Atomic Spectral Tables for the Chandra X-Ray Observatory. Part I S VIII–S XIV

L. I. Podobedova,[a] A. Musgrove, D. E. Kelleher, J. Reader, and W. L. Wiese
National Institute of Standards and Technology, Gaithersburg, Maryland 20899-8420

(Received 25 June 2002; revised 25 October 2002; accepted 4 November 2002; published 17 July 2003)

Tables of critically compiled wavelengths, energy levels, line classifications, and transition probabilities are given for spectra of ionized sulfur (S VIII–S XIV) in the region 21–170 Å. These tables provide data of interest for the Emission Line Project in support of the analysis of astronomical data from the Chandra X-Ray Observatory. They will also be useful for the diagnostics of plasmas encountered in fusion energy research. The transition probabilities were obtained mainly from recent sophisticated calculations carried out with complex computer codes. [DOI: 10.1063/1.1539857]

Key words: far ultraviolet; S VIII, S IX, S X, S XI, S XII, S XIII, S XIV; soft x rays; sulfur; transition probabilities; wavelengths.

Contents

List of Figures

List of Symbols

Symbols for indication of data accuracy

A uncertainties within 3%,
B uncertainties within 10%,
C uncertainties within 25%,
D uncertainties within 50%,
E uncertainties greater than 50% (but typically within factors of 2–3).

Symbols used for the table headings

E_i: lower energy level,
E_k: upper energy level,
g_i: statistical weight of the lower level,
g_k: statistical weight of the upper level,
A_{ki}: atomic transition probability for spontaneous emission,
f_{ik}: (absorption) oscillator strength,
S: line strength.

Abbreviations appearing in the column labeled Ref.

LS: decomposition from multiplet value according to LS rules.

In all tables, we have shown the power of 10 by the exponential notation. For example, 3.88 E-3 stands for 3.88×10^{-3}.

1. Introduction

The Chandra X-ray Observatory, launched by the Space Shuttle Columbia in July 1999, was designed to observe x rays from high-energy regions of the universe, as for example remnants of exploded stars. Spectral observations with Chandra are carried out with two principal instruments: the Low Energy Transmission Grating, which covers the region from 10 to 170 Å (1 Å = 0.1 nm), and the High Energy Transmission Grating, which covers the region from 1.2 to 30 Å. These gratings consist of arrays of fine gold wires that can be inserted into the path of the x rays after the main mirror and redirect the x rays according to their energies through diffraction. The Emission Line Project (ELP), situated at the Smithsonian Astrophysical Observatory, is an effort to improve the spectral models used to analyze the x-ray observations of stellar plasmas. The present tables were com-

[a]Electronic mail: larissa.podobedova@nist.gov

piled to assist the ELP project. They provide data for the cosmically abundant element S in the region of interest for Chandra. Similar tables are in preparation for Ne, Mg, and Si. These tables will also be of use for the diagnostics of plasmas found in fusion energy research devices such as tokamaks.

The wavelengths in the tables are Ritz-type values derived from experimental energy level values in the NIST Atomic Spectra Database (ASD)[1]—the wave number of a particular transition is found as the difference of the values of the combining energy levels in cm^{-1}, and the wavelength in vacuum is the reciprocal of the wave number. Except for Li-like ions, only transitions are considered for which experimental energies are known for both lower and upper levels. For Li-like ions extremely precise *ab initio* calculations provide values for some energy levels that have uncertainties comparable to experimental values. Thus, for some levels of Li-like ions that have not been observed experimentally we have made use of level values, and in turn wavelengths, obtained from such precise calculations. Where this has been done, the levels are specially denoted in the tables.

The ionization energies given in the text portion for each ion are taken from values for the ionization limits in ASD. The values in cm^{-1} were converted to electron volts[2] with the factor $1\ eV/hc = 8065.544\,77(32)\ cm^{-1}$. In compiling the transition probabilities we selected only values obtained with the most advanced theoretical and experimental methods. Our general evaluation criteria were those that have been developed at NIST.[3,4] We normally list here only values having estimated uncertainties of $\pm 50\%$ or less. A few exceptions have been made for important lines. Because of the limited amount of experimental results available for highly ionized ions, for most transitions we had to rely on theoretical data.

The most extensive source of theoretical data was the Opacity Project (OP),[5] which has produced multiplet *f* values for the spectra of many elements. However, since the OP calculations do not include spin–orbit interaction they do not provide values for individual lines of a fine-structure multiplet. Therefore for the present work the average values for LS multiplets were decomposed into their LSJ fine structure components using LS coupling rules.[6] For the present light atoms LS coupling should be a good approximation. For ions where this is clearly not the case we have used results of calculations that do include spin–orbit and other relativistic effects. Tachiev and Froese Fischer have performed calculations for Be-, B-, C-, N-, O-, F-, and Ne-like ions with the multiconfiguration Hartree–Fock (MCHF)[7] method with Breit–Pauli corrections and have made their results available on the World Wide Web. Blackford and Hibbert have carried out extensive calculations for F-like ions[8] with the configuration interaction code-version 3 (CIV3).[9] The same method was used by Aggarwal for several C-like ions.[10] For the Be- and B-like ions, the data of Safronova and co-workers were found to be very useful.[11–13] These calculations were performed using the relativistic many body perturbation theory (MBPT). Vilkas and co-workers applied MBPT including Breit–Pauli corrections to obtain transition probabilities for ions of C, N, and O.[14–16] For comparative purposes, data from several other sources were also used in our work.

2. Graphical and Numerical Comparisons in Support of the Assessment Procedure

In order to put the uncertainty estimates of transition probabilities for the present compilation on a firmer basis, we made graphical and numerical comparisons of the results of different advanced calculations for as many transitions as possible, regardless of wavelength. We then selected data for the Chandra spectral range 10–170 Å. To fit the data into systematic trends, or deviations from them, we found useful the theoretically predicted scaling of data along isoelectronic sequences. If available we always selected data from detailed configuration–interaction calculations with intermediate coupling. As usual these calculations were performed for transitions to the ground state or between low excited configurations. For transitions involving high-lying configurations, only OP data are available. For the stronger transitions of many spectra, good agreement exists between the OP data and data from more detailed calculations that consider spin–orbit interactions. However large disagreements are often observed for weaker transitions when appreciable cancellation of positive and negative components of the transition integral is encountered. Agreement between the OP calculations and various relativistic calculations becomes worse for transitions between levels where one or both are appreciably mixed due to breakdown of LS coupling. We found that studies of the dependence of accuracy on the purity of LS coupling are an especially useful guide for cases where transition probabilities are available from only one source and where we must estimate their accuracy on the basis of extrapolation from comparisons with other sources in overlapping areas.

The dependence of accuracy on the purity of LS coupling is illustrated by an example for the fluorine-like ion S VIII. Large discrepancies in transition probabilities for F-like spectra between the OP[5] and CIV3[8] results were discussed earlier by Wiese and Kelleher.[17] At that time extended relativistic calculations for individual lines were available only from CIV3.[8] More recently new MCHF[7] data have become available. The following plots show detailed comparisons of oscillator strengths for allowed transitions of S VIII.

In Fig. 1 the ratios of OP[5] and CIV3[8] oscillator strengths to the MCHF[7] values are plotted on a logarithmic scale against the logarithm of the MCHF oscillator strength. The dashed lines indicate a band of 50% around a perfect ratio of 1.00. Some large disagreements are observed with the OP data, even for the stronger lines. The agreement between MCHF and CIV3 is clearly better, but for many transitions the agreement is still not good.

In studying these transitions for which the agreement is

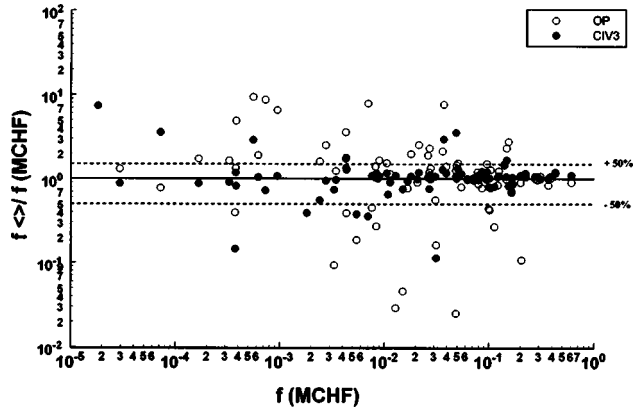

FIG. 1. Comparison of oscillator strengths for the F-like ion S VIII.

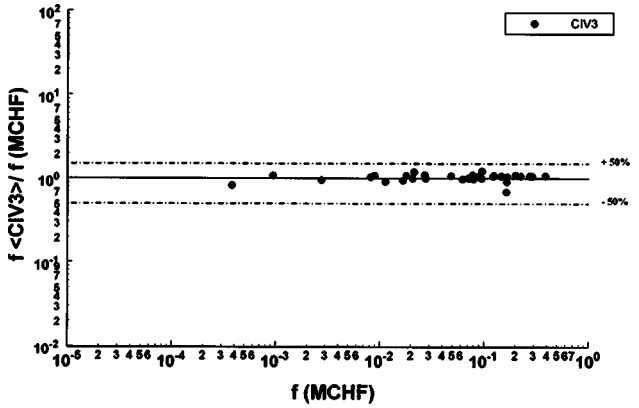

FIG. 3. Comparison of oscillator strengths of allowed transition between pure levels for the F-like ion S VIII.

not good, we found that for almost all of them, one or both of the levels involved in the transition could be considered as *mixed*. By *mixed* we mean that the main contribution to the wave function of the level is less than 80%. Correspondingly, a *pure* level here means that the main contribution to the wave function composition of this level is more than 80%.

Figure 2 shows a comparison of oscillator strengths of allowed transitions between mixed levels for the F-like ion S VIII. The ratios of CIV3[8] oscillator strengths to the corresponding MCHF[7] values are plotted on a logarithmic scale versus the logarithm of the MCHF oscillator strength. The dashed lines indicate a band of 50% around a perfect ratio of 1.00. It is seen that for most transitions the agreement is better than 50%, which is within the range of data listed in the NIST reference tables.

Figure 3 shows a comparison of oscillator strengths of allowed transitions between pure levels for the F-like ion S VIII. The ratios of CIV3[8] oscillator strengths to the corresponding MCHF[7] values are plotted on a logarithmic scale against the logarithm of the MCHF oscillator strength. Out of 33 transitions, 31 have agreements between the CIV3 and MCHF calculations of better than 10%. The others agree within 20%.

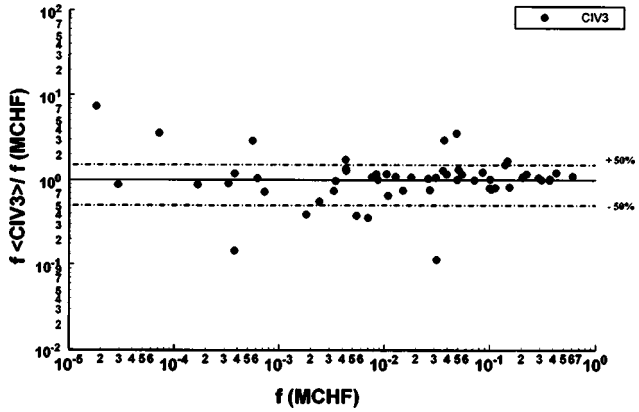

FIG. 2. Comparison of oscillator strengths of allowed transitions between mixed levels for the F-like ion S VIII.

In view of the pronounced differences, we have treated transitions with pure and mixed levels differently, and we did not include data from OP for weak transitions where one or both of the combining levels is mixed.

3. Arrangement of the Tables

The tables are ordered by increasing ionization stage. Individual lines are arranged in order of wavelength. Each transition is identified by its wavelength, the energy levels of the lower (i) and upper (k) states, the statistical weights of the levels ($g=2J+1$), and the level designation. In some cases the designations in ASD are given with a question mark. In the present tables we omitted these question marks because the designations were confirmed by later calculations in numerous studies.[5,7–16] If an energy level was given in ASD with a question mark to indicate that it is uncertain, we have retained the question mark and have added it to the Ritz wavelength as well. Levels whose values are noted with a $+x$ are not connected to the main system of levels by observed transitions. The level values have been estimated by theoretical methods so that the unknown quantity x will be minimized. All of the present values are for electric dipole transitions, E1.

For each line, the transition probability for spontaneous emission A_{ki} (in units of 10^8 s^{-1}), the oscillator strength f_{ik} (dimensionless), and $\log g_i f$ are given. Also, the line strength S is given and expressed in atomic units (a.u.). For electric dipole transitions E1, $1\ \text{a.u.}=a_0^2e^2=7.188\times10^{-59}\ \text{m}^2\,\text{C}^2$, where a_0 and e are the Bohr radius and electron charge. For conversion factors and more details on the units, see Wiese *et al.*[3] The power of 10 is indicated by exponential notation (E-02 indicates 10^{-2}). Finally, the estimated accuracy and the references are given. The estimated accuracy is indicated by the following letters, which are the same as used in earlier NIST publications:[3,4] A—uncertainty less than 3%, B—uncertainty less than 10%, C—uncertainty less than 25%, D—uncertainty less than 50%, and E—uncertainty greater than 50% (but typically within factors of 2–3).

4. Acknowledgments

Support for this work was provided by the National Aeronautics and Space Administration through Chandra Award EL9-1002A issued by the Chandra X-ray Observatory, which is operated by the Smithsonian Astrophysical Observatory for and on behalf of NASA under Contract No. NAS8-39073. Partial support was also provided by the Office of Fusion Energy Sciences of the U.S. Department of Energy.

5. References

[1] http://physics.nist.gov/asd
[2] P. J. Mohr and B. N. Taylor, J. Phys. Chem. Ref. Data **28**, 1713 (1999).
[3] W. L. Wiese, J. R. Fuhr, and T. M. Deters, J. Phys. Chem. Ref. Data, Monograph **7**, 532 pp. (1996).
[4] W. L. Wiese, Phys. Scr., **T65**, 188 (1996).
[5] http://www.legacy.gsfc.nasa.gov/topbase/
[6] C. R. Cowley, W. L. Wiese, J. R. Fuhr, and L. A. Kuznetsova, *Allen's Astrophysical Quantities*, 4th ed., edited by A. N. Cox (AIP, New York, 2000), Chap. 4, pp. 53–93.
[7] G. Tachiev and C. Froese Fischer, http://www.vuse.vanderbilt.edu/~cff/mchf_collection/
[8] H. M. S. Blackford and A. Hibbert, At. Data Nucl. Data Tables **58**, 101 (1994).
[9] A. Hibbert, Comput. Phys. Commun. **9**, 141 (1975).
[10] K. M. Aggarwal, Astrophys. J., Suppl. Ser. **118**, 589 (1998).
[11] U. I. Safronova, M. S. Safronova, W. R. Johnson, and A. Derevianko, Phys. Scr. **59**, 286 (1999). Complete data listing from private communication.
[12] U. I. Safronova, A. Derevianko, M. S. Safronova, and W. R. Johnson, J. Phys. B: At. Mol. Opt. Phys. **32**, 3527 (1999). Complete data listing from private communication.
[13] U. I. Safronova, W. R. Johnson, and A. E. Livingston, Phys. Rev. A **60**, 996 (1999). Complete data listing from private communication.
[14] M. J. Vilkas, I. Martinson, G. Merkelis, G. Gaigalas, and R. Kisielius, Phys. Scr. **54**, (1996).
[15] M. J. Vilkas, G. Merkelis, R. Kisielius, G. Gaigalas, A. Bernotas, and Z. Rudzikas, Phys. Scr. **49**, 592 (1994).
[16] G. Merkelis, M. J. Vilkas, R. Kisielius, G. Gaigalas, and I. Martinson, Phys. Scr. **56**, 41 (1997).
[17] W. L. Wiese and D. E. Kelleher, AIP Conf. Proc. **434**, 105 (1998).

6. S VIII

$Z=16$

F I isoelectronic sequence

Ground state $1s^2 2s^2 2p^5\ ^2P^\circ_{3/2}$

Ionization energy 2 651 500 cm^{-1} (328.74 eV)

Data are tabulated for 42 transitions in the range 47–85 Å. Because of breakdown of LS coupling for F-like ions, we mainly selected transition probabilities calculated with intermediate coupling. Mean values between MCHF[1] and CIV3[2] results are given for the transition arrays $2s^2 2p^5 - 2s^2 2p^4 3s$, $2s^2 2p^5 - 2s^2 2p^4 3d$, and $2s 2p^6 - 2s^2 2p^4 3p$. Remaining data were taken from calculations carried out with the Cowan relativistic Hartree–Fock program (HFR) by Fawcett.[3]

References

[1]G. Tachiev and C. Froese Fischer, http://www.vuse.vanderbilt.edu/~cff/mchf_collection/(Downloaded 10 May 2002).
[2]H. M. S. Blackford and A. Hibbert, At. Data Nucl. Data Tables **58**, 101 (1994).
[3]B. C. Fawcett, At. Data Nucl. Data Tables **36**, 80 (1987).

