

Extended calculations of energy levels, radiative properties, A_J , B_J hyperfine interaction constants, and Landé g_J -factors for nitrogen-like Ge XXVI

K. Wang^{a,b}, C. Y. Zhang^c, P. Jönsson^{*b}, R. Si^c, X. H. Zhao^a, Z. B. Chen^{†,d}, X. L. Guo^{‡,e}, C. Y. Chen^c, J. Yan^f

^aHebei Key Lab of Optic-electronic Information and Materials, The College of Physics Science and Technology, Hebei University, Baoding 071002, China

^bGroup for Materials Science and Applied Mathematics, Malmö University, SE-20506, Malmö, Sweden

^cShanghai EBIT Lab, Institute of Modern Physics, Department of Nuclear Science and Technology, Fudan University, Shanghai 200433, China

^dSchool of Science, Hunan University of Technology, Zhuzhou, 412007, China

^eDepartment of Radiotherapy, Shanghai Changhai Hospital, Shanghai 200433, China

^fInstitute of Applied Physics and Computational Mathematics, Beijing 100088, China

Abstract

Employing two state-of-the-art methods, multiconfiguration Dirac–Hartree–Fock and second-order many-body perturbation theory, highly accurate calculations are performed for the lowest 272 fine-structure levels arising from the $2s^22p^3$, $2s2p^4$, $2p^5$, $2s^22p^23l$ ($l = s, p, d$), $2s2p^33l$ ($l = s, p, d$), and $2p^43l$ ($l = s, p, d$) configurations in nitrogen-like Ge XXVI. Complete and consistent atomic data, including excitation energies, lifetimes, wavelengths, hyperfine structures, Landé g_J -factors, and E1, E2, M1, M2 line strengths, oscillator strengths, and transition rates among these 272 levels are provided. Comparisons are made between the present two data sets, as well as with other available experimental and theoretical values. The present data are accurate enough for identification and deblending of emission lines involving the $n = 3$ levels, and are also useful for modeling and diagnosing fusion plasmas.

Key words: Atomic data; nitrogen-like Ge, Multiconfiguration Dirac–Hartree–Fock; Many–body perturbation theory.

*per.jonsson@mah.se

†chenzb008@qq.com

‡xlguo12@fudan.edu.cn

1. Introduction

Spectra of N-like ions with $Z = 30 - 36$ have received a great attention both experimentally and theoretically, because of their wide applications in fusion plasmas [1–8]. Using high-energy lasers or tokamak discharges, spectra of N-like ions, including Zn XXIV, Se XXVIII, and Kr XXX, have been measured in plasmas [1–3, 5, 9–12]. In regard to N-like Ge XXVI, two M1 transitions ($1s^2 2s^2 2p^3 {}^4S_{3/2} - {}^2D_{3/2,5/2}$) were identified by Denne and Hinnov [13]. Behring et al. [14] observed nine E1 transition lines of the arrays $2s^2 2p^3 - 2s 2p^4$ and $2s 2p^4 - 2p^5$. Their results were extended by Feldman et al. [2] to 22 lines among the $n = 2$ levels by axially observing a laser produced plasma.

Experiments can, due to limited resources, never provide complete data sets for these N-like ions. Instead, the bulk of the data must be calculated. Theoretical studies have been performed using different methods [15–19], in which excitation energies and transition rates for the $n = 2$ levels were provided. It is clear that atomic data involving the $n > 2$ levels are also important because of their wide applications in plasma physics [4, 20]. In view of this, we have provided energy and transition data involving the $n > 2$ levels for ions from Ar XII to Zn XXIV [21, 22] and Kr XXX [23]. The accuracy of our calculations is high enough to facilitate identifications of spectral lines, and the data are also useful for modeling and diagnosing fusion plasmas.

This work presents our effort for N-like Ge XXVI to provide the database of energy and transition data involving high-lying levels. Based on the multi-configuration Dirac-Hartree-Fock (MCDHF) and relativistic configuration interaction (RCI) methods [24, 25] implemented in the GRASP2K code [26, 27], energy levels, wavelengths λ , line strengths S , oscillator strengths gf , transition rates A , lifetimes τ , hyperfine interaction constants A_J and B_J , and Landé g_J -factors are provided here for the 272 levels of the $2s^2 2p^3$, $2s 2p^4$, $2p^5$, $2s^2 2p^2 3l$ ($l = s, p, d$), $2s 2p^3 3l$ ($l = s, p, d$), and $2p^4 3l$ ($l = s, p, d$) configurations. To assess the accuracy of the MCDHF/RCI data, independent calculations are also performed using the many-body perturbation theory (MBPT) method [28–32] implemented in the FAC code [33].

Comparisons are made with other available experimental and theoretical results, and the accuracy of the present data is assessed. Our calculated energies are accurate enough to directly aid and confirm experimental identifications. The present work significantly increases the amount of accurate data for the $n = 3$ levels.

2. Calculations

2.1. MCDHF

The MCDHF method has been described by Grant [24] and Froese Fischer et al. [25]. Based on the active space (AS) approach [34, 35] for the generation of the configuration state function (CSF) expansions, separate calculations are done for the even and odd parity states. For the even parity states, the CSF expansions are obtained by allowing single and double (SD) excitations from the multi-reference (MR) configurations $2s 2p^4$, $2s^2 2p^2 3s$, $2s^2 2p^2 3d$, $2s 2p^3 3p$, $2p^4 3s$, $2p^4 3d$, $2s^2 2p^2 4s$, and $2s^2 2p^2 4d$ to an AS of orbitals. For the odd parity states, the CSF expansions are obtained by allowing SD excitations from the MR configurations $2s^2 2p^3$, $2p^5$, $2s^2 2p^2 3p$, $2s 2p^3 3s$, $2s 2p^3 3d$, $2p^4 3p$, $2s^2 2p^2 4p$, and $2s^2 2p^2 4f$ to an AS of orbitals. In the first step of the calculations, the AS is

$$AS_1 = \{1s, 2s, 2p, 3s, 3p, 3d, 4s, 4p, 4d, 4f\}.$$

Then, the AS is increased in the following way:

$$AS_2 = AS_1 + \{5s, 5p, 5d, 5f, 5g\},$$

$$AS_3 = AS_2 + \{6s, 6p, 6d, 6f, 6g, 6h\},$$

$$AS_4 = AS_3 + \{7s, 7p, 7d, 7f, 7g, 7h\},$$

$$AS_5 = AS_4 + \{8s, 8p, 8d, 8f, 8g, 8h\}.$$

By enlarging the AS layer by layer, the convergence of the computed properties can be monitored. At each stage only the outer orbitals are optimized, while the inner ones are fixed. To reduce the number of CSFs, the $1s^2$ core is closed during the relativistic self-consistent field (RSCF) calculations, but is opened during the RCI calculations, where the Breit interaction and leading quantum electrodynamic (QED) effects, i.e., vacuum polarization and

self-energy, are included in the Hamiltonian. In the RCI calculations the mixing coefficients c_r are calculated without changing the radial functions. The final model using the AS_5 active set contains about 1 380 000/7 151 000 even and 1 994 000/10 204 000 odd parity CSFs with the $1s^2$ core closed/opened. Once the atomic state functions (ASFs) have been obtained, atomic parameters, such as line strengths, transition rates, hyperfine interaction constants, and Landé g_J -factors can be calculated. A more detailed description of these parameters can be found in our recent work [23] as well as in the original write-ups of the computer codes [36, 37].

2.2. MBPT

The MBPT method is explained in [28–32]. The method has been implemented in the FAC package [33], and successfully used to calculate atomic data of high accuracy [22, 38–46]. The key feature of the MBPT method is the partitioning of the Hilbert space of the system into two subspaces, the model space M and the orthogonal space O . The configuration interaction effects in the M space are exactly considered, while the interaction between the space M and O is taken into account with the second-order perturbation method. For the MBPT calculation, the model space M contains the even and odd multi-reference configurations of the MCDHF method, while the space O contains all the possible configurations that are generated by SD virtual excitations of the O space. For single/double excitations, the maximum n value is 125/65, with the maximum l value of 25. Just as for the MCDHF calculations, QED effects are also included.

3. Results and Discussions

In the relativistic calculations, the ASFs are obtained as expansions over jj -coupled CSFs. To provide the LSJ labeling system used by the experimentalists, as well as used in other sources, the ASFs are transformed from a jj -coupled CSF basis into an LSJ -coupled CSF basis using the method provided by Gaigalas et al. [47, 48]. The computed excitation energies for all the 272 levels of the $2s^22p^3$, $2s2p^4$, $2p^5$, $2s^22p^23l$ ($l = s, p, d$), $2s2p^33l$ ($l = s, p, d$), and $2p^43l$ ($l = s, p, d$) configurations from

our MCDHF/RCI and MBPT calculations are listed in Table 1, along with the radiative lifetimes estimated from E1, E2, M1, and M2 transition rates, and the LSJ -coupled and jj -coupled labels obtained from our calculations. Table 2 lists wavelengths, and E1, E2, M1, and M2 line strengths S , oscillator strengths gf , and radiative rates A among the 272 energy levels, obtained from both the MCDHF/RCI and MBPT methods. All the E1 and E2 values are computed in the Babushkin gauge (equivalent to the non-relativistic length form), which is considered to be more accurate than the Coulomb gauge (equivalent to the non-relativistic velocity form).

3.1. Excitation energies

In Table 3, we present the MCDHF excitation energies of the 272 levels as a function of the increasing active set (AS). When the AS is increased from AS_{k-1} to AS_k , see section 2.1 for the definition of the AS, the energy differences $\Delta E_{k,k-1} \equiv (E_{AS_k} - E_{AS_{k-1}})$ for each of the 272 levels can be compared. The average absolute differences between the AS_{k-1} and AS_k excitation energies along with the standard deviation are found to be $-267 \pm 4182 \text{ cm}^{-1}$, $-275 \pm 634 \text{ cm}^{-1}$, $13 \pm 152 \text{ cm}^{-1}$, and $25 \pm 61 \text{ cm}^{-1}$ for, respectively, $k = 2, 3, 4, 5$. The MCDHF calculations are thus well converged with respect to an increasing size of the AS. Based on the the AS_5 expansion, including the correlation effects from the $1s^2$ electrons, the RCI excitation energies (hereafter referred to as RCI1) are presented in the Table 3. The correlation effects from the $1s^2$ electrons, included in the RCI1 calculations, change the excitation energies by amounts ranging from $-3\,500 \text{ cm}^{-1}$ to 1100 cm^{-1} for the AS_5 expansion.

Furthermore, the RCI excitation energies (hereafter referred to as RCI2), including both the $1s^2$ electron correlation effects and the Breit and QED effects, are also listed in Table 3. By comparing the RCI1 and RCI2 results, it is shown that the Breit and QED effects have contributions ranging from $-2\,300 \text{ cm}^{-1}$ to $-31\,000 \text{ cm}^{-1}$ to excitation energies, which is indispensable for accurate prediction of energy levels. The individual Breit and QED effects are shown in Figure 1. It is seen that the Breit corrections are significant, generally lowering the excited levels. For the lowest 15 levels of the $2s^22p^3$,

$2s2p^4$, and $2p^5$ configurations, the Breit results are lower than the corresponding Coulomb excitation energies by about 400 cm^{-1} - 11000 cm^{-1} with two exceptions for the $2s2p^4 \ ^4P_{1/2}$ and $2p^5 \ ^2P_{3/2}$ levels, where the former results are higher than the latter values by about 165 cm^{-1} and 2635 cm^{-1} , respectively. For the remaining levels belonging to the $2s^22p^2nl$ and $2s2p^3nl$ ($n = 3, l = s, p, d$) configurations, the Breit effects reduce the corresponding Coulomb excitation energies by about -2400 cm^{-1} - 23000 cm^{-1} . On the other hand, the QED effects generally reduce the excitation energies by up to about -15000 cm^{-1} . Moreover, we can see that the QED corrections are naturally grouped according to the number of s -orbital electron of the configurations, i.e., the $2s^22p^3$, $2s2p^4$, $2p^5$, $2s^22p^23l$, $2s2p^33l$, and $2p^43l$ groups. The QED effects on the energies of the configurations $2p^43l$ (without $2s$ electron) are generally larger than the configurations $2s2p^33l$ (with one $2s$ electron) by about 6000 cm^{-1} - 8000 cm^{-1} . Similarly, their effects on the configurations $2s2p^33l$ (with one $2s$ electron) are generally larger than the configurations $2s^22p^23l$ (with two $2s$ electron) by about 5000 cm^{-1} - 7000 cm^{-1} . To more clearly assess the Breit and QED effects, we also use the MBPT method to provide the results, i.e., the MBPT1 values (excluding the Breit and QED effects), and the MBPT2 values (including the Breit and QED effects), which are also included in Table 3. As shown in Figure 2, their relative contributions (in %) to the MCDHF/RCI2 and MBPT2 excitation energies of all the 272 levels show good agreement. By including the contributions from the Breit and QED effects, excitation energies of the $n = 2$ and $n = 3$ levels are reduced by about 0.4 %-2.8 % and 0.03 %-0.21 %, respectively.

As shown in Table 3, the MCDHF/RCI2 and MBPT2 excitation energies are in very good agreement for both the $n = 2$ and $n = 3$ levels. For the $n = 2$ levels, the absolute difference of the two data sets is within 800 cm^{-1} . Experimental determinations in the Atomic Spectra Database (ASD) of the National Institute of Standards and Technology (NIST) [49] are available for the $n = 2$ levels. The agreement of the NIST values and the present MCDHF/RCI2 (or MBPT2) excitation energies is very good, and the absolute difference is within 600 cm^{-1} . For the remaining levels belonging to the $n = 3$ configurations, the

average absolute difference with the standard deviation of the present MBPT2 and MCDHF/RCI2 excitation energies is $-50 \pm 462 \text{ cm}^{-1}$, corresponding to the average relative difference with the standard deviation of $-0.0005\% \pm 0.004\%$.

3.2. Transition rates

Among the calculations [15, 16, 18, 19] of the $n = 2$ levels for N-like ions, transition data (hereafter referred to as MCDHF/RCI3) reported by Rynkun et al. [19] are the most accurate so far. In Figure 3, we compare the present two sets of transition rates among the 15 levels belonging to the $n = 2$ configurations with the MCDHF/RCI3 values. The present two data sets and the MCDHF/RCI3 values are in good agreement, which is within 2 % for most transitions, with the largest difference of 5 %.

According to the uncertainty estimation method suggested by Kramida [50, 51] the averaged uncertainties for the line strengths S of E1 transitions from the present MCDHF/RCI and MBPT calculations in various ranges of S are assessed to be 1.5 % for $S \geq 10^{-1}$; 4 % for $10^{-1} > S \geq 10^{-2}$; 6 % for $10^{-2} > S \geq 10^{-3}$; 9 % for $10^{-3} > S \geq 10^{-4}$; and 19 % for $10^{-4} > S \geq 10^{-5}$. Accounting also for the contributions from the uncertainty of the wavelengths, about 2.7 % of the E1 transitions included in Table 2 have uncertainties of the transition rate A of ≤ 3 % (the categories A⁺ or A in the terminology of the NIST ASD [49]), 43.1 % have uncertainties of ≤ 7 % (the category B⁺), 36.5 % have uncertainties of ≤ 10 % (the category B), 2.1 % have uncertainties of ≤ 18 % (the category C⁺), 9.1 % have uncertainties of ≤ 25 % (the category C), while only 6.4 % have uncertainties of > 40 % (categories D⁺, D, and E). The uncertainty estimates of the A values are listed in the last column of Table 2. The largest differences between the two sets of results generally occur for transitions with large cancellation effects [43] or weak transitions. For example, as shown in Table 1, the levels with index 72 and 74 ($2s^22p^2(\ ^1D) \ ^1D3d \ ^2D_{3/2}$) and $2s \ ^2S \ 2p^3(\ ^4S) \ ^5S \ 3p \ ^4P_{3/2}$) are strongly mixed. The transitions involving these two levels have large cancellation effects. Even a slight difference in the calculations will lead to a relatively large difference in the computed S and A values, which has been pointed out in our recent work [43]. Most of

weak transitions are two-electrons-one-photon transitions. These transitions are strictly forbidden in the single configuration approximation and are induced through configuration interaction effects. Even with today's methods, which allow massive CSF expansions, such transitions are very difficult to compute accurately.

Again, using the method suggested in [50, 51], the uncertainties of the A values for the M1, E2, and M2 transitions are estimated. The estimated uncertainties for all M1, E2, and M2 transitions are listed in Table 2.

3.3. Lifetimes, Hyperfine interaction constants, and Landé g_J -factors

Lifetimes for the lowest 4 excited levels of the $2s^2 2p^3$ configuration are determined by the M1 transitions to the ground state. The lifetimes of the other levels are mostly dominated by E1 transitions, but the E2 transition rates from some $2s^2 2p^2 3p$ levels to the $2s^2 2p^3$ levels, and from some $2p^4 3d$ to the $2s 2p^4$ levels are not negligible, since their contributions may reach up to 20 %. Our two data sets agree well within 6 % except for two levels, i.e., levels 72 ($2s^2 2p^2 (\frac{1}{2}D) ^1D 3d ^2D_{3/2}$) and 74 ($2s ^2S 2p^3 (\frac{4}{3}S) ^5S 3p ^4P_{3/2}$), for which the differences are 7 % and 20 %, respectively. The large differences are due to the strong mixing of the states as discussed in Section 3.2.

The total energies, A_J , B_J hyperfine interaction constants and Landé g_J -factors for the 272 levels of Ge XXVI calculated using the MCDHF/RCI method are also given in Table 4. In the present calculations, the nuclear parameters I , μ_I , and Q are all set to 1. To obtain the A_J and B_J values for a specific isotope, the given values can be scaled with the tabulated values. The only available results for the A_J , B_J constants and the Landé g_J -factors are the data for the $n = 2$ provided by Verdebout et al. [52]. The present results for A_J , B_J show good agreement, which is within 2 %, with Ref. [52]. The Landé g_J -factors, which are known to be insensitive to electron correlation effects, are essentially identical to the ones calculated by Verdebout et al. [52].

4. Conclusions

Using the MCDHF/RCI and MBPT methods, energy levels, lifetimes, wavelengths, hyperfine interaction constants, Landé g_J -factors, E1, M1, E2, and M2 transition rates, line strengths, and oscillator strengths for the lowest 272 levels belonging to the $2s^2 2p^3$, $2s 2p^4$, $2p^5$, $2s^2 2p^2 3l$ ($l = s, p, d$), $2s 2p^3 3l$ ($l = s, p, d$), and $2p^4 3l$ ($l = s, p, d$) configurations of N-like Ge XXVI have been determined. The accuracy of energy levels and transition probabilities is estimated by comparing the MCDHF/RCI and MBPT results with available experimental and theoretical data. Excitation energies are accurate to within 800 cm^{-1} for the $n = 2$ levels. For the $n = 3$ levels, the average absolute difference with the standard deviation of our two data sets is only $-50 \pm 462 \text{ cm}^{-1}$. Lifetimes are assessed to be accurate to better than 6 % for most levels. We believe the present data could serve as benchmarks in future line identifications, and could make important contributions to modeling and diagnosing fusion plasmas.

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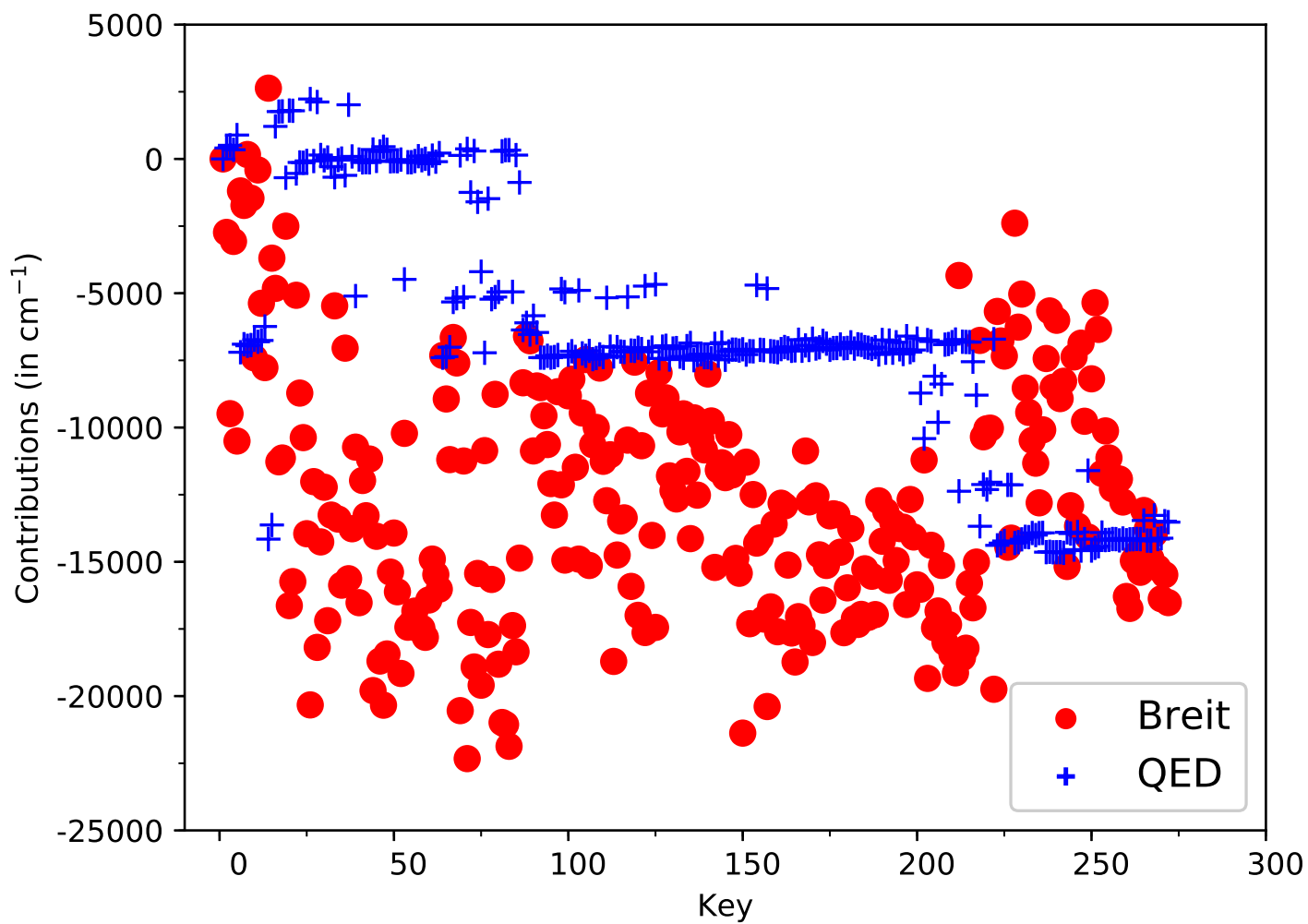


Figure 1. Contributions (in cm^{-1}) of the Breit and QED effects on the MCDHF/RCI2 excitation energies for the 272 levels of Ge XXVI.

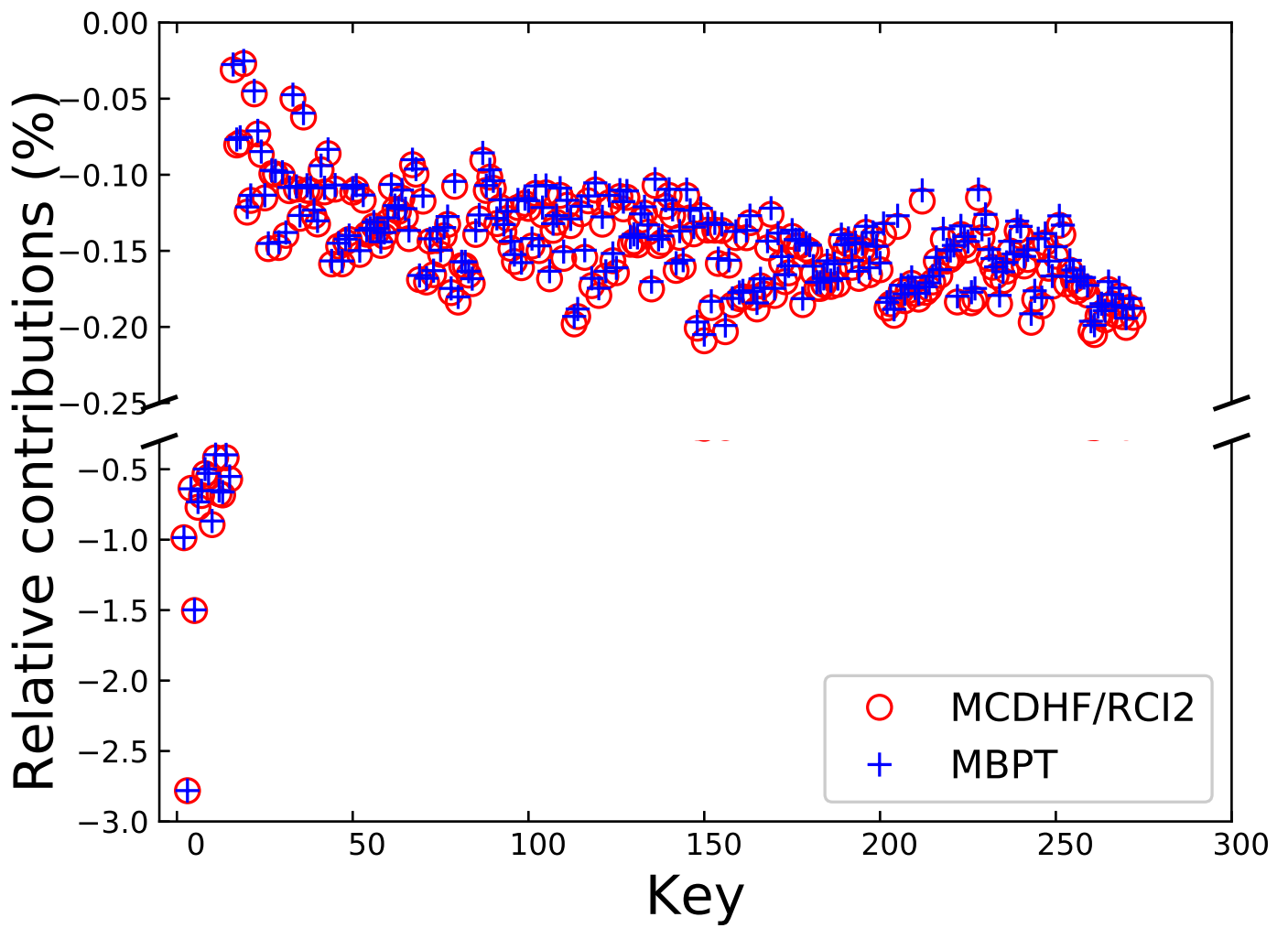


Figure 2. Relative total contributions (in %) of the Breit and QED effects on the MCDHF/RCI2 and MBPT excitation energies for the 272 levels of Ge XXVI.

