g_{9/2}(J=5)$ | $2p6g^3H_5$ | | 230371317 | | 1.052E-15 | | 39.9 (262) 33.2 (308) 26.8 (307) |
| 35 | 263 | $2p_{1/2}6f_{7/2}(J=3)$ | $2p6f^3D_3$ | | 230371410 | | 1.740E-15 | | 40.3 (256) 32.5 (263) 17.1 (296) |
| 35 | 264 | $2p_{1/2}6h_{9/2}(J=5)$ | $2p6h^3I_5$ | | 230371435 | | 1.053E-15 | | 71.9 (264) 17.8 (317) 10.2 (309) |
| 35 | 265 | $2p_{1/2}6g_{9/2}(J=4)$ | $2p6g^3F_4$ | | 230371588 | | 1.056E-15 | | 57.9 (265) 26.6 (303) 15.5 (310) |
| 35 | 266 | $2p_{1/2}6h_{9/2}(J=4)$ | $2p6h^3H_4$ | | 230371674 | | 1.053E-15 | | 40.2 (266) 33.2 (321) 26.6 (311) |
| 35 | 267 | $2p_{1/2}6h_{11/2}(J=6)$ | $2p6h^3I_6$ | | 230372646 | | 1.053E-15 | | 38.8 (267) 33.3 (312) 27.9 (315) |
| 35 | 268 | $2p_{1/2}6h_{11/2}(J=5)$ | $2p6h^3G_5$ | | 230372878 | | 1.053E-15 | | 59.7 (268) 24.5 (309) 15.7 (317) |
| 35 | 269 | $2s_{1/2}6d_{5/2}(J=2)$ | $2s6d^1D_2$ | | 230374804 | | 1.488E-14 | | 80.1 (269) |
| 35 | 270 | $2s_{1/2}6f_{5/2}(J=2)$ | $2s6f^3F_2$ | | 230376706 | | 3.545E-14 | | 98.3 (270) |
| 35 | 271 | $2s_{1/2}6f_{5/2}(J=3)$ | $2s6f^3F_3$ | | 230377203 | | 2.511E-14 | | 80.5 (271) |
| 35 | 272 | $2s_{1/2}6f_{7/2}(J=4)$ | $2s6f^3F_4$ | | 230378941 | | 1.040E-13 | | 100. (272) |
| 35 | 273 | $2s_{1/2}6f_{7/2}(J=3)$ | $2s6f^1F_3$ | | 230381284 | | 1.124E-13 | | 83.6 (273) |
| 35 | 274 | $2s_{1/2}6g_{7/2}(J=3)$ | $2s6g^3G_3$ | | 230381607 | | 2.234E-13 | | 100. (274) |
| 35 | 275 | $2s_{1/2}6g_{7/2}(J=4)$ | $2s6g^3G_4$ | | 230381610 | | 2.332E-13 | | 61.0 (275) 39.0 (277) |
| 35 | 276 | $2s_{1/2}6g_{9/2}(J=5)$ | $2s6g^3G_5$ | | 230383330 | | 2.835E-13 | | 100. (276) |
| 35 | 277 | $2s_{1/2}6g_{9/2}(J=4)$ | $2s6g^1G_4$ | | 230383526 | | 2.726E-13 | | 61.0 (277) 39.0 (275) |
| 35 | 278 | $2s_{1/2}6h_{9/2}(J=5)$ | $2s6h^3H_5$ | | 230383571 | | 4.064E-13 | | 54.8 (278) 45.2 (281) |
| 35 | 279 | $2s_{1/2}6h_{9/2}(J=4)$ | $2s6h^3H_4$ | | 230383601 | | 4.234E-13 | | 100. (279) |
| 35 | 280 | $2s_{1/2}6h_{11/2}(J=6)$ | $2s6h^3H_6$ | | 230384784 | | 4.071E-13 | | 100. (280) |
| 35 | 281 | $2s_{1/2}6h_{11/2}(J=5)$ | $2s6h^1H_5$ | | 230384806 | | 4.244E-13 | | 54.8 (281) 45.2 (278) |
| 35 | 282 | $2p_{3/2}6s_{1/2}(J=2)$ | $2p6s^3P_2$ | | 230889043 | | 1.079E-15 | | 100. (282) |
| 35 | 283 | $2p_{3/2}6s_{1/2}(J=1)$ | $2p6s^1P_1$ | | 230891585 | | 1.081E-15 | | 67.0 (283) 33.0 (239) |
| 35 | 284 | $2p_{3/2}6p_{1/2}(J=1)$ | $2p6p^3S_1$ | | 230896077 | | 1.045E-15 | | 49.7 (248) 21.3 (284) 17.8 (287) |
| 35 | 285 | $2p_{3/2}6p_{1/2}(J=2)$ | $2p6p^1D_2$ | | 230897244 | | 1.044E-15 | | 48.6 (245) 27.6 (285) 23.8 (288) |
| 35 | 286 | $2p_{3/2}6p_{3/2}(J=3)$ | $2p6p^3D_3$ | | 230912328 | | 1.044E-15 | | 100. (286) |
| 35 | 287 | $2p_{3/2}6p_{3/2}(J=1)$ | $2p6p^1P_1$ | | 230912522 | | 1.047E-15 | | 48.8 (287) 45.7 (284) 5.50 (242) |
| 35 | 288 | $2p_{3/2}6p_{3/2}(J=2)$ | $2p6p^3P_2$ | | 230920682 | | 1.044E-15 | | 60.0 (288) 40.0 (285) |
| 35 | 289 | $2p_{3/2}6d_{3/2}(J=2)$ | $2p6d^1D_2$ | | 230922757 | | 1.069E-15 | | 43.8 (289) 34.2 (295) 22.1 (249) |
| 35 | 290 | $2p_{3/2}6d_{3/2}(J=3)$ | $2p6d^3D_3$ | | 230925447 | | 1.069E-15 | | 52.1 (251) 34.0 (290) 13.9 (297) |
| 35 | 291 | $2p_{3/2}6d_{5/2}(J=4)$ | $2p6d^3F_4$ | | 230926311 | | 1.076E-15 | | 100. (291) |
| 35 | 292 | $2p_{3/2}6d_{3/2}(J=1)$ | $2p6d^3P_1$ | | 230927539 | | 1.068E-15 | | 63.2 (292) 34.2 (253) 2.53 (304) |
| 35 | 293 | $2p_{3/2}6d_{3/2}(J=0)$ | $2p6d^3P_0$ | | 230928121 | | 1.071E-15 | | 100. (293) |
| 35 | 294 | $2p_{3/2}6p_{3/2}(J=0)$ | $2p6p^1S_0$ | | 230929020 | | 1.053E-15 | | 67.8 (294) 32.2 (246) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 35 | 295 | $2p_{3/2}6d_{5/2}(J=2)$ | $2p6d\ ^3D_2$ | | 230930958 | | 1.069E-15 | | 50.3 (257) 27.1 (295) 22.6 (289) |
| 35 | 296 | $2p_{3/2}6f_{5/2}(J=3)$ | $2p6f\ ^3F_3$ | | 230935387 | | 1.074E-15 | | 40.1 (296) 34.9 (301) 25.0 (255) |
| 35 | 297 | $2p_{3/2}6d_{5/2}(J=3)$ | $2p6d\ ^1F_3$ | | 230937277 | | 1.061E-15 | | 53.9 (297) 43.7 (290) 2.36 (251) |
| 35 | 298 | $2p_{3/2}6f_{5/2}(J=4)$ | $2p6f\ ^3F_4$ | | 230937470 | | 1.074E-15 | | 52.2 (259) 41.6 (298) 6.16 (302) |
| 35 | 299 | $2p_{3/2}6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 230938042 | | 1.074E-15 | | 51.5 (258) 36.7 (299) 11.8 (316) |
| 35 | 300 | $2p_{3/2}6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 230940162 | | 1.074E-15 | | 100. (300) |
| 35 | 301 | $2p_{3/2}6f_{7/2}(J=3)$ | $2p6f\ ^1F_3$ | | 230940222 | | 1.074E-15 | | 44.4 (263) 31.8 (301) 23.8 (296) |
| 35 | 302 | $2p_{3/2}6f_{7/2}(J=4)$ | $2p6f\ ^1G_4$ | | 230940563 | | 1.074E-15 | | 60.8 (302) 33.1 (298) 6.03 (259) |
| 35 | 303 | $2p_{3/2}6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 230940643 | | 1.077E-15 | | 41.9 (303) 31.6 (310) 26.5 (260) |
| 35 | 304 | $2p_{3/2}6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 230940689 | | 1.068E-15 | | 65.1 (304) 19.8 (292) 15.1 (253) |
| 35 | 305 | $2p_{3/2}6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 230940820 | | 1.074E-15 | | 100. (305) |
| 35 | 306 | $2p_{3/2}6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 230941724 | | 1.076E-15 | | 57.3 (261) 25.4 (306) 17.3 (320) |
| 35 | 307 | $2p_{3/2}6g_{7/2}(J=5)$ | $2p6g\ ^3G_5$ | | 230941999 | | 1.077E-15 | | 57.0 (262) 33.6 (307) 9.42 (308) |
| 35 | 308 | $2p_{3/2}6g_{9/2}(J=5)$ | $2p6g\ ^1H_5$ | | 230942762 | | 1.077E-15 | | 57.3 (308) 39.6 (307) 3.05 (262) |