S VIII

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i–J_k	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
47.519	0	2 104 420	$2p^5$–$2p^4(^3P^\circ)4s$	$^2P^\circ$–^2P	3/2–3/2	4–4	3.03E+02	1.03E−02	6.41E−03	−1.387	D	3
47.748	10 085	2 104 420	$2p^5$–$2p^4(^3P^\circ)4s$	$^2P^\circ$–^2P	1/2–3/2	2–4	1.90E+02	1.30E−02	4.09E−03	−1.585	D	3
51.204	0	1 952 960	$2p^5$–$2p^4(^1S)3d$	$^2P^\circ$–^2D	3/2–3/2	4–4	2.13E+02	8.36E−03	5.64E−03	−1.476	A	1,2
51.227	0	1 952 100	$2p^5$–$2p^4(^1S)3d$	$^2P^\circ$–^2D	3/2–5/2	4–6	1.55E+03	9.13E−02	6.16E−02	−0.437	A	1,2
51.470	10 085	1 952 960	$2p^5$–$2p^4(^1S)3d$	$^2P^\circ$–^2D	1/2–3/2	2–4	2.19E+03	1.74E−01	5.90E−02	−0.458	B	1,2
52.681	0	1 898 220	$2p^5$–$2p^4(^1D)3d$	$^2P^\circ$–^2D	3/2–3/2	4–4	1.02E+03	4.25E−02	2.95E−02	−0.770	B	1,2
52.703	0	1 897 440	$2p^5$–$2p^4(^1D)3d$	$^2P^\circ$–^2P	3/2–1/2	4–2	2.83E+03	5.89E−02	4.09E−02	−0.628	C	1,2
52.756	0	1 895 520	$2p^5$–$2p^4(^1D)3d$	$^2P^\circ$–^2D	3/2–5/2	4–6	7.55E+03	4.73E−01	3.28E−01	0.277	B	1,2
52.790	0	1 894 310	$2p^5$–$2p^4(^1D)3d$	$^2P^\circ$–^2P	3/2–3/2	4–4	9.57E+03	4.00E−01	2.78E−01	0.204	A	1,2
52.955	0	1 888 410	$2p^5$–$2p^4(^1D)3d$	$^2P^\circ$–^2S	3/2–1/2	4–2	7.53E+03	1.58E−01	1.10E−01	−0.199	B	1,2
52.962	10 085	1 898 220	$2p^5$–$2p^4(^1D)3d$	$^2P^\circ$–^2D	1/2–3/2	2–4	7.60E+03	6.39E−01	2.23E−01	0.106	B	1,2
52.984	10 085	1 897 440	$2p^5$–$2p^4(^1D)3d$	$^2P^\circ$–^2P	1/2–1/2	2–2	8.73E+03	3.68E−01	1.28E−01	−0.134	A	1,2
53.072	10 085	1 894 310	$2p^5$–$2p^4(^1D)3d$	$^2P^\circ$–^2P	1/2–3/2	2–4	1.54E+03	1.30E−01	4.54E−02	−0.585	A	1,2
53.239	10 085	1 888 410	$2p^5$–$2p^4(^1D)3d$	$^2P^\circ$–^2S	1/2–1/2	2–2	2.50E+03	1.06E−01	3.73E−02	−0.672	B	1,2
54.088?	0	1 848 830?	$2p^5$–$2p^4(^3P)3d$	$^2P^\circ$–^2P	3/2–3/2	4–4	1.09E+02	4.76E−03	3.39E−03	−1.721	E	1,2
54.118	0	1 847 810	$2p^5$–$2p^4(^3P)3d$	$^2P^\circ$–^2D	3/2–5/2	4–6	5.72E+03	3.76E−01	2.68E−01	0.178	A	1,2
54.267	0	1 842 750	$2p^5$–$2p^4(^3P)3d$	$^2P^\circ$–^2D	3/2–3/2	4–4	2.31E+03	1.02E−01	7.30E−02	−0.389	A	1,2
54.368	0	1 839 316	$2p^5$–$2p^4(^3P)3d$	$^2P^\circ$–^2F	3/2–5/2	4–6	2.73E+02	1.82E−02	1.30E−02	−1.139	D	1,2
54.385?	10 085	1 848 830?	$2p^5$–$2p^4(^3P)3d$	$^2P^\circ$–^2P	1/2–3/2	2–4	2.39E+03	2.12E−01	7.60E−02	−0.372	A	1,2
54.424?	0	1 837 420?	$2p^5$–$2p^4(^3P)3d$	$^2P^\circ$–^4P	3/2–5/2	4–6	3.34E+02	2.22E−02	1.59E−02	−1.051	D	1,2
54.501	0	1 834 830	$2p^5$–$2p^4(^3P)3d$	$^2P^\circ$–^4P	3/2–3/2	4–4	5.82E+01	2.59E−03	1.86E−03	−1.984	E	1,2
54.565	10 085	1 842 750	$2p^5$–$2p^4(^3P)3d$	$^2P^\circ$–^2D	1/2–3/2	2–4	1.57E+03	1.40E−01	5.04E−02	−0.552	B	1,2
54.604	0	1 831 370	$2p^5$–$2p^4(^3P)3d$	$^2P^\circ$–^4F	3/2–5/2	4–6	1.25E+02	8.40E−03	6.04E−03	−1.474	C	1,2
54.802	10 085	1 834 830	$2p^5$–$2p^4(^3P)3d$	$^2P^\circ$–^4P	1/2–3/2	2–4	5.40E+00	4.87E−04	1.76E−04	−3.012	E	1,2
59.236	0	1 688 150	$2p^5$–$2p^4(^1S)3s$	$^2P^\circ$–^2S	3/2–1/2	4–2	4.11E+02	1.08E−02	8.43E−03	−1.364	B	1,2
59.592	10 085	1 688 150	$2p^5$–$2p^4(^1S)3s$	$^2P^\circ$–^2S	1/2–1/2	2–2	3.05E+02	1.63E−02	6.38E−03	−1.488	B	1,2
61.593	0	1 623 560	$2p^5$–$2p^4(^1D)3s$	$^2P^\circ$–^2D	3/2–3/2	4–4	4.74E+01	2.69E−03	2.19E−03	−1.968	A	1,2
61.600	0	1 623 380	$2p^5$–$2p^4(^1D)3s$	$^2P^\circ$–^2D	3/2–5/2	4–6	7.20E+02	6.14E−02	4.98E−02	−0.609	A	1,2
61.978	10 085	1 623 560	$2p^5$–$2p^4(^1D)3s$	$^2P^\circ$–^2D	1/2–3/2	2–4	6.84E+02	7.87E−02	3.21E−02	−0.803	A	1,2
63.028	0	1 586 600	$2p^5$–$2p^4(^3P)3s$	$^2P^\circ$–^2P	3/2–1/2	4–2	6.95E+02	2.07E−02	1.72E−02	−1.082	A	1,2
63.304	0	1 579 680	$2p^5$–$2p^4(^3P)3s$	$^2P^\circ$–^2P	3/2–3/2	4–4	1.58E+03	9.49E−02	7.91E−02	−0.420	A	1,2
63.431	10 085	1 586 600	$2p^5$–$2p^4(^3P)3s$	$^2P^\circ$–^2P	1/2–1/2	2–2	1.19E+03	7.20E−02	3.01E−02	−0.842	A	1,2
63.711	10 085	1 579 680	$2p^5$–$2p^4(^3P)3s$	$^2P^\circ$–^2P	1/2–3/2	2–4	2.27E+02	2.76E−02	1.16E−02	−1.257	A	1,2
63.740	0	1 568 872	$2p^5$–$2p^4(^3P)3s$	$^2P^\circ$–^4P	3/2–1/2	4–2	1.68E−01	5.12E−06	4.30E−06	−4.689	C	1,2
63.887	0	1 565 254	$2p^5$–$2p^4(^3P)3s$	$^2P^\circ$–^4P	3/2–3/2	4–4	7.34E+01	4.49E−03	3.78E−03	−1.746	B	1,2
64.129	0	1 559 345	$2p^5$–$2p^4(^3P)3s$	$^2P^\circ$–^4P	3/2–5/2	4–6	4.26E+00	3.94E−04	3.33E−04	−2.802	B	1,2
64.152	10 085	1 568 872	$2p^5$–$2p^4(^3P)3s$	$^2P^\circ$–^4P	1/2–1/2	2–2	1.24E+01	7.63E−04	3.22E−04	−2.816	B	1,2
64.302	10 085	1 565 254	$2p^5$–$2p^4(^3P)3s$	$^2P^\circ$–^4P	1/2–3/2	2–4	5.61E+00	6.96E−04	2.95E−04	−2.856	B	1,2
64.874	503 644	2 045 090	$2s2p^6$–$2s2p^5(^3P^\circ)3s$	^2S–$^2P^\circ$	1/2–1/2	2–2	1.32E+03	8.30E−02	3.55E−02	−0.780	C	3
65.149	503 644	2 038 590	$2s2p^6$–$2s2p^5(^3P^\circ)3s$	^2S–$^2P^\circ$	1/2–3/2	2–4	1.23E+03	1.56E−01	6.69E−02	−0.506	C	3
84.670	503 644	1 684 696	$2s2p^6$–$2s^2 2p^4(^3P)3p$	^2S–$^4D^\circ$	1/2–1/2	2–2	9.72E−02	1.05E−05	5.83E−06	−4.680	C	1,2
84.776	503 644	1 683 217	$2s2p^6$–$2s^2 2p^4(^3P)3p$	^2S–$^2D^\circ$	1/2–3/2	2–4	3.03E−02	6.53E−06	3.64E−06	−4.884	C	1,2

7. S IX

$Z=16$

O I isoelectronic sequence

Ground state $1s^2 2s^2 2p^4\ {}^3P_2$

Ionization energy 3 061 300 cm^{-1} (379.55 eV)

Data are tabulated for 99 transitions in the range 38–170 Å. Transition probabilities for the $2s^2 2p^4 - 2s^2 p^3 3s$, $2s^2 2p^4 - 2s^2 2p^3 3d$, and $2s 2p^5 - 2p^6$ arrays are taken from MCHF[1] calculations. For four transitions arising from upper levels with $n=4$ results are taken from the OP.[2] Multiplet average results from OP have been decomposed into fine-structure components assuming LS coupling, as indicated by the notation LS in the reference column.

References

[1]G. Tachiev and C. Froese Fischer, http://www.vuse.vanderbilt.edu/~cff/mchf_collection/(Downloaded 10 May 2002).
[2]http://www.legacy.gsfc.nasa.gov/topbase/(Downloaded 23 August 1995).

S IX

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i-J_k	g_i-g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
38.882?	0.0	2 571 880?	$2p^4-2p^3(^2D°)4d$	$^3P-^3P°$	2–2	5–5	2.94E+03	6.66E−02	4.26E−02	−0.478	D	2,LS
38.966?	0.0	2 566 340?	$2p^4-2p^3(^2D°)4d$	$^3P-^3D°$	2–3	5–7	2.00E+03	6.36E−02	4.08E−02	−0.498	D	2,LS
39.003?	7985	2 571 880?	$2p^4-2p^3(^2D°)4d$	$^3P-^3P°$	1–2	3–5	9.71E+02	3.69E−02	1.42E−02	−0.956	D	2,LS
40.171?	0.0	2 489 360?	$2p^4-2p^3(^4S°)4d$	$^3P-^3D°$	2–3	5–7	3.16E+03	1.07E−01	7.08E−02	−0.272	D	2,LS
46.157	0.0	2 166 530	$2p^4-2p^3(^2P°)3d$	$^3P-^1F°$	2–3	5–7	5.58E+01	2.50E−03	1.90E−03	−1.904	C	1
46.237	0.0	2 162 760	$2p^4-2p^3(^2P°)3d$	$^3P-^1D°$	2–2	5–5	2.21E+02	7.07E−03	5.38E−03	−1.452	C	1
46.373	0.0	2 156 430	$2p^4-2p^3(^2P°)3d$	$^3P-^3D°$	2–3	5–7	5.09E+03	2.30E−01	1.76E−01	0.060	B	1
46.377	0.0	2 156 260	$2p^4-2p^3(^2P°)3d$	$^3P-^3D°$	2–1	5–3	1.68E+02	3.24E−03	2.48E−03	−1.790	C	1
46.409	7985	2 162 760	$2p^4-2p^3(^2P°)3d$	$^3P-^1D°$	1–2	3–5	9.88E+02	5.32E−02	2.44E−02	−0.797	B	1
46.413	0.0	2 154 580	$2p^4-2p^3(^2P°)3d$	$^3P-^3D°$	2–2	5–5	1.29E+03	4.16E−02	3.18E−02	−0.682	B	1
46.549	7985	2 156 260	$2p^4-2p^3(^2P°)3d$	$^3P-^3D°$	1–1	3–3	3.78E+03	1.23E−01	5.65E−02	−0.434	C	1
46.585	0.0	2 146 600	$2p^4-2p^3(^2P°)3d$	$^3P-^3P°$	2–2	5–5	4.98E+02	1.62E−02	1.24E−02	−1.091	B	1
46.585	7985	2 154 580	$2p^4-2p^3(^2P°)3d$	$^3P-^3D°$	1–2	3–5	5.53E+03	3.00E−01	1.38E−01	−0.046	B	1
46.607	10 648	2 156 260	$2p^4-2p^3(^2P°)3d$	$^3P-^3D°$	0–1	1–3	5.46E+03	5.33E−01	8.18E−02	−0.273	C	1
46.624	0.0	2 144 800	$2p^4-2p^3(^2P°)3d$	$^3P-^3P°$	2–1	5–3	1.78E+02	3.47E−03	2.67E−03	−1.760	C	1
46.759	7985	2 146 600	$2p^4-2p^3(^2P°)3d$	$^3P-^3P°$	1–2	3–5	2.22E+02	1.21E−02	5.60E−03	−1.439	C	1
46.799	7985	2 144 800	$2p^4-2p^3(^2P°)3d$	$^3P-^3P°$	1–1	3–3	1.63E+03	5.36E−02	2.48E−02	−0.793	B	1
46.843	7985	2 142 780	$2p^4-2p^3(^2P°)3d$	$^3P-^3P°$	1–0	3–1	4.32E+03	4.74E−02	2.19E−02	−0.847	B	1
46.845	0.0	2 134 710	$2p^4-2p^3(^2D°)3d$	$^3P-^1F°$	2–3	5–7	5.86E+02	2.70E−02	2.08E−02	−0.870	B	1
46.857	10 648	2 144 800	$2p^4-2p^3(^2P°)3d$	$^3P-^3P°$	0–1	1–3	1.52E+03	1.50E−01	2.32E−02	−0.823	B	1
46.906?	58 293.9	2 190 220?	$2p^4-2p^3(^2P°)3d$	$^1D-^1P°$	2–1	5–3	8.28E+02	1.64E−02	1.27E−02	−1.087	B	1
47.047	0.0	2 125 530	$2p^4-2p^3(^2D°)3d$	$^3P-^3S°$	2–1	5–3	7.32E+03	1.46E−01	1.13E−01	−0.137	A	1
47.185	0.0	2 119 330	$2p^4-2p^3(^2D°)3d$	$^3P-^3P°$	2–1	5–3	5.69E+03	1.14E−01	8.85E−02	−0.245	A	1
47.224	7985	2 125 530	$2p^4-2p^3(^2D°)3d$	$^3P-^3S°$	1–1	3–3	3.95E+03	1.32E−01	6.16E−02	−0.402	A	1
47.227	0.0	2 117 430	$2p^4-2p^3(^2D°)3d$	$^3P-^1D°$	2–2	5–5	1.16E+02	3.87E−03	3.01E−03	−1.713	B	1
47.249	0.0	2 116 450	$2p^4-2p^3(^2D°)3d$	$^3P-^3P°$	2–2	5–5	1.15E+04	3.86E−01	3.00E−01	0.285	A	1
47.284	10 648	2 125 530	$2p^4-2p^3(^2D°)3d$	$^3P-^3S°$	0–1	1–3	1.25E+03	1.26E−01	1.96E−02	−0.899	A	1
47.363	7985	2 119 330	$2p^4-2p^3(^2D°)3d$	$^3P-^3P°$	1–1	3–3	2.69E+03	9.04E−02	4.23E−02	−0.567	B	1
47.406	7985	2 117 430	$2p^4-2p^3(^2D°)3d$	$^3P-^1D°$	1–2	3–5	9.28E+00	5.21E−04	2.44E−04	−2.806	C	1
47.418	0.0	2 108 900	$2p^4-2p^3(^2D°)3d$	$^3P-^1P°$	2–1	5–3	7.42E+01	1.50E−03	1.17E−03	−2.125	C	1
47.423	10 648	2 119 330	$2p^4-2p^3(^2D°)3d$	$^3P-^3P°$	0–1	1–3	2.87E+03	2.91E−01	4.54E−02	−0.537	A	1
47.428	7985	2 116 450	$2p^4-2p^3(^2D°)3d$	$^3P-^3P°$	1–2	3–5	2.07E+03	1.16E−01	5.44E−02	−0.458	A	1
47.433	58 293.9	2 166 530	$2p^4-2p^3(^2P°)3d$	$^1D-^1F°$	2–3	5–7	1.31E+04	6.20E−01	4.84E−01	0.491	B	1
47.433?	0.0	2 108 240?	$2p^4-2p^3(^2D°)3d$	$^3P-^3D°$	2–3	5–7	8.92E+03	4.21E−01	3.29E−01	0.323	A	1
47.436	0.0	2 108 120	$2p^4-2p^3(^2D°)3d$	$^3P-^3D°$	2–2	5–5	9.19E+02	3.10E−02	2.42E−02	−0.810	B	1
47.498	0.0	2 105 330	$2p^4-2p^3(^2D°)3d$	$^3P-^3D°$	2–1	5–3	4.26E+02	8.65E−03	6.77E−03	−1.364	C	1
47.518	58 293.9	2 162 760	$2p^4-2p^3(^2P°)3d$	$^1D-^1D°$	2–2	5–5	8.84E+03	2.99E−01	2.34E−01	0.175	B	1
47.598	7985	2 108 900	$2p^4-2p^3(^2D°)3d$	$^3P-^1P°$	1–1	3–3	4.68E+02	1.59E−02	7.48E−03	−1.322	B	1
47.616	7985	2 108 120	$2p^4-2p^3(^2D°)3d$	$^3P-^3D°$	1–2	3–5	6.28E+03	3.55E−01	1.67E−01	0.028	B	1
47.659	10 648	2 108 900	$2p^4-2p^3(^2D°)3d$	$^3P-^1P°$	0–1	1–3	2.36E+03	2.41E−01	3.79E−02	−0.617	B	1
47.661	58 293.9	2 156 430	$2p^4-2p^3(^2P°)3d$	$^1D-^3D°$	2–3	5–7	1.78E+02	8.47E−03	6.65E−03	−1.373	C	1
47.679	7985	2 105 330	$2p^4-2p^3(^2D°)3d$	$^3P-^3D°$	1–1	3–3	1.89E+03	6.45E−02	3.04E−02	−0.714	B	1
47.703	58 293.9	2 154 580	$2p^4-2p^3(^2P°)3d$	$^1D-^3D°$	2–2	5–5	1.34E+03	4.56E−02	3.58E−02	−0.642	B	1