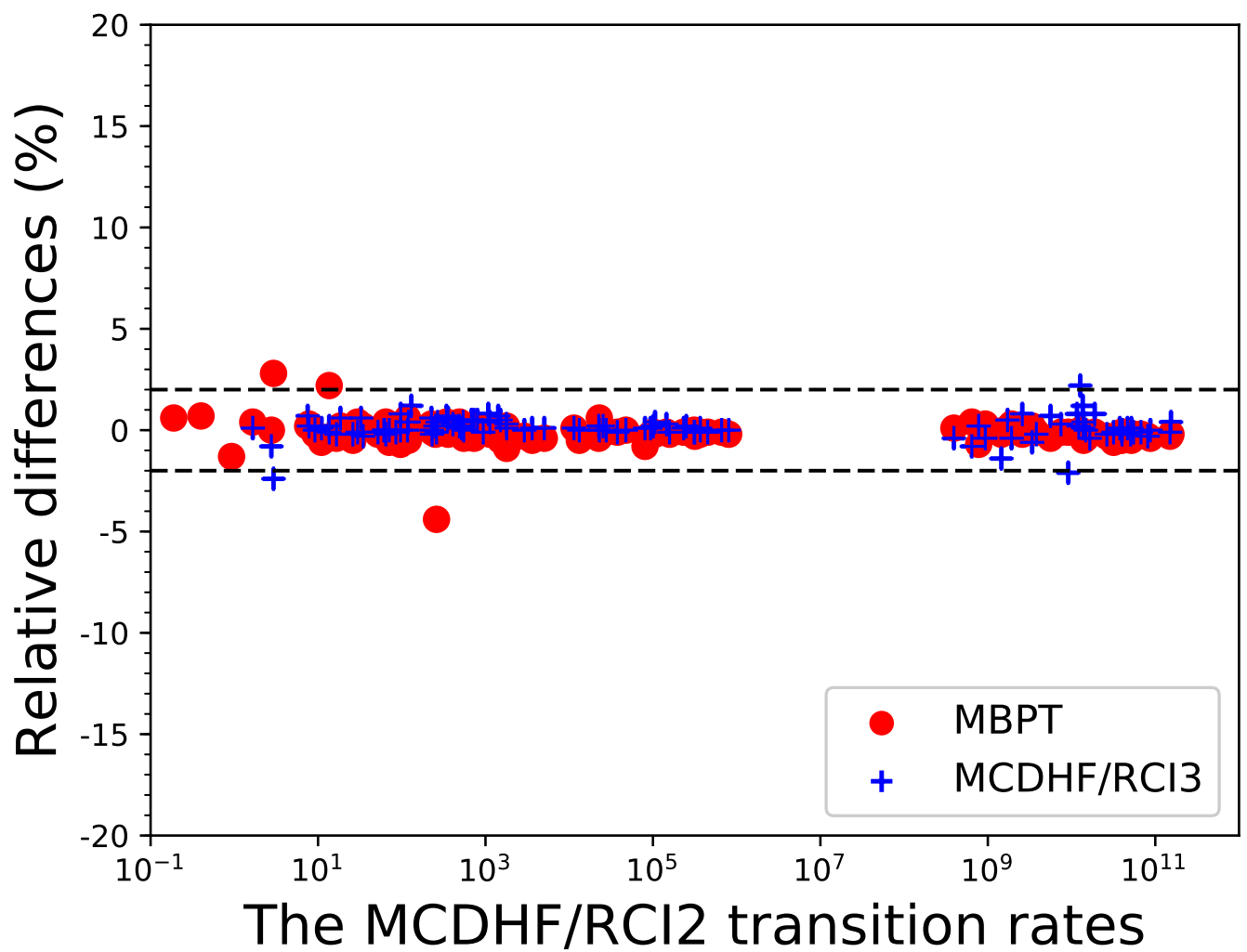


Figure 3. Differences (in %) of the MBPT transition rates and MCDHF/RCI3 transition rates of Rynkun et al. [19] relative to the present MCDHF/RCI2 values among the 15 levels. Dashed lines indicate the differences of $\pm 2\%$.

Table 1. Energies (E in cm^{-1}) relative to the ground state for the lowest 272 levels arising from the $2s^2 2p^3$, $2s 2p^4$, $2p^5$, $2s^2 2p^2 3l$ ($l = s, p, d$), $2s 2p^3 3l$ ($l = s, p, d$), and $2p^4 3l$ ($l = s, p, d$) configurations of Ge XXVI.

Key	$LS J$ -coupled CSF	E_{NIST}	$E_{\text{MCDHF/RCI}}$	E_{MBPT}	$\tau_{\text{MCDHF/RCI}}$	τ_{MBPT}	jj -coupled CSF ^{a,b,c}
1	$2s^2 2p^3 ({}^4S) {}^4S^{\circ}_{3/2}$	0	0	0			2p+1(3)3
2	$2s^2 2p^3 ({}^2D) {}^2D^{\circ}_{3/2}$	233740	233859	233805	4.30E-06	4.30E-06	2p-1(1)1 2p+2(4)3
3	$2s^2 2p^3 ({}^2D) {}^2D^{\circ}_{5/2}$	313520	313767	313636	2.44E-05	2.44E-05	2p-1(1)1 2p+2(4)5
4	$2s^2 2p^3 ({}^2P) {}^2P^{\circ}_{1/2}$	426510	426704	426572	2.62E-06	2.63E-06	2p-1(1)1 2p+2(0)1
5	$2s^2 2p^3 ({}^2P) {}^2P^{\circ}_{3/2}$	629730	630081	630053	1.07E-06	1.07E-06	2p+3(3)3
6	$2s^2 2p^4 ({}^3P) {}^4P_{5/2}$	1081480	1080918	1081687	4.81E-11	4.82E-11	2s+1(1)1 2p+2(4)5
7	$2s^2 2p^4 ({}^3P) {}^4P_{3/2}$	1248820	1248269	1249040	2.42E-11	2.42E-11	2s+1(1)1 2p+2(4)3
8	$2s^2 2p^4 ({}^3P) {}^4P_{1/2}$	1272280	1271834	1272539	2.27E-11	2.27E-11	2s+1(1)1 2p+2(0)1
9	$2s^2 2p^4 ({}^1D) {}^2D_{3/2}$	1504340	1504181	1504589	1.17E-11	1.18E-11	2s+1(1)1 2p-1(1)0 2p+3(3)3
10	$2s^2 2p^4 ({}^1D) {}^2D_{5/2}$	1569240	1569102	1569563	1.70E-11	1.70E-11	2s+1(1)1 2p-1(1)2 2p+3(3)5
11	$2s^2 2p^4 ({}^1S) {}^2S_{1/2}$	1716690	1716675	1717030	6.88E-12	6.90E-12	2s+1(1)1 2p-1(1)2 2p+3(3)1
12	$2s^2 2p^4 ({}^3P) {}^2P_{3/2}$	1787650	1787749	1788128	5.02E-12	5.03E-12	2s+1(1)1 2p-1(1)2 2p+3(3)3
13	$2s^2 2p^4 ({}^3P) {}^2P_{1/2}$	2038470	2038616	2039060	5.45E-12	5.46E-12	2s+1(1)1
14	$2p^5 {}^2P^{\circ}_{3/2}$	2743260	2743486	2743218	6.04E-12	6.06E-12	2p+3(3)3
15	$2p^5 {}^2P^{\circ}_{1/2}$	3016700	3017051	3016900	5.18E-12	5.20E-12	2p-1(1)1
16	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^4P_{1/2}$		11612716	11612639	2.24E-13	2.25E-13	3s+1(1)1
17	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^4P_{3/2}$		11820216	11820114	2.85E-13	2.86E-13	2p-1(1)1 2p+1(3)2 3s+1(1)3
18	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^2P_{1/2}$		11854651	11854268	1.27E-13	1.28E-13	2p-1(1)1 2p+1(3)2 3s+1(1)1
19	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D^{\circ}_{1/2}$		11877811	11877390	1.95E-11	1.98E-11	3p-1(1)1
20	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^4P_{5/2}$		11889157	11888985	2.38E-13	2.38E-13	2p-1(1)1 2p+1(3)4 3s+1(1)5
21	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^2P_{3/2}$		11919199	11918797	1.32E-13	1.33E-13	2p-1(1)1 2p+1(3)4 3s+1(1)3
22	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4P^{\circ}_{3/2}$		11982756	11982294	1.18E-11	1.20E-11	3p+1(3)3
23	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2S^{\circ}_{1/2}$		12082904	12082421	2.08E-11	2.11E-11	2p-1(1)1 2p+1(3)2 3p-1(1)1
24	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D^{\circ}_{3/2}$		12114627	12114093	1.83E-11	1.85E-11	2p-1(1)1 2p+1(3)2 3p-1(1)3
25	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D^{\circ}_{5/2}$		12159395	12158904	3.15E-11	3.16E-11	2p-1(1)1 2p+1(3)4 3p-1(1)5
26	$2s^2 2p^2 ({}^1D) {}^1D 3s {}^2D_{5/2}$		12165210	12164946	1.95E-13	1.95E-13	2p+2(4)4 3s+1(1)5
27	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4P^{\circ}_{5/2}$		12175071	12174587	1.16E-11	1.18E-11	2p-1(1)1 2p+1(3)2 3p+1(3)5
28	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4P^{\circ}_{1/2}$		12187548	12187012	1.19E-11	1.21E-11	2p-1(1)1 2p+1(3)2 3p+1(3)1
29	$2s^2 2p^2 ({}^1D) {}^1D 3s {}^2D_{3/2}$		12187688	12187257	1.36E-13	1.37E-13	2p+2(4)4 3s+1(1)3
30	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2D^{\circ}_{3/2}$		12210165	12209539	5.47E-12	5.56E-12	2p-1(1)1 2p+1(3)2 3p+1(3)3
31	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D^{\circ}_{7/2}$		12240068	12239567	2.98E-11	3.00E-11	2p-1(1)1 2p+1(3)4 3p+1(3)7
32	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4S^{\circ}_{3/2}$		12249586	12248875	1.75E-12	1.79E-12	2p-1(1)1 2p+1(3)4 3p-1(1)3
33	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{3/2}$		12277512	12277148	1.72E-13	1.72E-13	3d-1(3)3
34	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2P^{\circ}_{3/2}$		12282648	12281714	5.35E-12	5.38E-12	2p-1(1)1 2p+1(3)4 3p+1(3)3
35	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2F^{\circ}_{5/2}$		12311221	12310437	7.42E-12	7.50E-12	2p-1(1)1 2p+1(3)4 3p+1(3)5
36	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^2F_{5/2}$		12327308	12326874	5.29E-14	5.30E-14	3d+1(5)5
37	$2s^2 2p^2 ({}^1S) {}^1S 3s {}^2S_{1/2}$		12340962	12340982	1.71E-13	1.72E-13	2p+2(0)0 3s+1(1)1
38	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2P^{\circ}_{1/2}$		12360419	12359442	4.25E-12	4.29E-12	2p-1(1)1 2p+1(3)4 3p+1(3)1
39	$2s^2 2p^3 ({}^4S) {}^5S 3s {}^6S^{\circ}_{5/2}$		12446320	12446850	2.53E-12	2.53E-12	2s+1(1)1 2p+1(3)4 3s+1(1)5
40	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2D^{\circ}_{3/2}$		12481375	12480600	1.61E-12	1.65E-12	2p+2(4)4 3p-1(1)3
41	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^2P_{3/2}$		12491171	12490671	9.10E-14	9.12E-14	2p-1(1)1 2p+1(3)2 3d-1(3)3
42	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{5/2}$		12501554	12501000	1.53E-13	1.53E-13	2p-1(1)1 2p+1(3)2 3d-1(3)5
43	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{1/2}$		12504179	12503733	1.98E-13	1.98E-13	2p-1(1)1 2p+1(3)2 3d-1(3)1
44	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2D^{\circ}_{5/2}$		12504948	12504382	1.43E-11	1.46E-11	2p+2(4)4 3p+1(3)5
45	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{7/2}$		12504923	12504446	8.54E-13	8.53E-13	2p-1(1)1 2p+1(3)2 3d+1(5)7
46	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2D^{\circ}_{5/2}$		12512373	12511300	9.13E-12	9.26E-12	2p+2(4)4 3p-1(1)5
47	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2F^{\circ}_{7/2}$		12518060	12517469	1.60E-11	1.61E-11	2p+2(4)4 3p+1(3)7
48	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2P^{\circ}_{1/2}$		12525534	12524793	3.37E-12	3.42E-12	2p+2(4)4 3p+1(3)1
49	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{7/2}$		12550666	12550090	8.86E-12	9.16E-12	2p-1(1)1 2p+1(3)4 3d-1(3)7
50	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{3/2}$		12552163	12551621	5.32E-14	5.33E-14	2p-1(1)1 2p+1(3)2 3d+1(5)3
51	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4P_{5/2}$		12552378	12551753	3.35E-14	3.35E-14	2p-1(1)1 2p+1(3)2 3d+1(5)5
52	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{9/2}$		12571646	12571044	2.53E-10	2.54E-10	2p-1(1)1 2p+1(3)4 3d+1(5)9
53	$2s^2 2p^3 ({}^4S) {}^5S 3s {}^4S^{\circ}_{3/2}$		12581515	12580990	1.59E-13	1.59E-13	2s+1(1)1 2p+1(3)4 3s+1(1)3
54	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{5/2}$		12606575	12606002	2.63E-14	2.64E-14	2p-1(1)1 2p+1(3)4 3d+1(5)5
55	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4P_{3/2}$		12621253	12620735	1.88E-14	1.88E-14	2p-1(1)1 2p+1(3)4 3d-1(3)3
56	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4P_{1/2}$		12633209	12632625	1.86E-14	1.87E-14	2p-1(1)1 2p+1(3)4 3d-1(3)1
57	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2P^{\circ}_{3/2}$		12656021	12655055	1.32E-12	1.32E-12	2p+2(4)4 3p+1(3)3
58	$2s^2 2p^2 ({}^1D) {}^1D 3d {}^2G_{7/2}$		12662718	12661833	2.61E-14	2.61E-14	2p-1(1)1 2p+1(3)4 3d+1(5)7
59	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^2P_{1/2}$		12662795	12662206	2.61E-14	2.62E-14	2p-1(1)1 2p+1(3)4 3d+1(5)1
60	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^2D_{5/2}$		12664567	12663648	1.53E-14	1.54E-14	2p-1(1)1 2p+1(3)4 3d+1(5)5
61	$2s^2 2p^2 ({}^1S) {}^1S 3p {}^2P^{\circ}_{1/2}$		12666512	12665890	6.19E-12	6.29E-12	2p+2(0)0 3p-1(1)1

Table 1. (continued)

Key	LS J -coupled CSF	E_{NIST}	$E_{\text{MCDHF/RCI}}$	E_{MBPT}	$\tau_{\text{MCDHF/RCI}}$	τ_{MBPT}	jj -coupled CSF ^{a,b,c}
62	$2s^2 2p^2 ({}^3P) {}^3P 3d^2 D_{3/2}$	12672881	12672033	2.87E-14	2.88E-14	2p-1(1)1 2p+1(3)4 3d+1(5)3	
63	$2s^2 2p^2 ({}^1S) {}^1S 3p^2 P_{3/2}^{\circ}$	12719361	12718721	4.74E-12	4.87E-12	2p+2(0)0 3p+1(3)3	
64	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^6 P_{3/2}$	12736654	12737762	1.78E-12	1.75E-12	2s+1(1)1 2p+1(3)4 3p-1(1)3	
65	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^6 P_{5/2}$	12747357	12748395	4.77E-13	4.75E-13	2s+1(1)1 2p+1(3)4 3p-1(1)5	
66	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^6 P_{7/2}$	12803391	12804490	2.93E-12	2.83E-12	2s+1(1)1 2p+1(3)4 3p+1(3)7	
67	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{1/2}^{\circ}$	12809823	12809674	2.18E-13	2.19E-13	2s+1(1)1 2p+1(3)2 3s+1(1)1	
68	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{3/2}^{\circ}$	12818683	12818543	2.65E-13	2.66E-13	2s+1(1)1 2p+1(3)2 3s+1(1)3	
69	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 F_{7/2}$	12834588	12834007	5.67E-13	5.81E-13	2p+2(4)4 3d+1(5)7	
70	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{5/2}^{\circ}$	12839913	12839900	2.53E-13	2.54E-13	2s+1(1)1 2p-1(1)0 2p+2(4)4 3s+1(1)5	
71	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 G_{9/2}$	12854255	12853513	2.39E-10	2.40E-10	2p+2(4)4 3d+1(5)9	
72	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 D_{3/2}$	12866489	12866316	2.87E-14	2.66E-14	2p+2(4)4 3d-1(3)3	
73	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 D_{5/2}$	12871521	12870858	2.27E-14	2.27E-14	2p+2(4)4 3d-1(3)5	
74	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^4 P_{3/2}$	12871685	12871824	5.77E-14	6.93E-14	2s+1(1)1 2p+1(3)4 3p+1(3)3	
75	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 P_{1/2}$	12873291	12872727	3.86E-14	3.88E-14	2p+2(4)4 3d-1(5)1	
76	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^4 P_{5/2}$	12885422	12885966	7.72E-14	7.86E-14	2s+1(1)1 2p+1(3)4 3p+1(3)5	
77	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^4 P_{1/2}$	12898599	12899069	9.41E-14	9.46E-14	2s+1(1)1 2p+1(3)4 3p+1(3)1	
78	$2s^2 2p^2 ({}^3P) {}^3P 3d^2 F_{7/2}$	12900389	12899410	1.83E-14	1.84E-14	2p+2(4)4 3d-1(3)7	
79	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{3/2}^{\circ}$	12915310	12914746	1.97E-13	1.98E-13	2s+1(1)1 2p-1(1)0 2p+2(4)4 3s+1(1)3	
80	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{7/2}^{\circ}$	12915791	12915690	2.19E-13	2.21E-13	2s+1(1)1 2p-1(1)2 2p+2(4)6 3s+1(1)7	
81	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 S_{1/2}$	12934711	12933940	2.36E-14	2.37E-14	2p+2(4)4 3d-1(3)1	
82	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 P_{3/2}$	12953243	12952649	2.08E-14	2.09E-14	2p+2(4)4 3d+1(5)3	
83	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 F_{5/2}$	12962929	12962021	2.22E-14	2.21E-14	2p+2(4)4 3d+1(5)5	
84	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{5/2}^{\circ}$	12990369	12989837	1.66E-13	1.67E-13	2s+1(1)1 2p-1(1)2 2p+2(4)6 3s+1(1)5	
85	$2s^2 2p^2 ({}^1S) {}^1S 3d^2 D_{5/2}$	13060761	13060444	2.51E-14	2.53E-14	2p+2(0)0 3d+1(5)5	
86	$2s^2 2p^2 ({}^1S) {}^1S 3d^2 D_{3/2}$	13066526	13066312	2.24E-14	2.23E-14	2p+2(0)0 3d-1(3)3	
87	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 D_{1/2}$	13070434	13070955	2.24E-13	2.25E-13	2s+1(1)1 2p+1(3)2 3p-1(1)1	
88	$2s^2 S 2p^3 ({}^2P) {}^3P 3s^4 P_{1/2}^{\circ}$	13071848	13071963	2.44E-13	2.45E-13	2s+1(1)1 2p-1(1)0 2p+2(0)0 3s+1(1)1	
89	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 F_{3/2}$	13088800	13089085	1.43E-13	1.51E-13	2s+1(1)1 2p+1(3)2 3p-1(1)3	
90	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 D_{3/2}$	13103413	13104005	2.24E-13	2.26E-13	2s+1(1)1 2p-1(1)0 2p+2(4)4 3p-1(1)3	
91	$2s^2 S 2p^3 ({}^2P) {}^3P 3s^4 P_{3/2}^{\circ}$	13104289	13104271	2.28E-13	2.31E-13	2s+1(1)1 2p-1(1)2 2p+2(0)2 3s+1(1)3	
92	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^6 D_{1/2}^{\circ}$	13106060	13106742	1.47E-12	1.48E-12	2s+1(1)1 2p+1(3)4 3d-1(3)1	
93	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^6 D_{5/2}^{\circ}$	13106485	13107140	8.39E-13	8.40E-13	2s+1(1)1 2p+1(3)4 3d-1(3)5	
94	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^6 D_{3/2}^{\circ}$	13106560	13107213	1.06E-12	1.01E-12	2s+1(1)1 2p+1(3)4 3d-1(3)3	
95	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^6 D_{7/2}^{\circ}$	13107936	13108578	3.38E-12	3.36E-12	2s+1(1)1 2p+1(3)4 3d-1(3)7	
96	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^6 D_{9/2}^{\circ}$	13116317	13116978	2.61E-10	2.63E-10	2s+1(1)1 2p+1(3)4 3d+1(5)9	
97	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 F_{5/2}$	13126536	13127076	6.71E-13	6.71E-13	2s+1(1)1 2p-1(1)0 2p+2(4)4 3p-1(1)5	
98	$2s^2 S 2p^3 ({}^2P) {}^3P 3s^4 P_{5/2}^{\circ}$	13154788	13154632	2.59E-13	2.60E-13	2s+1(1)1 2p+3(3)4 3s+1(1)5	
99	$2s^2 S 2p^3 ({}^2P) {}^3P 3s^4 P_{1/2}^{\circ}$	13156111	13155711	1.49E-13	1.50E-13	2s+1(1)1 2p-1(1)2 2p+2(0)2 3s+1(1)1	
100	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 D_{5/2}$	13177281	13177784	3.84E-13	3.74E-13	2s+1(1)1 2p+1(3)2 3p+1(3)5	
101	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 F_{7/2}$	13186701	13187257	1.51E-11	1.46E-11	2s+1(1)1 2p-1(1)2 2p+2(4)6 3p-1(1)7	
102	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^2 D_{3/2}$	13187240	13187642	1.93E-13	1.94E-13	2s+1(1)1 2p+1(3)2 3p+1(3)3	
103	$2s^2 S 2p^3 ({}^2P) {}^3P 3s^2 P_{3/2}^{\circ}$	13190592	13190175	1.30E-13	1.31E-13	2s+1(1)1 2p-1(1)2 2p+2(4)4 3s+1(1)3	
104	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^2 F_{5/2}$	13197481	13197910	8.91E-14	8.98E-14	2s+1(1)1 2p-1(1)0 2p+2(4)4 3p+1(3)5	
105	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^2 P_{1/2}$	13205808	13206126	1.08E-13	1.09E-13	2s+1(1)1 2p+1(3)2 3p+1(3)1	
106	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 D_{7/2}$	13210876	13211357	2.21E-13	2.20E-13	2s+1(1)1 2p-1(1)2 2p+2(4)6 3p-1(1)7	
107	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^4 D_{5/2}^{\circ}$	13234928	13235003	6.01E-14	6.05E-14	2s+1(1)1 2p+1(3)4 3d+1(5)5	
108	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^4 D_{3/2}^{\circ}$	13246503	13246557	5.77E-14	5.81E-14	2s+1(1)1 2p+1(3)4 3d+1(5)3	
109	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 P_{1/2}$	13251899	13252113	2.25E-13	2.25E-13	2s+1(1)1 2p-1(1)0 2p+2(4)4 3p+1(3)1	
110	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^4 D_{7/2}^{\circ}$	13262718	13262707	3.68E-14	3.70E-14	2s+1(1)1 2p+1(3)4 3d-1(3)7	
111	$2s^2 S 2p^3 ({}^4S) {}^3S 3s^4 S_{3/2}^{\circ}$	13265404	13265180	2.66E-13	2.68E-13	2s+1(1)1 2p-1(1)2 2p+2(4)2 3s+1(1)3	
112	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^4 D_{1/2}^{\circ}$	13269616	13269629	4.23E-14	4.26E-14	2s+1(1)1 2p+1(3)4 3d+1(5)1	
113	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 F_{9/2}$	13269345	13269805	4.22E-11	4.24E-11	2s+1(1)1 2p-1(1)2 2p+2(4)6 3p+1(3)9	
114	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^2 F_{7/2}$	13275310	13275754	1.56E-13	1.56E-13	2s+1(1)1 2p-1(1)2 2p+2(4)6 3p+1(3)7	
115	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 P_{3/2}$	13280354	13280576	1.24E-13	1.25E-13	2s+1(1)1 2p-1(1)0 2p+2(4)4 3p+1(3)3	
116	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 P_{5/2}$	13298500	13298370	2.48E-13	2.49E-13	2s+1(1)1 2p-1(1)2 2p+2(4)6 3p-1(1)5	
117	$2s^2 S 2p^3 ({}^4S) {}^3S 3s^2 S_{1/2}^{\circ}$	13306754	13306323	1.25E-13	1.26E-13	2s+1(1)1 2p-1(1)2 2p+2(0)2 3s+1(1)1	
118	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^2 P_{1/2}$	13311758	13311920	7.14E-14	7.19E-14	2s+1(1)1 2p-1(1)2 2p+2(4)6 3p+1(3)3	
119	$2s^2 S 2p^3 ({}^2P) {}^3P 3p^4 D_{1/2}$	13349126	13349791	2.45E-13	2.46E-13	2s+1(1)1 2p-1(1)0 2p+2(0)0 3p-1(1)1	
120	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^2 D_{5/2}$	13373131	13373182	8.48E-14	8.51E-14	2s+1(1)1 2p-1(1)2 2p+2(4)6 3p+1(3)5	
121	$2s^2 S 2p^3 ({}^2P) {}^3P 3p^4 D_{3/2}$	13385457	13385998	2.64E-13	2.65E-13	2s+1(1)1 2p-1(1)2 2p+2(0)2 3p-1(1)3	
122	$2s^2 S 2p^3 ({}^2D) {}^1D 3s^2 D_{5/2}^{\circ}$	13400716	13400458	1.43E-13	1.44E-13	2s+1(1)1 2p+3(3)4 3s+1(1)5	
123	$2s^2 S 2p^3 ({}^2P) {}^3P 3p^4 P_{1/2}$	13421320	13421563	1.21E-13	1.21E-13	2s+1(1)1 2p-1(1)2 2p+2(4)2 3p-1(1)1	