| 35 | 309 | $2p_{3/2}6h_{9/2}(J=5)$ | $2p6h\ ^3H_5$ | | 230943144 | | 1.078E-15 | | 41.3 (309) 31.1 (317) 27.6 (264) |
| 35 | 310 | $2p_{3/2}6g_{9/2}(J=4)$ | $2p6g\ ^3G_4$ | | 230943420 | | 1.077E-15 | | 41.4 (265) 35.3 (310) 23.3 (303) |
| 35 | 311 | $2p_{3/2}6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 230943719 | | 1.078E-15 | | 59.4 (266) 23.5 (311) 17.1 (321) |
| 35 | 312 | $2p_{3/2}6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 230943840 | | 1.079E-15 | | 59.6 (267) 31.4 (312) 8.96 (315) |
| 35 | 313 | $2p_{3/2}6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 230943902 | | 1.076E-15 | | 100. (313) |
| 35 | 314 | $2p_{3/2}6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 230944000 | | 1.077E-15 | | 100. (314) |
| 35 | 315 | $2p_{3/2}6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 230944383 | | 1.078E-15 | | 63.2 (315) 35.3 (312) 1.53 (267) |
| 35 | 316 | $2p_{3/2}6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 230944882 | | 1.074E-15 | | 55.2 (316) 41.4 (299) 3.40 (258) |
| 35 | 317 | $2p_{3/2}6h_{11/2}(J=5)$ | $2p6h\ ^3H_5$ | | 230944889 | | 1.078E-15 | | 39.7 (268) 35.8 (317) 24.5 (309) |
| 35 | 318 | $2p_{3/2}6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 230944988 | | 1.077E-15 | | 100. (318) |
| 35 | 319 | $2p_{3/2}6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 230945097 | | 1.079E-15 | | 100. (319) |
| 35 | 320 | $2p_{3/2}6g_{9/2}(J=3)$ | $2p6g\ ^1F_3$ | | 230945708 | | 1.076E-15 | | 50.0 (306) 50.0 (320) |
| 35 | 321 | $2p_{3/2}6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 230946162 | | 1.077E-15 | | 50.1 (311) 49.9 (321) |
| 36 | 1 | $1s^2_{1/2}(J=0)$ | $1s^2\ ^1S_0$ | 0 | 0 | | | | 100. (1) |
| 36 | 2 | $1s_{1/2}2s_{1/2}(J=1)$ | $1s2s\ ^3S_1$ | 104685170 | 104683260 | | 1.720E-10 | | 100. (2) |
| 36 | 3 | $1s_{1/2}2p_{1/2}(J=0)$ | $1s2p\ ^3P_0$ | 105042090 | 105040612 | | 1.577E-09 | | 100. (3) |
| 36 | 4 | $1s_{1/2}2p_{1/2}(J=1)$ | $1s2p\ ^3P_1$ | 105063130 | 105061627 | | 2.551E-15 | | 79.8 (4) |
| 36 | 5 | $1s_{1/2}2s_{1/2}(J=0)$ | $1s2s\ ^1S_0$ | 105066500 | 105064711 | | 5.942E-04 | | 100. (5) |
| 36 | 6 | $1s_{1/2}2p_{3/2}(J=2)$ | $1s2p\ ^3P_2$ | 105585410 | 105584317 | | 9.627E-12 | | 100. (6) |
| 36 | 7 | $1s_{1/2}2p_{3/2}(J=1)$ | $1s2p\ ^1P_1$ | 105775630 | 105773556 | | 6.643E-16 | | 79.8 (7) |
| 36 | 8 | $1s_{1/2}3s_{1/2}(J=1)$ | $1s3s\ ^3S_1$ | 124175700 | 124175026 | | 8.430E-14 | | 100. (8) |
| 36 | 9 | $1s_{1/2}3p_{1/2}(J=0)$ | $1s3p\ ^3P_0$ | 124273800 | 124273201 | | 2.850E-14 | | 100. (9) |
| 36 | 10 | $1s_{1/2}3s_{1/2}(J=0)$ | $1s3s\ ^1S_0$ | 124278000 | 124275677 | | 8.753E-14 | | 100. (10) |
| 36 | 11 | $1s_{1/2}3p_{1/2}(J=1)$ | $1s3p\ ^3P_1$ | 124279600 | 124279059 | | 7.009E-15 | | 79.0 (11) |
| 36 | 12 | $1s_{1/2}3p_{3/2}(J=2)$ | $1s3p\ ^3P_2$ | 124435300 | 124435036 | | 3.031E-14 | | 100. (12) |
| 36 | 13 | $1s_{1/2}3d_{3/2}(J=2)$ | $1s3d\ ^3D_2$ | 124483100 | 124482631 | | 9.948E-15 | | 61.9 (13) 38.1 (17) |
| 36 | 14 | $1s_{1/2}3d_{3/2}(J=1)$ | $1s3d\ ^3D_1$ | 124485900 | 124485386 | | 9.996E-15 | | 100. (14) |
| 36 | 15 | $1s_{1/2}3p_{3/2}(J=1)$ | $1s3p\ ^1P_1$ | 124487500 | 124486812 | | 2.283E-15 | | 79.0 (15) |
| 36 | 16 | $1s_{1/2}3d_{5/2}(J=3)$ | $1s3d\ ^3D_3$ | 124537200 | 124536719 | | 1.023E-14 | | 100. (16) |
| 36 | 17 | $1s_{1/2}3d_{5/2}(J=2)$ | $1s3d\ ^1D_2$ | 124541600 | 124541072 | | 1.019E-14 | | 61.9 (17) 38.1 (13) |
| 36 | 18 | $1s_{1/2}4s_{1/2}(J=1)$ | $1s4s\ ^3S_1$ | 130928700 | 130929127 | | 1.233E-13 | | 100. (18) |
| 36 | 19 | $1s_{1/2}4p_{1/2}(J=0)$ | $1s4p\ ^3P_0$ | 130969500 | 130969412 | | 4.883E-14 | | 100. (19) |
| 36 | 20 | $1s_{1/2}4s_{1/2}(J=0)$ | $1s4s\ ^1S_0$ | 130970800 | 130969892 | | 1.271E-13 | | 100. (20) |
| 36 | 21 | $1s_{1/2}4p_{1/2}(J=1)$ | $1s4p\ ^3P_1$ | 130972200 | 130971832 | | 1.549E-14 | | 78.7 (21) |
| 36 | 22 | $1s_{1/2}4p_{3/2}(J=2)$ | $1s4p\ ^3P_2$ | 131037700 | 131037651 | | 5.135E-14 | | 100. (22) |
| 36 | 23 | $1s_{1/2}4d_{3/2}(J=2)$ | $1s4d\ ^3D_2$ | 131057800 | 131057376 | | 2.309E-14 | | 62.6 (23) 37.4 (29) |
| 36 | 24 | $1s_{1/2}4d_{3/2}(J=1)$ | $1s4d\ ^3D_1$ | 131059000 | 131058400 | | 2.322E-14 | | 100. (24) |
| 36 | 25 | $1s_{1/2}4p_{3/2}(J=1)$ | $1s4p\ ^1P_1$ | 131059600 | 131058885 | | 5.415E-15 | | 78.7 (25) |
| 36 | 26 | $1s_{1/2}4d_{5/2}(J=3)$ | $1s4d\ ^3D_3$ | 131080700 | 131080082 | | 2.382E-14 | | 100. (26) |
| 36 | 27 | $1s_{1/2}4f_{5/2}(J=3)$ | $1s4f\ ^3F_3$ | | 131081373 | | 4.767E-14 | | 56.9 (27) 43.1 (31) |
| 36 | 28 | $1s_{1/2}4f_{5/2}(J=2)$ | $1s4f\ ^3F_2$ | | 131082121 | | 4.769E-14 | | 100. (28) |
| 36 | 29 | $1s_{1/2}4d_{5/2}(J=2)$ | $1s4d\ ^1D_2$ | 131082500 | 131082150 | | 2.368E-14 | | 62.6 (29) 37.4 (23) |
| 36 | 30 | $1s_{1/2}4f_{7/2}(J=4)$ | $1s4f\ ^3F_4$ | | 131092936 | | 4.805E-14 | | 100. (30) |
| 36 | 31 | $1s_{1/2}4f_{7/2}(J=3)$ | $1s4f\ ^1F_3$ | | 131093506 | | 4.808E-14 | | 56.9 (31) 43.1 (27) |
| 36 | 32 | $1s_{1/2}5s_{1/2}(J=1)$ | $1s5s\ ^3S_1$ | 134035500 | 134035743 | | 1.959E-13 | | 100. (32) |
| 36 | 33 | $1s_{1/2}5p_{1/2}(J=0)$ | $1s5p\ ^3P_0$ | | 134056080 | | 8.388E-14 | | 100. (33) |
| 36 | 34 | $1s_{1/2}5s_{1/2}(J=0)$ | $1s5s\ ^1S_0$ | 134056900 | 134056201 | | 1.972E-13 | | 100. (34) |
| 36 | 35 | $1s_{1/2}5p_{1/2}(J=1)$ | $1s5p\ ^3P_1$ | 134057600 | 134057307 | | 2.925E-14 | | 78.6 (35) |
| 36 | 36 | $1s_{1/2}5p_{3/2}(J=2)$ | $1s5p\ ^3P_2$ | 134091100 | 134090976 | | 8.771E-14 | | 100. (36) |