S IX—Continued

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i–J_k	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
47.740	10648	2 105 330	$2p^4-2p^3(^2D°)3d$	$^3P-^3D°$	0–1	1–3	1.34E+03	1.37E−01	2.16E−02	−0.862	B	1
47.886	58 293.9	2 146 600	$2p^4-2p^3(^2P°)3d$	$^1D-^3P°$	2–2	5–5	1.68E+01	5.79E−04	4.56E−04	−2.539	C	1
47.927	58 293.9	2 144 800	$2p^4-2p^3(^2P°)3d$	$^1D-^3P°$	2–1	5–3	9.64E+01	1.99E−03	1.57E−03	−2.002	C	1
48.160	58 293.9	2 134 710	$2p^4-2p^3(^2D°)3d$	$^1D-^1F°$	2–3	5–7	8.10E+03	3.95E−01	3.13E−01	0.295	A	1
48.367?	122 700	2 190 220?	$2p^4-2p^3(^2P°)3d$	$^1S-^1P°$	0–1	1–3	1.55E+04	1.63E+00	2.59E−01	0.212	B	1
48.374	58 293.9	2 125 530	$2p^4-2p^3(^2D°)3d$	$^1D-^3S°$	2–1	5–3	4.43E+01	9.32E−04	7.42E−04	−2.332	C	1
48.519	58 293.9	2 119 330	$2p^4-2p^3(^2D°)3d$	$^1D-^3P°$	2–1	5–3	3.35E+02	7.08E−03	5.66E−03	−1.451	B	1
48.564	58 293.9	2 117 430	$2p^4-2p^3(^2D°)3d$	$^1D-^1D°$	2–2	5–5	4.61E+03	1.63E−01	1.30E−01	−0.089	A	1
48.587	58 293.9	2 116 450	$2p^4-2p^3(^2D°)3d$	$^1D-^3P°$	2–2	5–5	2.78E+01	9.83E−04	7.86E−04	−2.308	C	1
48.766	58 293.9	2 108 900	$2p^4-2p^3(^2D°)3d$	$^1D-^1P°$	2–1	5–3	2.87E+03	6.15E−02	4.94E−02	−0.512	C	1
48.782?	58 293.9	2 108 240?	$2p^4-2p^3(^2D°)3d$	$^1D-^3D°$	2–3	5–7	1.87E+01	9.36E−04	7.52E−04	−2.330	C	1
48.851	58 293.9	2 105 330	$2p^4-2p^3(^2D°)3d$	$^1D-^3D°$	2–1	5–3	2.70E+03	5.80E−02	4.66E−02	−0.538	B	1
49.119	0.0	2 035 870	$2p^4-2p^3(^4S°)3d$	$^3P-^3D°$	2–3	5–7	4.62E+03	2.34E−01	1.89E−01	0.068	A	1
49.132	0.0	2 035 350	$2p^4-2p^3(^4S°)3d$	$^3P-^3D°$	2–1	5–3	1.42E+02	3.08E−03	2.49E−03	−1.812	B	1
49.134	0.0	2 035 230	$2p^4-2p^3(^4S°)3d$	$^3P-^3D°$	2–2	5–5	1.23E+03	4.45E−02	3.60E−02	−0.653	B	1
49.325	7985	2 035 350	$2p^4-2p^3(^4S°)3d$	$^3P-^3D°$	1–1	3–3	1.88E+03	6.84E−02	3.34E−02	−0.688	B	1
49.328	7985	2 035 230	$2p^4-2p^3(^4S°)3d$	$^3P-^3D°$	1–2	3–5	3.17E+03	1.92E−01	9.38E−02	−0.239	A	1
49.390	10 648	2 035 350	$2p^4-2p^3(^4S°)3d$	$^3P-^3D°$	0–1	1–3	2.43E+03	2.67E−01	4.34E−02	−0.574	A	1
49.454	122 700	2 144 800	$2p^4-2p^3(^2P°)3d$	$^1S-^3P°$	0–1	1–3	8.09E+01	8.90E−03	1.45E−03	−2.051	C	1
49.929	122 700	2 125 530	$2p^4-2p^3(^2D°)3d$	$^1S-^3S°$	0–1	1–3	1.74E+01	1.95E−03	3.21E−04	−2.709	B	1
50.084	122 700	2 119 330	$2p^4-2p^3(^2D°)3d$	$^1S-^3P°$	0–1	1–3	5.22E+00	5.88E−04	9.70E−05	−3.230	C	1
50.347	122 700	2 108 900	$2p^4-2p^3(^2D°)3d$	$^1S-^1P°$	0–1	1–3	6.55E+02	7.47E−02	1.24E−02	−1.127	C	1
50.438	122 700	2 105 330	$2p^4-2p^3(^2D°)3d$	$^1S-^3D°$	0–1	1–3	4.27E+02	4.88E−02	8.11E−03	−1.311	B	1
50.567	58 293.9	2 035 870	$2p^4-2p^3(^4S°)3d$	$^1D-^3D°$	2–3	5–7	9.35E+00	5.02E−04	4.18E−04	−2.601	C	1
50.580	58 293.9	2 035 350	$2p^4-2p^3(^4S°)3d$	$^1D-^3D°$	2–1	5–3	2.50E+00	5.75E−05	4.79E−05	−3.541	D	1
50.583	58 293.9	2 035 230	$2p^4-2p^3(^4S°)3d$	$^1D-^3D°$	2–2	5–5	6.26E+00	2.40E−04	2.00E−04	−2.921	C	1
52.283	122 700	2 035 350	$2p^4-2p^3(^4S°)3d$	$^1S-^3D°$	0–1	1–3	4.90E+04	6.02E−08	1.04E−08	−7.221	E	1
52.859	0.0	1 891 830	$2p^4-2p^3(^2P°)3s$	$^3P-^3P°$	2–2	5–5	5.22E+02	2.19E−02	1.90E−02	−0.961	B	1
53.083	7985	1 891 830	$2p^4-2p^3(^2P°)3s$	$^3P-^3P°$	1–2	3–5	3.55E+02	2.50E−02	1.31E−02	−1.125	B	1
53.798	0.0	1 858 800	$2p^4-2p^3(^2D°)3s$	$^3P-^1D°$	2–2	5–5	5.36E+01	2.33E−03	2.06E−03	−1.934	B	1
54.030	7985	1 858 800	$2p^4-2p^3(^2D°)3s$	$^3P-^1D°$	1–2	3–5	1.60E+01	1.17E−03	6.23E−04	−2.456	B	1
54.171	8293.9	1 904 300	$2p^4-2p^3(^2P°)3s$	$^1D-^1P°$	2–1	5–3	1.18E+03	3.12E−02	2.79E−02	−0.806	B	1
54.175	0.0	1 845 870	$2p^4-2p^3(^2D°)3s$	$^3P-^3D°$	2–3	5–7	9.36E+02	5.77E−02	5.14E−02	−0.540	B	1
54.196	0.0	1 845 170	$2p^4-2p^3(^2D°)3s$	$^3P-^3D°$	2–2	5–5	3.61E+02	1.59E−02	1.42E−02	−1.100	B	1
54.201	0.0	1 844 970	$2p^4-2p^3(^2D°)3s$	$^3P-^3D°$	2–1	5–3	4.18E+01	1.11E−03	9.87E−04	−2.257	C	1
54.431	7985	1 845 170	$2p^4-2p^3(^2D°)3s$	$^3P-^3D°$	1–2	3–5	5.73E+02	4.24E−02	2.28E−02	−0.895	B	1
54.437	7985	1 844 970	$2p^4-2p^3(^2D°)3s$	$^3P-^3D°$	1–1	3–3	4.67E+02	2.08E−02	1.12E−02	−1.206	B	1
54.516	10 648	1 844 970	$2p^4-2p^3(^2D°)3s$	$^3P-^3D°$	0–1	1–3	4.20E+02	5.62E−02	1.01E−02	−1.251	B	1
54.539	58 293.9	1 891 830	$2p^4-2p^3(^2P°)3s$	$^1D-^3P°$	2–2	5–5	1.07E+02	4.75E−03	4.27E−03	−1.624	C	1
55.540	58 293.9	1 858 800	$2p^4-2p^3(^2D°)3s$	$^1D-^1D°$	2–2	5–5	2.29E+03	1.06E−01	9.69E−02	−0.276	A	1
55.942	58 293.9	1 845 870	$2p^4-2p^3(^2D°)3s$	$^1D-^3D°$	2–3	5–7	7.28E+00	4.78E−04	4.40E−04	−2.621	C	1
55.964	58 293.9	1 845 170	$2p^4-2p^3(^2D°)3s$	$^1D-^3D°$	2–2	5–5	1.78E−01	8.35E−06	7.70E−06	−4.379	E	1
55.970	58 293.9	1 844 970	$2p^4-2p^3(^2D°)3s$	$^1D-^3D°$	2–1	5–3	1.05E+01	2.95E−04	2.72E−04	−2.832	C	1
56.081	0.0	1 783 150	$2p^4-2p^3(^4S°)3s$	$^3P-^3S°$	2–1	5–3	1.69E+03	4.79E−02	4.42E−02	−0.621	B	1
56.129	122 700	1 904 300	$2p^4-2p^3(^2P°)3s$	$^1S-^1P°$	0–1	1–3	1.11E+03	1.57E−01	2.90E−02	−0.804	B	1
56.333	7985	1 783 150	$2p^4-2p^3(^4S°)3s$	$^3P-^3S°$	1–1	3–3	9.28E+02	4.41E−02	2.46E−02	−0.878	B	1
56.417	10 648	1 783 150	$2p^4-2p^3(^4S°)3s$	$^3P-^3S°$	0–1	1–3	3.13E+02	4.47E−02	8.31E−03	−1.349	B	1
57.976	58 293.9	1 783 150	$2p^4-2p^3(^4S°)3s$	$^1D-^3S°$	2–1	5–3	3.31E+00	1.00E−04	9.56E−05	−3.300	D	1
58.063	122 700	1 844 970	$2p^4-2p^3(^2D°)3s$	$^1S-^3D°$	0–1	1–3	4.10E+00	6.22E−04	1.19E−04	−3.206	C	1
60.225	122 700	1 783 150	$2p^4-2p^3(^4S°)3s$	$^1S-^3S°$	0–1	1–3	1.56E−02	2.55E−06	5.06E−07	−5.593	E	1
86.881?	1 039 219	2 190 220?	$2p^6-2s^22p^3(^2P°)3d$	$^1S-^1P°$	0–1	1–3	1.27E−01	4.30E−05	1.23E−05	−4.367	D	1
93.486	1 039 219	2 108 900	$2p^6-2s^22p^3(^2D°)3d$	$^1S-^1P°$	0–1	1–3	3.26E−02	1.28E−05	3.95E−06	−4.892	E	1
162.318	0.0	616 073	$2s^22p^4-2s2p^5$	$^3P-^1P°$	2–1	5–3	4.05E+00	9.59E−04	2.56E−03	−2.319	C	1
164.450	7985	616 073	$2s^22p^4-2s2p^5$	$^3P-^1P°$	1–1	3–3	1.04E−01	4.22E−05	6.85E−05	−3.898	D	1
165.173	10 648	616 073	$2s^22p^4-2s2p^5$	$^3P-^1P°$	0–1	1–3	2.18E−01	2.68E−04	1.46E−04	−3.572	C	1
170.293	451 995	1 039 219	$2s2p^5-2p^6$	$^3P°-^1S$	1–0	3–1	1.24E+00	1.79E−04	3.01E−04	−3.270	C	1

8. S x

$Z=16$

N I isoelectronic sequence

Ground state $1s^2 2s^2 2p^3\ {}^4S^\circ_{3/2}$

Ionization energy 3 609 000 cm^{-1} (447.5 eV)

Data are tabulated for 120 transitions in the range 34–167 Å. Transition probabilities for the $2s^2 2p^3 - 2s^2 2p^2 3s$, $2s^2 2p^3 - 2s^2 2p^2 3d$, $2s 2p^4 - 2p^5$, $2p^5 - 2s^2 2p^2 3s$, and $2p^5 - 2s^2 2p^2 3d$ arrays are taken from MCHF calculations.[1] Remaining results are taken from the OP.[2] Multiplet average results from OP have been decomposed into fine-structure components assuming LS coupling, as indicated by the notation LS in the reference column.

References

[1]G. Tachiev and C. Froese Fischer, http://www.vuse.vanderbilt.edu/~cff/mchf_collection/(Downloaded 10 May 2002).
[2]http://www.legacy.gsfc.nasa.gov/topbase/(Downloaded 23 August 1995).