Table 1. (continued)

Key	$LS J$ -coupled CSF	E_{NIST}	$E_{\text{MCDHF/RCI}}$	E_{MBPT}	$\tau_{\text{MCDHF/RCI}}$	τ_{MBPT}	jj -coupled CSF ^{a,b,c}
124	$2s^2S 2p^3(^2P) ^3P 3p^4D_{5/2}$	13423788	13424287	13424287	2.01E-13	2.02E-13	2s+1(1)1 2p-1(1)2 2p+2(4)4 3p-1(1)5
125	$2s^2S 2p^3(^2D) ^1D 3s^2D_{3/2}^{\circ}$	13430499	13430092	13430092	1.75E-13	1.77E-13	2s+1(1)1 2p+3(3)4 3s+1(1)3
126	$2s^2S 2p^3(^2D) ^3D 3d^4F_{3/2}^{\circ}$	13444101	13444160	13444160	1.41E-13	1.41E-13	2s+1(1)1 2p+1(3)2 3d-1(3)3
127	$2s^2S 2p^3(^2P) ^3P 3p^4S_{3/2}$	13445009	13445586	13445586	2.54E-13	2.55E-13	2s+1(1)1 2p-1(1)0 2p+2(0)0 3p+1(3)3
128	$2s^2S 2p^3(^2D) ^3D 3d^4G_{3/2}^{\circ}$	13463388	13463333	13463333	1.59E-12	1.65E-12	2s+1(1)1 2p+1(3)2 3d-1(3)5
129	$2s^2S 2p^3(^2P) ^3P 3p^2P_{1/2}$	13463015	13463536	13463536	1.54E-13	1.55E-13	2s+1(1)1 2p-1(1)2 2p+2(0)2 3p+1(3)1
130	$2s^2S 2p^3(^2P) ^3P 3p^4P_{3/2}$	13465754	13466068	13466068	2.04E-13	2.05E-13	2s+1(1)1 2p-1(1)2 2p+2(4)4 3p-1(1)3
131	$2s^2S 2p^3(^2P) ^3P 3p^4P_{5/2}$	13467384	13467787	13467787	1.91E-13	1.93E-13	2s+1(1)1 2p-1(1)2 2p+2(4)2 3p+1(3)5
132	$2s^2S 2p^3(^2D) ^3D 3d^4F_{5/2}^{\circ}$	13481892	13481893	13481893	9.32E-14	9.32E-14	2s+1(1)1 2p-1(1)0 2p+2(4)4 3d-1(3)5
133	$2s^2S 2p^3(^2D) ^3D 3d^4G_{7/2}^{\circ}$	13483311	13483268	13483268	6.31E-12	6.07E-12	2s+1(1)1 2p+1(3)2 3d+1(5)7
134	$2s^2S 2p^3(^2P) ^3P 3p^4D_{7/2}$	13487127	13487543	13487543	9.68E-14	9.71E-14	2s+1(1)1 2p-1(1)2 2p+2(0)2 3p+1(3)3
135	$2s^2S 2p^3(^2P) ^3P 3p^4D_{7/2}$	13489500	13490050	13490050	2.20E-13	2.21E-13	2s+1(1)1 2p+3(3)4 3p+1(3)7
136	$2s^2S 2p^3(^2D) ^3D 3d^4D_{1/2}^{\circ}$	13496025	13496015	13496015	1.52E-13	1.53E-13	2s+1(1)1 2p+1(3)2 3d-1(3)1
137	$2s^2S 2p^3(^2D) ^3D 3d^4F_{7/2}^{\circ}$	13503421	13503488	13503488	6.12E-14	6.14E-14	2s+1(1)1 2p-1(1)0 2p+2(4)4 3d+1(5)7
138	$2s^2S 2p^3(^2D) ^3D 3d^4G_{9/2}^{\circ}$	13513069	13513079	13513079	6.43E-11	6.52E-11	2s+1(1)1 2p-1(1)0 2p+2(4)4 3d+1(5)9
139	$2s^2S 2p^3(^2D) ^3D 3d^4D_{3/2}^{\circ}$	13514397	13514458	13514458	5.77E-14	5.79E-14	2s+1(1)1 2p-1(1)0 2p+2(4)4 3d-1(3)3
140	$2s^2S 2p^3(^2D) ^3D 3d^2S_{1/2}^{\circ}$	13529450	13529485	13529485	2.16E-13	2.17E-13	2s+1(1)1 2p-1(1)0 2p+2(4)4 3d-1(3)1
141	$2s^2S 2p^3(^2D) ^3D 3d^4P_{5/2}^{\circ}$	13534823	13534914	13534914	2.68E-14	2.69E-14	2s+1(1)1 2p+1(3)2 3d+1(5)5
142	$2s^2S 2p^3(^2P) ^3P 3p^2D_{5/2}$	13543353	13543608	13543608	3.01E-13	3.02E-13	2s+1(1)1 2p+3(3)4 3p+1(3)5
143	$2s^2S 2p^3(^2D) ^3D 3d^2G_{5/2}^{\circ}$	13557660	13557370	13557370	2.28E-12	2.27E-12	2s+1(1)1 2p-1(1)0 2p+2(4)4 3d-1(3)7
144	$2s^2S 2p^3(^2P) ^3P 3p^2P_{3/2}$	13558669	13558844	13558844	1.51E-13	1.51E-13	2s+1(1)1 2p+3(3)4 3p+1(3)3
145	$2s^2S 2p^3(^2D) ^3D 3d^4S_{3/2}^{\circ}$	13561130	13560931	13560931	4.27E-14	4.27E-14	2s+1(1)1 2p+1(3)2 3d+1(5)3
146	$2s^2S 2p^3(^4S) ^3S 3p^4P_{3/2}$	13565264	13565388	13565388	4.26E-13	4.29E-13	2s+1(1)1 2p-1(1)2 2p+2(4)2 3p-1(1)3
147	$2s^2S 2p^3(^2P) ^3P 3p^2S_{1/2}$	13569169	13569325	13569325	8.15E-14	8.18E-14	2s+1(1)1 2p-1(1)2 2p+2(0)2 3p+1(3)1
148	$2s^2S 2p^3(^2D) ^3D 3d^4F_{9/2}^{\circ}$	13569321	13569354	13569354	6.44E-11	6.52E-11	2s+1(1)1 2p-1(1)2 2p+2(4)6 3d+1(5)9
149	$2s^2S 2p^3(^4S) ^3S 3p^4P_{1/2}$	13574069	13574215	13574215	5.94E-13	5.90E-13	2s+1(1)1 2p+1(3)2 3p-1(1)1
150	$2s^2S 2p^3(^2D) ^3D 3d^4G_{11/2}^{\circ}$	13584461	13584355	13584355	9.06E-11	9.21E-11	2s+1(1)1 2p-1(1)2 2p+2(4)6 3d+1(5)11
151	$2s^2S 2p^3(^2D) ^3D 3d^2F_{5/2}^{\circ}$	13601741	13601558	13601558	3.89E-14	3.90E-14	2s+1(1)1 2p-1(1)0 2p+2(4)4 3d+1(5)5
152	$2s^2S 2p^3(^2D) ^3D 3d^4D_{7/2}^{\circ}$	13606864	13606815	13606815	2.35E-14	2.36E-14	2s+1(1)1 2p-1(1)2 2p+2(4)6 3d+1(5)7
153	$2s^2S 2p^3(^4S) ^3S 3p^4P_{5/2}$	13612732	13613098	13613098	2.40E-13	2.40E-13	2s+1(1)1 2p-1(1)2 2p+2(4)2 3p+1(3)5
154	$2s^2S 2p^3(^2P) ^1P 3s^2P_{3/2}^{\circ}$	13615805	13615411	13615411	1.57E-13	1.59E-13	2s+1(1)1 2p+3(3)2 3s+1(1)3
155	$2s^2S 2p^3(^2D) ^3D 3d^4P_{1/2}^{\circ}$	13616174	13615992	13615992	5.14E-14	5.17E-14	2s+1(1)1 2p-1(1)0 2p+2(4)4 3d+1(5)1
156	$2s^2S 2p^3(^2D) ^3D 3d^2G_{9/2}^{\circ}$	13617845	13617508	13617508	2.22E-11	2.24E-11	2s+1(1)1 2p-1(1)2 2p+2(4)6 3d-1(3)9
157	$2s^2S 2p^3(^2P) ^1P 3s^2P_{1/2}^{\circ}$	13620350	13619974	13619974	9.53E-14	9.60E-14	2s+1(1)1 2p+3(3)2 3s+1(1)1
158	$2s^2S 2p^3(^2D) ^3D 3d^4D_{5/2}^{\circ}$	13626601	13626633	13626633	2.00E-14	2.00E-14	2s+1(1)1 2p-1(1)2 2p+2(4)6 3d-1(3)5
159	$2s^2S 2p^3(^2D) ^3D 3d^2P_{3/2}^{\circ}$	13631147	13630871	13630871	2.80E-14	2.81E-14	2s+1(1)1 2p-1(1)0 2p+2(4)4 3d+1(5)3
160	$2s^2S 2p^3(^2D) ^3D 3d^4P_{3/2}^{\circ}$	13649248	13649154	13649154	1.73E-14	1.74E-14	2s+1(1)1 2p-1(1)2 2p+2(4)6 3d-1(3)3
161	$2s^2S 2p^3(^2D) ^3D 3d^2P_{1/2}^{\circ}$	13661195	13660914	13660914	4.19E-14	4.20E-14	2s+1(1)1 2p-1(1)2 2p+2(4)6 3d+1(5)1
162	$2s^2S 2p^3(^4S) ^3S 3p^2P_{3/2}$	13661752	13662028	13662028	2.25E-13	2.25E-13	2s+1(1)1 2p-1(1)2 2p+2(4)2 3p+1(3)3
163	$2s^2S 2p^3(^4S) ^3S 3p^2P_{1/2}$	13663686	13663606	13663606	1.84E-13	1.85E-13	2s+1(1)1 2p-1(1)2 2p+2(4)2 3p+1(3)1
164	$2s^2S 2p^3(^2D) ^3D 3d^2D_{3/2}^{\circ}$	13700659	13700330	13700330	2.75E-14	2.76E-14	2s+1(1)1 2p-1(1)2 2p+2(4)6 3d+1(5)3
165	$2s^2S 2p^3(^2D) ^3D 3d^2F_{7/2}^{\circ}$	13713198	13712714	13712714	3.96E-14	3.98E-14	2s+1(1)1 2p-1(1)2 2p+2(4)6 3d+1(5)7
166	$2s^2S 2p^3(^2D) ^1D 3p^2F_{5/2}$	13715860	13715976	13715976	9.58E-14	9.63E-14	2s+1(1)1 2p+3(3)4 3p-1(1)5
167	$2s^2S 2p^3(^2D) ^3D 3d^2D_{5/2}^{\circ}$	13718687	13718269	13718269	2.77E-14	2.79E-14	2s+1(1)1 2p-1(1)2 2p+2(4)6 3d+1(5)5
168	$2s^2S 2p^3(^2D) ^1D 3p^2D_{3/2}$	13740478	13740322	13740322	2.35E-13	2.36E-13	2s+1(1)1 2p+3(3)4 3p-1(1)3
169	$2s^2S 2p^3(^2P) ^3P 3d^4F_{3/2}^{\circ}$	13740968	13741075	13741075	1.70E-13	1.71E-13	2s+1(1)1 2p-1(1)0 2p+2(0)0 3d-1(3)3
170	$2s^2S 2p^3(^2D) ^1D 3p^2F_{7/2}$	13744509	13744874	13744874	4.71E-13	4.72E-13	2s+1(1)1 2p+3(3)4 3p+1(3)7
171	$2s^2S 2p^3(^2P) ^3P 3d^4F_{5/2}^{\circ}$	13753070	13753170	13753170	9.84E-14	9.89E-14	2s+1(1)1 2p-1(1)0 2p+2(0)0 3d+1(5)5
172	$2s^2S 2p^3(^2P) ^3P 3d^4F_{7/2}^{\circ}$	13768733	13768769	13768769	3.69E-13	3.68E-13	2s+1(1)1 2p-1(1)2 2p+2(0)2 3d+1(5)7
173	$2s^2S 2p^3(^2D) ^1D 3p^2D_{5/2}$	13780671	13780679	13780679	1.32E-12	1.30E-12	2s+1(1)1 2p+3(3)4 3p+1(3)5
174	$2s^2S 2p^3(^2D) ^1D 3p^2P_{3/2}$	13782167	13782314	13782314	1.30E-13	1.30E-13	2s+1(1)1 2p+3(3)4 3p+1(3)3
175	$2s^2S 2p^3(^2P) ^3P 3d^4D_{1/2}^{\circ}$	13784474	13784442	13784442	3.00E-14	3.01E-14	2s+1(1)1 2p-1(1)2 2p+2(4)2 3d-1(3)1
176	$2s^2S 2p^3(^2P) ^3P 3d^4P_{5/2}^{\circ}$	13788819	13788832	13788832	1.78E-13	1.78E-13	2s+1(1)1 2p-1(1)0 2p+2(0)0 3d+1(5)5
177	$2s^2S 2p^3(^2P) ^3P 3d^4D_{3/2}^{\circ}$	13799584	13799534	13799534	2.67E-14	2.68E-14	2s+1(1)1 2p-1(1)2 2p+2(0)2 3d+1(5)3
178	$2s^2S 2p^3(^2P) ^3P 3d^4F_{9/2}^{\circ}$	13812856	13812783	13812783	1.58E-11	1.59E-11	2s+1(1)1 2p+3(3)4 3d+1(5)9
179	$2s^2S 2p^3(^2P) ^3P 3d^2D_{3/2}$	13813815	13813677	13813677	2.33E-13	2.34E-13	2s+1(1)1 2p-1(1)2 2p+2(4)2 3d-1(3)3
180	$2s^2S 2p^3(^2P) ^3P 3d^2F_{5/2}^{\circ}$	13823936	13823790	13823790	6.09E-14	6.13E-14	2s+1(1)1 2p-1(1)2 2p+2(0)2 3d+1(5)5
181	$2s^2S 2p^3(^2D) ^1D 3p^2P_{1/2}$	13824188	13824273	13824273	9.36E-14	9.36E-14	2s+1(1)1 2p+3(3)4 3p+1(3)1
182	$2s^2S 2p^3(^2P) ^3P 3d^4D_{5/2}^{\circ}$	13827518	13827344	13827344	1.18E-13	1.18E-13	2s+1(1)1 2p-1(1)2 2p+2(4)4 3d-1(3)7
183	$2s^2S 2p^3(^2P) ^3P 3d^4P_{1/2}^{\circ}$	13847435	13847541	13847541	2.10E-14	2.10E-14	2s+1(1)1 2p+3(3)4 3d-1(3)1
184	$2s^2S 2p^3(^2P) ^3P 3d^4P_{3/2}^{\circ}$	13851274	13851193	13851193	2.99E-14	3.00E-14	2s+1(1)1 2p+3(3)4 3d-1(3)3

Table 1. (continued)

Key	LS J -coupled CSF	E_{NIST}	$E_{\text{MCDHF/RCI}}$	E_{MBPT}	$\tau_{\text{MCDHF/RCI}}$	τ_{MBPT}	jj -coupled CSF ^{a,b,c}
185	$2s^2S 2p^3(^2P) ^3P 3d^4D_{5/2}^{\circ}$	13855637	13855449	7.92E-14	7.94E-14	2s+1(1)1 2p+3(3)4 3d-1(3)5	
186	$2s^2S 2p^3(^2P) ^3P 3d^2F_{7/2}^{\circ}$	13874030	13873682	4.45E-14	4.47E-14	2s+1(1)1 2p+3(3)4 3d+1(5)7	
187	$2s^2S 2p^3(^2D) ^1D 3d^2P_{1/2}^{\circ}$	13900526	13900356	2.17E-14	2.18E-14	2s+1(1)1 2p-1(1)2 2p+2(4)4 3d+1(5)1	
188	$2s^2S 2p^3(^2P) ^3P 3d^2D_{5/2}^{\circ}$	13914499	13914047	2.44E-14	2.45E-14	2s+1(1)1 2p+3(3)4 3d+1(5)5	
189	$2s^2S 2p^3(^4S) ^3S 3d^4D_{5/2}^{\circ}$	13929461	13929227	5.13E-14	5.20E-14	2s+1(1)1 2p-1(1)2 2p+2(4)2 3d-1(3)5	
190	$2s^2S 2p^3(^2P) ^1P 3p^2P_{1/2}$	13932060	13931962	3.00E-13	3.00E-13	2s+1(1)1 2p+3(3)2 3p-1(1)1	
191	$2s^2S 2p^3(^4S) ^3S 3d^4D_{3/2}^{\circ}$	13933224	13932956	2.97E-14	2.97E-14	2s+1(1)1 2p-1(1)2 2p+2(4)2 3d-1(3)3	
192	$2s^2S 2p^3(^2P) ^1P 3p^2D_{3/2}$	13937472	13937374	1.75E-13	1.77E-13	2s+1(1)1 2p+3(3)2 3p-1(1)3	
193	$2s^2S 2p^3(^4S) ^3S 3d^4D_{7/2}^{\circ}$	13943805	13943566	8.96E-14	9.03E-14	2s+1(1)1 2p-1(1)2 2p+2(4)2 3d+1(5)7	
194	$2s^2S 2p^3(^2P) ^1P 3p^2D_{5/2}$	13953272	13953515	2.05E-13	2.05E-13	2s+1(1)1 2p+3(3)2 3p+1(3)5	
195	$2s^2S 2p^3(^2P) ^3P 3d^2P_{3/2}^{\circ}$	13954901	13954530	2.69E-14	2.70E-14	2s+1(1)1 2p-1(1)2 2p+2(0)2 3d+1(5)3	
196	$2s^2S 2p^3(^4S) ^3S 3d^4D_{1/2}^{\circ}$	13955795	13955578	2.61E-14	2.62E-14	2s+1(1)1 2p-1(1)2 2p+2(0)2 3d-1(3)1	
197	$2s^2S 2p^3(^2P) ^1P 3p^2P_{3/2}$	13972017	13972194	4.42E-13	4.32E-13	2s+1(1)1 2p+3(3)2 3p+1(3)3	
198	$2s^2S 2p^3(^4S) ^3S 3d^2D_{3/2}^{\circ}$	13988601	13988091	2.77E-14	2.80E-14	2s+1(1)1 2p-1(1)2 2p+2(4)2 3d+1(5)3	
199	$2s^2S 2p^3(^4S) ^3S 3d^2D_{5/2}^{\circ}$	14021231	14020813	3.09E-14	3.09E-14	2s+1(1)1 2p-1(1)2 2p+2(4)2 3d+1(5)5	
200	$2s^2S 2p^3(^2P) ^1P 3p^2S_{1/2}$	14059907	14059499	4.19E-13	4.22E-13	2s+1(1)1 2p+3(3)2 3p+1(3)1	
201	$2p^4(^2P) ^3P 3s^4P_{5/2}$	14062857	14063587	1.06E-12	1.07E-12	2p+2(4)4 3s+1(1)5	
202	$2s^2S 2p^3(^2D) ^1D 3d^2G_{9/2}^{\circ}$	14064794	14064523	1.15E-11	1.16E-11	2s+1(1)1 2p+3(3)4 3d+1(5)9	
203	$2s^2S 2p^3(^2D) ^1D 3d^2G_{7/2}^{\circ}$	14090514	14090181	1.72E-12	1.72E-12	2s+1(1)1 2p+3(3)4 3d+1(5)7	
204	$2s^2S 2p^3(^2D) ^1D 3d^2F_{7/2}^{\circ}$	14104239	14103768	2.06E-14	2.07E-14	2s+1(1)1 2p+3(3)4 3d-1(3)7	
205	$2p^4(^2P) ^3P 3s^2P_{3/2}$	14106503	14106803	1.81E-13	1.82E-13	2p+2(4)4 3s+1(1)3	
206	$2s^2S 2p^3(^2D) ^1D 3d^2P_{3/2}^{\circ}$	14107683	14107365	2.17E-14	2.18E-14	2s+1(1)1 2p+3(3)4 3d-1(3)3	
207	$2s^2S 2p^3(^2D) ^1D 3d^2F_{5/2}^{\circ}$	14110601	14110125	1.84E-14	1.83E-14	2s+1(1)1 2p+3(3)4 3d-1(3)5	
208	$2s^2S 2p^3(^2D) ^1D 3d^2D_{5/2}^{\circ}$	14112545	14112009	3.63E-14	3.72E-14	2s+1(1)1 2p+3(3)4 3d+1(5)5	
209	$2s^2S 2p^3(^2D) ^1D 3d^2S_{1/2}^{\circ}$	14114336	14114263	2.18E-14	2.19E-14	2s+1(1)1 2p-1(1)2 2p+2(4)4 3d-1(3)1	
210	$2s^2S 2p^3(^2D) ^1D 3d^2D_{3/2}^{\circ}$	14154852	14154404	3.33E-14	3.34E-14	2s+1(1)1 2p+3(3)4 3d+1(5)3	
211	$2s^2S 2p^3(^2P) ^3P 3d^2P_{1/2}^{\circ}$	14201734	14201359	1.74E-14	1.75E-14	2s+1(1)1 2p+3(3)4 3d+1(5)1	
212	$2p^4(^2P) ^3P 3s^4P_{1/2}$	14229677	14230381	5.44E-13	5.46E-13	2p+2(0)0 3s+1(1)1	
213	$2s^2S 2p^3(^2P) ^1P 3d^2F_{7/2}^{\circ}$	14286722	14286323	2.94E-13	2.95E-13	2s+1(1)1 2p+3(3)2 3d+1(5)7	
214	$2s^2S 2p^3(^2P) ^1P 3d^2D_{5/2}^{\circ}$	14295283	14294886	1.49E-13	1.46E-13	2s+1(1)1 2p+3(3)2 3d+1(5)5	
215	$2s^2S 2p^3(^2P) ^1P 3d^2P_{1/2}^{\circ}$	14306802	14306290	2.41E-14	2.42E-14	2s+1(1)1 2p+3(3)2 3d-1(3)1	
216	$2s^2S 2p^3(^2P) ^1P 3d^2P_{3/2}^{\circ}$	14306963	14306741	3.72E-14	3.65E-14	2s+1(1)1 2p+3(3)2 3d-1(3)3	
217	$2s^2S 2p^3(^2P) ^1P 3d^2F_{5/2}^{\circ}$	14310786	14310594	2.93E-14	2.90E-14	2s+1(1)1 2p+3(3)2 3d-1(3)5	
218	$2p^4(^2P) ^3P 3p^4P_{3/2}^{\circ}$	14315472	14315812	9.31E-14	9.90E-14	2p+2(4)4 3p-1(1)3	
219	$2p^4(^2P) ^3P 3s^4P_{3/2}$	14318132	14318869	4.44E-13	4.50E-13	2p-1(1)1 2p+3(3)2 3s+1(1)3	
220	$2p^4(^2P) ^3P 3p^4P_{5/2}^{\circ}$	14334216	14334264	6.34E-14	6.71E-14	2p+2(4)4 3p-1(1)5	
221	$2p^4(^2P) ^3P 3s^2P_{1/2}$	14359909	14360158	1.39E-13	1.40E-13	2p-1(1)1 2p+3(3)2 3s+1(1)1	
222	$2s^2S 2p^3(^2P) ^1P 3d^2D_{5/2}^{\circ}$	14380995	14380251	1.29E-14	1.30E-14	2s+1(1)1 2p+3(3)2 3d+1(5)3	
223	$2p^4(^2P) ^3P 3p^2P_{1/2}^{\circ}$	14390236	14390698	1.06E-13	1.06E-13	2p+2(4)4 3p+1(3)1	
224	$2p^4(^2P) ^3P 3p^2D_{5/2}^{\circ}$	14391309	14391722	1.36E-13	1.36E-13	2p+2(4)4 3p+1(3)5	
225	$2p^4(^2P) ^3P 3p^4D_{7/2}^{\circ}$	14395775	14396231	1.41E-13	1.41E-13	2p+2(4)4 3p+1(3)7	
226	$2p^4(^1D) ^1D 3s^2D_{5/2}$	14414354	14414755	2.68E-13	2.70E-13	2p-1(1)1 2p+3(3)4 3s+1(1)5	
227	$2p^4(^1D) ^1D 3s^2D_{3/2}$	14425654	14425937	2.09E-13	2.11E-13	2p-1(1)1 2p+3(3)4 3s+1(1)3	
228	$2p^4(^2P) ^3P 3p^4D_{1/2}^{\circ}$	14490097	14490447	1.25E-13	1.26E-13	2p+2(0)0 3p-1(1)1	
229	$2p^4(^2P) ^3P 3p^4S_{3/2}^{\circ}$	14500777	14500650	1.33E-13	1.34E-13	2p+2(4)4 3p+1(3)3	
230	$2p^4(^2P) ^3P 3p^4D_{3/2}^{\circ}$	14557805	14558273	1.35E-13	1.36E-13	2p+2(0)0 3p+1(3)3	
231	$2p^4(^2P) ^3P 3p^4P_{1/2}^{\circ}$	14559392	14560021	1.12E-13	1.13E-13	2p-1(1)1 2p+3(3)2 3p-1(1)1	
232	$2p^4(^2P) ^3P 3p^2P_{3/2}^{\circ}$	14600824	14601162	1.08E-13	1.09E-13	2p-1(1)1 2p+3(3)2 3p-1(1)3	
233	$2p^4(^2P) ^3P 3p^4D_{5/2}^{\circ}$	14641149	14641765	1.24E-13	1.24E-13	2p-1(1)1 2p+3(3)2 3p+1(3)5	
234	$2p^4(^1D) ^1D 3p^2F_{5/2}^{\circ}$	14665543	14665677	1.43E-13	1.43E-13	2p-1(1)1 2p+3(3)4 3p-1(1)5	
235	$2p^4(^2P) ^3P 3p^2S_{1/2}^{\circ}$	14665965	14666352	9.18E-14	9.21E-14	2p-1(1)1 2p+3(3)2 3p+1(3)1	
236	$2p^4(^2P) ^3P 3p^2D_{3/2}$	14672027	14672372	1.20E-13	1.20E-13	2p-1(1)1 2p+3(3)2 3p+1(3)3	
237	$2p^4(^2P) ^3P 3d^4D_{5/2}$	14677168	14677926	3.46E-12	3.43E-12	2p+2(4)4 3d-1(3)5	
238	$2p^4(^2P) ^3P 3d^4D_{7/2}$	14682649	14683367	5.93E-12	5.94E-12	2p+2(4)4 3d+1(5)7	
239	$2p^4(^2P) ^3P 3d^4D_{3/2}$	14682803	14683576	2.06E-12	2.05E-12	2p+2(4)4 3d-1(3)3	
240	$2p^4(^2P) ^3P 3d^2P_{1/2}$	14695925	14696682	1.61E-12	1.61E-12	2p+2(4)4 3d-1(3)1	
241	$2p^4(^2P) ^3P 3d^4F_{9/2}$	14707131	14707560	7.99E-12	8.08E-12	2p+2(4)4 3d+1(5)9	
242	$2p^4(^2P) ^3P 3d^2F_{7/2}$	14715256	14715509	2.86E-12	2.84E-12	2p+2(4)4 3d-1(3)7	
243	$2p^4(^1D) ^1D 3p^2F_{7/2}^{\circ}$	14732708	14732894	1.40E-13	1.40E-13	2p-1(1)1 2p+3(3)4 3p+1(3)7	
244	$2p^4(^1D) ^1D 3p^2D_{3/2}^{\circ}$	14747076	14747119	1.19E-13	1.19E-13	2p-1(1)1 2p+3(3)4 3p+1(3)3	
245	$2p^4(^2P) ^3P 3d^4P_{1/2}$	14758086	14758711	6.51E-14	6.54E-14	2p+2(4)4 3d+1(5)1	