| 36 | 37 | $1s_{1/2}5d_{3/2}(J=2)$ | $1s5d\ ^3D_2$ | | 134100986 | | 4.439E-14 | | 62.9 (37) 37.1 (43) |
| 36 | 38 | $1s_{1/2}5d_{3/2}(J=1)$ | $1s5d\ ^3D_1$ | | 134101481 | | 4.473E-14 | | 100. (38) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|--------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 36 | 39 | $1s_{1/2}5p_{3/2}(J=1)$ | $1s5p^1P_1$ | 134102400 | 134101699 | | 1.055E-14 | | 78.6 (39) |
| 36 | 40 | $1s_{1/2}5d_{5/2}(J=3)$ | $1s5d^3D_3$ | | 134112583 | | 4.595E-14 | | 100. (40) |
| 36 | 41 | $1s_{1/2}5f_{5/2}(J=3)$ | $1s5f^3F_3$ | | 134113303 | | 9.197E-14 | | 56.9 (41) 43.1 (47) |
| 36 | 42 | $1s_{1/2}5f_{5/2}(J=2)$ | $1s5f^3F_2$ | | 134113682 | | 9.200E-14 | | 100. (42) |
| 36 | 43 | $1s_{1/2}5d_{5/2}(J=2)$ | $1s5d^1D_2$ | | 134113691 | | 4.547E-14 | | 62.9 (43) 37.1 (37) |
| 36 | 44 | $1s_{1/2}5f_{7/2}(J=4)$ | $1s5f^3F_4$ | | 134119224 | | 9.274E-14 | | 100. (44) |
| 36 | 45 | $1s_{1/2}5g_{7/2}(J=4)$ | $1s5g^3G_4$ | | 134119261 | | 1.555E-13 | | 55.3 (45) 44.7 (49) |
| 36 | 46 | $1s_{1/2}5g_{7/2}(J=3)$ | $1s5g^3G_3$ | | 134119482 | | 1.555E-13 | | 100. (46) |
| 36 | 47 | $1s_{1/2}5f_{7/2}(J=3)$ | $1s5f^1F_3$ | | 134119520 | | 9.281E-14 | | 56.9 (47) 43.1 (41) |
| 36 | 48 | $1s_{1/2}5g_{9/2}(J=5)$ | $1s5g^3G_5$ | | 134122803 | | 1.561E-13 | | 100. (48) |
| 36 | 49 | $1s_{1/2}5g_{9/2}(J=4)$ | $1s5g^1G_4$ | | 134122980 | | 1.561E-13 | | 55.3 (49) 44.7 (45) |
| 36 | 50 | $1s_{1/2}6s_{1/2}(J=1)$ | $1s6s^3S_1$ | | 135716132 | | 2.983E-13 | | 100. (50) |
| 36 | 51 | $1s_{1/2}6p_{1/2}(J=0)$ | $1s6p^3P_0$ | | 135727793 | | 1.338E-13 | | 100. (51) |
| 36 | 52 | $1s_{1/2}6s_{1/2}(J=0)$ | $1s6s^1S_0$ | | 135727839 | | 3.039E-13 | | 100. (52) |
| 36 | 53 | $1s_{1/2}6p_{1/2}(J=1)$ | $1s6p^3P_1$ | | 135728499 | | 4.937E-14 | | 78.5 (53) |
| 36 | 54 | $1s_{1/2}6p_{3/2}(J=2)$ | $1s6p^3P_2$ | | 135747970 | | 1.394E-13 | | 100. (54) |
| 36 | 55 | $1s_{1/2}6d_{3/2}(J=2)$ | $1s6d^3D_2$ | | 135753710 | | 7.576E-14 | | 63.0 (55) 37.0 (61) |
| 36 | 56 | $1s_{1/2}6d_{3/2}(J=1)$ | $1s6d^3D_1$ | | 135753987 | | 7.618E-14 | | 100. (56) |
| 36 | 57 | $1s_{1/2}6p_{3/2}(J=1)$ | $1s6p^1P_1$ | | 135754130 | | 1.818E-14 | | 78.5 (57) |
| 36 | 58 | $1s_{1/2}6d_{5/2}(J=3)$ | $1s6d^3D_3$ | | 135760413 | | 7.819E-14 | | 100. (58) |
| 36 | 59 | $1s_{1/2}6f_{5/2}(J=3)$ | $1s6f^3F_3$ | | 135760822 | | 1.570E-13 | | 56.9 (59) 43.1 (65) |
| 36 | 60 | $1s_{1/2}6f_{5/2}(J=2)$ | $1s6f^3F_2$ | | 135761041 | | 1.571E-13 | | 100. (60) |
| 36 | 61 | $1s_{1/2}6d_{5/2}(J=2)$ | $1s6d^1D_2$ | | 135761069 | | 7.784E-14 | | 63.0 (61) 37.0 (55) |
| 36 | 62 | $1s_{1/2}6f_{7/2}(J=4)$ | $1s6f^3F_4$ | | 135764249 | | 1.584E-13 | | 100. (62) |
| 36 | 63 | $1s_{1/2}6g_{7/2}(J=4)$ | $1s6g^3G_4$ | | 135764257 | | 2.665E-13 | | 55.3 (63) 44.7 (69) |
| 36 | 64 | $1s_{1/2}6g_{7/2}(J=3)$ | $1s6g^3G_3$ | | 135764385 | | 2.666E-13 | | 100. (64) |
| 36 | 65 | $1s_{1/2}6f_{7/2}(J=3)$ | $1s6f^1F_3$ | | 135764422 | | 1.585E-13 | | 56.9 (65) 43.1 (59) |
| 36 | 66 | $1s_{1/2}6h_{9/2}(J=5)$ | $1s6h^3H_5$ | | 135766307 | | 4.033E-13 | | 54.3 (66) 45.7 (71) |
| 36 | 67 | $1s_{1/2}6g_{9/2}(J=5)$ | $1s6g^3G_5$ | | 135766308 | | 2.675E-13 | | 100. (67) |
| 36 | 68 | $1s_{1/2}6h_{9/2}(J=4)$ | $1s6h^3H_4$ | | 135766391 | | 4.033E-13 | | 100. (68) |
| 36 | 69 | $1s_{1/2}6g_{9/2}(J=4)$ | $1s6g^1G_4$ | | 135766409 | | 2.676E-13 | | 55.3 (69) 44.7 (63) |
| 36 | 70 | $1s_{1/2}6h_{11/2}(J=6)$ | $1s6h^3H_6$ | | 135767672 | | 4.040E-13 | | 100. (70) |
| 36 | 71 | $1s_{1/2}6h_{11/2}(J=5)$ | $1s6h^1H_5$ | | 135767741 | | 4.041E-13 | | 54.3 (71) 45.7 (66) |
| 36 | 72 | $2s_{1/2}^2(J=0)$ | $2s^2^1S_0$ | 212560000 | 212546607 | | 2.202E-15 | | 77.5 (72) |
| 36 | 73 | $2s_{1/2}2p_{1/2}(J=0)$ | $2s2p^3P_0$ | 212602000 | 212564319 | | 9.712E-16 | | 100. (73) |
| 36 | 74 | $2s_{1/2}2p_{1/2}(J=1)$ | $2s2p^3P_1$ | 212693000 | 212656726 | | 9.695E-16 | | 87.3 (74) |
| 36 | 75 | $2p_{1/2}^2(J=0)$ | $2p^2^3P_0$ | 213049000 | 213005627 | | 5.908E-16 | | 72.0 (75) 18.1 (72) 9.87 (81) |
| 36 | 76 | $2s_{1/2}2p_{3/2}(J=2)$ | $2s2p^3P_2$ | 213198000 | 213189041 | | 9.944E-16 | | 100. (76) |
| 36 | 77 | $2p_{1/2}2p_{3/2}(J=1)$ | $2p^2^3P_1$ | 213458000 | 213434354 | | 4.894E-16 | | 100. (77) |
| 36 | 78 | $2p_{1/2}2p_{3/2}(J=2)$ | $2p^2^1D_2$ | 213548000 | 213520948 | | 4.887E-16 | | 54.2 (78) 45.8 (80) |
| 36 | 79 | $2s_{1/2}2p_{3/2}(J=1)$ | $2s2p^1P_1$ | 213563000 | 213552728 | | 9.780E-16 | | 87.3 (79) |
| 36 | 80 | $2p_{3/2}^2(J=2)$ | $2p^2^3P_2$ | 214116000 | 214116731 | | 4.947E-16 | | 54.3 (80) 45.7 (78) |
| 36 | 81 | $2p_{3/2}^2(J=0)$ | $2p^2^1S_0$ | 214433000 | 214435222 | | 5.198E-16 | | 77.2 (81) |
| 36 | 82 | $2s_{1/2}3s_{1/2}(J=1)$ | $2s3s^3S_1$ | | 232330260 | | 4.585E-15 | | 85.9 (82) |
| 36 | 83 | $2p_{1/2}3s_{1/2}(J=1)$ | $2p3s^3P_1$ | | 232379701 | | 1.155E-15 | | 42.2 (83) 29.2 (103) 23.1 (92) |
| 36 | 84 | $2p_{1/2}3s_{1/2}(J=0)$ | $2p3s^3P_0$ | | 232399774 | | 1.118E-15 | | 79.2 (84) |
| 36 | 85 | $2s_{1/2}3s_{1/2}(J=0)$ | $2s3s^1S_0$ | | 232408814 | | 2.768E-15 | | 72.5 (85) |
| 36 | 86 | $2p_{1/2}3p_{1/2}(J=1)$ | $2p3p^3D_1$ | | 232409463 | | 8.088E-16 | | 71.1 (86) 18.3 (104) 7.89 (82) |
| 36 | 87 | $2s_{1/2}3p_{1/2}(J=1)$ | $2s3p^3P_1$ | | 232455263 | | 2.249E-15 | | 68.9 (87) 17.6 (83) 10.6 (92) |
| 36 | 88 | $2s_{1/2}3p_{1/2}(J=0)$ | $2s3p^3P_0$ | | 232455754 | | 2.233E-15 | | 78.3 (88) |