S x

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	$J_i - J_k$	$g_i - g_k$	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
34.310?	0.0	2 914 600?	$2p^3 - 2p^2(^3P)4d$	$^4S^\circ - ^4P$	3/2–5/2	4–6	7.14E+03	1.89E−01	8.54E−02	−0.121	C	2,LS
41.357?	0.0	2 417 970?	$2s^2 2p^3 - 2s 2p^3(^5S^\circ)3p$	$^4S^\circ - ^4P$	3/2–5/2	4–6	3.17E+03	1.22E−01	6.64E−02	−0.312	C	1
41.509	0.0	2 409 100	$2p^3 - 2p^2(^1D)3d$	$^4S^\circ - ^2D$	3/2–5/2	4–6	1.46E+01	5.66E−04	3.09E−04	−2.645	C	1
41.534	0.0	2 407 650	$2p^3 - 2p^2(^1D)3d$	$^4S^\circ - ^2D$	3/2–3/2	4–4	5.59E+00	1.45E−04	7.91E−05	−3.238	C	1
42.005?	378 458	2 759 130?	$2s 2p^4 - 2s 2p^3(^3P^\circ)3d$	$^4P - ^4D^\circ$	5/2–7/2	6–8	9.05E+03	3.19E−01	2.65E−01	0.282	C	2,LS
42.019?	0.0	2 379 900?	$2p^3 - 2p^2(^3P)3d$	$^4S^\circ - ^2D$	3/2–5/2	4–6	1.16E+01	4.61E−04	2.55E−04	−2.735	C	1
42.040?	0.0	2 378 700?	$2p^3 - 2p^2(^3P)3d$	$^4S^\circ - ^2D$	3/2–3/2	4–4	3.19E+00	8.45E−05	4.68E−05	−3.471	D	1
42.485	0.0	2 353 770	$2p^3 - 2p^2(^3P)3d$	$^4S^\circ - ^4P$	3/2–1/2	4–2	1.93E+04	2.62E−01	1.46E−01	0.020	A	1
42.495	0.0	2 353 220	$2p^3 - 2p^2(^3P)3d$	$^4S^\circ - ^4P$	3/2–3/2	4–4	1.88E+04	5.08E−01	2.84E−01	0.308	A	1
42.543	0.0	2 350 560	$2p^3 - 2p^2(^3P)3d$	$^4S^\circ - ^4P$	3/2–5/2	4–6	1.77E+04	7.22E−01	4.05E−01	0.461	A	1
42.681	0.0	2 342 990	$2p^3 - 2p^2(^3P)3d$	$^4S^\circ - ^2F$	3/2–5/2	4–6	1.86E+02	7.60E−03	4.28E−03	−1.517	C	1
42.713?	0.0	2 341 200?	$2p^3 - 2p^2(^3P)3d$	$^4S^\circ - ^2P$	3/2–1/2	4–2	3.92E+00	5.36E−05	3.02E−05	−3.669	D	1
42.817?	82 442.3	2 417 970?	$2s^2 2p^3 - 2s 2p^3(^5S^\circ)3p$	$^2D^\circ - ^4P$	3/2–5/2	4–6	5.00E−02	2.06E−06	1.16E−06	−5.084	E	1
42.838?	83 594.9	2 417 970?	$2s^2 2p^3 - 2s 2p^3(^5S^\circ)3p$	$^2D^\circ - ^4P$	5/2–5/2	6–6	2.79E−01	7.68E−06	6.50E−06	−4.337	D	1
42.897	0.0	2 331 160	$2p^3 - 2p^2(^3P)3d$	$^4S^\circ - ^2P$	3/2–3/2	4–4	4.06E+02	1.12E−02	6.32E−03	−1.349	B	1
42.916	82 442.3	2 412 550	$2p^3 - 2p^2(^1D)3d$	$^2D^\circ - ^2F$	3/2–5/2	4–6	1.07E+04	4.42E−01	2.50E−01	0.248	C	1
42.938	83 594.9	2 412 550	$2p^3 - 2p^2(^1D)3d$	$^2D^\circ - ^2F$	5/2–5/2	6–6	2.14E+02	5.91E−03	5.02E−03	−1.450	D	1
42.980	82 442.3	2 409 100	$2p^3 - 2p^2(^1D)3d$	$^2D^\circ - ^2D$	3/2–5/2	4–6	8.02E+03	3.33E−01	1.89E−01	0.124	B	1
43.001	83 594.9	2 409 100	$2p^3 - 2p^2(^1D)3d$	$^2D^\circ - ^2D$	5/2–5/2	6–6	8.22E+03	2.28E−01	1.94E−01	0.136	B	1
43.002	83 594.9	2 409 070	$2p^3 - 2p^2(^1D)3d$	$^2D^\circ - ^2F$	5/2–7/2	6–8	2.20E+04	8.13E−01	6.90E−01	0.688	C	1
43.007	82 442.3	2 407 650	$2p^3 - 2p^2(^1D)3d$	$^2D^\circ - ^2D$	3/2–3/2	4–4	8.38E+03	2.32E−01	1.32E−01	−0.032	B	1
43.028	83 594.9	2 407 650	$2p^3 - 2p^2(^1D)3d$	$^2D^\circ - ^2D$	5/2–3/2	6–4	1.06E+03	1.95E−02	1.66E−02	−0.931	B	1
43.263?	378 458	2 689 900?	$2s 2p^4 - 2s 2p^3(^3D^\circ)3d$	$^4P - ^4D^\circ$	5/2–7/2	6–8	9.01E+03	3.37E−01	2.88E−01	0.306	C	2,LS
43.526?	82 442.3	2 379 900?	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^2D$	3/2–5/2	4–6	3.34E+03	1.42E−01	8.17E−02	−0.244	B	1
43.548?	83 594.9	2 379 900?	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^2D$	5/2–5/2	6–6	5.99E+03	1.70E−01	1.47E−01	0.010	A	1
43.549?	82 442.3	2 378 700?	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^2D$	3/2–3/2	4–4	3.32E+03	9.45E−02	5.42E−02	−0.422	C	1
43.571?	83 594.9	2 378 700?	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^2D$	5/2–3/2	6–4	9.09E+02	1.72E−02	1.48E−02	−0.985	B	1
43.684?	128 804	2 417 970?	$2s^2 2p^3 - 2s 2p^3(^5S^\circ)3p$	$^2P^\circ - ^4P$	3/2–5/2	4–6	1.40E+01	6.01E−04	3.46E−04	−2.619	C	1
43.847	126 975	2 407 650	$2p^3 - 2p^2(^1D)3d$	$^2P^\circ - ^2D$	1/2–3/2	2–4	5.51E+03	3.18E−01	9.18E−02	−0.197	B	1
43.854	128 804	2 409 100	$2p^3 - 2p^2(^1D)3d$	$^2P^\circ - ^2D$	3/2–5/2	4–6	2.43E+03	1.05E−01	6.08E−02	−0.376	C	1
43.882	128 804	2 407 650	$2p^3 - 2p^2(^1D)3d$	$^2P^\circ - ^2D$	3/2–3/2	4–4	2.64E+02	7.63E−03	4.41E−03	−1.516	D	1
44.027	82 442.3	2 353 770	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^4P$	3/2–1/2	4–2	3.07E+00	4.46E−05	2.58E−05	−3.749	D	1
44.038	82 442.3	2 353 220	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^4P$	3/2–3/2	4–4	1.60E−03	4.64E−08	2.69E−08	−6.731	E	1
44.060	83 594.9	2 353 220	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^4P$	5/2–3/2	6–4	2.89E+01	5.60E−04	4.88E−04	−2.474	C	1
44.089	82 442.3	2 350 560	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^4P$	3/2–5/2	4–6	4.49E+00	1.96E−04	1.14E−04	−3.105	C	1
44.094	83 594.9	2 351 480	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^2F$	5/2–7/2	6–8	3.20E+03	1.24E−01	1.08E−01	−0.127	A	1
44.112	83 594.9	2 350 560	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^4P$	5/2–5/2	6–6	3.88E+01	1.13E−03	9.87E−04	−2.168	C	1
44.237	82 442.3	2 342 990	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^2F$	3/2–5/2	4–6	2.85E+03	1.25E−01	7.30E−02	−0.300	A	1
44.260	83 594.9	2 342 990	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^2F$	5/2–5/2	6–6	2.90E+02	8.52E−03	7.45E−03	−1.291	B	1
44.272?	82 442.3	2 341 200?	$2p^3 - 2p^2(^3P)3d$	$^2D^\circ - ^2P$	3/2–1/2	4–2	6.09E+02	8.94E−03	5.21E−03	−1.447	D	1
44.410?	126 975	2 378 700?	$2p^3 - 2p^2(^3P)3d$	$^2P^\circ - ^2D$	1/2–3/2	2–4	5.18E+03	3.06E−01	8.96E−02	−0.213	B	1
44.423?	128 804	2 379 900?	$2p^3 - 2p^2(^3P)3d$	$^2P^\circ - ^2D$	3/2–5/2	4–6	3.94E+03	1.75E−01	1.02E−01	−0.156	B	1
44.446?	128 804	2 378 700?	$2p^3 - 2p^2(^3P)3d$	$^2P^\circ - ^2D$	3/2–3/2	4–4	1.94E+03	5.76E−02	3.37E−02	−0.638	C	1

S X—Continued

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i–J_k	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
44.470	82 442.3	2 331 160	$2p^3$–$2p^2(^3P)3d$	$^2D^\circ$–^2P	3/2–3/2	4–4	5.60E+02	1.66E−02	9.72E−03	−1.178	C	1
44.493	83 594.9	2 331 160	$2p^3$–$2p^2(^3P)3d$	$^2D^\circ$–^2P	5/2–3/2	6–4	7.88E+02	1.56E−02	1.37E−02	−1.029	C	1
44.908	126 975	2 353 770	$2p^3$–$2p^2(^3P)3d$	$^2P^\circ$–^4P	1/2–1/2	2–2	5.18E−02	1.57E−06	4.63E−07	−5.504	D	1
44.919	126 975	2 353 220	$2p^3$–$2p^2(^3P)3d$	$^2P^\circ$–^4P	1/2–3/2	2–4	3.37E+00	2.04E−04	6.03E−05	−3.389	D	1
44.945	128 804	2 353 770	$2p^3$–$2p^2(^3P)3d$	$^2P^\circ$–^4P	3/2–1/2	4–2	2.40E+00	3.63E−05	2.15E−05	−3.838	D	1
44.956	128 804	2 353 220	$2p^3$–$2p^2(^3P)3d$	$^2P^\circ$–^4P	3/2–3/2	4–4	1.48E+00	4.50E−05	2.66E−05	−3.745	D	1
45.009	128 804	2 350 560	$2p^3$–$2p^2(^3P)3d$	$^2P^\circ$–^4P	3/2–5/2	4–6	7.69E+00	3.50E−04	2.08E−04	−2.854	C	1
45.163?	126 975	2 341 200?	$2p^3$–$2p^2(^3P)3d$	$^2P^\circ$–^2P	1/2–1/2	2–2	3.11E+03	9.51E−02	2.83E−02	−0.721	A	1
45.200?	128 804	2 341 200?	$2p^3$–$2p^2(^3P)3d$	$^2P^\circ$–^2P	3/2–1/2	4–2	1.68E+03	2.57E−02	1.53E−02	−0.988	A	1
45.368	126 975	2 331 160	$2p^3$–$2p^2(^3P)3d$	$^2P^\circ$–^2P	1/2–3/2	2–4	5.24E+02	3.23E−02	9.66E−03	−1.189	D	1
45.406	128 804	2 331 160	$2p^3$–$2p^2(^3P)3d$	$^2P^\circ$–^2P	3/2–3/2	4–4	1.85E+03	5.73E−02	3.43E−02	−0.640	D	1
45.997	378 458	2 552 510	$2s2p^4$–$2s2p^3(^3S^\circ)3d$	^4P–$^4D^\circ$	5/2–7/2	6–8	7.31E+03	3.09E−01	2.81E−01	0.268	C	2,LS
46.151	378 458	2 545 280	$2s2p^4$–$2s2p^3(^3S^\circ)3d$	^4P–$^4D^\circ$	5/2–5/2	6–6	2.17E+03	6.94E−02	6.33E−02	−0.380	D	2,LS
46.206	378 458	2 542 660	$2s2p^4$–$2s2p^3(^5S^\circ)3d$	^4P–$^4D^\circ$	5/2–3/2	6–4	3.61E+02	7.70E−03	7.03E−03	−1.335	D	2,LS
46.293	0.0	2 160 140	$2p^3$–$2p^2(^1D)3s$	$^4S^\circ$–^2D	3/2–5/2	4–6	3.07E+00	1.48E−04	9.01E−05	−3.228	C	1
46.298	385 362	2 545 280	$2s2p^4$–$2s2p^3(^3S^\circ)3d$	^4P–$^4D^\circ$	3/2–5/2	4–6	5.02E+03	2.42E−01	1.48E−01	−0.014	C	2,LS
46.312?	0.0	2 159 280?	$2p^3$–$2p^2(^1D)3s$	$^4S^\circ$–^2D	3/2–3/2	4–4	6.02E−01	1.93E−05	1.18E−05	−4.111	D	1
46.354	385 362	2 542 660	$2s2p^4$–$2s2p^3(^3S^\circ)3d$	^4P–$^4D^\circ$	3/2–3/2	4–4	3.82E+03	1.23E−01	7.51E−02	−0.308	C	2,LS
46.430	388 883	2 542 660	$2s2p^4$–$2s2p^3(^3S^\circ)3d$	^4P–$^4D^\circ$	1/2–3/2	2–4	2.97E+03	1.92E−01	5.87E−02	−0.416	C	2,LS
47.159	0.0	2 120 500	$2p^3$–$2p^2(^3P)3s$	$^4S^\circ$–^2P	3/2–3/2	4–4	1.17E+00	3.89E−05	2.42E−05	−3.808	D	1
47.324	0.0	2 113 100	$2p^3$–$2p^2(^3P)3s$	$^4S^\circ$–^2P	3/2–1/2	4–2	2.30E+00	3.86E−05	2.41E−05	−3.811	D	1
47.654	0.0	2 098 440	$2p^3$–$2p^2(^3P)3s$	$^4S^\circ$–^4P	3/2–5/2	4–6	1.12E+03	5.70E−02	3.58E−02	−0.642	A	1
47.792	0.0	2 092 400	$2p^3$–$2p^2(^3P)3s$	$^4S^\circ$–^4P	3/2–3/2	4–4	1.10E+03	3.76E−02	2.37E−02	−0.823	A	1
47.905	0.0	2 087 460	$2p^3$–$2p^2(^3P)3s$	$^4S^\circ$–^4P	3/2–1/2	4–2	1.08E+03	1.87E−02	1.18E−02	−1.127	A	1
48.130	82 442.3	2 160 140	$2p^3$–$2p^2(^1D)3s$	$^2D^\circ$–^2D	3/2–5/2	4–6	2.05E+02	1.07E−02	6.76E−03	−1.370	C	1
48.150?	82 442.3	2 159 280?	$2p^3$–$2p^2(^1D)3s$	$^2D^\circ$–^2D	3/2–3/2	4–4	1.22E+03	4.25E−02	2.70E−02	−0.769	A	1
48.157	83 594.9	2 160 140	$2p^3$–$2p^2(^1D)3s$	$^2D^\circ$–^2D	5/2–5/2	6–6	1.42E+03	4.92E−02	4.69E−02	−0.530	A	1
48.177?	83 594.9	2 159 280?	$2p^3$–$2p^2(^1D)3s$	$^2D^\circ$–^2D	5/2–3/2	6–4	4.08E+01	9.47E−04	9.01E−04	−2.246	C	1
49.066	82 442.3	2 120 500	$2p^3$–$2p^2(^3P)3s$	$^2D^\circ$–^2P	3/2–3/2	4–4	5.79E+00	2.09E−04	1.35E−04	−3.078	C	1
49.094	83 594.9	2 120 500	$2p^3$–$2p^2(^3P)3s$	$^2D^\circ$–^2P	5/2–3/2	6–4	1.86E+03	4.49E−02	4.36E−02	−0.570	A	1
49.205?	126 975	2 159 280?	$2p^3$–$2p^2(^1D)3s$	$^2P^\circ$–^2D	1/2–3/2	2–4	3.66E+02	2.66E−02	8.61E−03	−1.275	B	1
49.229	128 804	2 160 140	$2p^3$–$2p^2(^1D)3s$	$^2P^\circ$–^2D	3/2–5/2	4–6	4.51E+02	2.46E−02	1.60E−02	−1.007	B	1
49.245	82 442.3	2 113 100	$2p^3$–$2p^2(^3P)3s$	$^2D^\circ$–^2P	3/2–1/2	4–2	2.29E+03	4.16E−02	2.70E−02	−0.778	B	1
49.250?	128 804	2 159 280?	$2p^3$–$2p^2(^1D)3s$	$^2P^\circ$–^2D	3/2–3/2	4–4	4.52E+02	1.64E−02	1.07E−02	−1.182	C	1
49.603	82 442.3	2 098 440	$2p^3$–$2p^2(^3P)3s$	$^2D^\circ$–^4P	3/2–5/2	4–6	4.23E+01	2.34E−05	1.53E−05	−4.028	D	1
49.632	83 594.9	2 098 440	$2p^3$–$2p^2(^3P)3s$	$^2D^\circ$–^4P	5/2–5/2	6–6	1.08E+01	3.97E−04	3.89E−04	−2.623	C	1
49.752	82 442.3	2 092 400	$2p^3$–$2p^2(^3P)3s$	$^2D^\circ$–^4P	3/2–3/2	4–4	4.49E+00	1.67E−04	1.09E−04	−3.176	C	1
49.781	83 594.9	2 092 400	$2p^3$–$2p^2(^3P)3s$	$^2D^\circ$–^4P	5/2–3/2	6–4	1.36E+01	3.36E−04	3.31E−04	−2.695	C	1
49.875	82 442.3	2 087 460	$2p^3$–$2p^2(^3P)3s$	$^2D^\circ$–^4P	3/2–1/2	4–2	1.89E+01	3.53E−04	2.32E−04	−2.851	C	1
50.162	126 975	2 120 500	$2p^3$–$2p^2(^3P)3s$	$^2P^\circ$–^2P	1/2–3/2	2–4	3.32E+02	2.51E−02	8.28E−03	−1.300	B	1
50.208	128 804	2 120 500	$2p^3$–$2p^2(^3P)3s$	$^2P^\circ$–^2P	3/2–3/2	4–4	1.17E+03	4.44E−02	2.93E−02	−0.751	A	1
50.349	126 975	2 113 100	$2p^3$–$2p^2(^3P)3s$	$^2P^\circ$–^2P	1/2–1/2	2–2	8.86E+02	3.37E−02	1.12E−02	−1.172	A	1
50.396	128 804	2 113 100	$2p^3$–$2p^2(^3P)3s$	$^2P^\circ$–^2P	3/2–1/2	4–2	2.21E+02	4.21E−03	2.79E−03	−1.774	C	1
50.771	128 804	2 098 440	$2p^3$–$2p^2(^3P)3s$	$^2P^\circ$–^4P	3/2–5/2	4–6	6.58E+03	3.81E−07	2.55E−07	−5.816	E	1
50.880	126 975	2 092 400	$2p^3$–$2p^2(^3P)3s$	$^2P^\circ$–^4P	1/2–3/2	2–4	8.24E+01	6.40E−05	2.14E−05	−3.893	D	1
50.927	128 804	2 092 400	$2p^3$–$2p^2(^3P)3s$	$^2P^\circ$–^4P	3/2–3/2	4–4	4.22E+00	1.64E−04	1.10E−04	−3.183	C	1
51.008	126 975	2 087 460	$2p^3$–$2p^2(^3P)3s$	$^2P^\circ$–^4P	1/2–1/2	2–2	1.78E+00	6.94E−05	2.33E−05	−3.857	D	1
51.055	128 804	2 087 460	$2p^3$–$2p^2(^3P)3s$	$^2P^\circ$–^4P	3/2–1/2	4–2	2.70E+00	5.27E−05	3.54E−05	−3.676	D	1
70.091?	991 249	2 417 970?	$2p^5$–$2s2p^3(^5S^\circ)3p$	$^2P^\circ$–^4P	3/2–5/2	4–6	1.99E−02	2.20E−06	2.03E−06	−5.056	D	1
70.529	991 249	2 409 100	$2p^5$–$2s^22p^2(^1D)3d$	$^2P^\circ$–^2D	3/2–5/2	4–6	4.38E−03	4.90E−07	4.56E−07	−5.707	E	1
71.160	002 372	2 407 650	$2p^5$–$2s^22p^2(^1D)3d$	$^2P^\circ$–^2D	1/2–3/2	2–4	8.58E−03	1.30E−06	6.11E−07	−5.584	D	1
72.012?	991 249	2 379 900?	$2p^5$–$2s^22p^2(^3P)3d$	$^2P^\circ$–^2D	3/2–5/2	4–6	1.23E−01	1.44E−05	1.36E−05	−4.241	D	1
72.075?	991 249	2 378 700?	$2p^5$–$2s^22p^2(^3P)3d$	$^2P^\circ$–^2D	3/2–3/2	4–4	8.14E−03	6.34E−07	6.02E−07	−5.596	E	1
72.657?	1 002 372	2 378 700?	$2p^5$–$2s^22p^2(^3P)3d$	$^2P^\circ$–^2D	1/2–3/2	2–4	1.08E−01	1.71E−05	8.20E−06	−4.465	D	1
73.423	991 249	2 353 220	$2p^5$–$2s^22p^2(^3P)3d$	$^2P^\circ$–^4P	3/2–3/2	4–4	3.82E−04	3.08E−08	2.98E−08	−6.909	E	1
73.567	991 249	2 350 560	$2p^5$–$2s^22p^2(^3P)3d$	$^2P^\circ$–^4P	3/2–5/2	4–6	3.63E−04	4.41E−08	4.28E−08	−6.753	E	1
74.028	1 002 372	2 353 220	$2p^5$–$2s^22p^2(^3P)3d$	$^2P^\circ$–^4P	1/2–3/2	2–4	3.75E−04	6.16E−08	3.01E−08	−6.909	E	1
74.077?	991 249	2 341 200?	$2p^5$–$2s^22p^2(^3P)3d$	$^2P^\circ$–^2P	3/2–1/2	4–2	3.84E−02	1.58E−06	1.54E−06	−5.200	E	1
74.632	991 249	2 331 160	$2p^5$–$2s^22p^2(^3P)3d$	$^2P^\circ$–^2P	3/2–3/2	4–4	8.34E−02	6.96E−06	6.84E−06	−4.555	E	1
74.692?	1 002 372	2 341 200?	$2p^5$–$2s^22p^2(^3P)3d$	$^2P^\circ$–^2P	1/2–1/2	2–2	6.27E−02	5.25E−06	2.58E−06	−4.979	E	1
75.257	1 002 372	2 331 160	$2p^5$–$2s^22p^2(^3P)3d$	$^2P^\circ$–^2P	1/2–3/2	2–4	1.32E−02	2.25E−06	1.11E−06	−5.348	E	1
85.551	991 249	2 160 140	$2p^5$–$2s^22p^2(^1D)3s$	$^2P^\circ$–^2D	3/2–5/2	4–6	8.27E−03	1.36E−06	1.53E−06	−5.264	C	1