Table 1. (continued)

Key	<i>LS</i> <i>J</i> -coupled CSF	E_{NIST}	$E_{\text{MCDHF/RCI}}$	E_{MBPT}	$\tau_{\text{MCDHF/RCI}}$	τ_{MBPT}	<i>jj</i> -coupled CSF ^{a,b,c}
246	$2p^4(\frac{1}{2}D)1D3p^2D_{5/2}^{\circ}$	14772012	14771950	1.35E-13	1.36E-13	1.36E-13	2p-1(1)1 2p+3(3)4 3p+1(3)5
247	$2p^4(\frac{3}{2}P)3P3d^4P_{3/2}$	14790516	14790928	5.32E-14	5.32E-14	5.32E-14	2p+2(4)4 3d+1(5)3
248	$2p^4(\frac{1}{2}D)1D3p^2P_{3/2}^{\circ}$	14793515	14792158	7.63E-14	7.76E-14	7.76E-14	2p-1(1)1 2p+3(3)4 3p-1(1)3
249	$2p^4(\frac{1}{2}S)1S3s^2S_{1/2}$	14798136	14798685	2.22E-13	2.24E-13	2.24E-13	3s+1(1)1
250	$2p^4(\frac{3}{2}P)3P3d^2D_{5/2}$	14808338	14808512	4.15E-14	4.16E-14	4.16E-14	2p+2(4)4 3d+1(5)5
251	$2p^4(\frac{3}{2}P)3P3d^4F_{3/2}$	14866119	14866567	1.61E-13	1.62E-13	1.62E-13	2p+2(0)0 3d-1(3)3
252	$2p^4(\frac{3}{2}P)3P3d^4F_{5/2}$	14884094	14884640	2.22E-13	2.22E-13	2.22E-13	2p+2(0)0 3d+1(5)5
253	$2p^4(\frac{1}{2}D)1D3p^2P_{1/2}^{\circ}$	14886169	14885164	9.69E-14	9.81E-14	9.81E-14	2p-1(1)1 2p+3(3)4 3p+1(3)1
254	$2p^4(\frac{3}{2}P)3P3d^4D_{1/2}$	14919296	14920156	2.36E-12	2.38E-12	2.38E-12	2p-1(1)1 2p+3(3)2 3d-1(3)1
255	$2p^4(\frac{3}{2}P)3P3d^2D_{3/2}$	14950285	14950979	4.74E-13	4.80E-13	4.80E-13	2p-1(1)1 2p+3(3)2 3d-1(3)3
256	$2p^4(\frac{3}{2}P)3P3d^4F_{7/2}$	14952897	14953497	5.40E-12	5.44E-12	5.44E-12	2p-1(1)1 2p+3(3)2 3d+1(5)7
257	$2p^4(\frac{3}{2}P)3P3d^4P_{5/2}$	14986525	14987091	2.06E-13	2.05E-13	2.05E-13	2p-1(1)1 2p+3(3)2 3d+1(5)5
258	$2p^4(\frac{3}{2}P)3P3d^2F_{5/2}$	14999931	15000180	6.79E-14	6.86E-14	6.86E-14	2p-1(1)1 2p+3(3)2 3d-1(3)5
259	$2p^4(\frac{3}{2}P)3P3d^2P_{3/2}$	15002721	15003262	2.75E-13	2.76E-13	2.76E-13	2p-1(1)1 2p+3(3)2 3d+1(5)3
260	$2p^4(\frac{1}{2}D)1D3d^2G_{7/2}$	15026543	15026538	7.58E-12	7.66E-12	7.66E-12	2p-1(1)1 2p+3(3)4 3d-1(3)7
261	$2p^4(\frac{1}{2}D)1D3d^2G_{9/2}$	15039334	15039351	8.37E-12	8.48E-12	8.48E-12	2p-1(1)1 2p+3(3)4 3d+1(5)9
262	$2p^4(\frac{1}{2}D)1D3d^2D_{5/2}$	15073631	15073768	6.50E-13	6.59E-13	6.59E-13	2p-1(1)1 2p+3(3)4 3d+1(5)5
263	$2p^4(\frac{1}{2}D)1D3d^2S_{1/2}$	15082970	15083563	2.08E-14	2.09E-14	2.09E-14	2p-1(1)1 2p+3(3)4 3d-1(3)1
264	$2p^4(\frac{1}{2}D)1D3d^2F_{7/2}$	15093148	15093123	2.29E-12	2.24E-12	2.24E-12	2p-1(1)1 2p+3(3)4 3d+1(5)7
265	$2p^4(\frac{1}{2}S)1S3p^2P_{1/2}^{\circ}$	15109913	15109463	8.32E-14	8.43E-14	8.43E-14	3p-1(1)1
266	$2p^4(\frac{1}{2}D)1D3d^2P_{3/2}$	15112714	15112556	1.61E-14	1.63E-14	1.63E-14	2p-1(1)1 2p+3(3)4 3d-1(3)3
267	$2p^4(\frac{1}{2}D)1D3d^2F_{5/2}$	15116871	15116625	1.70E-14	1.72E-14	1.72E-14	2p-1(1)1 2p+3(3)4 3d-1(3)5
268	$2p^4(\frac{1}{2}S)1S3p^2P_{3/2}^{\circ}$	15130808	15131044	1.25E-13	1.26E-13	1.26E-13	3p+1(3)3
269	$2p^4(\frac{1}{2}D)1D3d^2D_{3/2}$	15171086	15170774	1.67E-14	1.68E-14	1.68E-14	2p-1(1)1 2p+3(3)4 3d+1(5)3
270	$2p^4(\frac{1}{2}D)1D3d^2P_{1/2}$	15193816	15193416	1.23E-14	1.24E-14	1.24E-14	2p-1(1)1 2p+3(3)4 3d+1(5)1
271	$2p^4(\frac{1}{2}S)1S3d^2D_{5/2}$	15449823	15450207	4.68E-13	4.66E-13	4.66E-13	3d+1(5)5
272	$2p^4(\frac{1}{2}S)1S3d^2D_{3/2}$	15477829	15477931	2.26E-14	2.28E-14	2.28E-14	3d-1(3)3

^a The number at the end or inside of the bracket is $2J$.

^b $s+ = s_{1/2}$, $p- = p_{1/2}$, $p+ = p_{3/2}$, $d- = d_{3/2}$, $d+ = d_{5/2}$, $f- = f_{5/2}$, and $f+ = f_{7/2}$.

^c The number after \pm is the occupation number of the corresponding sub-shell. For example, the *jj*-coupled CSF of level 9 is $2s_{1/2}2p_{1/2}2p_{3/2}^3$.

Table 2. Wavelengths (λ , in vacuum, Å), transition rates (A , in s^{-1}), oscillator strengths (gf , dimensionless) and line strengths (S , in a.u.) for the transitions among the 272 levels listed in Table 1. The last column represent the estimated accuracies of the A -values using the terminologies of the NIST ASD.

Upper	Lower	Type	$\lambda_{\text{MCDHF/RCI}}$	λ_{MBPT}	$S_{\text{MCDHF/RCI}}$	$gf_{\text{MCDHF/RCI}}$	$A_{\text{MCDHF/RCI}}$	S_{MBPT}	gf_{MBPT}	A_{MBPT}	Acc.
2	1	M1	4.2761E+02	4.2771E+02	2.70E+00	2.55E-05	2.33E+05	2.70E+00	2.55E-05	2.33E+05	B+
2	1	E2	4.2761E+02	4.2771E+02	4.65E-04	9.99E-10	9.11E+00	4.65E-04	9.97E-10	9.09E+00	B+
3	1	M1	3.1871E+02	3.1884E+02	2.71E-01	3.44E-06	3.76E+04	2.71E-01	3.44E-06	3.76E+04	B+
3	1	E2	3.1871E+02	3.1884E+02	1.10E-03	5.71E-09	6.25E+01	1.10E-03	5.70E-09	6.23E+01	B+
4	1	M1	2.3435E+02	2.3443E+02	3.51E-01	6.06E-06	3.68E+05	3.51E-01	6.06E-06	3.68E+05	B+
4	1	E2	2.3435E+02	2.3443E+02	2.07E-04	2.70E-09	1.64E+02	2.07E-04	2.70E-09	1.64E+02	B+
4	2	M1	5.1855E+02	5.1876E+02	1.37E-01	1.07E-06	1.32E+04	1.36E-01	1.06E-06	1.31E+04	B+
4	2	E2	5.1855E+02	5.1876E+02	1.11E-03	1.34E-09	1.66E+01	1.11E-03	1.34E-09	1.66E+01	B+
5	1	M1	1.5871E+02	1.5872E+02	4.76E-02	1.21E-06	8.04E+04	4.73E-02	1.21E-06	7.97E+04	B+
5	2	M1	2.5238E+02	2.5237E+02	1.58E+00	2.53E-05	6.62E+05	1.58E+00	2.53E-05	6.62E+05	B+
5	2	E2	2.5238E+02	2.5237E+02	3.41E-04	3.57E-09	9.33E+01	3.41E-04	3.56E-09	9.33E+01	B+
5	3	M1	3.1614E+02	3.1604E+02	6.77E-01	8.66E-06	1.45E+05	6.76E-01	8.65E-06	1.44E+05	B+
5	3	E2	3.1614E+02	3.1604E+02	2.61E-03	1.38E-08	2.31E+02	2.60E-03	1.38E-08	2.31E+02	B+
5	4	M1	4.9170E+02	4.9145E+02	8.37E-01	6.88E-06	4.75E+04	8.35E-01	6.87E-06	4.75E+04	B+
5	4	E2	4.9170E+02	4.9145E+02	4.82E-04	6.80E-10	4.69E+00	4.81E-04	6.80E-10	4.70E+00	B+
6	1	E1	9.2514E+01	9.2448E+01	3.86E-02	1.27E-01	1.65E+10	3.84E-02	1.26E-01	1.64E+10	B+
6	1	M2	9.2514E+01	9.2448E+01	1.33E+00	3.76E-09	4.89E+02	1.33E+00	3.77E-09	4.91E+02	A
6	2	E1	1.1806E+02	1.1794E+02	1.65E-02	4.24E-02	3.38E+09	1.65E-02	4.24E-02	3.39E+09	B+
6	2	M2	1.1806E+02	1.1794E+02	8.47E-02	1.15E-10	9.18E+00	8.41E-02	1.15E-10	9.16E+00	B+
6	3	E1	1.3035E+02	1.3020E+02	6.12E-03	1.43E-02	9.33E+08	6.11E-03	1.43E-02	9.35E+08	B+
6	3	M2	1.3035E+02	1.3020E+02	1.14E-01	1.15E-10	7.52E+00	1.14E-01	1.15E-10	7.54E+00	B+
6	4	M2	1.5286E+02	1.5264E+02	5.57E-02	3.49E-11	1.66E+00	5.56E-02	3.49E-11	1.67E+00	B+
6	5	E1	2.2181E+02	2.2142E+02	6.28E-04	8.60E-04	1.94E+07	6.25E-04	8.57E-04	1.94E+07	B
6	5	M2	2.2181E+02	2.2142E+02	8.64E-02	1.77E-11	4.00E-01	8.62E-02	1.78E-11	4.03E-01	B+
7	1	E1	8.0111E+01	8.0061E+01	4.06E-02	1.54E-01	4.00E+10	4.05E-02	1.54E-01	3.99E+10	B+
7	1	M2	8.0111E+01	8.0061E+01	2.60E-03	1.13E-11	2.94E+00	2.67E-03	1.16E-11	3.02E+00	C+
7	2	E1	9.8579E+01	9.8499E+01	5.11E-04	1.58E-03	2.70E+08	5.06E-04	1.56E-03	2.68E+08	B
7	2	M2	9.8579E+01	9.8499E+01	5.64E-01	1.32E-09	2.26E+02	5.63E-01	1.32E-09	2.26E+02	A
7	3	E1	1.0701E+02	1.0691E+02	1.56E-03	4.42E-03	6.44E+08	1.56E-03	4.43E-03	6.46E+08	B+
7	3	M2	1.0701E+02	1.0691E+02	1.23E-01	2.24E-10	3.26E+01	1.22E-01	2.24E-10	3.26E+01	B+
7	4	E1	1.2172E+02	1.2159E+02	1.28E-04	3.19E-04	3.60E+07	1.28E-04	3.21E-04	3.62E+07	B
7	4	M2	1.2172E+02	1.2159E+02	2.13E-01	2.64E-10	2.97E+01	2.13E-01	2.65E-10	2.99E+01	B+
7	5	E1	1.6176E+02	1.6155E+02	3.28E-03	6.16E-03	3.93E+08	3.27E-03	6.15E-03	3.93E+08	B+
7	6	M1	5.9755E+02	5.9754E+02	3.34E+00	2.26E-05	1.06E+05	3.34E+00	2.26E-05	1.05E+05	B+
7	6	E2	5.9755E+02	5.9754E+02	8.90E-04	7.00E-10	3.27E+00	8.86E-04	6.97E-10	3.26E+00	B+
8	1	E1	7.8627E+01	7.8583E+01	1.94E-02	7.49E-02	4.04E+10	1.93E-02	7.47E-02	4.03E+10	B+
8	1	M2	7.8627E+01	7.8583E+01	1.38E-01	6.33E-10	3.42E+02	1.38E-01	6.35E-10	3.43E+02	A
8	2	E1	9.6341E+01	9.6271E+01	1.52E-03	4.79E-03	1.72E+09	1.52E-03	4.79E-03	1.72E+09	B+
8	2	M2	9.6341E+01	9.6271E+01	1.08E-01	2.70E-10	9.71E+01	1.08E-01	2.70E-10	9.72E+01	A
8	3	M2	1.0438E+02	1.0429E+02	3.07E-02	6.04E-11	1.85E+01	3.07E-02	6.04E-11	1.85E+01	B+
8	4	E1	1.1833E+02	1.1821E+02	3.14E-03	8.05E-03	1.92E+09	3.14E-03	8.06E-03	1.92E+09	B+
8	5	E1	1.5582E+02	1.5565E+02	2.30E-04	4.49E-04	6.16E+07	2.30E-04	4.50E-04	6.19E+07	B
8	5	M2	1.5582E+02	1.5565E+02	9.60E-02	5.67E-11	7.79E+00	9.57E-02	5.68E-11	7.81E+00	B+
9	1	E1	6.6481E+01	6.6463E+01	7.91E-03	3.62E-02	1.36E+10	7.90E-03	3.61E-02	1.36E+10	B+
9	1	M2	6.6481E+01	6.6463E+01	1.80E-01	1.37E-09	5.16E+02	1.80E-01	1.37E-09	5.17E+02	A
9	2	E1	7.8720E+01	7.8692E+01	6.49E-02	2.50E-01	6.74E+10	6.47E-02	2.50E-01	6.72E+10	B+
9	2	M2	7.8720E+01	7.8692E+01	1.10E-02	5.04E-11	1.36E+01	1.12E-02	5.15E-11	1.39E+01	B+
9	3	E1	8.4004E+01	8.3966E+01	1.70E-03	6.14E-03	1.45E+09	1.69E-03	6.12E-03	1.45E+09	B+
9	3	M2	8.4004E+01	8.3966E+01	3.94E-01	1.49E-09	3.51E+02	3.94E-01	1.49E-09	3.52E+02	A
9	4	E1	9.2809E+01	9.2763E+01	4.07E-03	1.33E-02	2.58E+09	4.06E-03	1.33E-02	2.58E+09	B+
9	4	M2	9.2809E+01	9.2763E+01	1.19E-01	3.33E-10	6.45E+01	1.19E-01	3.34E-10	6.48E+01	A
9	5	E1	1.1440E+02	1.1435E+02	5.30E-04	1.41E-03	1.79E+08	5.23E-04	1.39E-03	1.77E+08	B
9	5	M2	1.1440E+02	1.1435E+02	1.46E-02	2.18E-11	2.77E+00	1.45E-02	2.17E-11	2.77E+00	B+
9	6	M1	2.3626E+02	2.3646E+02	4.48E-02	7.66E-07	2.29E+04	4.51E-02	7.72E-07	2.30E+04	B+
9	6	E2	2.3626E+02	2.3646E+02	3.30E-04	4.21E-09	1.26E+02	3.31E-04	4.20E-09	1.25E+02	B+
9	7	M1	3.9076E+02	3.9131E+02	8.92E-01	9.23E-06	1.01E+05	8.95E-01	9.25E-06	1.01E+05	B+
9	8	M1	4.3039E+02	4.3094E+02	3.00E-01	2.82E-06	2.54E+04	3.00E-01	2.82E-06	2.53E+04	B+
9	8	E2	4.3039E+02	4.3094E+02	1.65E-04	3.48E-10	3.13E+00	1.65E-04	3.46E-10	3.11E+00	B+
10	1	E1	6.3731E+01	6.3712E+01	2.52E-05	1.20E-04	3.29E+07	2.51E-05	1.20E-04	3.28E+07	C
10	1	M2	6.3731E+01	6.3712E+01	3.60E-02	3.11E-10	8.51E+01	3.60E-02	3.11E-10	8.52E+01	B+
10	2	E1	7.4893E+01	7.4864E+01	5.97E-04	2.42E-03	4.80E+08	5.96E-04	2.42E-03	4.80E+08	B
10	2	M2	7.4893E+01	7.4864E+01	3.88E-01	2.06E-09	4.09E+02	3.87E-01	2.06E-09	4.09E+02	A
10	3	E1	7.9660E+01	7.9623E+01	7.62E-02	2.91E-01	5.09E+10	7.60E-02	2.90E-01	5.08E+10	B+
10	3	M2	7.9660E+01	7.9623E+01	1.03E+00	4.57E-09	8.01E+02	1.03E+00	4.58E-09	8.03E+02	A
10	4	M2	8.7535E+01	8.7490E+01	4.76E-01	1.59E-09	2.30E+02	4.76E-01	1.59E-09	2.31E+02	A

Table 2. (continued)