| 36 | 89 | $2s_{1/2}3p_{3/2}(J=2)$ | $2s3p^3P_2$ | | 232610309 | | 2.770E-15 | | 90.0 (89) |
| 36 | 90 | $2p_{1/2}3p_{1/2}(J=0)$ | $2p3p^3P_0$ | | 232616701 | | 9.687E-16 | | 63.0 (90) 24.8 (85) 12.2 (115) |
| 36 | 91 | $2p_{1/2}3p_{3/2}(J=2)$ | $2p3p^3D_2$ | | 232632738 | | 8.616E-16 | | 54.7 (91) 17.8 (96) 17.5 (109) |
| 36 | 92 | $2s_{1/2}3p_{3/2}(J=1)$ | $2s3p^1P_1$ | | 232656711 | | 2.237E-15 | | 58.6 (92) 25.5 (87) 15.9 (83) |
| 36 | 93 | $2p_{1/2}3p_{3/2}(J=1)$ | $2p3p^3P_1$ | | 232664016 | | 8.638E-16 | | 35.8 (93) 24.7 (107) 17.5 (104) |
| 36 | 94 | $2p_{1/2}3d_{3/2}(J=2)$ | $2p3d^3F_2$ | | 232678367 | | 9.490E-16 | | 76.3 (94) |
| 36 | 95 | $2s_{1/2}3d_{3/2}(J=1)$ | $2s3d^3D_1$ | | 232720587 | | 3.935E-15 | | 86.3 (95) |
| 36 | 96 | $2s_{1/2}3d_{3/2}(J=2)$ | $2s3d^3D_2$ | | 232730453 | | 3.902E-15 | | 71.3 (96) 14.2 (101) 6.76 (109) |
| 36 | 97 | $2s_{1/2}3d_{5/2}(J=3)$ | $2s3d^3D_3$ | | 232755217 | | 7.434E-15 | | 98.6 (97) |
| 36 | 98 | $2p_{1/2}3d_{5/2}(J=3)$ | $2p3d^3F_3$ | | 232803803 | | 8.855E-16 | | 57.5 (98) 21.4 (116) 21.1 (111) |
| 36 | 99 | $2p_{1/2}3d_{3/2}(J=1)$ | $2p3d^3D_1$ | | 232804596 | | 8.560E-16 | | 57.1 (99) 24.3 (117) 16.8 (112) |
| 36 | 100 | $2p_{1/2}3d_{5/2}(J=2)$ | $2p3d^3P_2$ | | 232813401 | | 9.177E-16 | | 39.0 (100) 31.6 (114) 16.8 (108) |
| 36 | 101 | $2s_{1/2}3d_{5/2}(J=2)$ | $2s3d^1D_2$ | | 232853354 | | 5.523E-15 | | 82.7 (101) |
| 36 | 102 | $2p_{3/2}3s_{1/2}(J=2)$ | $2p3s^3P_2$ | | 233054934 | | 9.657E-16 | | 97.7 (102) |
| 36 | 103 | $2p_{3/2}3s_{1/2}(J=1)$ | $2p3s^1P_1$ | | 233116781 | | 1.001E-15 | | 68.1 (103) 25.2 (83) 6.69 (92) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 36 | 104 | $2p_{3/2}3p_{1/2}(J=1)$ | $2p3p\ ^1P_1$ | 233118749 | | | 7.570E-16 | | 56.0 (93) 19.2 (104) 13.9 (107) |
| 36 | 105 | $2p_{3/2}3p_{1/2}(J=2)$ | $2p3p\ ^3P_2$ | 233140965 | | | 7.667E-16 | | 34.2 (91) 32.6 (105) 31.1 (109) |
| 36 | 106 | $2p_{3/2}3p_{3/2}(J=3)$ | $2p3p\ ^3D_3$ | 233245000 | | | 7.679E-16 | | 98.6 (106) |
| 36 | 107 | $2p_{3/2}3p_{3/2}(J=1)$ | $2p3p\ ^3S_1$ | 233253503 | | | 7.611E-16 | | 51.3 (107) 41.6 (104) 4.73 (86) |
| 36 | 108 | $2p_{3/2}3d_{3/2}(J=2)$ | $2p3d\ ^1D_2$ | 233347635 | | | 9.051E-16 | | 46.7 (108) 32.8 (114) 20.6 (94) |
| 36 | 109 | $2p_{3/2}3p_{3/2}(J=2)$ | $2p3p\ ^1D_2$ | 233362174 | | | 7.546E-16 | | 54.5 (105) 45.5 (109) |
| 36 | 110 | $2p_{3/2}3d_{5/2}(J=4)$ | $2p3d\ ^3F_4$ | 233365429 | | | 9.742E-16 | | 100. (110) |
| 36 | 111 | $2p_{3/2}3d_{3/2}(J=3)$ | $2p3d\ ^3D_3$ | 233383207 | | | 8.851E-16 | | 46.8 (111) 40.2 (98) 13.0 (116) |
| 36 | 112 | $2p_{3/2}3d_{3/2}(J=1)$ | $2p3d\ ^3P_1$ | 233414267 | | | 8.838E-16 | | 66.7 (112) 30.9 (99) 2.44 (117) |
| 36 | 113 | $2p_{3/2}3d_{3/2}(J=0)$ | $2p3d\ ^3P_0$ | 233420993 | | | 9.028E-16 | | 100. (113) |
| 36 | 114 | $2p_{3/2}3d_{5/2}(J=2)$ | $2p3d\ ^3D_2$ | 233439371 | | | 8.920E-16 | | 54.2 (100) 30.1 (114) 15.7 (108) |
| 36 | 115 | $2p_{3/2}3p_{3/2}(J=0)$ | $2p3p\ ^1S_0$ | 233479222 | | | 7.696E-16 | | 74.0 (115) |
| 36 | 116 | $2p_{3/2}3d_{5/2}(J=3)$ | $2p3d\ ^1F_3$ | 233517012 | | | 8.231E-16 | | 65.6 (116) 32.1 (111) 2.27 (98) |
| 36 | 117 | $2p_{3/2}3d_{5/2}(J=1)$ | $2p3d\ ^1P_1$ | 233550920 | | | 8.761E-16 | | 72.0 (117) 15.7 (112) 12.3 (99) |
| 36 | 118 | $2s_{1/2}4s_{1/2}(J=1)$ | $2s4s\ ^3S_1$ | 239191948 | | | 3.916E-15 | | 79.2 (118) |
| 36 | 119 | $2p_{1/2}4s_{1/2}(J=0)$ | $2p4s\ ^3P_0$ | 239205119 | | | 1.194E-15 | | 76.4 (119) |
| 36 | 120 | $2p_{1/2}4s_{1/2}(J=1)$ | $2p4s\ ^3P_1$ | 239206403 | | | 1.056E-15 | | 56.4 (120) 30.5 (147) 13.1 (130) |
| 36 | 121 | $2s_{1/2}4s_{1/2}(J=0)$ | $2s4s\ ^1S_0$ | 239212607 | | | 2.473E-15 | | 65.6 (121) 20.3 (125) 14.1 (159) |
| 36 | 122 | $2p_{1/2}4p_{1/2}(J=1)$ | $2p4p\ ^3D_1$ | 239222019 | | | 9.927E-16 | | 68.6 (122) 15.3 (148) 13.1 (118) |
| 36 | 123 | $2s_{1/2}4p_{1/2}(J=1)$ | $2s4p\ ^3P_1$ | 239238078 | | | 5.324E-15 | | 72.4 (123) |
| 36 | 124 | $2s_{1/2}4p_{1/2}(J=0)$ | $2s4p\ ^3P_0$ | 239250232 | | | 2.901E-15 | | 76.3 (124) |
| 36 | 125 | $2p_{1/2}4p_{1/2}(J=0)$ | $2p4p\ ^3P_0$ | 239302349 | | | 1.255E-15 | | 50.7 (125) 33.6 (121) 15.7 (159) |
| 36 | 126 | $2s_{1/2}4p_{3/2}(J=2)$ | $2s4p\ ^3P_2$ | 239305631 | | | 3.784E-15 | | 84.7 (126) |
| 36 | 127 | $2p_{1/2}4p_{3/2}(J=2)$ | $2p4p\ ^3D_2$ | 239311242 | | | 9.685E-16 | | 46.7 (127) 25.7 (149) 13.4 (152) |
| 36 | 128 | $2p_{1/2}4p_{3/2}(J=1)$ | $2p4p\ ^3P_1$ | 239325468 | | | 9.714E-16 | | 42.3 (128) 25.3 (151) 14.0 (148) |
| 36 | 129 | $2p_{1/2}4d_{3/2}(J=2)$ | $2p4d\ ^3F_2$ | 239328851 | | | 9.815E-16 | | 73.5 (129) |
| 36 | 130 | $2s_{1/2}4p_{3/2}(J=1)$ | $2s4p\ ^1P_1$ | 239334251 | | | 3.845E-15 | | 59.7 (130) 27.2 (123) 9.03 (120) |
| 36 | 131 | $2s_{1/2}4d_{3/2}(J=1)$ | $2s4d\ ^3D_1$ | 239353596 | | | 6.926E-15 | | 90.6 (131) |
| 36 | 132 | $2s_{1/2}4d_{3/2}(J=2)$ | $2s4d\ ^3D_2$ | 239354779 | | | 7.372E-15 | | 75.1 (132) |
| 36 | 133 | $2s_{1/2}4d_{5/2}(J=3)$ | $2s4d\ ^3D_3$ | 239367855 | | | 9.457E-15 | | 94.5 (133) |
| 36 | 134 | $2p_{1/2}4d_{3/2}(J=1)$ | $2p4d\ ^3D_1$ | 239376473 | | | 9.482E-16 | | 50.6 (134) 27.7 (168) 16.1 (156) |
| 36 | 135 | $2p_{1/2}4d_{5/2}(J=3)$ | $2p4d\ ^3F_3$ | 239377149 | | | 1.001E-15 | | 44.8 (135) 26.2 (163) 20.2 (154) |
| 36 | 136 | $2p_{1/2}4d_{5/2}(J=2)$ | $2p4d\ ^3P_2$ | 239385254 | | | 1.024E-15 | | 40.7 (136) 30.7 (158) 14.9 (153) |