S X—Continued

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i–J_k	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
85.614?	991 249	2 159 280?	$2p^5$–$2s^2 2p^2(^1D)3s$	$^2P^\circ$–^2D	3/2–3/2	4–4	2.07E−03	2.27E−07	2.56E−07	−6.042	D	1
86.437?	1 002 372	2 159 280?	$2p^5$–$2s^2 2p^2(^1D)3s$	$^2P^\circ$–^2D	1/2–3/2	2–4	6.32E−03	1.41E−06	8.05E−07	−5.548	C	1
88.554	991 249	2 120 500	$2p^5$–$2s^2 2p^2(^3P)3s$	$^2P^\circ$–^2P	3/2–3/2	4–4	2.69E−04	3.16E−08	3.69E−08	−6.898	D	1
89.138	991 249	2 113 100	$2p^5$–$2s^2 2p^2(^3P)3s$	$^2P^\circ$–^2P	3/2–1/2	4–2	1.91E−04	1.14E−08	1.34E−08	−7.342	D	1
90.031	1 002 372	2 113 100	$2p^5$–$2s^2 2p^2(^3P)3s$	$^2P^\circ$–^2P	1/2–1/2	2–2	7.46E−04	9.06E−08	5.37E−08	−6.742	D	1
92.158	1 002 372	2 087 460	$2p^5$–$2s^2 2p^2(^3P)3s$	$^2P^\circ$–^4P	1/2–1/2	2–2	1.01E−04	1.28E−08	7.78E−09	−7.591	E	1
151.357?	2 098 440	2 759 130?	$2s^2 2p^2(^3P)3s$ –$2s2p^3(^3P^\circ)3d$	^4P–$^4D^\circ$	5/2–7/2	6–8	1.33E+00	6.07E−04	1.82E−03	−2.439	E	2,LS
154.880	0.0	645 660	$2s^2 2p^3$–$2s2p^4$	$^4S^\circ$–^2P	3/2–1/2	4–2	1.64E−01	2.95E−05	6.01E−05	−3.929	B	1
157.011	0.0	636 898	$2s^2 2p^3$–$2s2p^4$	$^4S^\circ$–^2P	3/2–3/2	4–4	6.23E−01	2.30E−04	4.76E−04	−3.036	B	1
162.072	385 362	1 002 372	$2s2p^4$–$2p^5$	^4P–$^2P^\circ$	3/2–1/2	4–2	2.85E−02	5.61E−06	1.20E−05	−4.649	B	1
163.002	388 883	1 002 372	$2s2p^4$–$2p^5$	^4P–$^2P^\circ$	1/2–1/2	2–2	1.82E−01	7.26E−05	7.79E−05	−3.838	C	1
163.188	378 458	991 249	$2s2p^4$–$2p^5$	^4P–$^2P^\circ$	5/2–3/2	6–4	5.50E−01	1.46E−04	4.72E−04	−3.057	B	1
164.262	0.0	608 784	$2s^2 2p^3$–$2s2p^4$	$^4S^\circ$–^2S	3/2–1/2	4–2	2.40E−01	4.86E−05	1.05E−04	−3.711	B	1
165.047	385 362	991 249	$2s2p^4$–$2p^5$	^4P–$^2P^\circ$	3/2–3/2	4–4	1.64E−01	6.68E−05	1.45E−04	−3.573	C	1
166.012	388 883	991 249	$2s2p^4$–$2p^5$	^4P–$^2P^\circ$	1/2–3/2	2–4	4.79E−02	3.96E−05	4.33E−05	−4.102	B	1

9. S XI

$Z=16$

C I isoelectronic sequence

Ground state $1s^2 2s^2 2p^2\ {}^3P_0$

Ionization energy 4 071 300 cm^{-1} (504.8 eV)

Data are tabulated for 116 transitions in the range 31–174 Å. Transition probabilities for the $2s^2 2p^2 - 2s^2 2p 3s$, $2s^2 2p^2 - 2s^2 2p 3d$, $2p^4 - 2s^2 2p 3s$, and $2p^4 - 2s^2 2p 3d$ arrays are selected from CIV3[1] calculations. Values for the $2s 2p^3 - 2s 2p^2 3s$, $2s 2p^3 - 2s 2p^2 3d$, $2s^2 2p^2 - 2s 2p^2 3p$, and $2s^2 2p^2 - 2s^2 2p 4d$ transitions are taken from the OP.[2] Multiplet average results from OP have been decomposed into fine-structure components assuming LS coupling, as indicated by the notation LS in the reference column.

References

[1]K. M. Aggarwal, Astrophys. J., Suppl. Ser. **118**, 589 (1998).
[2]http://legacy.gsfc.nasa.gov/topbase/(Downloaded 23 August 1995).

S XI

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	$J_i - J_k$	$g_i - g_k$	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
31.054	12 388.1	3 232 600	$2s^2 2p^2 - 2s^2 2p 4d$	$^3P - ^3D^\circ$	2–3	5–7	8.15E+03	1.65E−01	8.43E−02	−0.084	B	2,LS
31.483	67 146.3	3 243 450	$2s^2 2p^2 - 2s^2 2p 4d$	$^1D - ^1F^\circ$	2–3	5–7	1.03E+04	2.15E−01	1.11E−01	0.031	B	2,LS
36.659?	67 146.3	2 795 000?	$2s^2 2p^2 - 2s 2p^2(^2D) 3p$	$^1D - ^1F^\circ$	2–3	5–7	6.28E+03	1.77E−01	1.07E−01	−0.053	B	2,LS
36.733?	67 146.3	2 789 500?	$2s^2 2p^2 - 2s 2p^2(^2D) 3p$	$^1D - ^1D^\circ$	2–2	5–5	7.17E+03	1.45E−01	8.77E−02	−0.140	B	2,LS
37.065	355 076	3 053 050	$2s 2p^3 - 2s 2p^2(^2P) 3d$	$^3D^\circ - ^3P$	2–2	5–5	5.34E+00	1.10E−04	6.71E−05	−3.260	D	2,LS
37.069	355 350	3 053 050	$2s 2p^3 - 2s 2p^2(^2P) 3d$	$^3D^\circ - ^3P$	3–2	7–5	3.00E+01	4.41E−04	3.77E−04	−2.510	D	2,LS
37.069	355 364	3 053 050	$2s 2p^3 - 2s 2p^2(^2P) 3d$	$^3D^\circ - ^3P$	1–2	3–5	3.55E−01	1.22E−05	4.47E−06	−4.437	E	2,LS
37.773	12 388.1	2 659 800	$2s^2 2p^2 - 2s 2p^2(^4P) 3p$	$^3P - ^3D^\circ$	2–3	5–7	5.01E+03	1.50E−01	9.33E−02	−0.125	B	2,LS
37.935	416 986	3 053 050	$2s 2p^3 - 2s 2p^2(^2P) 3d$	$^3P^\circ - ^3P$	1–2	3–5	3.73E+02	1.34E−02	5.02E−03	−1.396	C	2,LS
37.942	417 419	3 053 050	$2s 2p^3 - 2s 2p^2(^2P) 3d$	$^3P^\circ - ^3P$	2–2	5–5	1.12E+03	2.42E−02	1.51E−02	−0.917	C	2,LS
38.617?	0	2 589 510?	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^1P^\circ$	0–1	1–3	4.22E+01	2.83E−03	3.60E−04	−2.548	C	1
38.695?	5 208.0	2 589 510?	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^1P^\circ$	1–1	3–3	5.48E+01	1.23E−03	4.70E−04	−2.433	C	1
38.806	12 388.1	2 589 340	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^1F^\circ$	2–3	5–7	2.50E+01	7.90E−04	5.05E−04	−2.403	C	1
38.966	186 251+x	2 752 600+x	$2s 2p^3 - 2s 2p^2(^4P) 3d$	$^5S^\circ - ^5P$	2–1	5–3	2.54E+04	3.47E−01	2.23E−01	0.239	B	2,LS
38.966	186 251+x	2 752 600+x	$2s 2p^3 - 2s 2p^2(^4P) 3d$	$^5S^\circ - ^5P$	2–2	5–5	2.54E+04	5.78E−01	3.71E−01	0.461	B	2,LS
39.049?	186 251+x	2 747 150+x?	$2s 2p^3 - 2s 2p^2(^4P) 3d$	$^5S^\circ - ^5P$	2–3	5–7	2.53E+04	8.08E−01	5.19E−01	0.606	B	2,LS
39.110	5 208.0	2 562 100	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^3P^\circ$	1–1	3–3	7.70E+03	1.77E−01	6.82E−02	−0.276	B	1
39.130	5 208.0	2 560 810	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^3P^\circ$	1–2	3–5	6.37E+02	2.44E−02	9.41E−03	−1.136	B	1
39.220	12 388.1	2 562 100	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^3P^\circ$	2–1	5–3	6.00E+03	8.31E−02	5.36E−02	−0.382	B	1
39.240	0	2 548 420	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^3D^\circ$	0–1	1–3	1.67E+04	1.16E+00	1.49E−01	0.063	B	1
39.240	12 388.1	2 560 810	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^3P^\circ$	2–2	5–5	1.50E+04	3.46E−01	2.24E−01	0.238	B	1
39.300	5 208.0	2 549 740	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^3D^\circ$	1–2	3–5	1.91E+04	7.37E−01	2.86E−01	0.344	B	1
39.320	5 208.0	2 548 420	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^3D^\circ$	1–1	3–3	5.27E+03	1.22E−01	4.75E−02	−0.436	B	1
39.323	12 388.1	2 555 430	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^3D^\circ$	2–3	5–7	2.26E+04	7.34E−01	4.75E−01	0.565	B	1
39.411	12 388.1	2 549 740	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^3D^\circ$	2–2	5–5	1.42E+02	3.30E−03	2.14E−03	−1.783	C	1
39.432	12 388.1	2 548 420	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^3D^\circ$	2–1	5–3	1.44E+00	2.01E−05	1.30E−05	−3.998	D	1
39.572	355 350	2 882 400	$2s 2p^3 - 2s 2p^2(^2D) 3d$	$^3D^\circ - ^3F$	3–4	7–9	2.13E+04	6.43E−01	5.86E−01	0.653	B	2,LS
39.572	5 208.0	2 532 260	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^1D^\circ$	1–2	3–5	8.55E+02	3.35E−02	1.31E−02	−0.998	B	1
39.645?	67 146.3	2 589 510?	$2s^2 2p^2 - 2s^2 2p 3d$	$^1D - ^1P^\circ$	2–1	5–3	9.12E+02	1.29E−02	8.41E−03	−1.191	B	1
39.648	67 146.3	2 589 340	$2s^2 2p^2 - 2s^2 2p 3d$	$^1D - ^1F^\circ$	2–3	5–7	2.90E+04	9.58E−01	6.25E−01	0.680	B	1
39.685	12 388.1	2 532 260	$2s^2 2p^2 - 2s^2 2p 3d$	$^3P - ^1D^\circ$	2–2	5–5	1.28E+02	3.03E−03	1.98E−03	−1.820	C	1
39.717	535 220	3 053 050	$2s 2p^3 - 2s 2p^2(^2P) 3d$	$^3S^\circ - ^3P$	1–2	3–5	2.14E+04	8.43E−01	3.31E−01	0.403	B	2,LS
40.081	67 146.3	2 562 100	$2s^2 2p^2 - 2s^2 2p 3d$	$^1D - ^3P^\circ$	2–1	5–3	4.17E+01	6.02E−04	3.97E−04	−2.521	C	1
40.102	67 146.3	2 560 810	$2s^2 2p^2 - 2s^2 2p 3d$	$^1D - ^3P^\circ$	2–2	5–5	3.88E+02	9.35E−03	6.17E−03	−1.330	C	1
40.188	67 146.3	2 555 430	$2s^2 2p^2 - 2s^2 2p 3d$	$^1D - ^3D^\circ$	2–3	5–7	6.45E+00	2.19E−04	1.45E−04	−2.961	C	1
40.280	67 146.3	2 549 740	$2s^2 2p^2 - 2s^2 2p 3d$	$^1D - ^3D^\circ$	2–2	5–5	2.24E+02	5.45E−03	3.61E−03	−1.565	C	1
40.302	67 146.3	2 548 420	$2s^2 2p^2 - 2s^2 2p 3d$	$^1D - ^3D^\circ$	2–1	5–3	1.74E+01	2.54E−04	1.69E−04	−2.896	C	1
40.566	67 146.3	2 532 260	$2s^2 2p^2 - 2s^2 2p 3d$	$^1D - ^1D^\circ$	2–2	5–5	5.53E+03	1.36E−01	9.10E−02	−0.167	B	1
40.707?	132 929	2 589 510?	$2s^2 2p^2 - 2s^2 2p 3d$	$^1S - ^1P^\circ$	0–1	1–3	1.74E+04	1.30E+00	1.74E−01	0.114	B	1
40.904	355 076	2 799 800	$2s 2p^3 - 2s 2p^2(^2P) 3d$	$^3D^\circ - ^3D$	2–3	5–7	5.21E+02	1.83E−02	1.23E−02	−1.039	C	2,LS
40.909	355 350	2 799 800	$2s 2p^3 - 2s 2p^2(^2P) 3d$	$^3D^\circ - ^3D$	3–3	7–7	4.15E+03	1.04E−01	9.81E−02	−0.138	B	2,LS