Upper	Lower	Type	$\lambda_{\text{MCDHF/RCI}}$	λ_{MBPT}	$S_{\text{MCDHF/RCI}}$	$g_{\text{fMCDHF/RCI}}$	$A_{\text{MCDHF/RCI}}$	S_{MBPT}	g_{fMBPT}	A_{MBPT}	Acc.
10	5	E1	1.0649E+02	1.0644E+02	2.67E-02	7.62E-02	7.47E+09	2.66E-02	7.60E-02	7.46E+09	B+
10	5	M2	1.0649E+02	1.0644E+02	1.04E-03	1.92E-12	1.89E-01	1.04E-03	1.93E-12	1.90E-01	C+
10	6	M1	2.0484E+02	2.0497E+02	5.93E-01	1.17E-05	3.10E+05	5.94E-01	1.17E-05	3.10E+05	B+
10	6	E2	2.0484E+02	2.0497E+02	5.35E-04	1.05E-08	2.77E+02	5.35E-04	1.04E-08	2.76E+02	B+
10	7	M1	3.1169E+02	3.1199E+02	1.20E-02	1.56E-07	1.79E+03	1.20E-02	1.55E-07	1.77E+03	B+
10	7	E2	3.1169E+02	3.1199E+02	2.95E-04	1.63E-09	1.87E+01	2.95E-04	1.63E-09	1.86E+01	B+
11	1	E1	5.8252E+01	5.8240E+01	1.78E-03	9.29E-03	9.13E+09	1.78E-03	9.28E-03	9.12E+09	B+
11	1	M2	5.8252E+01	5.8240E+01	1.28E-01	1.45E-09	1.42E+03	1.27E-01	1.44E-09	1.42E+03	A
11	2	E1	6.7439E+01	6.7421E+01	2.46E-02	1.11E-01	8.12E+10	2.45E-02	1.10E-01	8.10E+10	B+
11	2	M2	6.7439E+01	6.7421E+01	2.19E-02	1.60E-10	1.17E+02	2.20E-02	1.61E-10	1.18E+02	B+
11	3	M2	7.1281E+01	7.1256E+01	6.62E-02	4.08E-10	2.68E+02	6.61E-02	4.09E-10	2.68E+02	B+
11	4	E1	7.7521E+01	7.7492E+01	2.53E-02	9.90E-02	5.50E+10	2.52E-02	9.88E-02	5.48E+10	B+
11	5	M2	9.2031E+01	9.1998E+01	1.16E-01	3.31E-10	1.30E+02	1.16E-01	3.32E-10	1.31E+02	A
11	7	M1	2.1349E+02	2.1368E+02	5.80E-01	1.10E-05	8.03E+05	5.80E-01	1.10E-05	8.02E+05	B+
11	7	E2	2.1349E+02	2.1368E+02	6.46E-05	1.12E-09	8.16E+01	6.48E-05	1.12E-09	8.14E+01	B
11	9	M1	4.7060E+02	4.7072E+02	2.01E-03	1.73E-08	2.60E+02	1.92E-03	1.65E-08	2.49E+02	C+
11	9	E2	4.7060E+02	4.7072E+02	1.08E-03	1.74E-09	2.61E+01	1.07E-03	1.73E-09	2.60E+01	B+
12	1	E1	5.5936E+01	5.5924E+01	4.40E-03	2.39E-02	1.27E+10	4.39E-03	2.39E-02	1.27E+10	B+
12	1	M2	5.5936E+01	5.5924E+01	1.66E-01	2.11E-09	1.13E+03	1.65E-01	2.11E-09	1.12E+03	A
12	2	E1	6.4355E+01	6.4337E+01	2.95E-03	1.39E-02	5.61E+09	2.94E-03	1.39E-02	5.59E+09	B+
12	2	M2	6.4355E+01	6.4337E+01	2.01E-01	1.69E-09	6.80E+02	2.02E-01	1.69E-09	6.81E+02	A
12	3	E1	6.7843E+01	6.7820E+01	9.26E-02	4.15E-01	1.50E+11	9.23E-02	4.13E-01	1.50E+11	B+
12	3	M2	6.7843E+01	6.7820E+01	2.09E-01	1.49E-09	5.41E+02	2.08E-01	1.49E-09	5.40E+02	A
12	4	E1	7.3473E+01	7.3445E+01	1.48E-02	6.13E-02	1.89E+10	1.48E-02	6.12E-02	1.89E+10	B+
12	4	M2	7.3473E+01	7.3445E+01	1.99E-02	1.12E-10	3.46E+01	1.99E-02	1.12E-10	3.47E+01	B+
12	5	E1	8.6381E+01	8.6350E+01	1.48E-02	5.20E-02	1.16E+10	1.48E-02	5.19E-02	1.16E+10	B+
12	5	M2	8.6381E+01	8.6350E+01	1.42E-02	4.92E-11	1.10E+01	1.41E-02	4.89E-11	1.09E+01	B+
12	6	M1	1.4148E+02	1.4155E+02	1.05E-01	3.00E-06	2.50E+05	1.05E-01	3.00E-06	2.49E+05	B+
12	7	M1	1.8536E+02	1.8550E+02	1.08E-02	2.35E-07	1.14E+04	1.08E-02	2.35E-07	1.14E+04	B+
12	7	E2	1.8536E+02	1.8550E+02	1.66E-04	4.38E-09	2.13E+02	1.66E-04	4.38E-09	2.12E+02	B+
12	8	M1	1.9383E+02	1.9395E+02	2.99E-02	6.24E-07	2.77E+04	2.99E-02	6.24E-07	2.77E+04	B+
12	8	E2	1.9383E+02	1.9395E+02	4.32E-05	9.96E-10	4.42E+01	4.32E-05	9.94E-10	4.41E+01	B
12	9	M1	3.5265E+02	3.5268E+02	6.08E-01	6.98E-06	9.36E+04	6.07E-01	6.96E-06	9.33E+04	B+
12	9	E2	3.5265E+02	3.5268E+02	7.29E-04	2.79E-09	3.74E+01	7.27E-04	2.78E-09	3.73E+01	B+
12	10	M1	4.5736E+02	4.5753E+02	3.19E-01	2.82E-06	2.25E+04	3.18E-01	2.81E-06	2.24E+04	B+
12	10	E2	4.5736E+02	4.5753E+02	1.25E-04	2.20E-10	1.76E+00	1.25E-04	2.19E-10	1.75E+00	B+
13	1	M2	4.9053E+01	4.9042E+01	2.78E-02	5.26E-10	7.29E+02	2.77E-02	5.24E-10	7.27E+02	B+
13	2	E1	5.5409E+01	5.5394E+01	4.43E-03	2.43E-02	2.64E+10	4.41E-03	2.42E-02	2.63E+10	B+
13	2	M2	5.5409E+01	5.5394E+01	7.57E-02	9.95E-10	1.08E+03	7.56E-02	9.95E-10	1.08E+03	B+
13	3	M2	5.7976E+01	5.7957E+01	3.14E-02	3.60E-10	3.57E+02	3.12E-02	3.59E-10	3.56E+02	B+
13	4	E1	6.2038E+01	6.2016E+01	6.54E-04	3.20E-03	2.77E+09	6.54E-04	3.21E-03	2.78E+09	B
13	5	E1	7.0996E+01	7.0972E+01	5.46E-02	2.33E-01	1.54E+11	5.44E-02	2.33E-01	1.54E+11	B+
13	5	M2	7.0996E+01	7.0972E+01	4.32E-01	2.70E-09	1.78E+03	4.32E-01	2.70E-09	1.79E+03	A
13	7	M1	1.2653E+02	1.2658E+02	4.75E-02	1.52E-06	3.16E+05	4.74E-02	1.52E-06	3.15E+05	B+
13	9	M1	1.8711E+02	1.8710E+02	2.19E-01	4.74E-06	4.51E+05	2.19E-01	4.74E-06	4.51E+05	B+
13	9	E2	1.8711E+02	1.8710E+02	1.44E-04	3.69E-09	3.51E+02	1.44E-04	3.69E-09	3.51E+02	B+
13	12	M1	3.9862E+02	3.9851E+02	7.43E-01	7.54E-06	1.58E+05	7.41E-01	7.52E-06	1.58E+05	B+
13	12	E2	3.9862E+02	3.9851E+02	1.10E-03	2.91E-09	6.11E+01	1.09E-03	2.90E-09	6.10E+01	B+
14	1	M1	3.6450E+01	3.6454E+01	9.89E-05	1.10E-08	1.38E+04	1.03E-04	1.14E-08	1.44E+04	C
14	1	E2	3.6450E+01	3.6454E+01	1.64E-05	5.70E-08	7.15E+04	1.65E-05	5.71E-08	7.17E+04	B
14	2	M1	3.9847E+01	3.9850E+01	7.82E-04	7.94E-08	8.33E+04	7.76E-04	7.87E-08	8.27E+04	C
14	2	E2	3.9847E+01	3.9850E+01	3.72E-05	9.88E-08	1.04E+05	3.72E-05	9.87E-08	1.04E+05	B
14	3	M1	4.1157E+01	4.1159E+01	2.47E-04	2.42E-08	2.39E+04	2.47E-04	2.42E-08	2.39E+04	C
14	3	E2	4.1157E+01	4.1159E+01	8.99E-05	2.17E-07	2.13E+05	8.99E-05	2.16E-07	2.13E+05	B
14	4	M1	4.3163E+01	4.3166E+01	2.52E-04	2.36E-08	2.11E+04	2.49E-04	2.34E-08	2.09E+04	C
14	4	E2	4.3163E+01	4.3166E+01	2.13E-05	4.44E-08	3.97E+04	2.13E-05	4.44E-08	3.98E+04	B
14	6	E1	6.0148E+01	6.0185E+01	5.23E-03	2.64E-02	1.22E+10	5.23E-03	2.64E-02	1.22E+10	B+
14	6	M2	6.0148E+01	6.0185E+01	1.06E+00	1.09E-08	5.04E+03	1.06E+00	1.09E-08	5.02E+03	A
14	7	E1	6.6880E+01	6.6926E+01	8.14E-03	3.70E-02	1.38E+10	8.15E-03	3.70E-02	1.38E+10	B+
14	7	M2	6.6880E+01	6.6926E+01	9.07E-02	6.78E-10	2.53E+02	9.08E-02	6.77E-10	2.52E+02	B+
14	8	E1	6.7951E+01	6.7996E+01	2.35E-03	1.05E-02	3.80E+09	2.35E-03	1.05E-02	3.79E+09	B+
14	8	M2	6.7951E+01	6.7996E+01	2.14E-01	1.52E-09	5.50E+02	2.14E-01	1.52E-09	5.48E+02	A
14	9	E1	8.0690E+01	8.0734E+01	3.91E-02	1.47E-01	3.77E+10	3.89E-02	1.46E-01	3.75E+10	B+
14	9	M2	8.0690E+01	8.0734E+01	1.10E-01	4.67E-10	1.20E+02	1.09E-01	4.65E-10	1.19E+02	A
14	10	E1	8.5151E+01	8.5204E+01	6.31E-02	2.25E-01	5.18E+10	6.29E-02	2.24E-01	5.15E+10	B+
14	10	M2	8.5151E+01	8.5204E+01	1.16E-01	4.20E-10	9.65E+01	1.15E-01	4.17E-10	9.58E+01	A
14	11	E1	9.7389E+01	9.7448E+01	2.53E-02	7.88E-02	1.39E+10	2.52E-02	7.85E-02	1.38E+10	B+
14	11	M2	9.7389E+01	9.7448E+01	1.67E-01	4.03E-10	7.09E+01	1.66E-01	4.01E-10	7.05E+01	A

Table 2. (continued)

Upper	Lower	Type	$\lambda_{\text{MCDHF/RCI}}$	λ_{MBPT}	$S_{\text{MCDHF/RCI}}$	$gf_{\text{MCDHF/RCI}}$	$A_{\text{MCDHF/RCI}}$	S_{MBPT}	gf_{MBPT}	A_{MBPT}	Acc.
14	12	E1	1.0463E+02	1.0470E+02	7.20E-02	2.09E-01	3.18E+10	7.17E-02	2.08E-01	3.16E+10	B+
14	12	M2	1.0463E+02	1.0470E+02	4.58E-02	8.93E-11	1.36E+01	4.58E-02	8.91E-11	1.36E+01	B+
14	13	E1	1.4187E+02	1.4201E+02	4.38E-03	9.38E-03	7.77E+08	4.36E-03	9.33E-03	7.71E+08	B+
14	13	M2	1.4187E+02	1.4201E+02	1.43E-02	1.12E-11	9.27E-01	1.42E-02	1.11E-11	9.15E-01	B+
15	5	M1	4.1894E+01	4.1896E+01	4.71E-04	4.54E-08	8.63E+04	4.74E-04	4.58E-08	8.70E+04	C
15	5	E2	4.1894E+01	4.1896E+01	4.80E-05	1.10E-07	2.08E+05	4.80E-05	1.10E-07	2.08E+05	B
15	6	M2	5.1649E+01	5.1674E+01	7.46E-02	1.21E-09	1.51E+03	7.44E-02	1.21E-09	1.51E+03	B+
15	7	E1	5.6536E+01	5.6566E+01	4.36E-04	2.34E-03	2.44E+09	4.38E-04	2.35E-03	2.45E+09	B
15	7	M2	5.6536E+01	5.6566E+01	2.80E-01	3.46E-09	3.61E+03	2.79E-01	3.45E-09	3.59E+03	A
15	8	E1	5.7299E+01	5.7328E+01	4.79E-04	2.54E-03	2.58E+09	4.78E-04	2.53E-03	2.57E+09	B
15	9	E1	6.6100E+01	6.6124E+01	1.33E-02	6.10E-02	4.65E+10	1.32E-02	6.08E-02	4.64E+10	B+
15	9	M2	6.6100E+01	6.6124E+01	1.59E-01	1.23E-09	9.40E+02	1.59E-01	1.23E-09	9.39E+02	A
15	10	M2	6.9063E+01	6.9092E+01	6.14E-01	4.16E-09	2.91E+03	6.13E-01	4.16E-09	2.90E+03	A
15	11	E1	7.6901E+01	7.6931E+01	6.65E-03	2.63E-02	1.48E+10	6.62E-03	2.62E-02	1.47E+10	B+
15	12	E1	8.1347E+01	8.1382E+01	4.64E-02	1.73E-01	8.73E+10	4.62E-02	1.73E-01	8.69E+10	B+
15	12	M2	8.1347E+01	8.1382E+01	2.49E-02	1.03E-10	5.20E+01	2.49E-02	1.03E-10	5.20E+01	B+
15	13	E1	1.0220E+02	1.0227E+02	4.17E-02	1.24E-01	3.96E+10	4.16E-02	1.24E-01	3.94E+10	B+
15	14	M1	3.6554E+02	3.6539E+02	1.33E+00	1.47E-05	3.66E+05	1.32E+00	1.46E-05	3.65E+05	B+
15	14	E2	3.6554E+02	3.6539E+02	9.83E-04	3.38E-09	8.43E+01	9.80E-04	3.37E-09	8.43E+01	B+

Only transitions among the lowest 15 levels of the $n = 2$ configurations are shown here. Table 2 is available online in its entirety in the [JQSRT](#) website.

Table 3. Energies (E in cm^{-1}) relative to the ground state for the lowest 272 levels arising from the $2s^2 2p^3$, $2s 2p^4$, $2p^5$, $2s^2 2p^2 3l$ ($l = s, p, d$), $2s 2p^3 3l$ ($l = s, p, d$), and $2p^4 3l$ ($l = s, p, d$) configurations of Ge XXVI. AS₁, AS₂, AS₃, AS₄, and AS₅ – the present MCDHF excitation energies; RCI1 and RCI2 – the present RCI excitation energies, excluding the Breit and QED effects, and including the Breit and QED effects, respectively, using the MCDHF/RCI method; MBPT1 and MBPT2 – the present MBPT excitation energies, excluding the Breit and QED effects, and including the Breit and QED effects, respectively, using the MBPT method; NIST – the compiled values from the NIST ASD.

Key	State	MCDHF/RCI						MBPT		NIST	
		AS ₁	AS ₂	AS ₃	AS ₄	AS ₅	RCI1	RCI2	MBPT1		MPBT2
1	$2s^2 2p^3 ({}^4S) {}^4S_{3/2}^{\circ}$	0	0	0	0	0	0	0	0	0	0
2	$2s^2 2p^3 ({}^2D) {}^2D_{3/2}^{\circ}$	236799	236226	236151	236106	236094	236188	233859	236131	233805	233740
3	$2s^2 2p^3 ({}^2D) {}^2D_{5/2}^{\circ}$	324198	322932	322756	322655	322624	322745	313767	322607	313636	313520
4	$2s^2 2p^3 ({}^2P) {}^2P_{1/2}^{\circ}$	431628	429819	429403	429212	429129	429434	426704	429316	426572	426510
5	$2s^2 2p^3 ({}^2P) {}^2P_{3/2}^{\circ}$	640905	639754	639492	639365	639315	639695	630081	639638	630053	629730
6	$2s^2 2p^3 ({}^2P) {}^4P_{5/2}$	1093017	1090117	1090295	1090428	1090495	1089307	1080918	1089667	1081687	1081480
7	$2s^2 2p^3 ({}^2P) {}^4P_{3/2}$	1260953	1257723	1257881	1258013	1258079	1256897	1248269	1257246	1249040	1248820
8	$2s^2 2p^3 ({}^2P) {}^4P_{1/2}$	1283134	1279555	1279597	1279693	1279741	1278625	1271834	1278919	1272539	1272280
9	$2s^2 2p^3 ({}^2D) {}^2D_{3/2}$	1522639	1514501	1514232	1514239	1514245	1512574	1504181	1512593	1504589	1504340
10	$2s^2 2p^3 ({}^2D) {}^2D_{5/2}$	1592571	1584896	1584647	1584659	1584665	1583242	1569102	1583294	1569563	1569240
11	$2s^2 2p^3 ({}^2S) {}^2S_{1/2}$	1735370	1726319	1725817	1725761	1725738	1723891	1716675	1723871	1717030	1716690
12	$2s^2 2p^3 ({}^2P) {}^2P_{3/2}$	1814736	1803082	1802641	1802610	1802605	1799882	1787749	1799854	1788128	1787650
13	$2s^2 2p^3 ({}^2P) {}^2P_{1/2}$	2065846	2055332	2054829	2054783	2054766	2052624	2038616	2052646	2039060	2038470
14	$2p^5 {}^2P_{3/2}^{\circ}$	2764925	2759741	2758973	2758657	2758545	2755007	2743486	2754181	2743218	2743260
15	$2p^5 {}^2P_{1/2}^{\circ}$	3043621	3038840	3038105	3037803	3037700	3034374	3017051	3033625	3016900	3016700
16	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^4P_{1/2}$	11614954	11614788	11615347	11615508	11615609	11616324	11612716	11615839	11612639	
17	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^4P_{3/2}$	11828205	11827901	11828563	11828773	11828898	11829729	11820216	11829201	11820114	
18	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^2P_{1/2}$	11863198	11862348	11863029	11863213	11863320	11864016	11854651	11863216	11854268	
19	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D_{1/2}$	11875237	11880215	11880198	11880301	11880322	11881014	11877811	11880386	11877390	
20	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^4P_{5/2}$	11903048	11902297	11902861	11903031	11903134	11903986	11889157	11903409	11888985	
21	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^2P_{3/2}$	11932893	11931612	11932171	11932313	11932399	11933144	11919199	11932350	11918797	
22	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4P_{3/2}$	11982649	11987483	11987518	11987641	11987670	11988372	11982756	11987672	11982294	
23	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2S_{1/2}$	12085320	12090701	12090785	12090949	12091005	12091753	12082904	12091026	12082421	
24	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D_{3/2}$	12119128	12124165	12124206	12124346	12124388	12125145	12114627	12124369	12114093	
25	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D_{5/2}$	12167437	12172423	12172466	12172600	12172640	12173422	12159395	12172713	12158904	
26	$2s^2 2p^2 ({}^1D) {}^1D 3s {}^2D_{5/2}$	12182518	12181556	12182076	12182233	12182328	12183307	12165210	12182625	12164946	
27	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4P_{5/2}$	12181044	12186117	12186191	12186333	12186377	12187165	12175071	12186424	12174587	
28	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4P_{1/2}$	12193406	12198603	12198696	12198846	12198895	12199688	12187548	12198903	12187012	
29	$2s^2 2p^2 ({}^1D) {}^1D 3s {}^2D_{3/2}$	12205227	12204032	12204591	12204741	12204830	12205729	12187688	12204879	12187257	
30	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2D_{3/2}$	12216505	12221413	12221484	12221618	12221659	12222439	12210165	12221559	12209539	
31	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D_{7/2}$	12251346	12256197	12256236	12256357	12256390	12257208	12240068	12256474	12239567	
32	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4S_{3/2}$	12257969	12262150	12262262	12262378	12262411	12263135	12249586	12262163	12248875	
33	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{3/2}$	12283042	12282623	12282818	12282880	12282964	12283664	12277512	12282968	12277148	
34	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2P_{3/2}$	12291715	12295405	12295262	12295305	12295308	12296103	12282648	12294948	12281714	
35	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2P_{5/2}$	12322310	12326253	12326181	12326256	12326270	12327078	12311221	12326059	12310437	
36	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^2F_{5/2}$	12334597	12333964	12334159	12334209	12334295	12334964	12327308	12334213	12326874	
37	$2s^2 2p^2 ({}^1S) {}^1S 3s {}^2S_{1/2}$	12352421	12353203	12353366	12353404	12353438	12354576	12340962	12354189	12340982	
38	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2P_{1/2}$	12370198	12373699	12373281	12373236	12373196	12374095	12360419	12372885	12359442	
39	$2s^2 2p^3 ({}^4S) {}^5S 3s {}^6S_{5/2}^{\circ}$	12452591	12460415	12461319	12461694	12461850	12462156	12446320	12462201	12446850	
40	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2D_{3/2}$	12493079	12496933	12496976	12497058	12497082	12497920	12481375	12496888	12480600	
41	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^2P_{3/2}$	12502652	12501969	12502304	12502420	12502527	12503272	12491171	12502423	12490671	
42	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{5/2}$	12515250	12514302	12514529	12514598	12514688	12515478	12501554	12514586	12501000	
43	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{1/2}$	12514180	12513575	12513941	12514072	12514185	12514959	12504179	12514163	12503733	
44	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2D_{5/2}$	12519112	12523690	12523740	12523841	12523873	12524816	12504948	12523997	12504382	
45	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{7/2}$	12517981	12517307	12517623	12517719	12517825	12518624	12504923	12517811	12504446	
46	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2D_{5/2}$	12526896	12530076	12529892	12529927	12529925	12530788	12512373	12529468	12511300	
47	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2F_{7/2}$	12532432	12536872	12536870	12536959	12536980	12537944	12518060	12537108	12517469	
48	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2P_{1/2}$	12539020	12542675	12542627	12542663	12542668	12543622	12525534	12542643	12524793	
49	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{7/2}$	12568585	12567443	12567612	12567664	12567744	12568578	12550666	12567679	12550090	
50	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{3/2}$	12565643	12564883	12565219	12565335	12565442	12566172	12552163	12565299	12551621	
51	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4P_{5/2}$	12565931	12564986	12565254	12565333	12565431	12566142	12552378	12565184	12551753	
52	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{9/2}$	12590892	12589711	12589868	12589902	12589984	12590827	12571646	12589912	12571044	
53	$2s^2 2p^3 ({}^4S) {}^5S 3s {}^4S_{3/2}^{\circ}$	12591350	12596007	12595970	12596043	12596091	12596217	12581515	12595265	12580990	
54	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{5/2}$	12624038	12622989	12623262	12623350	12623445	12624132	12606575	12623226	12606002	

Table 3. (continued)