| 36 | 137 | $2p_{1/2}4f_{5/2}(J=3)$ | $2p4f\ ^3G_3$ | 239393685 | | | 9.267E-16 | | 73.8 (137) |
| 36 | 138 | $2p_{1/2}4f_{5/2}(J=2)$ | $2p4f\ ^3F_2$ | 239399708 | | | 1.116E-15 | | 38.1 (138) 26.1 (169) 18.1 (139) |
| 36 | 139 | $2s_{1/2}4d_{5/2}(J=2)$ | $2s4d\ ^1D_2$ | 239403301 | | | 3.360E-15 | | 62.1 (139) 14.2 (132) 7.88 (138) |
| 36 | 140 | $2p_{1/2}4f_{7/2}(J=4)$ | $2p4f\ ^3G_4$ | 239408423 | | | 9.252E-16 | | 41.7 (140) 32.4 (164) 26.0 (161) |
| 36 | 141 | $2s_{1/2}4f_{5/2}(J=2)$ | $2s4f\ ^3F_2$ | 239408832 | | | 1.735E-14 | | 97.8 (141) |
| 36 | 142 | $2p_{1/2}4f_{7/2}(J=3)$ | $2p4f\ ^3D_3$ | 239411038 | | | 9.744E-16 | | 50.4 (142) 28.9 (160) 15.3 (165) |
| 36 | 143 | $2s_{1/2}4f_{5/2}(J=3)$ | $2s4f\ ^3F_3$ | 239411099 | | | 8.677E-15 | | 68.3 (143) 23.2 (145) 3.76 (135) |
| 36 | 144 | $2s_{1/2}4f_{7/2}(J=4)$ | $2s4f\ ^3F_4$ | 239417191 | | | 4.537E-14 | | 100. (144) |
| 36 | 145 | $2s_{1/2}4f_{7/2}(J=3)$ | $2s4f\ ^1F_3$ | 239423697 | | | 3.421E-14 | | 76.9 (145) |
| 36 | 146 | $2p_{3/2}4s_{1/2}(J=2)$ | $2p4s\ ^3P_2$ | 239857241 | | | 9.625E-16 | | 100. (146) |
| 36 | 147 | $2p_{3/2}4s_{1/2}(J=1)$ | $2p4s\ ^1P_1$ | 239871684 | | | 9.657E-16 | | 68.2 (147) 31.8 (120) |
| 36 | 148 | $2p_{3/2}4p_{1/2}(J=1)$ | $2p4p\ ^1P_1$ | 239882941 | | | 8.631E-16 | | 50.6 (128) 19.2 (148) 18.7 (151) |
| 36 | 149 | $2p_{3/2}4p_{1/2}(J=2)$ | $2p4p\ ^1D_2$ | 239887671 | | | 8.633E-16 | | 45.8 (127) 28.6 (149) 25.7 (152) |
| 36 | 150 | $2p_{3/2}4p_{3/2}(J=3)$ | $2p4p\ ^3D_3$ | 239942445 | | | 8.635E-16 | | 100. (150) |
| 36 | 151 | $2p_{3/2}4p_{3/2}(J=1)$ | $2p4p\ ^3S_1$ | 239945345 | | | 8.636E-16 | | 48.6 (151) 46.3 (148) 5.16 (122) |
| 36 | 152 | $2p_{3/2}4p_{3/2}(J=2)$ | $2p4p\ ^3P_2$ | 239978110 | | | 8.617E-16 | | 58.5 (152) 41.5 (149) |
| 36 | 153 | $2p_{3/2}4d_{3/2}(J=2)$ | $2p4d\ ^1D_2$ | 239981299 | | | 9.356E-16 | | 44.6 (153) 33.6 (158) 21.8 (129) |
| 36 | 154 | $2p_{3/2}4d_{3/2}(J=3)$ | $2p4d\ ^3D_3$ | 239992595 | | | 9.325E-16 | | 49.0 (135) 37.3 (154) 13.7 (163) |
| 36 | 155 | $2p_{3/2}4d_{5/2}(J=4)$ | $2p4d\ ^3F_4$ | 239993583 | | | 9.583E-16 | | 100. (155) |
| 36 | 156 | $2p_{3/2}4d_{3/2}(J=1)$ | $2p4d\ ^3P_1$ | 240002484 | | | 9.274E-16 | | 63.8 (156) 33.5 (134) 2.69 (168) |
| 36 | 157 | $2p_{3/2}4d_{3/2}(J=0)$ | $2p4d\ ^3P_0$ | 240005303 | | | 9.345E-16 | | 100. (157) |
| 36 | 158 | $2p_{3/2}4d_{5/2}(J=2)$ | $2p4d\ ^3D_2$ | 240014646 | | | 9.320E-16 | | 51.5 (136) 27.8 (158) 20.7 (153) |
| 36 | 159 | $2p_{3/2}4p_{3/2}(J=0)$ | $2p4p\ ^1S_0$ | 240017735 | | | 8.673E-16 | | 70.8 (159) 29.2 (125) |
| 36 | 160 | $2p_{3/2}4f_{5/2}(J=3)$ | $2p4f\ ^3F_3$ | 240029728 | | | 9.479E-16 | | 40.8 (160) 33.7 (165) 25.5 (137) |
| 36 | 161 | $2p_{3/2}4f_{5/2}(J=4)$ | $2p4f\ ^3F_4$ | 240038098 | | | 9.478E-16 | | 50.8 (140) 44.8 (161) 4.37 (164) |
| 36 | 162 | $2p_{3/2}4f_{5/2}(J=2)$ | $2p4f\ ^3D_2$ | 240039400 | | | 9.473E-16 | | 51.2 (138) 34.3 (162) 14.5 (169) |
| 36 | 163 | $2p_{3/2}4d_{5/2}(J=3)$ | $2p4d\ ^1F_3$ | 240039891 | | | 9.071E-16 | | 57.3 (163) 40.3 (154) 2.38 (135) |
| 36 | 164 | $2p_{3/2}4f_{7/2}(J=4)$ | $2p4f\ ^1G_4$ | 240048168 | | | 9.476E-16 | | 63.2 (164) 29.2 (161) 7.53 (140) |
| 36 | 165 | $2p_{3/2}4f_{7/2}(J=3)$ | $2p4f\ ^1F_3$ | 240048232 | | | 9.477E-16 | | 45.6 (142) 32.1 (165) 22.3 (160) |
| 36 | 166 | $2p_{3/2}4f_{7/2}(J=5)$ | $2p4f\ ^3G_5$ | 240049916 | | | 9.477E-16 | | 100. (166) |
| 36 | 167 | $2p_{3/2}4f_{5/2}(J=1)$ | $2p4f\ ^3D_1$ | 240051187 | | | 9.469E-16 | | 100. (167) |
| 36 | 168 | $2p_{3/2}4d_{5/2}(J=1)$ | $2p4d\ ^1P_1$ | 240053740 | | | 9.265E-16 | | 67.1 (168) 19.0 (156) 13.9 (134) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 36 | 169 | $2p_{3/2}4f_{7/2}(J=2)$ | $2p4f\ ^1D_2$ | | 240064850 | | 9.466E-16 | | 53.5 (169) 44.2 (162) 2.33 (138) |
| 36 | 170 | $2s_{1/2}5s_{1/2}(J=1)$ | $2s5s\ ^3S_1$ | | 242331699 | | 2.458E-15 | | 64.1 (170) 15.7 (174) 11.0 (211) |
| 36 | 171 | $2p_{1/2}5s_{1/2}(J=0)$ | $2p5s\ ^3P_0$ | | 242332945 | | 1.133E-15 | | 82.1 (171) |
| 36 | 172 | $2p_{1/2}5s_{1/2}(J=1)$ | $2p5s\ ^3P_1$ | | 242334153 | | 1.026E-15 | | 60.6 (172) 31.0 (207) 8.44 (182) |
| 36 | 173 | $2s_{1/2}5s_{1/2}(J=0)$ | $2s5s\ ^1S_0$ | | 242339414 | | 2.077E-15 | | 57.1 (173) 27.1 (177) 15.7 (218) |
| 36 | 174 | $2p_{1/2}5p_{1/2}(J=1)$ | $2p5p\ ^3D_1$ | | 242344019 | | 1.234E-15 | | 59.3 (174) 26.0 (170) 10.4 (211) |
| 36 | 175 | $2s_{1/2}5p_{1/2}(J=1)$ | $2s5p\ ^3P_1$ | | 242356016 | | 8.379E-15 | | 70.3 (175) 25.0 (182) 1.96 (185) |
| 36 | 176 | $2s_{1/2}5p_{1/2}(J=0)$ | $2s5p\ ^3P_0$ | | 242362969 | | 4.156E-15 | | 82.1 (176) |
| 36 | 177 | $2p_{1/2}5p_{1/2}(J=0)$ | $2p5p\ ^3P_0$ | | 242385117 | | 1.535E-15 | | 42.6 (173) 41.7 (177) 15.7 (218) |
| 36 | 178 | $2p_{1/2}5p_{3/2}(J=2)$ | $2p5p\ ^3D_2$ | | 242387655 | | 9.861E-16 | | 46.4 (178) 28.6 (209) 14.6 (212) |
| 36 | 179 | $2s_{1/2}5p_{3/2}(J=2)$ | $2s5p\ ^3P_2$ | | 242389361 | | 3.085E-15 | | 73.9 (179) |
| 36 | 180 | $2p_{1/2}5p_{3/2}(J=1)$ | $2p5p\ ^3P_1$ | | 242395607 | | 1.022E-15 | | 43.2 (180) 25.9 (208) 12.8 (211) |
| 36 | 181 | $2p_{1/2}5d_{3/2}(J=2)$ | $2p5d\ ^3F_2$ | | 242396680 | | 1.041E-15 | | 69.7 (181) 12.3 (213) 8.26 (179) |
| 36 | 182 | $2s_{1/2}5p_{3/2}(J=1)$ | $2s5p\ ^1P_1$ | | 242405331 | | 4.409E-15 | | 55.3 (182) 29.6 (175) 6.75 (172) |
| 36 | 183 | $2s_{1/2}5d_{3/2}(J=2)$ | $2s5d\ ^3D_2$ | | 242414820 | | 8.672E-15 | | 74.7 (183) |