S XI—Continued

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i–J_k	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
41.166	132 929	2 562 100	$2s^22p^2$–$2s^22p3d$	^{1}S–^{3}P°	0–1	1–3	1.29E+01	9.80E−04	1.33E−04	−3.009	C	1
41.307	811 702	3 232 600	$2p^4$–$2s^22p4d$	^{3}P–^{3}D°	2–3	5–7	1.08E−01	3.85E−06	2.62E−06	−4.716	E	2,LS
41.386	355 350	2 771 600	$2s2p^3$–$2s2p^2(^4$P)$3d$	^{3}D°–^{3}F	3–4	7–9	8.15E+03	2.69E−01	2.57E−01	0.275	B	2,LS
41.399	132 929	2 548 420	$2s^22p^2$–$2s^22p3d$	^{1}S–^{3}D°	0–1	1–3	6.06E+01	4.67E−03	6.37E−04	−2.331	C	1
41.474	355 076	2 766 200	$2s2p^3$–$2s2p^2(^4$P)$3d$	^{3}D°–^{3}F	2–3	5–7	7.20E+03	2.60E−01	1.78E−01	0.114	B	2,LS
41.479	355 350	2 766 200	$2s2p^3$–$2s2p^2(^4$P)$3d$	^{3}D°–^{3}F	3–3	7–7	9.03E+02	2.33E−02	2.23E−02	−0.788	C	2,LS
41.538	355 076	2 762 500	$2s2p^3$–$2s2p^2(^4$P)$3d$	^{3}D°–^{3}F	2–2	5–5	1.26E+03	3.25E−02	2.22E−02	−0.789	C	2,LS
41.543	355 350	2 762 500	$2s2p^3$–$2s2p^2(^4$P)$3d$	^{3}D°–^{3}F	3–2	7–5	3.54E+01	6.55E−04	6.27E−04	−2.339	D	2,LS
41.543	355 364	2 762 500	$2s2p^3$–$2s2p^2(^4$P)$3d$	^{3}D°–^{3}F	1–2	3–5	6.77E+03	2.92E−01	1.20E−01	−0.057	B	2,LS
41.829	530 177	2 920 850	$2s2p^3$–$2s2p^2(^2$D)$3d$	^{1}D°–^{1}D	2–2	5–5	1.12E+04	2.93E−01	2.02E−01	0.166	B	2,LS
41.975	417 419	2 799 800	$2s2p^3$–$2s2p^2(^2$P)$3d$	^{3}P°–^{3}D	2–3	5–7	8.28E+03	3.06E−01	2.11E−01	0.185	B	2,LS
42.105	868 462	3 243 450	$2p^4$–$2s^22p4d$	^{1}D–^{1}F°	2–3	5–7	3.71E+00	1.38E−04	9.57E−05	−3.161	D	2,LS
42.342	530 177	2 891 900	$2s2p^3$–$2s2p^2(^2$D)$3d$	^{1}D°–^{1}F	2–3	5–7	3.59E+03	1.35E−01	9.41E−02	−0.171	B	2,LS
42.643	0	2 345 060	$2s^22p^2$–$2s^22p3s$	^{3}P–^{1}P°	0–1	1–3	1.39E+01	1.14E−03	1.59E−04	−2.945	C	1
42.738	5 208.0	2 345 060	$2s^22p^2$–$2s^22p3s$	^{3}P–^{1}P°	1–1	3–3	2.74E+01	7.51E−04	3.17E−04	−2.648	C	1
42.751	186 251+x	2 525 380+x	$2s2p^3$–$2s2p^2(^4$P)$3s$	^{5}S°–^{5}P	2–3	5–7	1.82E+03	6.97E−02	4.91E−02	−0.458	C	2,LS
42.823?	355 076	2 690 250?	$2s2p^3$–$2s2p^2(^2$D)$3s$	^{3}D°–^{3}D	2–3	5–7	2.88E+02	1.11E−02	7.82E−03	−1.256	C	2,LS
42.828?	355 350	2 690 250?	$2s2p^3$–$2s2p^2(^2$D)$3s$	^{3}D°–^{3}D	3–3	7–7	2.30E+03	6.31E−02	6.23E−02	−0.355	C	2,LS
42.865	186 251+x	2 519 160+x	$2s2p^3$–$2s2p^2(^4$P)$3s$	^{5}S°–^{5}P	2–2	5–5	1.80E+03	4.96E−02	3.50E−02	−0.606	C	2,LS
42.869	12 388.1	2 345 060	$2s^22p^2$–$2s^22p3s$	^{3}P–^{1}P°	2–1	5–3	2.94E+00	4.86E−05	3.43E−05	−3.614	D	1
42.949	59 2480	2 920 850	$2s2p^3$–$2s2p^2(^2$D)$3d$	^{1}P°–^{1}D	1–2	3–5	3.62E+03	1.67E−01	7.08E−02	−0.300	B	2,LS
42.990	5 208.0	2 331 340	$2s^22p^2$–$2s^22p3s$	^{3}P–^{3}P°	1–2	3–5	5.74E+02	2.65E−02	1.13E−02	−1.100	B	1
43.099	0	2 320 260	$2s^22p^2$–$2s^22p3s$	^{3}P–^{3}P°	0–1	1–3	7.39E+02	6.17E−02	8.76E−03	−1.210	B	1
43.123	12 388.1	2 331 340	$2s^22p^2$–$2s^22p3s$	^{3}P–^{3}P°	2–2	5–5	1.69E+03	4.71E−02	3.34E−02	−0.628	B	1
43.196	5 208.0	2 320 260	$2s^22p^2$–$2s^22p3s$	^{3}P–^{3}P°	1–1	3–3	5.31E+02	1.49E−02	6.34E−03	−1.351	B	1
43.330	12 388.1	2 320 260	$2s^22p^2$–$2s^22p3s$	^{3}P–^{3}P°	2–1	5–3	9.60E+02	1.62E−02	1.16E−02	−1.091	B	1
43.900	67 146.3	2 345 060	$2s^22p^2$–$2s^22p3s$	^{1}D–^{1}P°	2–1	5–3	2.72E+03	4.72E−02	3.41E−02	−0.627	B	1
43.998?	417 419	2 690 250?	$2s2p^3$–$2s2p^2(^2$D)$3s$	^{3}P°–^{3}D	2–3	5–7	9.97E+02	4.05E−02	2.93E−02	−0.694	C	2,LS
44.166	67 146.3	2 331 340	$2s^22p^2$–$2s^22p3s$	^{1}D–^{3}P°	2–2	5–5	1.76E+01	5.15E−04	3.75E−04	−2.589	C	1
44.383	67 146.3	2 320 260	$2s^22p^2$–$2s^22p3s$	^{1}D–^{3}P°	2–1	5–3	7.72E+01	1.37E−03	9.99E−04	−2.165	C	1
44.728?	355 076	2 590 790?	$2s2p^3$–$2s2p^2(^4$P)$3s$	^{3}D°–^{3}P	2–2	5–5	2.36E+02	7.07E−03	5.21E−03	−1.452	D	2,LS
44.734?	355 364	2 590 790?	$2s2p^3$–$2s2p^2(^4$P)$3s$	^{3}D°–^{3}P	1–2	3–5	1.57E+01	7.85E−04	3.47E−04	−2.628	D	2,LS
44.734?	355 350	2 590 790?	$2s2p^3$–$2s2p^2(^4$P)$3s$	^{3}D°–^{3}P	3–2	7–5	1.32E+03	2.83E−02	2.92E−02	−0.703	C	2,LS
45.205	132 929	2 345 060	$2s^22p^2$–$2s^22p3s$	^{1}S–^{1}P°	0–1	1–3	8.18E+02	7.52E−02	1.12E−02	−1.124	B	1
45.718	132 929	2 320 260	$2s^22p^2$–$2s^22p3s$	^{1}S–^{3}P°	0–1	1–3	1.69E+01	1.59E−03	2.40E−04	−2.798	C	1
46.002?	416 986	2 590 790?	$2s2p^3$–$2s2p^2(^4$P)$3s$	^{3}P°–^{3}P	1–2	3–5	3.12E+02	1.65E−02	7.50E−03	−1.305	C	2,LS
46.011?	417 419	2 590 790?	$2s2p^3$–$2s2p^2(^4$P)$3s$	^{3}P°–^{3}P	2–2	5–5	9.36E+02	2.97E−02	2.25E−02	−0.828	C	2,LS
48.648?	535 220	2 590 790?	$2s2p^3$–$2s2p^2(^4$P)$3s$	^{3}S°–^{3}P	1–2	3–5	2.35E+01	1.39E−03	6.68E−04	−2.380	D	2,LS
51.907?	868 462	2 795 000?	$2p^4$–$2s2p^2(^2$D)$3p$	^{1}D–^{1}F°	2–3	5–7	6.63E+01	3.75E−03	3.20E−03	−1.727	D	2,LS
52.055?	868 462	2 789 500?	$2p^4$–$2s2p^2(^2$D)$3p$	^{1}D–^{1}D°	2–2	5–5	6.97E+01	2.83E−03	2.43E−03	−1.849	D	2,LS
54.110	811 702	2 659 800	$2p^4$–$2s2p^2(^4$P)$3p$	^{3}P–^{3}D°	2–3	5–7	6.23E+00	3.83E−04	3.41E−04	−2.718	D	2,LS
57.130	811 702	2 562 100	$2p^4$–$2s^22p3d$	^{3}P–^{3}P°	2–1	5–3	3.95E−01	1.16E−05	1.09E−05	−4.237	D	1
57.172	811 702	2 560 810	$2p^4$–$2s^22p3d$	^{3}P–^{3}P°	2–2	5–5	6.92E−01	3.39E−05	3.19E−05	−3.770	D	1
57.348	811 702	2 555 430	$2p^4$–$2s^22p3d$	^{3}P–^{3}D°	2–3	5–7	5.24E−02	3.62E−06	3.41E−06	−4.743	E	1
57.419	820 531	2 562 100	$2p^4$–$2s^22p3d$	^{3}P–^{3}P°	1–1	3–3	2.52E−01	1.25E−05	7.07E−06	−4.427	D	1
57.462	820 531	2 560 810	$2p^4$–$2s^22p3d$	^{3}P–^{3}P°	1–2	3–5	1.27E−01	1.05E−05	5.96E−06	−4.502	D	1
57.522	823 645	2 562 100	$2p^4$–$2s^22p3d$	^{3}P–^{3}P°	0–1	1–3	2.52E−01	3.75E−05	7.10E−06	−4.426	D	1
57.536	811 702	2 549 740	$2p^4$–$2s^22p3d$	^{3}P–^{3}D°	2–2	5–5	1.51E−01	7.48E−06	7.09E−06	−4.427	E	1
57.580	811 702	2 548 420	$2p^4$–$2s^22p3d$	^{3}P–^{3}D°	2–1	5–3	3.00E−02	8.93E−07	8.47E−07	−5.350	E	1
57.830	820 531	2 549 740	$2p^4$–$2s^22p3d$	^{3}P–^{3}D°	1–2	3–5	1.65E−01	1.38E−05	7.87E−06	−4.384	D	1
57.874	820 531	2 548 420	$2p^4$–$2s^22p3d$	^{3}P–^{3}D°	1–1	3–3	3.27E−03	1.64E−07	9.37E−08	−6.308	E	1
57.979	823 645	2 548 420	$2p^4$–$2s^22p3d$	^{3}P–^{3}D°	0–1	1–3	9.30E−02	1.41E−05	2.68E−06	−4.852	D	1
58.104?	868 462	2 589 510?	$2p^4$–$2s^22p3d$	^{1}D–^{1}P°	2–1	5–3	1.26E−02	3.82E−07	3.66E−07	−5.719	E	1
58.110	868 462	2 589 340	$2p^4$–$2s^22p3d$	^{1}D–^{1}F°	2–3	5–7	3.80E−01	2.69E−05	2.58E−05	−3.871	D	1
60.103	868 462	2 532 260	$2p^4$–$2s^22p3d$	^{1}D–^{1}D°	2–2	5–5	8.81E−02	4.77E−06	4.72E−06	−4.622	E	1
62.392?	986 736	2 589 510?	$2p^4$–$2s^22p3d$	^{1}S–^{1}P°	0–1	1–3	1.49E+00	2.60E−04	5.35E−05	−3.585	C	1
65.216	811 702	2 345 060	$2p^4$–$2s^22p3s$	^{3}P–^{1}P°	2–1	5–3	3.45E−03	1.32E−07	1.42E−07	−6.181	E	1
65.728	823 645	2 345 060	$2p^4$–$2s^22p3s$	^{3}P–^{1}P°	0–1	1–3	6.68E−04	1.30E−07	2.81E−08	−6.887	E	1
65.805	811 702	2 331 340	$2p^4$–$2s^22p3s$	^{3}P–^{3}P°	2–2	5–5	4.28E−02	2.78E−06	3.01E−06	−4.857	E	1
66.190	820 531	2 331 340	$2p^4$–$2s^22p3s$	^{3}P–^{3}P°	1–2	3–5	1.14E−02	1.25E−06	8.17E−07	−5.426	E	1
66.288	811 702	2 320 260	$2p^4$–$2s^22p3s$	^{3}P–^{3}P°	2–1	5–3	2.08E−02	8.21E−07	8.96E−07	−5.387	E	1
66.679	820 531	2 320 260	$2p^4$–$2s^22p3s$	^{3}P–^{3}P°	1–1	3–3	1.04E−02	6.96E−07	4.58E−07	−5.680	E	1