Key	State	MCDHF/RCI						MBPT		NIST
		AS ₁	AS ₂	AS ₃	AS ₄	AS ₅	RCI1	RCI2	MBPT1	
55	$2s^2 2p^2 ({}^3P) {}^3P 3d^4 P_{3/2}$	12638389	12637492	12637806	12637912	12638011	12638669	12621253	12637818	12620735
56	$2s^2 2p^2 ({}^3P) {}^3P 3d^4 P_{1/2}$	12649882	12648948	12649267	12649375	12649472	12650122	12633209	12649204	12632625
57	$2s^2 2p^2 ({}^1D) {}^1D 3p^2 P_{3/2}^o$	12669756	12672864	12672527	12672471	12672425	12673408	12656021	12672208	12655055
58	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 G_{7/2}$	12682586	12680567	12680524	12680487	12680543	12681287	12662718	12680096	12661833
59	$2s^2 2p^2 ({}^3P) {}^3P 3d^2 P_{1/2}$	12680874	12679559	12679736	12679805	12679888	12680601	12662795	12679694	12662206
60	$2s^2 2p^2 ({}^3P) {}^3P 3d^2 D_{5/2}$	12682774	12680596	12680523	12680485	12680527	12681163	12664567	12679919	12663648
61	$2s^2 2p^2 ({}^1S) {}^1S 3p^2 P_{1/2}^o$	12677110	12679649	12679292	12679209	12679138	12680238	12666512	12679373	12665890
62	$2s^2 2p^2 ({}^3P) {}^3P 3d^2 D_{3/2}$	12689592	12687765	12687697	12687681	12687728	12688455	12672881	12687296	12672033
63	$2s^2 2p^2 ({}^1S) {}^1S 3p^2 P_{3/2}^o$	12731764	12734469	12734179	12734118	12734061	12735162	12719361	12734259	12718721
64	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^6 P_{3/2}$	12744348	12750196	12751152	12751530	12751721	12751371	12736654	12751791	12737762
65	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^6 P_{5/2}$	12756909	12762532	12763448	12763810	12763994	12763655	12747357	12764008	12748395
66	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^6 P_{7/2}$	12814563	12820337	12821313	12821695	12821889	12821596	12803391	12822004	12804490
67	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{1/2}^o$	12817038	12821592	12821852	12821912	12821946	12821797	12809823	12821227	12809674
68	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{3/2}^o$	12826662	12831145	12831420	12831488	12831525	12831466	12818683	12830894	12818543
69	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 F_{7/2}$	12856120	12855039	12855221	12855280	12855360	12856300	12834588	12855369	12834007
70	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{5/2}^o$	12849333	12854385	12854779	12854891	12854947	12854999	12839913	12854548	12839900
71	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 G_{9/2}$	12876583	12875115	12875161	12875162	12875229	12876208	12854255	12875143	12853513
72	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 D_{3/2}$	12880567	12884061	12884617	12884831	12884954	12884993	12866489	12884622	12866316
73	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 D_{5/2}$	12892896	12891717	12891923	12891991	12892072	12892876	12871521	12891874	12870858
74	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^4 P_{3/2}$	12889294	12889054	12889435	12889599	12889707	12890141	12871685	12889445	12871824
75	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 P_{1/2}$	12892587	12891734	12891927	12892010	12892084	12892924	12873291	12892011	12872727
76	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^4 P_{5/2}$	12898127	12902654	12903364	12903661	12903811	12903499	12885422	12903348	12885966
77	$2s^2 S 2p^3 ({}^4S) {}^5S 3p^4 P_{1/2}$	12910986	12914969	12915575	12915844	12915979	12915733	12898599	12915532	12899069
78	$2s^2 2p^2 ({}^3P) {}^3P 3d^2 F_{7/2}$	12924764	12922597	12922503	12922453	12922499	12923320	12900389	12921984	12899410
79	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{3/2}^o$	12926370	12929354	12929280	12929232	12929235	12929218	12915310	12928236	12914746
80	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{5/2}^o$	12933792	12938868	12939305	12939429	12939494	12939558	12915791	12939017	12915690
81	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 S_{1/2}$	12955783	12954335	12954486	12954548	12954616	12955409	12934711	12954303	12933940
82	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 P_{3/2}$	12974418	12972951	12973013	12973049	12973111	12973974	12953243	12973048	12952649
83	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 F_{5/2}$	12985439	12983708	12983608	12983577	12983618	12984471	12962929	12983239	12962021
84	$2s^2 S 2p^3 ({}^2D) {}^3D 3s^4 D_{5/2}^o$	13009160	13012686	13012702	13012684	13012700	13012692	12990369	13011735	12989837
85	$2s^2 2p^2 ({}^1S) {}^1S 3d^2 D_{5/2}$	13078478	13078313	13078031	13077928	13077932	13078969	13060761	13078311	13060444
86	$2s^2 2p^2 ({}^1S) {}^1S 3d^2 D_{3/2}$	13083382	13083033	13082822	13082755	13082762	13083404	13066526	13082854	13066312
87	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 D_{1/2}$	13082810	13082374	13082671	13082845	13082932	13082265	13070434	13082157	13070955
88	$2s^2 S 2p^3 ({}^2P) {}^3P 3s^4 P_{1/2}^o$	13081497	13085873	13086052	13086069	13086076	13086285	13071848	13085977	13071963
89	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 F_{3/2}$	13103513	13102177	13102234	13102302	13102353	13102108	13088800	13101757	13089085
90	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 D_{3/2}$	13117032	13117510	13117896	13118098	13118198	13117702	13103413	13117643	13104005
91	$2s^2 S 2p^3 ({}^2P) {}^3P 3s^4 P_{3/2}^o$	13114847	13121271	13121506	13121563	13121589	13121623	13104289	13121154	13104271
92	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^6 D_{5/2}$	13113460	13120552	13121212	13121611	13121773	13121971	13106060	13122027	13106742
93	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^6 D_{3/2}$	13116163	13123173	13123782	13124171	13124329	13124523	13106485	13124556	13107140
94	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^6 D_{1/2}$	13117349	13122154	13122744	13123113	13123266	13123448	13106560	13123489	13107213
95	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^6 D_{7/2}$	13119136	13126103	13126687	13127072	13127228	13127424	13107936	13127449	13108578
96	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^6 D_{9/2}$	13128609	13135622	13136204	13136594	13136752	13136952	13116317	13137003	13116978
97	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 F_{5/2}$	13142399	13142326	13142700	13142880	13142974	13142505	13126536	13142391	13127076
98	$2s^2 S 2p^3 ({}^2P) {}^3P 3s^4 P_{5/2}^o$	13172146	13175829	13175984	13175996	13176015	13176010	13154788	13175415	13154632
99	$2s^2 S 2p^3 ({}^2P) {}^3P 3s^4 P_{1/2}^o$	13169121	13172220	13172041	13171955	13171932	13171762	13156111	13170948	13155711
100	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 D_{5/2}$	13193926	13193369	13193704	13193868	13193953	13193951	13177281	13193232	13177784
101	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 F_{7/2}$	13205910	13205807	13206221	13206411	13206510	13206090	13186701	13206000	13187257
102	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 D_{3/2}$	13203087	13202228	13202466	13202629	13202712	13202063	13187240	13201812	13187642
103	$2s^2 S 2p^3 ({}^2P) {}^3P 3s^4 P_{3/2}^o$	13207670	13210983	13210859	13210794	13210783	13210386	13190592	13209555	13190175
104	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 F_{5/2}$	13214108	13214060	13214425	13214579	13214660	13214182	13197481	13213974	13197910
105	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 P_{1/2}$	13221784	13220866	13221005	13221117	13221170	13220608	13205808	13220279	13206126
106	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 D_{7/2}$	13233050	13232923	13233341	13233520	13233612	13233160	13210876	13232977	13211357
107	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^4 D_{5/2}^o$	13247560	13252659	13252588	13252825	13252923	13253020	13234928	13252513	13235003
108	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^4 D_{3/2}^o$	13258447	13263560	13263479	13263717	13263814	13263912	13246503	13263382	13246557
109	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 P_{1/2}$	13268394	13267285	13267273	13267368	13267411	13266965	13251899	13266545	13252113
110	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^4 D_{7/2}^o$	13277942	13283068	13282842	13283088	13283187	13283298	13262718	13282694	13262707
111	$2s^2 S 2p^3 ({}^4S) {}^5S 3s^4 S_{3/2}^o$	13279332	13282671	13282668	13282673	13282686	13281353	13265404	13280693	13265180
112	$2s^2 S 2p^3 ({}^4S) {}^5S 3d^4 D_{1/2}^o$	13281736	13286988	13286859	13287110	13287212	13287347	13269616	13286770	13269629
113	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 F_{9/2}$	13295892	13295364	13295790	13295979	13296078	13295677	13269345	13295477	13269805
114	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^2 F_{7/2}$	13300868	13300730	13301162	13301347	13301441	13301005	13275310	13300791	13275754
115	$2s^2 S 2p^3 ({}^2D) {}^3D 3p^4 P_{3/2}$	13297688	13297280	13297337	13297466	13297529	13297065	13280354	13296628	13280576

Table 3. (continued)

Key	State	MCDHF/RCI						MBPT		NIST
		AS ₁	AS ₂	AS ₃	AS ₄	AS ₅	RCI1	RCI2	MBPT1	
116	$2s^2S 2p^3(^2D) ^3D 3p^4P_{5/2}$	13320487	13319431	13319381	13319536	13319613	13319051	13298500	13318294	13298370
117	$2s^2S 2p^3(^4S) ^3S 3s^2S_{1/2}$	13321126	13324049	13323782	13323698	13323675	13322359	13306754	13321501	13306323
118	$2s^2S 2p^3(^2D) ^3D 3p^2P_{3/2}$	13336067	13334991	13335172	13335321	13335392	13334808	13311758	13334331	13311920
119	$2s^2S 2p^3(^2P) ^3P 3p^4D_{1/2}$	13364559	13363906	13364006	13364102	13364155	13363837	13349126	13363869	13349791
120	$2s^2S 2p^3(^2D) ^3D 3p^2D_{5/2}$	13398658	13397399	13397457	13397564	13397616	13397153	13373131	13396568	13373182
121	$2s^2S 2p^3(^2P) ^3P 3p^4D_{3/2}$	13404685	13403403	13403555	13403668	13403730	13403215	13385457	13403111	13385998
122	$2s^2S 2p^3(^2D) ^1D 3s^2D_{5/2}$	13420641	13423769	13423767	13423727	13423727	13423085	13400716	13422397	13400458
123	$2s^2S 2p^3(^2P) ^3P 3p^4P_{1/2}$	13440372	13438043	13438100	13438231	13438297	13437220	13421320	13436819	13421563
124	$2s^2S 2p^3(^2P) ^3P 3p^4D_{5/2}$	13446866	13445093	13445266	13445387	13445452	13444830	13423788	13444684	13424287
125	$2s^2S 2p^3(^2D) ^1D 3s^2D_{3/2}$	13450618	13453241	13453140	13453062	13453049	13452611	13430499	13451772	13430092
126	$2s^2S 2p^3(^2D) ^3D 3d^4F_{5/2}^o$	13456304	13459729	13459389	13459496	13459547	13459485	13444101	13458981	13444160
127	$2s^2S 2p^3(^2P) ^3P 3p^4S_{3/2}$	13462248	13461619	13461664	13461746	13461787	13461491	13445009	13461422	13445586
128	$2s^2S 2p^3(^2D) ^3D 3d^4G_{5/2}$	13477270	13479828	13478933	13478941	13478947	13478868	13463388	13478250	13463333
129	$2s^2S 2p^3(^2P) ^3P 3p^2P_{1/2}$	13484178	13482873	13483034	13483155	13483217	13482657	13463015	13482526	13463536
130	$2s^2S 2p^3(^2P) ^3P 3p^4P_{3/2}$	13487606	13485696	13485750	13485878	13485942	13485160	13465754	13484834	13466068
131	$2s^2S 2p^3(^2P) ^3P 3p^4P_{5/2}$	13489613	13487537	13487642	13487752	13487811	13487086	13467384	13486828	13467787
132	$2s^2S 2p^3(^2D) ^3D 3d^4F_{5/2}^o$	13496404	13499711	13499296	13499395	13499442	13499413	13481892	13498865	13481893
133	$2s^2S 2p^3(^2D) ^3D 3d^4G_{7/2}^o$	13498508	13501123	13500234	13500247	13500254	13500212	13483311	13499611	13483268
134	$2s^2S 2p^3(^2P) ^3P 3p^2D_{3/2}$	13507499	13506097	13506151	13506218	13506255	13505729	13487127	13505500	13487543
135	$2s^2S 2p^3(^2P) ^3P 3p^4D_{7/2}$	13514820	13513276	13513506	13513637	13513708	13513155	13489500	13513053	13490050
136	$2s^2S 2p^3(^2D) ^3D 3d^4D_{1/2}^o$	13508226	13510950	13510560	13510595	13510616	13510490	13496025	13509919	13496015
137	$2s^2S 2p^3(^2D) ^3D 3d^4F_{7/2}^o$	13519830	13523365	13523059	13523173	13523227	13523236	13503421	13522753	13503488
138	$2s^2S 2p^3(^2D) ^3D 3d^4G_{9/2}^o$	13530247	13533212	13532473	13532523	13532547	13532609	13513069	13532064	13513079
139	$2s^2S 2p^3(^2D) ^3D 3d^4D_{3/2}^o$	13527455	13530850	13530698	13530786	13530827	13530753	13514397	13530254	13514458
140	$2s^2S 2p^3(^2D) ^3D 3d^2S_{1/2}^o$	13541922	13544922	13544760	13544832	13544869	13544837	13529450	13544323	13529485
141	$2s^2S 2p^3(^2D) ^3D 3d^4P_{5/2}^o$	13549041	13552351	13552070	13552149	13552185	13552001	13534823	13551543	13534914
142	$2s^2S 2p^3(^2P) ^3P 3p^2D_{5/2}$	13568615	13565964	13565954	13566023	13566059	13565444	13543353	13565060	13543608
143	$2s^2S 2p^3(^2D) ^3D 3d^2G_{7/2}^o$	13575096	13577668	13576831	13576821	13576821	13576819	13557660	13575973	13557370
144	$2s^2S 2p^3(^2P) ^3P 3p^2P_{3/2}$	13583108	13580993	13580888	13580946	13580974	13580475	13558669	13580049	13558844
145	$2s^2S 2p^3(^2D) ^3D 3d^4S_{3/2}^o$	13575197	13577337	13576758	13576755	13576759	13576564	13561130	13575828	13560931
146	$2s^2S 2p^3(^4S) ^3S 3p^4P_{3/2}$	13588736	13584138	13584047	13584148	13584203	13582698	13565264	13582143	13565388
147	$2s^2S 2p^3(^2P) ^3P 3p^2S_{1/2}$	13592907	13589255	13589124	13589194	13589231	13588034	13569169	13587579	13569325
148	$2s^2S 2p^3(^2D) ^3D 3d^4F_{9/2}^o$	13593067	13596606	13596386	13596505	13596564	13596630	13569321	13596103	13569354
149	$2s^2S 2p^3(^2D) ^3S 3p^4P_{1/2}$	13596002	13592330	13592193	13592285	13592334	13591296	13574069	13590802	13574215
150	$2s^2S 2p^3(^2D) ^3D 3d^4G_{11/2}^o$	13610748	13613585	13612778	13612828	13612857	13612927	13584461	13612266	13584355
151	$2s^2S 2p^3(^2D) ^3D 3d^2F_{5/2}^o$	13618320	13621030	13620361	13620390	13620408	13620315	13601741	13619577	13601558
152	$2s^2S 2p^3(^2D) ^3D 3d^4D_{7/2}^o$	13629497	13632696	13632262	13632367	13632421	13632392	13606864	13631783	13606815
153	$2s^2S 2p^3(^4S) ^3S 3p^4P_{5/2}$	13637951	13632863	13632913	13633008	13633060	13631327	13612732	13631041	13613098
154	$2s^2S 2p^3(^2P) ^1P 3s^2P_{3/2}^o$	13636125	13638469	13638289	13638201	13638175	13637390	13615805	13636561	13615411
155	$2s^2S 2p^3(^2D) ^3D 3d^4P_{1/2}^o$	13632628	13635245	13634820	13634856	13634879	13634806	13616174	13634076	13615992
156	$2s^2S 2p^3(^2D) ^3D 3d^2G_{9/2}^o$	13643892	13646396	13645498	13645498	13645507	13645564	13617845	13644672	13617508
157	$2s^2S 2p^3(^2P) ^1P 3s^2S_{1/2}$	13640566	13643481	13643232	13643140	13643111	13642096	13620350	13641276	13619974
158	$2s^2S 2p^3(^2D) ^3D 3d^4D_{5/2}^o$	13648565	13652063	13651841	13651953	13652008	13651915	13626601	13651378	13626633
159	$2s^2S 2p^3(^2D) ^3D 3d^2P_{3/2}^o$	13648358	13650989	13650515	13650547	13650568	13650435	13631147	13649602	13630871
160	$2s^2S 2p^3(^2D) ^3D 3d^4P_{3/2}^o$	13671094	13674194	13674033	13674120	13674168	13674049	13649248	13673400	13649154
161	$2s^2S 2p^3(^2D) ^3D 3d^2P_{1/2}^o$	13683143	13686222	13685933	13685990	13686026	13685857	13661195	13685042	13660914
162	$2s^2S 2p^3(^4S) ^3S 3p^2P_{3/2}$	13687867	13682558	13682599	13682688	13682736	13681093	13661752	13680714	13662028
163	$2s^2S 2p^3(^4S) ^3S 3p^2P_{1/2}$	13688976	13683522	13683168	13683216	13683241	13681677	13663686	13680966	13663606
164	$2s^2S 2p^3(^2D) ^3D 3d^2D_{3/2}^o$	13723684	13726025	13725508	13725537	13725562	13725454	13700659	13724578	13700330
165	$2s^2S 2p^3(^2D) ^3D 3d^2F_{7/2}^o$	13737960	13740082	13739108	13739085	13739081	13739057	13713198	13738024	13712714
166	$2s^2S 2p^3(^2D) ^1D 3p^2F_{5/2}$	13744776	13740478	13740442	13740501	13740538	13739635	13715860	13739111	13715976
167	$2s^2S 2p^3(^2D) ^3D 3d^2D_{5/2}^o$	13742130	13744115	13743283	13743281	13743292	13743203	13718687	13742248	13718269
168	$2s^2S 2p^3(^2D) ^1D 3p^2D_{3/2}$	13768333	13762373	13762015	13762063	13762089	13760849	13740478	13760083	13740322
169	$2s^2S 2p^3(^2P) ^3P 3d^4F_{3/2}^o$	13756914	13759131	13758185	13758137	13758110	13758300	13740968	13757855	13741075
170	$2s^2S 2p^3(^2D) ^1D 3p^2F_{7/2}$	13775082	13770054	13770129	13770210	13770257	13769204	13744509	13768923	13744874
171	$2s^2S 2p^3(^2P) ^3P 3d^4F_{5/2}^o$	13771044	13773419	13772549	13772522	13772505	13772673	13753070	13772227	13753170
172	$2s^2S 2p^3(^2P) ^3P 3d^4F_{7/2}^o$	13788968	13791458	13790514	13790492	13790481	13790485	13768733	13789973	13768769
173	$2s^2S 2p^3(^2D) ^1D 3p^2D_{5/2}$	13810827	13805442	13805094	13805126	13805139	13804178	13780671	13803551	13780679
174	$2s^2S 2p^3(^2D) ^1D 3p^2P_{3/2}$	13811669	13806168	13806000	13806045	13806066	13804869	13782167	13804386	13782314
175	$2s^2S 2p^3(^2P) ^3P 3d^4D_{1/2}^o$	13802539	13804986	13804214	13804234	13804247	13803872	13784474	13803272	13784442

Table 3. (continued)

Key	State	MCDHF/RCI						MBPT		NIST
		AS ₁	AS ₂	AS ₃	AS ₄	AS ₅	RCI1	RCI2	MBPT1	
176	$2s^2S 2p^3(^1P) 3P 3d^4P_{5/2}^{\circ}$	13807656	13809870	13809113	13809092	13809085	13809075	13788819	13808529	13788832
177	$2s^2S 2p^3(^1P) 3P 3d^4D_{3/2}^{\circ}$	13818276	13820697	13820008	13820022	13820033	13819868	13799584	13819260	13799534
178	$2s^2S 2p^3(^1P) 3P 3d^4F_{9/2}^{\circ}$	13837169	13839532	13838537	13838511	13838502	13838504	13812856	13837885	13812783
179	$2s^2S 2p^3(^1P) 3P 3d^2D_{3/2}^{\circ}$	13833844	13835666	13834716	13834675	13834664	13834407	13813815	13833726	13813677
180	$2s^2S 2p^3(^1P) 3P 3d^2F_{5/2}^{\circ}$	13844349	13846106	13845011	13844934	13844904	13844736	13823936	13844042	13823790
181	$2s^2S 2p^3(^3D) 1D 3p^2P_{1/2}$	13853695	13848299	13848078	13848114	13848131	13846986	13824188	13846438	13824273
182	$2s^2S 2p^3(^1P) 3P 3d^4D_{7/2}^{\circ}$	13851462	13853190	13852082	13852019	13852000	13851702	13827518	13850977	13827344
183	$2s^2S 2p^3(^1P) 3P 3d^4P_{3/2}^{\circ}$	13868626	13871876	13871650	13871714	13871747	13871669	13847435	13871209	13847541
184	$2s^2S 2p^3(^1P) 3P 3d^4F_{3/2}^{\circ}$	13873187	13875719	13875216	13875235	13875250	13875156	13851274	13874517	13851193
185	$2s^2S 2p^3(^1P) 3P 3d^4D_{5/2}^{\circ}$	13877216	13879041	13878054	13877985	13877959	13877904	13855637	13877180	13855449
186	$2s^2S 2p^3(^1P) 3P 3d^2F_{7/2}^{\circ}$	13899074	13900152	13898648	13898551	13898516	13898127	13874030	13897244	13873682
187	$2s^2S 2p^3(^3D) 1D 3d^2P_{1/2}^{\circ}$	13922786	13924575	13923610	13923566	13923552	13923135	13900526	13922430	13900356
188	$2s^2S 2p^3(^1P) 3P 3d^2D_{5/2}^{\circ}$	13939790	13940473	13938884	13938762	13938716	13938473	13914499	13937495	13914047
189	$2s^2S 2p^3(^3S) 3S 3d^4D_{5/2}^{\circ}$	13951956	13952870	13951027	13950911	13950871	13949469	13929461	13948666	13929227
190	$2s^2S 2p^3(^1P) 1P 3p^2P_{1/2}$	13961360	13954827	13954351	13954351	13954354	13953032	13932060	13952315	13931962
191	$2s^2S 2p^3(^3S) 3S 3d^4D_{3/2}^{\circ}$	13955702	13956672	13954872	13954744	13954697	13953557	13933224	13952747	13932956
192	$2s^2S 2p^3(^3S) 1P 3p^2D_{3/2}$	13968253	13961646	13961335	13961355	13961371	13959921	13937472	13959187	13937374
193	$2s^2S 2p^3(^3S) 3S 3d^4D_{7/2}^{\circ}$	13967067	13967782	13965968	13965843	13965800	13964545	13943805	13963762	13943566
194	$2s^2S 2p^3(^1P) 1P 3p^2D_{5/2}$	13983961	13978216	13978043	13978066	13978083	13976769	13953272	13976360	13953515
195	$2s^2S 2p^3(^1P) 3P 3d^2P_{3/2}^{\circ}$	13977091	13977672	13976302	13976176	13976129	13975752	13954901	13974848	13954530
196	$2s^2S 2p^3(^3S) 3S 3d^4D_{1/2}^{\circ}$	13977366	13978248	13976442	13976309	13976261	13975053	13955795	13974284	13955578
197	$2s^2S 2p^3(^1P) 1P 3p^2P_{3/2}$	14002838	13996826	13996525	13996523	13996525	13995204	13972017	13994742	13972194
198	$2s^2S 2p^3(^3S) 3S 3d^2D_{3/2}$	14011649	14011993	14009943	14009783	14009723	14008476	13988601	14007406	13988091
199	$2s^2S 2p^3(^3S) 3S 3d^2S_{1/2}$	14045647	14045854	14043836	14043683	14043626	14042420	14021231	14041455	14020813
200	$2s^2S 2p^3(^1P) 1P 3p^2S_{1/2}$	14092206	14084836	14084173	14084167	14084163	14082781	14059907	14081746	14059499
201	$2p^4(^3P) 3P 3s^4P_{5/2}$	14090050	14084489	14084545	14084689	14084752	14082456	14062857	14082179	14063587
202	$2s^2S 2p^3(^3D) 1D 3d^2G_{9/2}^{\circ}$	14093250	14093743	14092044	14091900	14091850	14091225	14064794	14090419	14064523
203	$2s^2S 2p^3(^3D) 1D 3d^2G_{5/2}^{\circ}$	14118141	14118822	14117263	14117102	14117047	14116600	14090514	14115724	14090181
204	$2s^2S 2p^3(^3D) 1D 3d^2F_{7/2}^{\circ}$	14133747	14134134	14132176	14132021	14131964	14131425	14104239	14130392	14103768
205	$2p^4(^3P) 3P 3s^2P_{3/2}$	14135218	14128138	14127741	14127831	14127863	14125421	14106503	14124735	14106803
206	$2s^2S 2p^3(^3D) 1D 3d^2P_{3/2}^{\circ}$	14133648	14134669	14133598	14133515	14133492	14132624	14107683	14131757	14107365
207	$2s^2S 2p^3(^3D) 1D 3d^2F_{5/2}^{\circ}$	14138989	14139059	14137377	14137225	14137176	14136443	14110601	14135328	14110125
208	$2s^2S 2p^3(^3D) 1D 3d^2D_{5/2}^{\circ}$	14139867	14140117	14138290	14138112	14138050	14137463	14112545	14136484	14112009
209	$2s^2S 2p^3(^3D) 1D 3d^2S_{1/2}^{\circ}$	14139773	14140365	14139529	14139466	14139458	14138565	14114336	14137939	14114263
210	$2s^2S 2p^3(^3D) 1D 3d^2D_{3/2}^{\circ}$	14181999	14182389	14180910	14180754	14180698	14180111	14154852	14179129	14154404
211	$2s^2S 2p^3(^1P) 3P 3d^2P_{1/2}^{\circ}$	14228975	14229456	14228328	14228245	14228224	14227594	14201734	14226673	14201359
212	$2p^4(^3P) 3P 3s^4P_{1/2}$	14255217	14248636	14248399	14248482	14248514	14246390	14229677	14246087	14230381
213	$2s^2S 2p^3(^1P) 1P 3d^2F_{7/2}^{\circ}$	14315523	14315318	14313299	14313069	14312982	14312097	14286722	14311165	14286323
214	$2s^2S 2p^3(^1P) 1P 3d^2D_{5/2}^{\circ}$	14323233	14323337	14321554	14321345	14321261	14320315	14295283	14319384	14294886
215	$2s^2S 2p^3(^1P) 1P 3d^2P_{1/2}^{\circ}$	14335180	14334663	14332475	14332209	14332105	14331227	14306802	14330170	14306290
216	$2s^2S 2p^3(^1P) 1P 3d^2P_{3/2}^{\circ}$	14329078	14331887	14331279	14331157	14331105	14329424	14306963	14328852	14306741
217	$2s^2S 2p^3(^1P) 1P 3d^2F_{5/2}^{\circ}$	14335536	14337331	14336329	14336207	14336154	14334590	14310786	14333871	14310594
218	$2p^4(^3P) 3P 3p^4P_{3/2}^{\circ}$	14338076	14338759	14337748	14337634	14337589	14335906	14315472	14335240	14315812
219	$2p^4(^3P) 3P 3s^4P_{3/2}$	14347650	14342591	14342591	14342755	14342824	14340602	14318132	14340295	14318869
220	$2p^4(^3P) 3P 3p^4P_{5/2}^{\circ}$	14358380	14359655	14358589	14358479	14358434	14356573	14334216	14355764	14334264
221	$2p^4(^3P) 3P 3s^2P_{1/2}$	14391448	14384678	14384212	14384315	14384350	14381970	14359909	14381217	14360158
222	$2s^2S 2p^3(^1P) 1P 3d^2D_{3/2}^{\circ}$	14412437	14411434	14408907	14408681	14408591	14407451	14380995	14406160	14380251
223	$2p^4(^3P) 3P 3p^2P_{1/2}^{\circ}$	14408798	14412366	14412733	14412715	14412710	14410302	14390236	14409951	14390698
224	$2p^4(^3P) 3P 3p^2D_{5/2}^{\circ}$	14410871	14414524	14414820	14414809	14414798	14412390	14391309	14411984	14391722
225	$2p^4(^3P) 3P 3p^4D_{7/2}^{\circ}$	14415752	14419518	14419756	14419769	14419764	14417341	14395775	14416970	14396231
226	$2p^4(^1D) 1D 3s^2D_{5/2}$	14450823	14443007	14442763	14442851	14442878	14440948	14414354	14440337	14414755
227	$2p^4(^1D) 1D 3s^2D_{3/2}$	14462295	14454200	14453819	14453897	14453918	14451908	14425654	14451185	14425937
228	$2p^4(^3P) 3P 3p^4D_{1/2}^{\circ}$	14506207	14509158	14509196	14509100	14509043	14506791	14490097	14506363	14490447
229	$2p^4(^3P) 3P 3p^4S_{3/2}^{\circ}$	14522363	14524097	14523927	14523758	14523681	14521306	14500777	14520369	14500650
230	$2p^4(^3P) 3P 3p^4D_{3/2}^{\circ}$	14575819	14579197	14579342	14579293	14579258	14576999	14557805	14576645	14558273
231	$2p^4(^3P) 3P 3p^4P_{1/2}^{\circ}$	14579632	14583826	14584314	14584359	14584380	14581992	14559392	14581763	14560021
232	$2p^4(^3P) 3P 3p^2P_{3/2}^{\circ}$	14623198	14626405	14626655	14626617	14626601	14624341	14600824	14623839	14601162
233	$2p^4(^3P) 3P 3p^4D_{5/2}^{\circ}$	14663178	14667401	14667825	14667869	14667883	14665557	14641149	14665310	14641765
234	$2p^4(^1D) 1D 3p^2F_{5/2}^{\circ}$	14691872	14694711	14694826	14694750	14694713	14692700	14665543	14692017	14665677