| 36 | 184 | $2s_{1/2}5d_{3/2}(J=1)$ | $2s5d\ ^3D_1$ | | 242414845 | | 1.167E-14 | | 94.5 (184) |
| 36 | 185 | $2p_{1/2}5d_{3/2}(J=1)$ | $2p5d\ ^3D_1$ | | 242420085 | | 1.034E-15 | | 45.8 (185) 27.4 (229) 15.0 (216) |
| 36 | 186 | $2p_{1/2}5d_{5/2}(J=3)$ | $2p5d\ ^3F_3$ | | 242420471 | | 9.863E-16 | | 43.7 (186) 29.3 (221) 20.9 (214) |
| 36 | 187 | $2s_{1/2}5d_{5/2}(J=3)$ | $2s5d\ ^3D_3$ | | 242421591 | | 5.537E-15 | | 85.3 (187) |
| 36 | 188 | $2p_{1/2}5d_{5/2}(J=2)$ | $2p5d\ ^3P_2$ | | 242425701 | | 1.116E-15 | | 39.0 (188) 28.4 (219) 17.9 (179) |
| 36 | 189 | $2p_{1/2}5f_{5/2}(J=3)$ | $2p5f\ ^3G_3$ | | 242427739 | | 9.424E-16 | | 74.5 (189) |
| 36 | 190 | $2p_{1/2}5f_{5/2}(J=2)$ | $2p5f\ ^3F_2$ | | 242432093 | | 9.935E-16 | | 42.7 (190) 30.6 (236) 20.5 (223) |
| 36 | 191 | $2p_{1/2}5f_{7/2}(J=4)$ | $2p5f\ ^3G_4$ | | 242435667 | | 9.347E-16 | | 41.8 (191) 32.8 (226) 25.4 (222) |
| 36 | 192 | $2p_{1/2}5g_{7/2}(J=4)$ | $2p5g\ ^3H_4$ | | 242437016 | | 9.371E-16 | | 72.7 (192) |
| 36 | 193 | $2p_{1/2}5g_{7/2}(J=3)$ | $2p5g\ ^3G_3$ | | 242437679 | | 9.388E-16 | | 42.2 (193) 33.0 (237) 24.8 (230) |
| 36 | 194 | $2p_{1/2}5f_{7/2}(J=3)$ | $2p5f\ ^3D_3$ | | 242438012 | | 1.082E-15 | | 46.6 (194) 25.3 (220) 14.2 (187) |
| 36 | 195 | $2s_{1/2}5d_{5/2}(J=2)$ | $2s5d\ ^1D_2$ | | 242438553 | | 9.242E-15 | | 77.8 (195) |
| 36 | 196 | $2p_{1/2}5g_{9/2}(J=5)$ | $2p5g\ ^3H_5$ | | 242440629 | | 9.371E-16 | | 39.9 (196) 33.2 (232) 27.0 (231) |
| 36 | 197 | $2p_{1/2}5g_{9/2}(J=4)$ | $2p5g\ ^3F_4$ | | 242441056 | | 9.511E-16 | | 56.8 (197) 26.4 (227) 15.3 (233) |
| 36 | 198 | $2s_{1/2}5f_{5/2}(J=2)$ | $2s5f\ ^3F_2$ | | 242441777 | | 2.316E-14 | | 97.9 (198) |
| 36 | 199 | $2s_{1/2}5f_{5/2}(J=3)$ | $2s5f\ ^3F_3$ | | 242442828 | | 1.321E-14 | | 74.6 (199) |
| 36 | 200 | $2s_{1/2}5f_{7/2}(J=4)$ | $2s5f\ ^3F_4$ | | 242446128 | | 3.681E-14 | | 100. (200) |
| 36 | 201 | $2s_{1/2}5f_{7/2}(J=3)$ | $2s5f\ ^1F_3$ | | 242450024 | | 5.938E-14 | | 80.6 (201) |
| 36 | 202 | $2s_{1/2}5g_{7/2}(J=4)$ | $2s5g\ ^3G_4$ | | 242450533 | | 1.265E-13 | | 58.5 (202) 41.5 (205) |
| 36 | 203 | $2s_{1/2}5g_{7/2}(J=3)$ | $2s5g\ ^3G_3$ | | 242450617 | | 1.273E-13 | | 100. (203) |
| 36 | 204 | $2s_{1/2}5g_{9/2}(J=5)$ | $2s5g\ ^3G_5$ | | 242453950 | | 1.483E-13 | | 100. (204) |
| 36 | 205 | $2s_{1/2}5g_{9/2}(J=4)$ | $2s5g\ ^1G_4$ | | 242454237 | | 1.442E-13 | | 58.5 (205) 41.5 (202) |
| 36 | 206 | $2p_{3/2}5s_{1/2}(J=2)$ | $2p5s\ ^3P_2$ | | 242979997 | | 9.634E-16 | | 100. (206) |
| 36 | 207 | $2p_{3/2}5s_{1/2}(J=1)$ | $2p5s\ ^1P_1$ | | 242985701 | | 9.638E-16 | | 67.3 (207) 32.7 (172) |
| 36 | 208 | $2p_{3/2}5p_{1/2}(J=1)$ | $2p5p\ ^3S_1$ | | 242992849 | | 9.101E-16 | | 49.9 (180) 20.6 (208) 18.2 (211) |
| 36 | 209 | $2p_{3/2}5p_{1/2}(J=2)$ | $2p5p\ ^1D_2$ | | 242994882 | | 9.101E-16 | | 48.0 (178) 28.0 (209) 24.0 (212) |
| 36 | 210 | $2p_{3/2}5p_{3/2}(J=3)$ | $2p5p\ ^3D_3$ | | 243024318 | | 9.098E-16 | | 100. (210) |
| 36 | 211 | $2p_{3/2}5p_{3/2}(J=1)$ | $2p5p\ ^1P_1$ | | 243025320 | | 9.097E-16 | | 48.1 (211) 46.5 (208) 5.39 (174) |
| 36 | 212 | $2p_{3/2}5p_{3/2}(J=2)$ | $2p5p\ ^3P_2$ | | 243040278 | | 9.096E-16 | | 59.8 (212) 40.2 (209) |
| 36 | 213 | $2p_{3/2}5d_{3/2}(J=2)$ | $2p5d\ ^1D_2$ | | 243043425 | | 9.497E-16 | | 43.2 (213) 34.8 (219) 22.0 (181) |
| 36 | 214 | $2p_{3/2}5d_{3/2}(J=3)$ | $2p5d\ ^3D_3$ | | 243048572 | | 9.488E-16 | | 51.5 (186) 34.3 (214) 14.3 (221) |
| 36 | 215 | $2p_{3/2}5d_{5/2}(J=4)$ | $2p5d\ ^3F_4$ | | 243050342 | | 9.601E-16 | | 100. (215) |
| 36 | 216 | $2p_{3/2}5d_{3/2}(J=1)$ | $2p5d\ ^3P_1$ | | 243052812 | | 9.454E-16 | | 63.0 (216) 34.3 (185) 2.72 (229) |
| 36 | 217 | $2p_{3/2}5d_{3/2}(J=0)$ | $2p5d\ ^3P_0$ | | 243054111 | | 9.485E-16 | | 100. (217) |
| 36 | 218 | $2p_{3/2}5p_{3/2}(J=0)$ | $2p5p\ ^1S_0$ | | 243057881 | | 9.117E-16 | | 68.7 (218) 31.3 (177) |
| 36 | 219 | $2p_{3/2}5d_{5/2}(J=2)$ | $2p5d\ ^3D_2$ | | 243059452 | | 9.479E-16 | | 50.6 (188) 26.5 (219) 22.9 (213) |
| 36 | 220 | $2p_{3/2}5f_{5/2}(J=3)$ | $2p5f\ ^3F_3$ | | 243067317 | | 9.566E-16 | | 40.8 (220) 34.2 (224) 25.1 (189) |
| 36 | 221 | $2p_{3/2}5d_{5/2}(J=3)$ | $2p5d\ ^1F_3$ | | 243071167 | | 9.365E-16 | | 54.4 (221) 43.4 (214) 2.20 (186) |
| 36 | 222 | $2p_{3/2}5f_{5/2}(J=4)$ | $2p5f\ ^3F_4$ | | 243071367 | | 9.564E-16 | | 52.3 (191) 41.5 (222) 6.21 (226) |
| 36 | 223 | $2p_{3/2}5f_{5/2}(J=2)$ | $2p5f\ ^3D_2$ | | 243072108 | | 9.562E-16 | | 51.5 (190) 36.0 (223) 12.6 (236) |
| 36 | 224 | $2p_{3/2}5f_{7/2}(J=3)$ | $2p5f\ ^1F_3$ | | 243076500 | | 9.564E-16 | | 44.7 (194) 32.3 (224) 23.0 (220) |
| 36 | 225 | $2p_{3/2}5f_{7/2}(J=5)$ | $2p5f\ ^3G_5$ | | 243076813 | | 9.563E-16 | | 100. (225) |
| 36 | 226 | $2p_{3/2}5f_{7/2}(J=4)$ | $2p5f\ ^1G_4$ | | 243076971 | | 9.564E-16 | | 61.0 (226) 33.1 (222) 5.90 (191) |
| 36 | 227 | $2p_{3/2}5g_{7/2}(J=4)$ | $2p5g\ ^3G_4$ | | 243077166 | | 9.605E-16 | | 42.4 (227) 31.0 (233) 26.6 (192) |
| 36 | 228 | $2p_{3/2}5f_{3/2}(J=1)$ | $2p5f\ ^3D_1$ | | 243077427 | | 9.558E-16 | | 100. (228) |
| 36 | 229 | $2p_{3/2}5d_{5/2}(J=1)$ | $2p5d\ ^1P_1$ | | 243077830 | | 9.451E-16 | | 65.5 (229) 20.0 (216) 14.5 (185) |
| 36 | 230 | $2p_{3/2}5g_{7/2}(J=3)$ | $2p5g\ ^3F_3$ | | 243078990 | | 9.603E-16 | | 57.1 (193) 25.5 (230) 17.3 (237) |
| 36 | 231 | $2p_{3/2}5g_{7/2}(J=5)$ | $2p5g\ ^3G_5$ | | 243079851 | | 9.602E-16 | | 56.6 (196) 34.8 (231) 8.57 (232) |