S XI—Continued

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i–J_k	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
66.817	823 645	2 320 260	$2p^4-2s^22p3s$	^{3}P–^{3}P°	0–1	1–3	1.25E−02	2.50E−06	5.50E−07	−5.602	E	1
67.723	868 462	2 345 060	$2p^4-2s^22p3s$	^{1}D–^{1}P°	2–1	5–3	1.32E−03	5.43E−08	6.06E−08	−6.566	E	1
73.620	986 736	2 345 060	$2p^4-2s^22p3s$	^{1}S–^{1}P°	0–1	1–3	2.09E−03	5.11E−07	1.24E−07	−6.292	E	1
74.989	986 736	2 320 260	$2p^4-2s^22p3s$	^{1}S–^{3}P°	0–1	1–3	4.07E−04	1.03E−07	2.54E−08	−6.988	E	1
136.465	2 320 260	3 053 050	$2s^22p3s-2s2p^2(^2P)3d$	^{3}P°–^{3}P	1–2	3–5	3.07E−01	1.43E−04	1.93E−04	−3.368	D	2,LS
138.560	2 331 340	3 053 050	$2s^22p3s-2s2p^2(^2P)3d$	^{3}P°–^{3}P	2–2	5–5	8.83E−01	2.54E−04	5.79E−04	−2.896	D	2,LS
155.809?	2 590 790?	3 232 600	$2s2p^2(^4P)3s-2s^22p4d$	^{3}P–^{3}D°	2–3	5–7	6.71E+01	3.42E−02	8.77E−02	−0.767	C	2,LS
157.659?	186 251+x	820 531	$2s2p^3-2p^4$	^{5}S°–^{3}P	2–1	5–3	7.16E−02	1.60E−05	4.15E−05	−4.097	D	1
158.385	355 364	986 736	$2s2p^3-2p^4$	^{3}D°–^{1}S	1–0	3–1	7.83E−02	9.82E−06	1.54E−05	−4.531	E	1
159.885?	186 251+x	811 702	$2s2p^3-2p^4$	^{5}S°–^{3}P	2–2	5–5	1.77E−01	6.78E−05	1.79E−04	−3.470	D	1
168.782	0	592 480	$2s^22p^2-2s2p^3$	^{3}P–^{1}P°	0–1	1–3	7.78E−03	9.97E−06	5.54E−06	−5.001	E	1
170.279	5 208.0	592 480	$2s^22p^2-2s2p^3$	^{3}P–^{1}P°	1–1	3–3	1.77E+00	7.68E−04	1.29E−03	−2.637	C	1
173.674	2 345 060	2 920 850	$2s^22p3s-2s2p^2(^2D)3d$	^{1}P°–^{1}D	1–2	3–5	1.62E+00	1.22E−03	2.09E−03	−2.437	D	2,LS

10. S XII

$Z=16$

B I isoelectronic sequence

Ground state $1s^2 2s^2 2p\ {}^2P^{\circ}_{1/2}$

Ionization energy 4 552 500 cm^{-1} (564.44 eV)

Data are tabulated for 156 transitions in the range 23–170 Å. Transition probabilities for the $2s^2 2p - 2s^2 nd (n=3-4)$, $2s2p^2 - 2s2pnd (n=3-4)$, and $2s^2 2p - 2s2p3p$ transitions are from calculations with the Cowan relativistic HFR code by Fawcett and Hayes.[1] Remaining results are taken from the OP.[2] Multiplet average results from OP have been decomposed into fine-structure components assuming LS coupling, as indicated by the notation LS in the reference column.

References

[1]B. C. Fawcett and R. W. Hayes, Phys. Scr. **36**, 80 (1987).
[2]http://legacy.gsfc.nasa.gov/topbase/(Downloaded 23 August 1995).

S XII

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	$J_i - J_k$	$g_i - g_k$	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
23.726?	13 135.3	4 228 000?	$2s^2 2p - 2s^2 7d$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	1.04E+03	1.31E−02	4.09E−03	−1.281	C	2,LS
24.421?	13 135.3	4 108 000?	$2s^2 2p - 2s^2 6d$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	1.63E+03	2.18E−02	7.01E−03	−1.059	C	2,LS
25.569	0.0	3 911 000	$2s^2 2p - 2s^2 5d$	$^2P^{\circ} - {}^2D$	1/2–3/2	2–4	2.14E+03	4.20E−02	7.07E−03	−1.076	C	2,LS
25.655	13 135.3	3 911 000	$2s^2 2p - 2s^2 5d$	$^2P^{\circ} - {}^2D$	3/2–3/2	4–4	4.25E+02	4.19E−03	1.42E−03	−1.776	D	2,LS
25.655	13 135.3	3 911 000	$2s^2 2p - 2s^2 5d$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	2.55E+03	3.77E−02	1.27E−02	−0.822	C	2,LS
26.890?	13 135.3	3 732 000?	$2s^2 2p - 2s2p(^3P^{\circ})4p$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	3.51E+03	5.70E−02	2.02E−02	−0.642	C	1
27.884?	346 700	3 933 000?	$2s2p^2 - 2s2p(^1P^{\circ})4d$	$^2D - {}^2F^{\circ}$	3/2–5/2	4–6	2.63E+03	4.60E−02	1.69E−02	−0.735	C	2,LS
27.886?	347 005	3 933 000?	$2s2p^2 - 2s2p(^1P^{\circ})4d$	$^2D - {}^2F^{\circ}$	5/2–7/2	6–8	3.56E+03	5.53E−02	3.05E−02	−0.479	C	1
27.886?	347 005	3 933 000?	$2s2p^2 - 2s2p(^1P^{\circ})4d$	$^2D - {}^2F^{\circ}$	5/2–5/2	6–6	1.88E+02	2.19E−03	1.21E−03	−1.881	D	2,LS
28.180?	205 425+x	3 754 000+x?	$2s2p^2 - 2s2p(^3P^{\circ})4d$	$^4P - {}^4D^{\circ}$	5/2–7/2	6–8	8.58E+03	1.36E−01	7.58E−02	−0.088	B	1
28.222	0.0	3 543 300	$2s^2 2p - 2s^2 4d$	$^2P^{\circ} - {}^2D$	1/2–3/2	2–4	5.34E+03	1.28E−01	2.37E−02	−0.593	B	1
28.268?	690 480	4 228 000?	$2p^3 - 2s^2 7d$	$^2D^{\circ} - {}^2D$	5/2–5/2	6–6	8.77E−02	1.05E−06	5.86E−07	−5.201	E	2,LS
28.327	13 135.3	3 543 300	$2s^2 2p - 2s^2 4d$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	6.33E+03	1.14E−01	4.26E−02	−0.340	B	1
28.327	13 135.3	3 543 300	$2s^2 2p - 2s^2 4d$	$^2P^{\circ} - {}^2D$	3/2–3/2	4–4	1.04E+03	1.25E−02	4.66E−03	−1.301	C	2,LS
28.967?	775 805	4 228 000?	$2p^3 - 2s^2 7d$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	2.35E+00	4.44E−05	1.69E−05	−3.751	E	2,LS
29.200	347 005	3 771 700	$2s2p^2 - 2s2p(^3P^{\circ})4d$	$^2D - {}^2F^{\circ}$	5/2–7/2	6–8	8.41E+03	1.43E−01	8.27E−02	−0.066	B	1
29.240	346 700	3 766 700	$2s2p^2 - 2s2p(^3P^{\circ})4d$	$^2D - {}^2F^{\circ}$	3/2–5/2	4–6	5.83E+03	1.12E−01	4.31E−02	−0.349	C	1
29.242	347 005	3 766 700	$2s2p^2 - 2s2p(^3P^{\circ})4d$	$^2D - {}^2F^{\circ}$	5/2–5/2	6–6	5.66E+02	7.25E−03	4.19E−03	−1.362	D	2,LS
29.256?	689 910	4 108 000?	$2p^3 - 2s^2 6d$	$^2D^{\circ} - {}^2D$	3/2–5/2	4–6	5.00E−01	9.62E−06	3.71E−06	−4.415	E	2,LS
29.261?	690 480	4 108 000?	$2p^3 - 2s^2 6d$	$^2D^{\circ} - {}^2D$	5/2–5/2	6–6	6.99E+00	8.97E−05	5.19E−05	−3.269	E	2,LS
30.010?	775 805	4 108 000?	$2p^3 - 2s^2 6d$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	7.51E+00	1.52E−04	6.01E−05	−3.216	D	2,LS
31.045	689 910	3 911 000	$2p^3 - 2s^2 5d$	$^2D^{\circ} - {}^2D$	3/2–3/2	4–4	3.35E−01	4.84E−06	1.98E−06	−4.713	E	2,LS
31.051	690 480	3 911 000	$2p^3 - 2s^2 5d$	$^2D^{\circ} - {}^2D$	5/2–5/2	6–6	3.47E−01	5.02E−06	3.08E−06	−4.521	E	2,LS
31.878	774 020	3 911 000	$2p^3 - 2s^2 5d$	$^2P^{\circ} - {}^2D$	1/2–3/2	2–4	6.99E−01	2.13E−05	4.47E−06	−4.371	E	2,LS
31.896	775 805	3 911 000	$2p^3 - 2s^2 5d$	$^2P^{\circ} - {}^2D$	3/2–3/2	4–4	1.39E−01	2.12E−06	8.90E−07	−5.072	E	2,LS
31.896	775 805	3 911 000	$2p^3 - 2s^2 5d$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	8.35E−01	1.91E−05	8.02E−06	−4.117	E	2,LS
32.669	0.0	3 061 000	$2s^2 2p - 2s2p(^1P^{\circ})3p$	$^2P^{\circ} - {}^2D$	1/2–3/2	2–4	7.81E+02	2.50E−02	5.38E−03	−1.301	C	1
32.810	13 135.3	3 061 000	$2s^2 2p - 2s2p(^1P^{\circ})3p$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	7.23E+02	1.75E−02	7.56E−03	−1.155	C	1
32.810	13 135.3	3 061 000	$2s^2 2p - 2s2p(^1P^{\circ})3p$	$^2P^{\circ} - {}^2D$	3/2–3/2	4–4	1.18E+02	1.91E−03	8.25E−04	−2.117	D	2,LS
32.878?	690 480	3 732 000?	$2p^3 - 2s2p(^3P^{\circ})4p$	$^2D^{\circ} - {}^2D$	5/2–5/2	6–6	3.86E−01	6.25E−06	4.06E−06	−4.426	E	2,LS
33.827?	775 805	3 732 000?	$2p^3 - 2s2p(^3P^{\circ})4p$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	1.57E+02	4.04E−03	1.80E−03	−1.792	D	2,LS
34.132?	0.0	2 929 800?	$2s^2 2p - 2s2p(^3P^{\circ})3p$	$^2P^{\circ} - {}^2S$	1/2–1/2	2–2	2.72E+03	4.75E−02	1.07E−02	−1.022	C	1
34.286?	13 135.3	2 929 800?	$2s^2 2p - 2s2p(^3P^{\circ})3p$	$^2P^{\circ} - {}^2S$	3/2–1/2	4–2	5.99E+03	5.28E−02	2.38E−02	−0.675	C	2,LS
34.533	0.0	2 895 800	$2s^2 2p - 2s2p(^3P^{\circ})3p$	$^2P^{\circ} - {}^2D$	1/2–3/2	2–4	2.08E+03	7.45E−02	1.69E−02	−0.827	C	1
34.586	13 135.3	2 904 500	$2s^2 2p - 2s2p(^3P^{\circ})3p$	$^2P^{\circ} - {}^2D$	3/2–5/2	4–6	8.99E+03	2.42E−01	1.10E−01	−0.015	B	1
34.690	13 135.3	2 895 800	$2s^2 2p - 2s2p(^3P^{\circ})3p$	$^2P^{\circ} - {}^2D$	3/2–3/2	4–4	1.44E+03	2.59E−02	1.18E−02	−0.985	C	2,LS
35.046	689 910	3 543 300	$2p^3 2s^2 4d$	$^2D^{\circ} - {}^2D$	3/2–3/2	4–4	1.96E+00	3.61E−05	1.67E−05	−3.840	E	2,LS
35.046	689 910	3 543 300	$2p^3 - 2s^2 4d$	$^2D^{\circ} - {}^2D$	3/2–5/2	4–6	1.45E−01	4.01E−06	1.85E−06	−4.795	E	2,LS
35.053	690 480	3 543 300	$2p^3 - 2s^2 4d$	$^2D^{\circ} - {}^2D$	5/2–5/2	6–6	2.03E+00	3.74E−05	2.59E−05	−3.649	E	2,LS
35.053	690 480	3 543 300	$2p^3 - 2s^2 4d$	$^2D^{\circ} - {}^2D$	5/2–3/2	6–4	2.17E−01	2.67E−06	1.85E−06	−4.795	E	2,LS
35.112	0.0	2 848 000	$2s^2 2p - 2s2p(^3P^{\circ})3p$	$^2P^{\circ} - {}^2P$	1/2–3/2	2–4	1.26E+03	4.67E−02	1.08E−02	−1.030	C	2,LS
35.203	0.0	2 840 700	$2s^2 2p - 2s2p(^3P^{\circ})3p$	$^2P^{\circ} - {}^2P$	1/2–1/2	2–2	4.23E+03	7.85E−02	1.82E−02	−0.804	C	1
35.275	13 135.3	2 848 000	$2s^2 2p - 2s2p(^3P^{\circ})3p$	$^2P^{\circ} - {}^2P$	3/2–3/2	4–4	4.42E+03	8.25E−02	3.83E−02	−0.481	C	1