Table 3. (continued)

Key	State	MCDHF/RCI						MBPT		NIST
		AS ₁	AS ₂	AS ₃	AS ₄	AS ₅	RCI1	RCI2	MBPT1	
235	$2p^4(\frac{3}{2}P)^3P3p^2S^{\circ}_{1/2}$	14689201	14692807	14693167	14693147	14693139	14690876	14665965	14690411	14666352
236	$2p^4(\frac{3}{2}P)^3P3p^2D^{\circ}_{3/2}$	14694409	14698057	14698343	14698311	14698285	14696037	14672027	14695532	14672372
237	$2p^4(\frac{3}{2}P)^3P3d^4D_{5/2}$	14706826	14701830	14701488	14701467	14701523	14699239	14677168	14699055	14677926
238	$2p^4(\frac{3}{2}P)^3P3d^4D_{7/2}$	14713606	14708606	14708240	14708178	14708236	14705949	14682649	14705730	14683367
239	$2p^4(\frac{3}{2}P)^3P3d^4F_{3/2}$	14710605	14705496	14705156	14705154	14705208	14702935	14682803	14702767	14683576
240	$2p^4(\frac{3}{2}P)^3P3d^2P_{1/2}$	14724387	14719147	14718785	14718783	14718837	14716574	14695925	14716390	14696682
241	$2p^4(\frac{3}{2}P)^3P3d^4F_{9/2}$	14739350	14733685	14733103	14732909	14732958	14730695	14707131	14730198	14707560
242	$2p^4(\frac{3}{2}P)^3P3d^2F_{7/2}$	14747190	14741366	14740649	14740425	14740452	14738200	14715256	14737523	14715509
243	$2p^4(\frac{1}{2}D)^1D3p^2F^{\circ}_{7/2}$	14760705	14763704	14763859	14763798	14763770	14761784	14732708	14761141	14732894
244	$2p^4(\frac{1}{2}D)^1D3p^2D^{\circ}_{3/2}$	14773525	14775968	14776098	14775982	14775931	14773935	14747076	14773161	14747119
245	$2p^4(\frac{3}{2}P)^3P3d^4P_{1/2}$	14789024	14782841	14782341	14782282	14782323	14780002	14758086	14779703	14758711
246	$2p^4(\frac{1}{2}D)^1D3p^2D^{\circ}_{5/2}$	14799333	14801695	14801718	14801567	14801494	14799573	14772012	14798698	14771950
247	$2p^4(\frac{3}{2}P)^3P3d^4P_{3/2}$	14821767	14814966	14814330	14814195	14814214	14811958	14790516	14811458	14790928
248	$2p^4(\frac{1}{2}D)^1D3p^2P^{\circ}_{3/2}$	14826219	14821737	14820497	14819986	14819809	14817438	14793515	14815375	14792158
249	$2p^4(\frac{1}{2}S)^1S3s^2S_{1/2}$	14834505	14826073	14825463	14825467	14825459	14823818	14798136	14823371	14798685
250	$2p^4(\frac{3}{2}P)^3P3d^2D_{5/2}$	14841629	14834531	14833687	14833429	14833432	14831104	14808338	14830358	14808512
251	$2p^4(\frac{3}{2}P)^3P3d^4F_{3/2}$	14896121	14889180	14888297	14888056	14888059	14885950	14866119	14885472	14866567
252	$2p^4(\frac{3}{2}P)^3P3d^4F_{5/2}$	14914538	14907914	14907152	14906931	14906951	14904861	14884094	14904479	14884640
253	$2p^4(\frac{1}{2}D)^1D3p^2P^{\circ}_{1/2}$	14917959	14915519	14914533	14914094	14913934	14911790	14886169	14910029	14885164
254	$2p^4(\frac{3}{2}P)^3P3d^4D_{1/2}$	14950572	14945938	14945671	14945689	14945751	14943612	14919296	14943504	14920156
255	$2p^4(\frac{3}{2}P)^3P3d^2D_{3/2}$	14983230	14978118	14977715	14977676	14977729	14975600	14950285	14975328	14950979
256	$2p^4(\frac{3}{2}P)^3P3d^4F_{7/2}$	14986871	14982033	14981567	14981426	14981486	14979329	14952897	14978975	14953497
257	$2p^4(\frac{3}{2}P)^3P3d^4P_{5/2}$	15020625	15015357	15014814	15014688	15014737	15012575	14986525	15012187	14987091
258	$2p^4(\frac{3}{2}P)^3P3d^2F_{5/2}$	15035714	15029212	15028421	15028174	15028191	15026052	14999931	15025354	15000180
259	$2p^4(\frac{3}{2}P)^3P3d^2P_{3/2}$	15038043	15032316	15031780	15031668	15031707	15029627	15002721	15029218	15003262
260	$2p^4(\frac{1}{2}D)^1D3d^2G_{7/2}$	15067550	15059933	15059122	15058875	15058880	15057030	15026543	15056086	15026538
261	$2p^4(\frac{1}{2}D)^1D3d^2G_{9/2}$	15080718	15073079	15072322	15072056	15072073	15070231	15039334	15069324	15039351
262	$2p^4(\frac{1}{2}D)^1D3d^2D_{5/2}$	15113262	15105481	15104741	15104581	15104595	15102749	15073631	15101968	15073768
263	$2p^4(\frac{1}{2}D)^1D3d^2S_{1/2}$	15122400	15114199	15113872	15113923	15113954	15111830	15082970	15111481	15083563
264	$2p^4(\frac{1}{2}D)^1D3d^2F_{7/2}$	15133767	15125704	15124796	15124542	15124546	15122695	15093148	15121751	15093123
265	$2p^4(\frac{1}{2}S)^1S3p^2P^{\circ}_{1/2}$	15141084	15139673	15138870	15138509	15138366	15136465	15109913	15135223	15109463
266	$2p^4(\frac{1}{2}D)^1D3d^2P_{3/2}$	15153891	15143940	15143006	15142779	15142734	15140701	15112714	15139612	15112556
267	$2p^4(\frac{1}{2}D)^1D3d^2F_{5/2}$	15160052	15149638	15148472	15148105	15148043	15145962	15116871	15144767	15116625
268	$2p^4(\frac{1}{2}S)^1S3p^2P^{\circ}_{3/2}$	15158051	15160235	15159986	15159780	15159675	15158047	15130808	15157485	15131044
269	$2p^4(\frac{1}{2}D)^1D3d^2D_{3/2}$	15214944	15204233	15202990	15202606	15202538	15200467	15171086	15199228	15170774
270	$2p^4(\frac{1}{2}D)^1D3d^2P_{1/2}$	15239062	15227951	15226819	15226487	15226412	15224314	15193816	15222986	15193416
271	$2p^4(\frac{1}{2}S)^1S3d^2D_{5/2}$	15490789	15481898	15480699	15480327	15480295	15478793	15449823	15478282	15450207
272	$2p^4(\frac{1}{2}S)^1S3d^2D_{3/2}$	15522052	15511474	15510061	15509605	15509525	15507873	15477829	15507046	15477931

Table 4. The total energies E_h (a.u.), hyperfine magnetic dipole constants $A_J(I/\mu_I)$ (MHz per unit of μ_N), electric quadrupole constants B_J/Q (MHz/barn), and Landé g_J -factors from the present MCDHF/RCI calculations.

Key	State	E (a.u.)	A (MHz)	B (MHz)	g_J
1	$2s^2 2p^3 ({}^4S) {}^4S^{\circ}_{3/2}$	-1548.763283	3.066E+04	4.573E+04	1.680406E+00
2	$2s^2 2p^3 ({}^2D) {}^2D^{\circ}_{3/2}$	-1547.697743	2.480E+04	6.897E+04	1.204494E+00
3	$2s^2 2p^3 ({}^2D) {}^2D^{\circ}_{5/2}$	-1547.333653	1.037E+05	-5.956E+02	1.194149E+00
4	$2s^2 2p^3 ({}^2P) {}^2P^{\circ}_{1/2}$	-1546.819074	3.006E+05	0.000E+00	6.583320E-01
5	$2s^2 2p^3 ({}^2P) {}^2P^{\circ}_{3/2}$	-1545.892421	5.860E+04	-1.157E+05	1.233373E+00
6	$2s^2 S 2p^4 ({}^3P) {}^4P_{5/2}$	-1543.838256	2.368E+05	8.035E+04	1.563662E+00
7	$2s^2 S 2p^4 ({}^3P) {}^4P_{3/2}$	-1543.075749	1.274E+05	-7.865E+04	1.647208E+00
8	$2s^2 S 2p^4 ({}^3P) {}^4P_{1/2}$	-1542.968381	6.258E+05	0.000E+00	2.535795E+00
9	$2s^2 S 2p^4 ({}^1D) {}^2D_{3/2}$	-1541.909727	-1.771E+04	-1.046E+05	9.631864E-01
10	$2s^2 S 2p^4 ({}^1D) {}^2D_{5/2}$	-1541.613928	2.895E+05	-1.812E+05	1.225216E+00
11	$2s^2 S 2p^4 ({}^1S) {}^2S_{1/2}$	-1540.941534	3.238E+05	0.000E+00	1.580990E+00
12	$2s^2 S 2p^4 ({}^3P) {}^2P_{3/2}$	-1540.617699	1.705E+04	6.169E+04	1.240326E+00
13	$2s^2 S 2p^4 ({}^3P) {}^2P_{1/2}$	-1539.474664	6.747E+05	0.000E+00	1.201557E+00
14	$2p^5 {}^2P^{\circ}_{3/2}$	-1536.263039	4.948E+04	-9.871E+04	1.328173E+00
15	$2p^5 {}^2P^{\circ}_{1/2}$	-1535.016587	3.018E+05	0.000E+00	6.583762E-01
16	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^4P_{1/2}$	-1495.851855	2.496E+05	0.000E+00	2.169013E+00
17	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^4P_{3/2}$	-1494.906415	7.284E+04	6.894E+04	1.693879E+00
18	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^2P_{1/2}$	-1494.749515	-8.320E+04	0.000E+00	1.175562E+00
19	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D^{\circ}_{1/2}$	-1494.643991	8.161E+04	0.000E+00	6.845401E-01
20	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^4P_{5/2}$	-1494.592296	1.388E+05	1.699E+04	1.435881E+00
21	$2s^2 2p^2 ({}^3P) {}^3P 3s {}^2P_{3/2}$	-1494.455413	9.299E+04	1.835E+04	1.077789E+00
22	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4P^{\circ}_{3/2}$	-1494.165829	1.562E+04	2.414E+04	1.344039E+00
23	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2S^{\circ}_{1/2}$	-1493.709518	-3.388E+04	0.000E+00	1.563996E+00
24	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D^{\circ}_{3/2}$	-1493.564978	7.217E+04	-4.969E+03	1.179118E+00
25	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D^{\circ}_{5/2}$	-1493.361003	8.509E+04	2.204E+04	1.231175E+00
26	$2s^2 2p^2 ({}^1D) {}^1D 3s {}^2D_{5/2}$	-1493.334505	1.059E+05	8.507E+04	1.354595E+00
27	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4P^{\circ}_{5/2}$	-1493.289575	2.011E+04	9.773E+04	1.407869E+00
28	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4P^{\circ}_{1/2}$	-1493.232727	-7.206E+04	0.000E+00	1.986023E+00
29	$2s^2 2p^2 ({}^1D) {}^1D 3s {}^2D_{3/2}$	-1493.232088	2.283E+04	3.554E+04	1.078291E+00
30	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2D^{\circ}_{3/2}$	-1493.129677	7.243E+04	-5.130E+04	1.237493E+00
31	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4D^{\circ}_{7/2}$	-1492.993426	6.802E+04	3.813E+04	1.317178E+00
32	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^4S^{\circ}_{3/2}$	-1492.950063	8.241E+04	3.091E+04	1.678802E+00
33	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{3/2}$	-1492.822818	1.174E+04	1.382E+03	7.390717E-01
34	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2P^{\circ}_{3/2}$	-1492.799418	3.284E+04	4.097E+04	1.218049E+00
35	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2F^{\circ}_{5/2}$	-1492.66923	8.648E+04	1.620E+04	1.183998E+00
36	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^2F_{5/2}$	-1492.595933	2.522E+03	-1.285E+02	1.192974E+00
37	$2s^2 2p^2 ({}^1S) {}^1S 3s {}^2S_{1/2}$	-1492.533721	2.622E+05	0.000E+00	1.980566E+00
38	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2P^{\circ}_{1/2}$	-1492.445069	2.605E+05	0.000E+00	7.967913E-01
39	$2s^2 S 2p^3 ({}^4S) {}^3S 3s {}^6S^{\circ}_{5/2}$	-1492.053676	2.481E+05	1.394E+04	1.919737E+00
40	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2D^{\circ}_{3/2}$	-1491.893952	7.378E+04	5.528E+04	1.298419E+00
41	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^2P_{3/2}$	-1491.849317	1.782E+04	-4.968E+04	9.710946E-01
42	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{5/2}$	-1491.802012	4.881E+04	-3.240E+04	1.009153E+00
43	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{1/2}$	-1491.790051	6.833E+04	0.000E+00	1.964495E-01
44	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2D^{\circ}_{5/2}$	-1491.786547	5.231E+04	2.857E+04	1.259036E+00
45	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{7/2}$	-1491.786661	-6.469E+02	6.792E+04	1.284494E+00
46	$2s^2 2p^2 ({}^3P) {}^3P 3p {}^2D^{\circ}_{5/2}$	-1491.752715	6.938E+04	4.301E+04	1.145845E+00
47	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2F^{\circ}_{7/2}$	-1491.726802	4.714E+04	1.205E+05	1.246570E+00
48	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2P^{\circ}_{1/2}$	-1491.692748	1.430E+05	0.000E+00	9.307773E-01
49	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{7/2}$	-1491.578238	5.728E+04	2.982E+04	1.185808E+00
50	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{3/2}$	-1491.571417	-2.600E+04	-2.576E+04	1.239551E+00
51	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4P_{5/2}$	-1491.570439	2.396E+04	-4.627E+04	1.191951E+00
52	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4F_{9/2}$	-1491.482648	4.879E+04	1.062E+04	1.250394E+00
53	$2s^2 S 2p^3 ({}^4S) {}^3S 3s {}^4S^{\circ}_{3/2}$	-1491.43768	2.253E+05	9.731E+03	1.799211E+00
54	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4D_{5/2}$	-1491.323498	4.279E+04	8.023E+03	1.318239E+00
55	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4P_{3/2}$	-1491.256619	4.609E+04	6.652E+03	1.462784E+00
56	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^4P_{1/2}$	-1491.202143	1.176E+05	0.000E+00	2.248434E+00
57	$2s^2 2p^2 ({}^1D) {}^1D 3p {}^2P^{\circ}_{3/2}$	-1491.098207	5.847E+04	5.775E+04	1.326180E+00
58	$2s^2 2p^2 ({}^1D) {}^1D 3d {}^2G^{\circ}_{7/2}$	-1491.067692	5.864E+04	2.521E+04	1.086251E+00
59	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^2P_{1/2}$	-1491.067342	-8.667E+04	0.000E+00	7.195222E-01
60	$2s^2 2p^2 ({}^3P) {}^3P 3d {}^2D_{5/2}$	-1491.059268	7.121E+03	6.777E+04	1.109120E+00
61	$2s^2 2p^2 ({}^1S) {}^1S 3p {}^2P^{\circ}_{1/2}$	-1491.050405	8.377E+04	0.000E+00	6.720419E-01

Table 4. (continued)

Key	State	$E(\text{a.u.})$	$A(\text{MHz})$	$B(\text{MHz})$	g_J
62	$2s^2 2p^2 ({}^3P) {}^3P 3d^2 D_{3/2}$	-1491.021389	7.710E+04	2.547E+04	8.650474E-01
63	$2s^2 2p^2 ({}^1S) {}^1S 3p^2 P_{3/2}^o$	-1490.809606	2.676E+04	-3.860E+04	1.298126E+00
64	$2s^2 2s 2p^3 ({}^4S) {}^5S 3p^6 P_{3/2}$	-1490.730818	2.783E+05	1.224E+04	2.255898E+00
65	$2s^2 2s 2p^3 ({}^4S) {}^5S 3p^6 P_{5/2}$	-1490.682049	2.085E+05	-3.728E+03	1.763824E+00
66	$2s^2 2s 2p^3 ({}^4S) {}^5S 3p^6 P_{7/2}$	-1490.426738	1.461E+05	3.810E+04	1.653918E+00
67	$2s^2 2s 2p^3 ({}^2D) {}^3D 3s^4 D_{1/2}^o$	-1490.397432	-2.593E+05	0.000E+00	3.672464E-01
68	$2s^2 2s 2p^3 ({}^2D) {}^3D 3s^4 D_{3/2}^o$	-1490.357065	1.008E+05	8.887E+04	1.345042E+00
69	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 F_{7/2}$	-1490.284594	3.271E+04	2.560E+04	1.207539E+00
70	$2s^2 2s 2p^3 ({}^2D) {}^3D 3s^4 D_{5/2}^o$	-1490.260331	2.237E+05	1.541E+05	1.450203E+00
71	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 G_{9/2}$	-1490.194987	3.298E+04	1.050E+05	1.187077E+00
72	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 D_{3/2}$	-1490.139245	1.320E+05	-3.243E+04	1.312890E+00
73	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 D_{5/2}$	-1490.116318	4.120E+04	-8.520E+03	1.198806E+00
74	$2s^2 2s 2p^3 ({}^4S) {}^5S 3p^4 P_{3/2}$	-1490.115571	1.596E+05	-2.881E+04	1.403257E+00
75	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 P_{1/2}$	-1490.10825	1.491E+04	0.000E+00	8.507395E-01
76	$2s^2 2s 2p^3 ({}^4S) {}^5S 3p^4 P_{5/2}$	-1490.05298	1.638E+05	2.535E+04	1.589407E+00
77	$2s^2 2s 2p^3 ({}^4S) {}^5S 3p^4 P_{1/2}$	-1489.992941	3.950E+05	0.000E+00	2.393913E+00
78	$2s^2 2p^2 ({}^3P) {}^3P 3d^2 F_{7/2}$	-1489.984783	4.112E+04	4.570E+04	1.075407E+00
79	$2s^2 2s 2p^3 ({}^2D) {}^3D 3s^2 D_{3/2}^o$	-1489.916801	8.413E+04	9.001E+04	1.051639E+00
80	$2s^2 2s 2p^3 ({}^2D) {}^3D 3s^4 D_{7/2}^o$	-1489.914606	2.503E+05	-3.777E+02	1.423209E+00
81	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 S_{1/2}$	-1489.828402	3.172E+04	0.000E+00	2.034820E+00
82	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 P_{3/2}$	-1489.743961	1.486E+04	-2.115E+04	1.284722E+00
83	$2s^2 2p^2 ({}^1D) {}^1D 3d^2 F_{5/2}$	-1489.699831	2.511E+04	4.927E+04	1.109342E+00
84	$2s^2 2s 2p^3 ({}^2D) {}^3D 3s^2 D_{5/2}^o$	-1489.574805	2.589E+05	-3.198E+04	1.241087E+00
85	$2s^2 2p^2 ({}^1S) {}^1S 3d^2 D_{5/2}$	-1489.254076	7.231E+03	-2.215E+04	1.173227E+00
86	$2s^2 2p^2 ({}^1S) {}^1S 3d^2 D_{3/2}$	-1489.227807	5.489E+03	4.164E+04	7.970485E-01
87	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 D_{1/2}$	-1489.21	-2.052E+05	0.000E+00	5.503258E-01
88	$2s^2 2s 2p^3 ({}^2P) {}^3P 3s^4 P_{1/2}$	-1489.203559	5.045E+05	0.000E+00	2.419389E+00
89	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 F_{3/2}$	-1489.126318	-5.290E+04	8.272E+04	7.427052E-01
90	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 D_{3/2}$	-1489.059739	2.411E+05	8.561E+04	1.398778E+00
91	$2s^2 2s 2p^3 ({}^2P) {}^3P 3s^4 P_{3/2}$	-1489.055746	2.281E+05	-8.118E+04	1.564975E+00
92	$2s^2 2s 2p^3 ({}^4S) {}^5S 3d^6 D_{1/2}^o$	-1489.047678	4.702E+05	0.000E+00	3.200466E+00
93	$2s^2 2s 2p^3 ({}^4S) {}^5S 3d^6 D_{3/2}^o$	-1489.045741	1.431E+05	2.076E+03	1.603032E+00
94	$2s^2 2s 2p^3 ({}^4S) {}^5S 3d^6 D_{5/2}^o$	-1489.0454	1.849E+05	-7.782E+03	1.794773E+00
95	$2s^2 2s 2p^3 ({}^4S) {}^5S 3d^6 D_{7/2}^o$	-1489.039128	1.274E+05	9.691E+03	1.541239E+00
96	$2s^2 2s 2p^3 ({}^4S) {}^5S 3d^6 D_{9/2}^o$	-1489.000944	1.133E+05	1.531E+04	1.521071E+00
97	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 F_{5/2}$	-1488.954383	1.459E+05	8.996E+04	1.172698E+00
98	$2s^2 2s 2p^3 ({}^2P) {}^3P 3s^4 P_{5/2}$	-1488.825655	1.356E+05	-1.073E+05	1.419833E+00
99	$2s^2 2s 2p^3 ({}^2P) {}^3P 3s^2 P_{1/2}^o$	-1488.819627	-7.863E+04	0.000E+00	7.635500E-01
100	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 D_{5/2}$	-1488.723173	9.023E+04	6.391E+04	1.288960E+00
101	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 F_{7/2}$	-1488.680249	1.631E+05	8.101E+04	1.288526E+00
102	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^2 D_{3/2}$	-1488.677795	1.143E+04	-3.923E+04	1.217904E+00
103	$2s^2 2s 2p^3 ({}^2P) {}^3P 3s^2 P_{3/2}$	-1488.662522	7.695E+04	-7.752E+04	1.083362E+00
104	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^2 F_{5/2}$	-1488.631131	6.142E+04	9.413E+04	1.097200E+00
105	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^2 P_{1/2}$	-1488.593191	-1.178E+05	0.000E+00	1.021076E+00
106	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 D_{7/2}$	-1488.570101	1.874E+05	7.131E+04	1.315340E+00
107	$2s^2 2s 2p^3 ({}^4S) {}^5S 3d^4 D_{3/2}^o$	-1488.460512	1.329E+05	-1.414E+03	1.338090E+00
108	$2s^2 2s 2p^3 ({}^4S) {}^5S 3d^4 D_{5/2}^o$	-1488.40777	3.453E+04	-7.657E+03	1.155472E+00
109	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 P_{1/2}$	-1488.383185	6.514E+05	0.000E+00	2.180301E+00
110	$2s^2 2s 2p^3 ({}^4S) {}^5S 3d^4 D_{7/2}^o$	-1488.33389	1.240E+05	2.378E+04	1.387220E+00
111	$2s^2 2s 2p^3 ({}^4S) {}^5S 3s^4 S_{3/2}^o$	-1488.321654	1.009E+05	4.300E+03	1.763853E+00
112	$2s^2 2s 2p^3 ({}^4S) {}^5S 3d^4 D_{1/2}^o$	-1488.302462	-2.929E+05	0.000E+00	8.828169E-02
113	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 F_{9/2}$	-1488.303697	1.723E+05	2.698E+04	1.328795E+00
114	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^2 F_{7/2}$	-1488.276517	2.036E+05	-1.853E+04	1.274087E+00
115	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 P_{3/2}$	-1488.253534	1.803E+05	2.179E+04	1.479116E+00
116	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^4 P_{5/2}$	-1488.170858	2.525E+05	4.841E+04	1.519201E+00
117	$2s^2 2s 2p^3 ({}^4S) {}^5S 3s^2 S_{1/2}^o$	-1488.133249	3.007E+04	0.000E+00	1.394131E+00
118	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^2 P_{3/2}$	-1488.110449	3.426E+05	-4.722E+04	1.203862E+00
119	$2s^2 2s 2p^3 ({}^2P) {}^3P 3p^4 D_{1/2}$	-1487.940188	-9.043E+04	0.000E+00	2.963829E-01
120	$2s^2 2s 2p^3 ({}^2D) {}^3D 3p^2 D_{5/2}$	-1487.830814	1.841E+05	5.459E+02	1.229881E+00
121	$2s^2 2s 2p^3 ({}^2P) {}^3P 3p^4 D_{3/2}$	-1487.774651	1.720E+05	-8.654E+04	1.057959E+00
122	$2s^2 2s 2p^3 ({}^2D) {}^3D 3s^2 D_{5/2}^o$	-1487.705125	2.064E+05	-2.795E+04	1.294958E+00
123	$2s^2 2s 2p^3 ({}^2P) {}^3P 3p^4 P_{1/2}$	-1487.611249	1.580E+04	0.000E+00	2.173721E+00
124	$2s^2 2s 2p^3 ({}^2P) {}^3P 3p^4 D_{5/2}$	-1487.600001	1.010E+05	-9.053E+04	1.209531E+00