| 36 | 232 | $2p_{3/2}5g_{9/2}(J=5)$ | $2p5g\ ^1H_5$ | | 243081231 | | 9.603E-16 | | 58.2 (232) 38.2 (231) 3.53 (196) |
| 36 | 233 | $2p_{3/2}5g_{9/2}(J=4)$ | $2p5g\ ^1G_4$ | | 243082311 | | 9.603E-16 | | 41.5 (197) 35.8 (233) 22.7 (227) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|-----------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 36 | 234 | $2p_{3/2} 5g_{7/2}(J = 2)$ | $2p5g^3 F_2$ | 243082943 | | | 9.598E-16 | | 100. (234) |
| 36 | 235 | $2p_{3/2} 5g_{9/2}(J = 6)$ | $2p5g^3 H_6$ | 243083814 | | | 9.600E-16 | | 100. (235) |
| 36 | 236 | $2p_{3/2} 5f_{7/2}(J = 2)$ | $2p5f^1 D_2$ | 243084914 | | | 9.556E-16 | | 54.7 (236) 42.2 (223) 3.06 (190) |
| 36 | 237 | $2p_{3/2} 5g_{9/2}(J = 3)$ | $2p5g^1 F_3$ | 243086392 | | | 9.598E-16 | | 50.0 (230) 50.0 (237) |
| 36 | 238 | $2p_{1/2} 6s_{1/2}(J = 0)$ | $2p6s^3 P_0$ | 244022823 | | | 1.064E-15 | | 88.2 (238) |
| 36 | 239 | $2p_{1/2} 6s_{1/2}(J = 1)$ | $2p6s^3 P_1$ | 244023376 | | | 1.008E-15 | | 61.9 (239) 31.2 (283) 5.82 (250) |
| 36 | 240 | $2p_{1/2} 6p_{1/2}(J = 1)$ | $2p6p^3 D_1$ | 244024534 | | | 1.347E-15 | | 39.9 (240) 31.5 (242) 19.0 (287) |
| 36 | 241 | $2p_{1/2} 6p_{1/2}(J = 0)$ | $2s6s^1 S_0$ | 244028530 | | | 1.675E-15 | | 45.5 (241) 35.5 (246) 18.9 (294) |
| 36 | 242 | $2s_{1/2} 6s_{1/2}(J = 1)$ | $2s6s^3 S_1$ | 244031411 | | | 2.036E-15 | | 54.6 (242) 36.1 (240) 5.19 (248) |
| 36 | 243 | $2s_{1/2} 6p_{1/2}(J = 1)$ | $2s6p^3 P_1$ | 244041007 | | | 8.939E-15 | | 66.9 (243) 26.1 (250) 3.22 (252) |
| 36 | 244 | $2s_{1/2} 6p_{1/2}(J = 0)$ | $2s6p^3 P_0$ | 244044959 | | | 6.465E-15 | | 88.2 (244) |
| 36 | 245 | $2p_{1/2} 6p_{3/2}(J = 2)$ | $2p6p^3 D_2$ | 244054313 | | | 9.787E-16 | | 47.3 (245) 30.3 (285) 15.3 (288) |
| 36 | 246 | $2s_{1/2} 6s_{1/2}(J = 0)$ | $2p6p^3 P_0$ | 244055353 | | | 1.981E-15 | | 54.4 (241) 32.3 (246) 13.3 (294) |
| 36 | 247 | $2p_{1/2} 6d_{3/2}(J = 2)$ | $2p6d^3 F_2$ | 244057863 | | | 1.271E-15 | | 42.1 (247) 26.1 (249) 21.2 (289) |
| 36 | 248 | $2p_{1/2} 6p_{3/2}(J = 1)$ | $2p6p^3 P_1$ | 244059456 | | | 1.084E-15 | | 42.0 (248) 25.3 (284) 14.5 (242) |
| 36 | 249 | $2s_{1/2} 6p_{3/2}(J = 2)$ | $2s6p^3 P_2$ | 244060548 | | | 1.674E-15 | | 45.4 (249) 33.8 (247) 14.5 (295) |
| 36 | 250 | $2s_{1/2} 6p_{3/2}(J = 1)$ | $2s6p^1 P_1$ | 244068575 | | | 2.438E-15 | | 33.3 (250) 30.7 (243) 15.0 (252) |
| 36 | 251 | $2p_{1/2} 6d_{5/2}(J = 3)$ | $2p6d^3 F_3$ | 244072906 | | | 9.645E-16 | | 44.0 (251) 31.1 (297) 21.5 (290) |
| 36 | 252 | $2p_{1/2} 6d_{3/2}(J = 1)$ | $2p6d^3 D_1$ | 244073693 | | | 1.425E-15 | | 35.1 (250) 32.6 (252) 19.9 (302) |
| 36 | 253 | $2s_{1/2} 6d_{3/2}(J = 2)$ | $2s6d^3 D_2$ | 244074222 | | | 3.841E-15 | | 64.6 (253) 13.1 (269) 9.85 (258) |
| 36 | 254 | $2s_{1/2} 6d_{3/2}(J = 1)$ | $2s6d^3 D_1$ | 244074941 | | | 1.879E-14 | | 97.4 (254) |
| 36 | 255 | $2p_{1/2} 6f_{5/2}(J = 3)$ | $2p6f^3 G_3$ | 244076451 | | | 1.007E-15 | | 62.4 (255) 23.2 (301) 6.97 (257) |
| 36 | 256 | $2p_{1/2} 6d_{5/2}(J = 2)$ | $2p6d^3 P_2$ | 244077180 | | | 1.307E-15 | | 34.2 (256) 29.8 (249) 24.4 (295) |
| 36 | 257 | $2s_{1/2} 6d_{5/2}(J = 3)$ | $2s6d^3 D_3$ | 244077542 | | | 1.804E-15 | | 48.7 (257) 19.6 (264) 18.5 (296) |
| 36 | 258 | $2p_{1/2} 6f_{5/2}(J = 2)$ | $2p6f^3 F_2$ | 244080045 | | | 1.192E-15 | | 35.4 (258) 25.8 (316) 17.1 (299) |
| 36 | 259 | $2p_{1/2} 6f_{7/2}(J = 4)$ | $2p6f^3 G_4$ | 244081298 | | | 9.382E-16 | | 41.7 (259) 33.0 (303) 25.2 (298) |
| 36 | 260 | $2p_{1/2} 6g_{7/2}(J = 4)$ | $2p6g^3 H_4$ | 244082102 | | | 9.394E-16 | | 72.9 (260) |
| 36 | 261 | $2p_{1/2} 6g_{7/2}(J = 3)$ | $2p6g^3 G_3$ | 244082551 | | | 9.400E-16 | | 42.0 (261) 33.2 (320) 24.9 (306) |
| 36 | 262 | $2p_{1/2} 6g_{9/2}(J = 5)$ | $2p6g^3 H_5$ | 244084224 | | | 9.394E-16 | | 39.9 (262) 33.2 (308) 26.8 (307) |
| 36 | 263 | $2p_{1/2} 6h_{9/2}(J = 5)$ | $2p6h^3 I_5$ | 244084342 | | | 9.406E-16 | | 71.9 (263) 17.9 (318) 10.2 (309) |
| 36 | 264 | $2p_{1/2} 6f_{7/2}(J = 3)$ | $2p6f^3 D_3$ | 244084393 | | | 1.668E-15 | | 44.5 (257) 30.3 (264) 15.9 (296) |
| 36 | 265 | $2p_{1/2} 6g_{9/2}(J = 4)$ | $2p6g^3 F_4$ | 244084498 | | | 9.426E-16 | | 57.9 (265) 26.6 (305) 15.5 (310) |
| 36 | 266 | $2p_{1/2} 6h_{9/2}(J = 4)$ | $2p6h^3 H_4$ | 244084581 | | | 9.406E-16 | | 40.2 (266) 33.2 (321) 26.6 (311) |
| 36 | 267 | $2p_{1/2} 6h_{11/2}(J = 6)$ | $2p6h^3 I_6$ | 244085702 | | | 9.406E-16 | | 38.8 (267) 33.3 (313) 27.9 (315) |
| 36 | 268 | $2p_{1/2} 6h_{11/2}(J = 5)$ | $2p6h^3 G_5$ | 244085934 | | | 9.406E-16 | | 59.7 (268) 24.6 (309) 15.7 (318) |
| 36 | 269 | $2s_{1/2} 6d_{5/2}(J = 2)$ | $2s6d^1 D_2$ | 244088142 | | | 1.412E-14 | | 80.6 (269) |
| 36 | 270 | $2s_{1/2} 6f_{5/2}(J = 2)$ | $2s6f^3 F_2$ | 244090170 | | | 3.412E-14 | | 98.4 (270) |
| 36 | 271 | $2s_{1/2} 6f_{5/2}(J = 3)$ | $2s6f^3 F_3$ | 244090695 | | | 2.469E-14 | | 79.6 (271) |
| 36 | 272 | $2s_{1/2} 6f_{7/2}(J = 4)$ | $2s6f^3 F_4$ | 244092781 | | | 9.967E-14 | | 100. (272) |
| 36 | 273 | $2s_{1/2} 6f_{7/2}(J = 3)$ | $2s6f^1 F_3$ | 244095171 | | | 1.013E-13 | | 82.4 (273) |
| 36 | 274 | $2s_{1/2} 6g_{7/2}(J = 3)$ | $2s6g^3 G_3$ | 244095522 | | | 2.050E-13 | | 100. (274) |
| 36 | 275 | $2s_{1/2} 6g_{7/2}(J = 4)$ | $2s6g^3 G_4$ | 244095523 | | | 2.120E-13 | | 60.6 (275) 39.4 (277) |
| 36 | 276 | $2s_{1/2} 6g_{9/2}(J = 5)$ | $2s6g^3 G_5$ | 244097464 | | | 2.526E-13 | | 100. (276) |
| 36 | 277 | $2s_{1/2} 6g_{9/2}(J = 4)$ | $2s6g^1 G_4$ | 244097669 | | | 2.450E-13 | | 60.6 (277) 39.4 (275) |
| 36 | 278 | $2s_{1/2} 6h_{9/2}(J = 5)$ | $2s6h^3 H_5$ | 244097712 | | | 3.620E-13 | | 54.8 (278) 45.2 (281) |
| 36 | 279 | $2s_{1/2} 6h_{9/2}(J = 4)$ | $2s6h^3 H_4$ | 244097744 | | | 3.780E-13 | | 100. (279) |
| 36 | 280 | $2s_{1/2} 6h_{11/2}(J = 6)$ | $2s6h^3 H_6$ | 244099074 | | | 3.627E-13 | | 100. (280) |
| 36 | 281 | $2s_{1/2} 6h_{11/2}(J = 5)$ | $2s6h^1 H_5$ | 244099097 | | | 3.788E-13 | | 54.8 (281) 45.2 (278) |
| 36 | 282 | $2p_{3/2} 6s_{1/2}(J = 2)$ | $2p6s^3 P_2$ | 244667273 | | | 9.650E-16 | | 100. (282) |
| 36 | 283 | $2p_{3/2} 6s_{1/2}(J = 1)$ | $2p6s^1 P_1$ | 244669828 | | | 9.674E-16 | | 66.9 (283) 33.1 (239) |
| 36 | 284 | $2p_{3/2} 6p_{1/2}(J = 1)$ | $2p6p^3 S_1$ | 244674498 | | | 9.350E-16 | | 49.8 (284) 22.2 (284) 17.0 (287) |
| 36 | 285 | $2p_{3/2} 6p_{1/2}(J = 2)$ | $2p6p^1 D_2$ | 244675691 | | | 9.342E-16 | | 48.8 (245) 28.0 (285) 23.2 (288) |
| 36 | 286 | $2p_{3/2} 6p_{3/2}(J = 3)$ | $2p6p^3 D_3$ | 244693091 | | | 9.337E-16 | | 100. (286) |
| 36 | 287 | $2p_{3/2} 6p_{3/2}(J = 1)$ | $2p6p^1 P_1$ | 244693201 | | | 9.370E-16 | | 49.7 (287) 44.6 (284) 5.73 (240) |
| 36 | 288 | $2p_{3/2} 6p_{3/2}(J = 2)$ | $2p6p^3 P_2$ | 244701696 | | | 9.337E-16 | | 60.5 (288) 39.5 (285) |
| 36 | 289 | $2p_{3/2} 6d_{3/2}(J = 2)$ | $2p6d^1 D_2$ | 244703928 | | | 9.562E-16 | | 42.4 (289) 35.5 (295) 22.1 (247) |
| 36 | 290 | $2p_{3/2} 6d_{3/2}(J = 3)$ | $2p6d^3 D_3$ | 244706704 | | | 9.559E-16 | | 52.5 (251) 32.6 (290) 14.9 (297) |
| 36 | 291 | $2p_{3/2} 6d_{5/2}(J = 4)$ | $2p6d^3 F_4$ | 244708093 | | | 9.619E-16 | | 100. (291) |
| 36 | 292 | $2p_{3/2} 6d_{3/2}(J = 1)$ | $2p6d^3 P_1$ | 244708746 | | | 9.556E-16 | | 62.9 (292) 34.5 (252) 2.64 (302) |
| 36 | 293 | $2p_{3/2} 6d_{3/2}(J = 0)$ | $2p6d^3 P_0$ | 244709341 | | | 9.584E-16 | | 100. (293) |
| 36 | 294 | $2p_{3/2} 6p_{3/2}(J = 0)$ | $2p6p^1 S_0$ | 244710113 | | | 9.436E-16 | | 67.7 (294) 32.3 (246) |
| 36 | 295 | $2p_{3/2} 6d_{5/2}(J = 2)$ | $2p6d^3 D_2$ | 244712779 | | | 9.566E-16 | | 50.2 (256) 25.7 (295) 24.1 (289) |
| 36 | 296 | $2p_{3/2} 6f_{5/2}(J = 3)$ | $2p6f^3 F_3$ | 244717450 | | | 9.608E-16 | | 40.7 (296) 34.3 (301) 24.9 (255) |
| 36 | 297 | $2p_{3/2} 6d_{5/2}(J = 3)$ | $2p6d^1 F_3$ | 244719285 | | | 9.492E-16 | | 52.8 (297) 45.2 (290) 1.99 (251) |
| 36 | 298 | $2p_{3/2} 6f_{5/2}(J = 4)$ | $2p6f^3 F_4$ | 244719669 | | | 9.608E-16 | | 53.7 (259) 38.4 (298) 7.96 (303) |

Table 1. continued.

| Z | Key | <i>jj</i> -coupling | <i>LS</i> -coupling | E_{NIST} | E_{MBPT} | E_{MCDHF} | τ_{MBPT} | τ_{MCDHF} | Composition(%) |
|----|-----|---------------------------|---------------------|-------------------|-------------------|--------------------|----------------------|-----------------------|----------------------------------|
| 36 | 299 | $2p_{3/2} 6f_{5/2}(J=2)$ | $2p6f\ ^3D_2$ | | 244720179 | | 9.606E-16 | | 51.5 (258) 36.8 (299) 11.7 (316) |
| 36 | 300 | $2p_{3/2} 6f_{7/2}(J=5)$ | $2p6f\ ^3G_5$ | | 244722622 | | 9.608E-16 | | 100. (300) |
| 36 | 301 | $2p_{3/2} 6f_{7/2}(J=3)$ | $2p6f\ ^1F_3$ | | 244722700 | | 9.607E-16 | | 44.3 (264) 32.4 (301) 23.3 (296) |
| 36 | 302 | $2p_{3/2} 6d_{5/2}(J=1)$ | $2p6d\ ^1P_1$ | | 244722849 | | 9.557E-16 | | 64.9 (302) 20.2 (292) 14.9 (252) |
| 36 | 303 | $2p_{3/2} 6f_{7/2}(J=4)$ | $2p6f\ ^1G_4$ | | 244722963 | | 9.611E-16 | | 59.0 (303) 36.4 (298) 4.58 (259) |
| 36 | 304 | $2p_{3/2} 6f_{5/2}(J=1)$ | $2p6f\ ^3D_1$ | | 244723049 | | 9.606E-16 | | 100. (304) |
| 36 | 305 | $2p_{3/2} 6g_{7/2}(J=4)$ | $2p6g\ ^3G_4$ | | 244723134 | | 9.632E-16 | | 42.2 (305) 31.3 (310) 26.5 (260) |
| 36 | 306 | $2p_{3/2} 6g_{7/2}(J=3)$ | $2p6g\ ^3F_3$ | | 244724260 | | 9.628E-16 | | 57.3 (261) 25.7 (306) 17.0 (320) |
| 36 | 307 | $2p_{3/2} 6g_{7/2}(J=5)$ | $2p6g\ ^3G_5$ | | 244724551 | | 9.634E-16 | | 59.2 (262) 25.9 (307) 14.9 (308) |
| 36 | 308 | $2p_{3/2} 6g_{9/2}(J=5)$ | $2p6g\ ^1H_5$ | | 244725431 | | 9.633E-16 | | 52.3 (308) 47.7 (307) |
| 36 | 309 | $2p_{3/2} 6h_{9/2}(J=5)$ | $2p6h\ ^3H_5$ | | 244725872 | | 9.646E-16 | | 41.4 (309) 31.0 (318) 27.6 (263) |
| 36 | 310 | $2p_{3/2} 6g_{9/2}(J=4)$ | $2p6g\ ^1G_4$ | | 244726173 | | 9.629E-16 | | 41.3 (265) 35.6 (310) 23.1 (305) |
| 36 | 311 | $2p_{3/2} 6h_{9/2}(J=4)$ | $2p6h\ ^3G_4$ | | 244726482 | | 9.640E-16 | | 59.4 (266) 23.8 (311) 16.8 (321) |
| 36 | 312 | $2p_{3/2} 6g_{7/2}(J=2)$ | $2p6g\ ^3F_2$ | | 244726504 | | 9.626E-16 | | 100. (312) |
| 36 | 313 | $2p_{3/2} 6h_{9/2}(J=6)$ | $2p6h\ ^1I_6$ | | 244726548 | | 9.656E-16 | | 58.4 (267) 35.1 (313) 6.47 (315) |
| 36 | 314 | $2p_{3/2} 6g_{9/2}(J=6)$ | $2p6g\ ^3H_6$ | | 244726726 | | 9.636E-16 | | 100. (314) |
| 36 | 315 | $2p_{3/2} 6h_{11/2}(J=6)$ | $2p6h\ ^3H_6$ | | 244727252 | | 9.647E-16 | | 65.7 (315) 31.5 (313) 2.77 (267) |
| 36 | 316 | $2p_{3/2} 6f_{7/2}(J=2)$ | $2p6f\ ^1D_2$ | | 244727511 | | 9.604E-16 | | 55.3 (316) 41.3 (299) 3.45 (258) |
| 36 | 317 | $2p_{3/2} 6h_{9/2}(J=3)$ | $2p6h\ ^3G_3$ | | 244727790 | | 9.637E-16 | | 100. (317) |
| 36 | 318 | $2p_{3/2} 6h_{11/2}(J=5)$ | $2p6h\ ^1H_5$ | | 244727799 | | 9.640E-16 | | 39.7 (268) 35.9 (318) 24.4 (309) |
| 36 | 319 | $2p_{3/2} 6h_{11/2}(J=7)$ | $2p6h\ ^3I_7$ | | 244727947 | | 9.657E-16 | | 100. (319) |
| 36 | 320 | $2p_{3/2} 6g_{9/2}(J=3)$ | $2p6g\ ^1F_3$ | | 244728529 | | 9.626E-16 | | 50.3 (320) 49.7 (306) |
| 36 | 321 | $2p_{3/2} 6h_{11/2}(J=4)$ | $2p6h\ ^1G_4$ | | 244729109 | | 9.637E-16 | | 50.2 (321) 49.8 (311) |