Table 4. (continued)

Key	State	$E(\text{a.u.})$	$A(\text{MHz})$	$B(\text{MHz})$	g_J
125	$2s^2S 2p^3(^3D) ^1D 3s^2D_{3/2}^o$	-1487.569427	2.293E+05	-1.464E+04	1.017480E+00
126	$2s^2S 2p^3(^3D) ^3D 3d^4F_{3/2}^o$	-1487.507449	-8.736E+04	-6.928E+04	5.495938E-01
127	$2s^2S 2p^3(^3P) ^3P 3p^4S_{3/2}$	-1487.503312	1.216E+05	4.704E+04	1.606592E+00
128	$2s^2S 2p^3(^3D) ^3D 3d^4G_{5/2}^o$	-1487.41957	-5.630E+04	6.998E+04	7.650244E-01
129	$2s^2S 2p^3(^3P) ^3P 3p^4P_{1/2}$	-1487.42127	-1.156E+04	0.000E+00	5.702971E-01
130	$2s^2S 2p^3(^3P) ^3P 3p^4P_{3/2}$	-1487.408792	9.469E+04	-3.605E+04	1.491641E+00
131	$2s^2S 2p^3(^3P) ^3P 3p^4P_{5/2}$	-1487.401366	5.974E+04	-7.068E+04	1.347448E+00
132	$2s^2S 2p^3(^3D) ^3D 3d^4F_{5/2}^o$	-1487.335261	5.480E+04	-2.796E+04	1.046013E+00
133	$2s^2S 2p^3(^3D) ^3D 3d^4G_{7/2}^o$	-1487.328794	2.071E+04	9.302E+04	1.069772E+00
134	$2s^2S 2p^3(^3P) ^3P 3p^2D_{3/2}$	-1487.311408	5.645E+04	5.496E+04	1.166189E+00
135	$2s^2S 2p^3(^3P) ^3P 3p^4D_{7/2}$	-1487.300599	6.874E+04	-7.676E+04	1.308185E+00
136	$2s^2S 2p^3(^3D) ^3D 3d^4D_{1/2}^o$	-1487.270867	-1.793E+05	0.000E+00	2.392629E-01
137	$2s^2S 2p^3(^3D) ^3D 3d^4F_{7/2}^o$	-1487.237169	1.268E+05	3.953E+03	1.289806E+00
138	$2s^2S 2p^3(^3D) ^3D 3d^4G_{9/2}^o$	-1487.193207	1.003E+05	1.207E+05	1.227499E+00
139	$2s^2S 2p^3(^3D) ^3D 3d^4D_{3/2}^o$	-1487.18716	2.041E+05	-1.817E+04	1.287362E+00
140	$2s^2S 2p^3(^3D) ^3D 3d^2S_{1/2}^o$	-1487.11857	7.234E+05	0.000E+00	2.146350E+00
141	$2s^2S 2p^3(^3D) ^3D 3d^4P_{5/2}^o$	-1487.094092	1.112E+05	-7.121E+04	1.386543E+00
142	$2s^2S 2p^3(^3P) ^3P 3p^2D_{5/2}$	-1487.055226	1.148E+05	-7.436E+04	1.262805E+00
143	$2s^2S 2p^3(^3D) ^3D 3d^2G_{7/2}^o$	-1486.990038	4.732E+04	6.807E+04	1.025315E+00
144	$2s^2S 2p^3(^3P) ^3P 3p^2P_{3/2}$	-1486.985442	1.054E+05	-4.307E+04	1.111683E+00
145	$2s^2S 2p^3(^3D) ^3D 3d^4S_{3/2}^o$	-1486.974225	1.421E+05	2.825E+03	1.555732E+00
146	$2s^2S 2p^3(^4S) ^3S 3p^4P_{3/2}$	-1486.955391	4.022E+04	-1.617E+04	1.442181E+00
147	$2s^2S 2p^3(^3P) ^3P 3p^2S_{1/2}$	-1486.9376	-6.785E+03	0.000E+00	1.302716E+00
148	$2s^2S 2p^3(^3D) ^3D 3d^4F_{9/2}^o$	-1486.936906	1.556E+05	1.048E+04	1.316837E+00
149	$2s^2S 2p^3(^4S) ^3S 3p^4P_{1/2}$	-1486.915273	3.540E+05	0.000E+00	2.098252E+00
150	$2s^2S 2p^3(^3D) ^3D 3d^4G_{11/2}^o$	-1486.867922	1.396E+05	6.287E+03	1.268719E+00
151	$2s^2S 2p^3(^3D) ^3D 3d^2F_{5/2}^o$	-1486.789188	5.068E+04	1.732E+04	1.154156E+00
152	$2s^2S 2p^3(^3D) ^3D 3d^4D_{7/2}^o$	-1486.765847	1.619E+05	3.556E+04	1.347375E+00
153	$2s^2S 2p^3(^4S) ^3S 3p^4P_{5/2}$	-1486.739112	4.625E+04	2.369E+04	1.442938E+00
154	$2s^2S 2p^3(^3P) ^1P 3s^2P_{3/2}^o$	-1486.72511	1.301E+04	-1.965E+04	1.464421E+00
155	$2s^2S 2p^3(^3D) ^3D 3d^4P_{1/2}^o$	-1486.72343	-5.390E+04	0.000E+00	1.669324E+00
156	$2s^2S 2p^3(^3D) ^3D 3d^2G_{9/2}^o$	-1486.715813	1.664E+05	-2.423E+04	1.132688E+00
157	$2s^2S 2p^3(^3P) ^1P 3s^2P_{1/2}^o$	-1486.704401	-1.661E+05	0.000E+00	1.090591E+00
158	$2s^2S 2p^3(^3D) ^3D 3d^4D_{5/2}^o$	-1486.67592	2.248E+05	2.653E+04	1.430143E+00
159	$2s^2S 2p^3(^3D) ^3D 3d^2P_{3/2}^o$	-1486.655204	1.027E+05	-4.815E+04	1.319782E+00
160	$2s^2S 2p^3(^3D) ^3D 3d^4P_{3/2}^o$	-1486.572731	3.301E+05	2.667E+04	1.645849E+00
161	$2s^2S 2p^3(^3D) ^3D 3d^2P_{1/2}^o$	-1486.518295	4.759E+05	0.000E+00	1.169858E+00
162	$2s^2S 2p^3(^4S) ^3S 3p^2P_{3/2}$	-1486.515759	6.846E+04	2.940E+03	1.400097E+00
163	$2s^2S 2p^3(^4S) ^3S 3p^2P_{1/2}$	-1486.506948	1.740E+05	0.000E+00	1.497574E+00
164	$2s^2S 2p^3(^3D) ^3D 3d^2D_{3/2}^o$	-1486.338486	1.947E+05	-2.177E+04	1.198009E+00
165	$2s^2S 2p^3(^3D) ^3D 3d^2F_{7/2}^o$	-1486.281353	1.435E+05	4.842E+04	1.147149E+00
166	$2s^2S 2p^3(^3D) ^1D 3p^2F_{5/2}$	-1486.269224	1.860E+05	-2.830E+04	1.016270E+00
167	$2s^2S 2p^3(^3D) ^3D 3d^2D_{5/2}^o$	-1486.256343	1.482E+05	-4.882E+04	1.100905E+00
168	$2s^2S 2p^3(^3D) ^1D 3p^2D_{3/2}$	-1486.157054	1.290E+05	-6.106E+04	1.122494E+00
169	$2s^2S 2p^3(^3P) ^3P 3d^4F_{3/2}^o$	-1486.154822	-8.180E+04	3.187E+04	5.519793E-01
170	$2s^2S 2p^3(^3D) ^1D 3p^2F_{7/2}$	-1486.138692	1.216E+05	2.540E+03	1.213063E+00
171	$2s^2S 2p^3(^3P) ^3P 3d^4F_{5/2}^o$	-1486.099683	6.536E+04	-2.093E+04	1.101317E+00
172	$2s^2S 2p^3(^3P) ^3P 3d^4F_{7/2}^o$	-1486.028319	6.601E+04	-6.691E+04	1.203048E+00
173	$2s^2S 2p^3(^3D) ^1D 3p^2D_{5/2}$	-1485.973923	1.759E+05	-4.649E+04	1.277866E+00
174	$2s^2S 2p^3(^3D) ^1D 3p^2P_{3/2}$	-1485.967109	1.730E+05	3.388E+04	1.121125E+00
175	$2s^2S 2p^3(^3P) ^3P 3d^4D_{1/2}^o$	-1485.956596	-3.112E+04	0.000E+00	5.377256E-01
176	$2s^2S 2p^3(^3P) ^3P 3d^4P_{5/2}^o$	-1485.936799	8.840E+04	4.775E+04	1.311655E+00
177	$2s^2S 2p^3(^3P) ^3P 3d^4D_{3/2}^o$	-1485.887751	2.195E+04	2.124E+04	1.354083E+00
178	$2s^2S 2p^3(^3P) ^3P 3d^4F_{9/2}^o$	-1485.82728	5.037E+04	-7.965E+04	1.236001E+00
179	$2s^2S 2p^3(^3P) ^3P 3d^2D_{3/2}^o$	-1485.822909	1.423E+04	1.906E+04	7.580206E-01
180	$2s^2S 2p^3(^3P) ^3P 3d^2F_{5/2}^o$	-1485.776793	1.809E+04	9.829E+03	1.151386E+00
181	$2s^2S 2p^3(^3D) ^1D 3p^2P_{1/2}$	-1485.775648	1.905E+04	0.000E+00	1.019946E+00
182	$2s^2S 2p^3(^3P) ^3P 3d^4D_{7/2}^o$	-1485.760473	3.268E+04	-7.123E+04	1.228989E+00
183	$2s^2S 2p^3(^3P) ^3P 3d^4P_{3/2}^o$	-1485.669725	2.323E+05	0.000E+00	2.083374E+00
184	$2s^2S 2p^3(^3P) ^3P 3d^4F_{3/2}^o$	-1485.652233	7.228E+04	2.302E+04	1.403311E+00
185	$2s^2S 2p^3(^3P) ^3P 3d^4D_{5/2}^o$	-1485.632354	3.985E+04	4.799E+04	1.119282E+00

Table 4. (continued)

Key	State	$E(\text{a.u.})$	$A(\text{MHz})$	$B(\text{MHz})$	g_J
186	$2s^2S 2p^3({}^2P) {}^3P 3d^2F_{7/2}^{\circ}$	-1485.548549	6.127E+04	-5.470E+04	1.110779E+00
187	$2s^2S 2p^3({}^2D) {}^1D 3d^2P_{1/2}^{\circ}$	-1485.427824	-1.248E+05	0.000E+00	6.711802E-01
188	$2s^2S 2p^3({}^2P) {}^3P 3d^2D_{5/2}^{\circ}$	-1485.364159	7.534E+04	-2.259E+04	1.062756E+00
189	$2s^2S 2p^3({}^4S) {}^3S 3d^4D_{5/2}^{\circ}$	-1485.295988	-1.104E+04	4.082E+03	1.238331E+00
190	$2s^2S 2p^3({}^2P) {}^1P 3p^2P_{1/2}$	-1485.284145	1.606E+03	0.000E+00	1.502919E+00
191	$2s^2S 2p^3({}^4S) {}^3S 3d^4D_{3/2}^{\circ}$	-1485.278843	-1.356E+04	-1.773E+03	1.072718E+00
192	$2s^2S 2p^3({}^2P) {}^1P 3p^2D_{3/2}$	-1485.259487	-4.719E+04	-8.507E+03	1.155768E+00
193	$2s^2S 2p^3({}^4S) {}^3S 3d^4D_{7/2}^{\circ}$	-1485.230631	2.950E+04	-7.144E+03	1.305291E+00
194	$2s^2S 2p^3({}^2P) {}^1P 3p^2D_{5/2}$	-1485.187495	-3.432E+03	3.976E+04	1.285573E+00
195	$2s^2S 2p^3({}^2P) {}^3P 3d^2P_{3/2}^{\circ}$	-1485.180072	4.353E+04	2.919E+04	1.089009E+00
196	$2s^2S 2p^3({}^4S) {}^3S 3d^4D_{1/2}^{\circ}$	-1485.175998	-5.290E+04	0.000E+00	2.547818E-01
197	$2s^2S 2p^3({}^2P) {}^1P 3p^2P_{3/2}$	-1485.102085	-3.934E+04	-9.352E+03	1.239352E+00
198	$2s^2S 2p^3({}^4S) {}^3S 3d^2D_{3/2}^{\circ}$	-1485.026524	8.555E+04	1.081E+04	1.079693E+00
199	$2s^2S 2p^3({}^4S) {}^3S 3d^2D_{5/2}^{\circ}$	-1484.877852	2.898E+04	-2.116E+03	1.180708E+00
200	$2s^2S 2p^3({}^2P) {}^1P 3p^2S_{1/2}$	-1484.70163	4.312E+05	0.000E+00	1.274307E+00
201	$2p^4({}^3P) {}^3P 3s^4P_{5/2}$	-1484.68819	7.989E+04	5.314E+04	1.525527E+00
202	$2s^2S 2p^3({}^2D) {}^1D 3d^2G_{9/2}^{\circ}$	-1484.679365	8.597E+04	-1.287E+04	1.159594E+00
203	$2s^2S 2p^3({}^2D) {}^1D 3d^2G_{7/2}^{\circ}$	-1484.562176	9.963E+04	7.471E+02	1.090318E+00
204	$2s^2S 2p^3({}^2D) {}^1D 3d^2F_{7/2}^{\circ}$	-1484.499641	1.379E+05	-7.124E+04	1.114158E+00
205	$2p^4({}^3P) {}^3P 3s^2P_{3/2}$	-1484.489323	7.112E+03	1.271E+04	1.304638E+00
206	$2s^2S 2p^3({}^2D) {}^1D 3d^2P_{3/2}^{\circ}$	-1484.483948	1.256E+05	-1.701E+04	1.262969E+00
207	$2s^2S 2p^3({}^2D) {}^1D 3d^2F_{5/2}^{\circ}$	-1484.470651	1.164E+05	-7.751E+04	1.062501E+00
208	$2s^2S 2p^3({}^2D) {}^1D 3d^2D_{5/2}^{\circ}$	-1484.461796	9.379E+04	6.468E+04	1.082984E+00
209	$2s^2S 2p^3({}^2D) {}^1D 3d^2S_{1/2}^{\circ}$	-1484.453633	3.012E+05	0.000E+00	1.597941E+00
210	$2s^2S 2p^3({}^2D) {}^1D 3d^2D_{3/2}^{\circ}$	-1484.269029	-4.228E+04	2.621E+04	1.023144E+00
211	$2s^2S 2p^3({}^2P) {}^3P 3d^2P_{1/2}^{\circ}$	-1484.055418	-2.411E+05	0.000E+00	1.043125E+00
212	$2p^4({}^3P) {}^3P 3s^4P_{1/2}$	-1483.9281	1.949E+05	0.000E+00	2.315203E+00
213	$2s^2S 2p^3({}^2P) {}^1P 3d^2F_{7/2}^{\circ}$	-1483.668187	-1.152E+04	4.152E+04	1.201983E+00
214	$2s^2S 2p^3({}^2P) {}^1P 3d^2D_{5/2}^{\circ}$	-1483.629179	-2.833E+04	-2.761E+03	1.137362E+00
215	$2s^2S 2p^3({}^2P) {}^1P 3d^2P_{1/2}$	-1483.576693	-5.007E+04	0.000E+00	5.378322E-01
216	$2s^2S 2p^3({}^2P) {}^1P 3d^2P_{3/2}^{\circ}$	-1483.575961	-1.161E+03	-2.530E+03	1.225632E+00
217	$2s^2S 2p^3({}^2P) {}^1P 3d^2F_{5/2}^{\circ}$	-1483.558543	-1.648E+03	2.227E+04	1.155849E+00
218	$2p^4({}^3P) {}^3P 3p^4P_{3/2}$	-1483.537193	3.194E+04	2.421E+04	1.506461E+00
219	$2p^4({}^3P) {}^3P 3s^4P_{3/2}$	-1483.525071	6.520E+04	-4.478E+04	1.624786E+00
220	$2p^4({}^3P) {}^3P 3p^4P_{5/2}$	-1483.451786	2.035E+04	2.902E+04	1.272919E+00
221	$2p^4({}^3P) {}^3P 3s^2P_{1/2}$	-1483.334723	-4.733E+04	0.000E+00	1.057949E+00
222	$2s^2S 2p^3({}^2P) {}^1P 3d^2D_{3/2}^{\circ}$	-1483.238645	1.083E+05	1.430E+04	9.393002E-01
223	$2p^4({}^3P) {}^3P 3p^2P_{1/2}$	-1483.196539	7.226E+04	0.000E+00	1.388068E+00
224	$2p^4({}^3P) {}^3P 3p^2D_{5/2}^{\circ}$	-1483.191654	3.484E+04	1.634E+04	1.294565E+00
225	$2p^4({}^3P) {}^3P 3p^4D_{7/2}^{\circ}$	-1483.171302	3.037E+04	7.260E+04	1.370858E+00
226	$2p^4({}^1D) {}^1D 3s^2D_{5/2}$	-1483.08665	1.416E+05	-1.556E+05	1.258996E+00
227	$2p^4({}^1D) {}^1D 3s^2D_{3/2}$	-1483.035166	9.848E+04	-8.708E+04	9.206557E-01
228	$2p^4({}^3P) {}^3P 3p^4D_{1/2}^{\circ}$	-1482.741543	9.001E+04	0.000E+00	5.839406E-01
229	$2p^4({}^3P) {}^3P 3p^4S_{3/2}^{\circ}$	-1482.692879	4.028E+04	-1.187E+04	1.348253E+00
230	$2p^4({}^3P) {}^3P 3p^4D_{3/2}^{\circ}$	-1482.433042	1.701E+04	2.213E+04	1.308096E+00
231	$2p^4({}^3P) {}^3P 3p^4P_{1/2}^{\circ}$	-1482.425811	-4.620E+04	0.000E+00	2.041384E+00
232	$2p^4({}^3P) {}^3P 3p^2P_{3/2}^{\circ}$	-1482.237032	6.823E+04	-3.473E+04	1.331316E+00
233	$2p^4({}^3P) {}^3P 3p^4D_{5/2}^{\circ}$	-1482.053299	-3.488E+02	-1.791E+04	1.384077E+00
234	$2p^4({}^1D) {}^1D 3p^2F_{5/2}^{\circ}$	-1481.942151	1.094E+05	-1.420E+05	9.765117E-01
235	$2p^4({}^3P) {}^3P 3p^2S_{1/2}^{\circ}$	-1481.94023	-6.142E+04	0.000E+00	1.275015E+00
236	$2p^4({}^3P) {}^3P 3p^2D_{3/2}^{\circ}$	-1481.912606	2.357E+04	4.155E+04	1.260234E+00
237	$2p^4({}^3P) {}^3P 3d^4D_{5/2}$	-1481.889183	2.952E+04	7.887E+02	1.300703E+00
238	$2p^4({}^3P) {}^3P 3d^4D_{7/2}$	-1481.86421	2.240E+04	1.076E+04	1.335611E+00
239	$2p^4({}^3P) {}^3P 3d^4D_{3/2}$	-1481.863508	4.128E+04	-1.557E+04	1.220966E+00
240	$2p^4({}^3P) {}^3P 3d^2P_{1/2}$	-1481.803722	6.631E+04	0.000E+00	9.784587E-01
241	$2p^4({}^3P) {}^3P 3d^4F_{9/2}$	-1481.752659	2.306E+04	5.009E+04	1.287143E+00
242	$2p^4({}^3P) {}^3P 3d^2F_{7/2}^{\circ}$	-1481.71564	2.758E+04	2.486E+04	1.111948E+00
243	$2p^4({}^1D) {}^1D 3p^2F_{7/2}^{\circ}$	-1481.636124	7.256E+04	-1.226E+05	1.190616E+00
244	$2p^4({}^1D) {}^1D 3p^2D_{3/2}^{\circ}$	-1481.57066	8.152E+04	-3.861E+04	1.064291E+00
245	$2p^4({}^3P) {}^3P 3d^4P_{1/2}$	-1481.520495	-2.243E+04	0.000E+00	1.908365E+00
246	$2p^4({}^1D) {}^1D 3p^2D_{5/2}^{\circ}$	-1481.457043	8.338E+04	-5.776E+04	1.184841E+00

Table 4. (continued)

Key	State	$E(\text{a.u.})$	$A(\text{MHz})$	$B(\text{MHz})$	g_J
247	$2p^4(\frac{3}{2}P)^3P3d^4P_{3/2}$	-1481.372734	6.853E+03	-1.855E+04	1.243531E+00
248	$2p^4(\frac{1}{2}D)^1D3p^2P_{3/2}^o$	-1481.359067	6.792E+04	-1.042E+05	1.288167E+00
249	$2p^4(\frac{1}{2}S)^1S3s^2S_{1/2}$	-1481.33801	2.431E+05	0.000E+00	1.952645E+00
250	$2p^4(\frac{3}{2}P)^3P3d^2D_{5/2}$	-1481.29153	1.991E+04	1.556E+04	1.151125E+00
251	$2p^4(\frac{3}{2}P)^3P3d^4F_{3/2}$	-1481.028257	2.043E+04	1.935E+04	6.769751E-01
252	$2p^4(\frac{3}{2}P)^3P3d^4F_{5/2}$	-1480.946359	3.109E+03	2.422E+03	1.176400E+00
253	$2p^4(\frac{1}{2}D)^1D3p^2P_{1/2}^o$	-1480.936903	2.895E+05	0.000E+00	6.770512E-01
254	$2p^4(\frac{3}{2}P)^3P3d^4D_{1/2}$	-1480.785968	8.294E+04	0.000E+00	3.297979E-01
255	$2p^4(\frac{3}{2}P)^3P3d^2D_{3/2}$	-1480.644772	4.522E+04	2.268E+04	1.116248E+00
256	$2p^4(\frac{3}{2}P)^3P3d^4F_{7/2}$	-1480.632867	-4.015E+03	-3.455E+04	1.269432E+00
257	$2p^4(\frac{3}{2}P)^3P3d^4P_{5/2}$	-1480.479648	1.847E+04	4.190E+04	1.275939E+00
258	$2p^4(\frac{3}{2}P)^3P3d^2F_{5/2}$	-1480.418565	2.766E+04	-1.470E+04	9.979459E-01
259	$2p^4(\frac{3}{2}P)^3P3d^2P_{3/2}$	-1480.405853	-4.144E+04	4.650E+04	1.207427E+00
260	$2p^4(\frac{1}{2}D)^1D3d^2G_{7/2}$	-1480.297315	7.083E+04	-1.345E+05	9.570290E-01
261	$2p^4(\frac{1}{2}D)^1D3d^2G_{9/2}$	-1480.239034	5.454E+04	-1.395E+05	1.150329E+00
262	$2p^4(\frac{1}{2}D)^1D3d^2D_{5/2}$	-1480.082762	3.676E+04	3.380E+04	1.084551E+00
263	$2p^4(\frac{1}{2}D)^1D3d^2S_{1/2}$	-1480.040214	1.081E+05	0.000E+00	1.975969E+00
264	$2p^4(\frac{1}{2}D)^1D3d^2F_{7/2}$	-1479.993838	5.567E+04	-1.511E+04	1.149188E+00
265	$2p^4(\frac{1}{2}S)^1S3p^2P_{1/2}^o$	-1479.917451	9.703E+04	0.000E+00	6.646499E-01
266	$2p^4(\frac{1}{2}D)^1D3d^2P_{3/2}$	-1479.904688	2.650E+04	-2.918E+03	1.277282E+00
267	$2p^4(\frac{1}{2}D)^1D3d^2F_{5/2}$	-1479.88575	3.905E+04	-8.683E+04	1.108660E+00
268	$2p^4(\frac{1}{2}S)^1S3p^2P_{3/2}^o$	-1479.822246	1.437E+04	3.984E+04	1.326010E+00
269	$2p^4(\frac{1}{2}D)^1D3d^2D_{3/2}$	-1479.638725	8.237E+04	3.021E+04	8.144137E-01
270	$2p^4(\frac{1}{2}D)^1D3d^2P_{1/2}$	-1479.535163	-9.454E+04	0.000E+00	7.923636E-01
271	$2p^4(\frac{1}{2}S)^1S3d^2D_{5/2}$	-1478.368707	3.749E+03	3.430E+04	1.194756E+00
272	$2p^4(\frac{1}{2}S)^1S3d^2D_{3/2}$	-1478.241101	8.758E+03	6.653E+03	8.192917E-01