S XII—Continued

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i–J_k	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
35.366	13 135.3	2 840 700	$2s^22p$–$2s2p(^3P°)3p$	$^2P°$–^2P	3/2–1/2	4–2	2.47E+03	2.32E−02	1.08E−02	−1.032	C	2,LS
35.791	346 700	3 140 700	$2s2p^2$–$2s2p(^1P°)3d$	^2D–$^2D°$	3/2–5/2	4–6	1.47E+02	4.24E−03	2.00E−03	−1.771	D	2,LS
35.795	347 005	3 140 700	$2s2p^2$–$2s2p(^1P°)3d$	^2D–$^2D°$	5/2–5/2	6–6	2.06E+03	3.96E−02	2.80E−02	−0.624	C	2,LS
35.952	346 700	3 128 200	$2s2p^2$–$2s2p(^1P°)3d$	^2D–$^2F°$	3/2–5/2	4–6	1.51E+04	4.39E−01	2.08E−01	0.245	B	2,LS
35.956	347 005	3 128 200	$2s2p^2$–$2s2p(^1P°)3d$	^2D–$^2F°$	5/2–7/2	6–8	1.33E+04	3.44E−01	2.44E−01	0.314	B	1
35.956	347 005	3 128 200	$2s2p^2$–$2s2p(^1P°)3d$	^2D–$^2F°$	5/2–5/2	6–6	1.08E+03	2.09E−02	1.48E−02	−0.902	C	2,LS
36.062	193 882+x	2 966 900+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4P°$	1/2–3/2	2–4	6.69E+03	2.61E−01	6.20E−02	−0.282	B	2,LS
36.110	774 020	3 543 300	$2p^3$–$2s^24d$	$^2P°$–^2D	1/2–3/2	2–4	1.98E+01	7.74E−04	1.84E−04	−2.810	D	2,LS
36.124	198 675+x	2 966 900+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4P°$	3/2–3/2	4–4	7.05E+03	1.38E−01	6.57E−02	−0.258	B	1
36.134	775 805	3 543 300	$2p^3$–$2s^24d$	$^2P°$–^2D	3/2–5/2	4–6	2.37E+01	6.97E−04	3.32E−04	−2.555	D	2,LS
36.134	775 805	3 543 300	$2p^3$–$2s^24d$	$^2P°$–^2D	3/2–3/2	4–4	3.95E+00	7.74E−05	3.68E−05	−3.509	E	2,LS
36.165	198 675+x	2 963 800+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4P°$	3/2–5/2	4–6	4.79E+03	1.41E−01	6.72E−02	−0.249	B	2,LS
36.213	205 425+x	2 966 900+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4P°$	5/2–3/2	6–4	7.14E+03	9.36E−02	6.70E−02	−0.251	C	2,LS
36.253	205 425+x	2 963 800+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4P°$	5/2–5/2	6–6	1.15E+04	2.27E−01	1.62E−01	0.133	B	1
36.253	193 882+x	2 952 300+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4D°$	1/2–3/2	2–4	1.65E+04	6.49E−01	1.55E−01	0.113	B	1
36.316	198 675+x	2 952 300+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4D°$	3/2–3/2	4–4	1.59E+04	3.15E−01	1.51E−01	0.100	B	2,LS
36.335	205 425+x	2 957 600+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4D°$	5/2–7/2	6–8	2.80E+04	7.38E−01	5.30E−01	0.646	B	1
36.336	198 675+x	2 950 800+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4D°$	3/2–5/2	4–6	2.07E+04	6.14E−01	2.94E−01	0.390	B	1
36.398	0.0	2 747 400	$2s^22p$–$2s^23d$	$^2P°$–^2D	1/2–3/2	2–4	1.69E+04	6.71E−01	1.61E−01	0.128	B	1
36.405	205 425+x	2 952 300+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4D°$	5/2–3/2	6–4	1.49E+03	1.97E−02	1.42E−02	−0.927	C	2,LS
36.425	205 425+x	2 950 800+x	$2s2p^2$–$2s2p(^3P°)3d$	^4P–$^4D°$	5/2–5/2	6–6	8.90E+03	1.77E−01	1.27E−01	0.026	B	2,LS
36.564	13 135.3	2 748 100	$2s^22p$–$2s^23d$	$^2P°$–^2D	3/2–5/2	4–6	1.99E+04	5.98E−01	2.88E−01	0.379	B	1
36.573	13 135.3	2 747 400	$2s^22p$–$2s^23d$	$^2P°$–^2D	3/2–3/2	4–4	3.19E+03	6.40E−02	3.08E−02	−0.592	C	2,LS
37.463	471 430	3 140 700	$2s2p^2$–$2s2p(^1P°)3d$	^2P–$^2D°$	3/2–5/2	4–6	2.37E+04	7.49E−01	3.70E−01	0.477	B	1
37.473	346 700	3 015 300	$2s2p^2$–$2s2p(^3P°)3d$	^2D–$^2P°$	3/2–1/2	4–2	3.52E+02	3.70E−03	1.83E−03	−1.830	D	2,LS
37.526	346 700	3 011 500	$2s2p^2$–$2s2p(^3P°)3d$	^2D–$^2P°$	3/2–3/2	4–4	3.50E+01	7.39E−04	3.65E−04	−2.529	D	2,LS
37.531	347 005	3 011 500	$2s2p^2$–$2s2p(^3P°)3d$	^2D–$^2P°$	5/2–3/2	6–4	3.15E+02	4.44E−03	3.29E−03	−1.574	D	2,LS
37.603	347 005	3 006 400	$2s2p^2$–$2s2p(^3P°)3d$	^2D–$^2F°$	5/2–7/2	6–8	2.26E+04	6.39E−01	4.75E−01	0.584	B	1
37.719	347 005	2 998 200	$2s2p^2$–$2s2p(^3P°)3d$	^2D–$^2F°$	5/2–5/2	6–6	1.30E+03	2.78E−02	2.07E−02	−0.778	C	2,LS
38.316	346 700	2 956 600	$2s2p^2$–$2s2p(^3P°)3d$	^2D–$^2D°$	3/2–5/2	4–6	5.33E+02	1.76E−02	8.88E−03	−1.152	C	2,LS
38.320	347 005	2 956 600	$2s2p^2$–$2s2p(^3P°)3d$	^2D–$^2D°$	5/2–5/2	6–6	3.64E+03	8.02E−02	6.07E−02	−0.318	C	1
38.819	198 675+x	2 774 700+x	$2s2p^2$–$2s2p(^3P°)3s$	^4P–$^4P°$	3/2–5/2	4–6	1.12E+03	3.81E−02	1.95E−02	−0.817	C	2,LS
38.824	439 580	3 015 300	$2s2p^2$–$2s2p(^3P°)3d$	^2S–$^2P°$	1/2–1/2	2–2	1.05E+04	2.37E−01	6.05E−02	−0.325	B	1
38.881	439 580	3 011 500	$2s2p^2$–$2s2p(^3P°)3d$	^2S–$^2P°$	1/2–3/2	2–4	1.25E+04	5.67E−01	1.45E−01	−0.055	B	1
38.921	205 425+x	2 774 700+x	$2s2p^2$–$2s2p(^3P°)3s$	^4P–$^4P°$	5/2–5/2	6–6	2.12E+03	4.82E−02	3.70E−02	−0.539	C	1
39.207	464 755	3 015 300	$2s2p^2$–$2s2p(^3P°)3d$	^2P–$^2P°$	1/2–1/2	2–2	1.36E+03	3.13E−02	8.08E−03	−1.203	C	2,LS
39.266	464 755	3 011 500	$2s2p^2$–$2s2p(^3P°)3d$	^2P–$^2P°$	1/2–3/2	2–4	3.37E+02	1.56E−02	4.03E−03	−1.506	C	2,LS
39.310	471 430	3 015 300	$2s2p^2$–$2s2p(^3P°)3d$	^2P–$^2P°$	3/2–1/2	4–2	6.73E+02	7.79E−03	4.03E−03	−1.506	D	2,LS
39.369	471 430	3 011 500	$2s2p^2$–$2s2p(^3P°)3d$	^2P–$^2P°$	3/2–3/2	4–4	1.67E+03	3.89E−02	2.02E−02	−0.808	C	2,LS
40.239	471 430	2 956 600	$2s2p^2$–$2s2p(^3P°)3d$	^2P–$^2D°$	3/2–5/2	4–6	2.28E+03	8.30E−02	4.40E−02	−0.479	C	2,LS
42.175	689 910	3 061 000	$2p^3$–$2s2p(^1P°)^3P$	$^2D°$–^2D	3/2–3/2	4–4	2.09E+00	5.57E−05	3.09E−05	−3.652	E	2,LS
42.175	689 910	3 061 000	$2p^3$–$2s2p(^1P°)^3P$	$^2D°$–^2D	3/2–5/2	4–6	1.55E−01	6.19E−06	3.44E−06	−4.606	E	2,LS
42.185	690 480	3 061 000	$2p^3$–$2s2p(^1P°)^3P$	$^2D°$–^2D	5/2–3/2	6–4	2.32E−01	4.13E−06	3.44E−06	−4.606	E	2,LS
42.185	690 480	3 061 000	$2p^3$–$2s2p(^1P°)^3P$	$^2D°$–^2D	5/2–5/2	6–6	2.17E+00	5.78E−05	4.82E−05	−3.460	E	2,LS
43.726	774 020	3 061 000	$2p^3$–$2s2p(^1P°)^3P$	$^2P°$–^2D	1/2–3/2	2–4	2.32E+00	1.33E−04	3.83E−05	−3.575	D	2,LS
43.760	775 805	3 061 000	$2p^3$–$2s2p(^1P°)^3P$	$^2P°$–^2D	3/2–3/2	4–4	4.63E−01	1.33E−05	7.66E−06	−4.274	E	2,LS
43.760	775 805	3 061 000	$2p^3$–$2s2p(^1P°)^3P$	$^2P°$–^2D	3/2–5/2	4–6	2.79E+00	1.20E−04	6.92E−05	−3.319	D	2,LS
45.155	689 910	2 904 500	$2p^3$–$2s2p(^3P°)^3P$	$^2D°$–^2D	3/2–5/2	4–6	5.95E+00	2.73E−04	1.62E−04	−2.962	D	2,LS
45.167	690 480	2 904 500	$2p^3$–$2s2p(^3P°)^3P$	$^2D°$–^2D	5/2–5/2	6–6	8.31E+01	2.54E−03	2.27E−03	−1.817	D	2,LS
45.333	689 910	2 895 800	$2p^3$–$2s2p(^3P°)^3P$	$^2D°$–^2D	3/2–3/2	4–4	7.92E+01	2.44E−03	1.46E−03	−2.011	D	2,LS
45.345	690 480	2 895 800	$2p^3$–$2s2p(^3P°)^3P$	$^2D°$–^2D	5/2–3/2	6–4	8.81E+00	1.81E−04	1.62E−04	−2.964	D	2,LS
46.337	689 910	2 848 000	$2p^3$–$2s2p(^3P°)^3P$	$^2D°$–^2P	3/2–3/2	4–4	1.26E+01	4.05E−04	2.47E−04	−2.790	D	2,LS
46.350	690 480	2 848 000	$2p^3$–$2s2p(^3P°)^3P$	$^2D°$–^2P	5/2–3/2	6–4	1.13E+02	2.43E−03	2.23E−03	−1.836	D	2,LS
46.387?	774 020	2 929 800?	$2p^3$–$2s2p(^3P°)^3P$	$^2P°$–^2S	1/2–1/2	2–2	1.39E+02	4.49E−03	1.37E−03	−2.047	D	2,LS
46.425?	775 805	2 929 800?	$2p^3$–$2s2p(^3P°)^3P$	$^2P°$–^2S	3/2–1/2	4–2	2.77E+02	4.48E−03	2.74E−03	−1.747	D	2,LS
46.495	689 910	2 840 700	$2p^3$–$2s2p(^3P°)^3P$	$^2D°$–^2P	3/2–1/2	4–2	1.25E+02	2.02E−03	1.24E−03	−2.093	D	2,LS
46.977	775 805	2 904 500	$2p^3$–$2s2p(^3P°)^3P$	$^2P°$–^2D	3/2–5/2	4–6	4.78E+01	2.37E−03	1.47E−03	−2.023	D	2
47.130	774 020	2 895 800	$2p^3$–$2s2p(^3P°)^3P$	$^2P°$–^2D	1/2–3/2	2–4	3.93E+01	2.62E−03	8.13E−04	−2.281	D	2,LS
47.170	775 805	2 895 800	$2p^3$–$2s2p(^3P°)^3P$	$^2P°$–^2D	3/2–3/2	4–4	7.85E+00	2.62E−04	1.63E−04	−2.980	D	2,LS
48.216	774 020	2 848 000	$2p^3$–$2s2p(^3P°)^3P$	$^2P°$–^2P	1/2–3/2	2–4	2.18E−01	1.52E−05	4.83E−06	−4.517	E	2,LS
48.258	775 805	2 848 000	$2p^3$–$2s2p(^3P°)^3P$	$^2P°$–^2P	3/2–3/2	4–4	1.09E+00	3.79E−05	2.41E−05	−3.819	E	2,LS
48.387	774 020	2 840 700	$2p^3$–$2s2p(^3P°)^3P$	$^2P°$–^2P	1/2–1/2	2–2	8.60E−01	3.02E−05	9.62E−06	−4.219	E	2,LS

S XII—Continued

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i–J_k	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
48.429	775 805	2 840 700	$2p^3$–$2s2p(^3P°)^3P$	$^2P°$–^2P	3/2–1/2	4–2	4.30E−01	7.55E−06	4.82E−06	−4.520	E	2,LS
48.586	689 910	2 748 100	$2p^3$–$2s^23d$	$^2D°$–^2D	3/2–5/2	4–6	1.12E−01	5.94E−06	3.80E−06	−4.624	E	2,LS
48.600	690 480	2 748 100	$2p^3$–$2s^23d$	$^2D°$–^2D	5/2–5/2	6–6	1.57E+00	5.54E−05	5.32E−05	−3.478	E	2,LS
48.603	689 910	2 747 400	$2p^3$–$2s^23d$	$^2D°$–^2D	3/2–3/2	4–4	1.51E+00	5.34E−05	3.42E−05	−3.670	E	2,LS
48.616	690 480	2 747 400	$2p^3$–$2s^23d$	$^2D°$–^2D	5/2–3/2	6–4	1.68E−01	3.96E−06	3.80E−06	−4.624	E	2,LS
50.674	774 020	2 747 400	$2p^3$–$2s^23d$	$^2P°$–^2D	1/2–3/2	2–4	5.94E−02	4.57E−06	1.53E−06	−5.039	E	2,LS
50.702	775 805	2 748 100	$2p^3$–$2s^23d$	$^2P°$–^2D	3/2–5/2	4–6	7.11E−02	4.11E−06	2.74E−06	−4.784	E	2,LS
78.653?	2 956 600	4 228 000?	$2s2p(^3P°)3d$–$2s^27d$	$^2D°$–^2D	5/2–5/2	6–6	6.57E−02	6.09E−06	9.46E−06	−4.437	E	2,LS
82.203?	3 011 500	4 228 000?	$2s2p(^3P°)3d$–$2s^27d$	$^2P°$–^2D	3/2–5/2	4–6	3.77E−02	5.73E−06	6.20E−06	−4.640	E	2,LS
84.345?	2 747 400	3 933 000?	$2s^23d$–$2s2p(^1P°)4d$	^2D–$^2F°$	3/2–5/2	4–6	3.97E+02	6.35E−02	7.05E−02	−0.595	C	2,LS
84.395?	2 748 100	3 933 000?	$2s^23d$–$2s2p(^1P°)4d$	^2D–$^2F°$	5/2–7/2	6–8	4.24E+02	6.04E−02	1.01E−01	−0.441	C	2,LS
84.395?	2 748 100	3 933 000?	$2s^23d$–$2s2p(^1P°)4d$	^2D–$^2F°$	5/2–5/2	6–6	2.83E+01	3.02E−03	5.03E−03	−1.742	D	2,LS
86.851?	2 956 600	4 108 000?	$2s2p(^3P°)3d$–$2s^26d$	$^2D°$–^2D	5/2–5/2	6–6	5.04E−01	5.70E−05	9.78E−05	−3.466	E	2,LS
90.777?	3 006 400	4 108 000?	$2s2p(^3P°)3d$–$2s^26d$	$^2F°$–^2D	7/2–5/2	8–6	4.92E−02	4.56E−06	1.09E−05	−4.438	E	2,LS
90.926?	3 128 200	4 228 000?	$2s2p(^1P°)3d$–$2s^27d$	$^2F°$–^2D	5/2–5/2	6–6	1.02E−02	1.26E−06	2.26E−06	−5.121	E	2,LS
90.926?	3 128 200	4 228 000?	$2s2p(^1P°)3d$–$2s^27d$	$^2F°$–^2D	7/2–5/2	8–6	2.02E−01	1.88E−05	4.50E−05	−3.823	E	2,LS
91.199?	3 011 500	4 108 000?	$2s2p(^3P°)3d$–$2s^26d$	$^2P°$–^2D	3/2–5/2	4–6	3.28E+00	6.13E−04	7.36E−04	−2.610	D	2,LS
91.971?	3 140 700	4 228 000?	$2s2p(^1P°)3d$–$2s^27d$	$^2D°$–^2D	5/2–5/2	6–6	2.77E−02	3.51E−06	6.38E−06	−4.677	E	2,LS
96.413?	2 895 800	3 933 000?	$2s2p(^3P°)^3P$–$2s2p(^1P°)4d$	^2D–$^2F°$	3/2–5/2	4–6	1.30E+01	2.72E−03	3.45E−03	−1.963	D	2,LS
97.229?	2 904 500	3 933 000?	$2s2p(^3P°)^3P$–$2s2p(^1P°)4d$	^2D–$^2F°$	5/2–7/2	6–8	1.36E+01	2.57E−03	4.94E−03	−1.812	D	2,LS
97.229?	2 904 500	3 933 000?	$2s2p(^3P°)^3P$–$2s2p(^1P°)4d$	^2D–$^2F°$	5/2–5/2	6–6	9.03E−01	1.28E−04	2.46E−04	−3.115	D	2,LS
97.694	2 748 100	3 771 700	$2s^23d$–$2s2p(^3P°)4d$	^2D–$^2F°$	5/2–7/2	6–8	4.83E−01	9.22E−05	1.78E−04	−3.257	E	2,LS
98.107	2 747 400	3 766 700	$2s^23d$–$2s2p(^3P°)4d$	^2D–$^2F°$	3/2–5/2	4–6	4.45E−01	9.64E−05	1.25E−04	−3.414	E	2,LS
98.174	2 748 100	3 766 700	$2s^23d$–$2s2p(^3P°)4d$	^2D–$^2F°$	5/2–5/2	6–6	3.18E−02	4.59E−06	8.90E−06	−4.560	E	2,LS
102.062?	3 128 200	4 108 000?	$2s2p(^1P°)3d$–$2s^26d$	$^2F°$–^2D	7/2–5/2	8–6	2.96E−01	3.47E−05	9.33E−05	−3.557	E	2,LS
102.062?	3 128 200	4 108 000?	$2s2p(^1P°)3d$–$2s^26d$	$^2F°$–^2D	5/2–5/2	6–6	1.49E−02	2.32E−06	4.68E−06	−4.856	E	2,LS
104.778	2 956 600	3 911 000	$2s2p(^3P°)3d$–$2s^25d$	$^2D°$–^2D	5/2–5/2	6–6	2.59E−01	4.27E−05	8.84E−05	−3.591	E	2,LS
104.778	2 956 600	3 911 000	$2s2p(^3P°)3d$–$2s^25d$	$^2D°$–^2D	5/2–3/2	6–4	2.78E−02	3.05E−06	6.31E−06	−4.738	E	2,LS
109.553	2 998 200	3 911 000	$2s2p(^3P°)3d$–$2s^25d$	$^2F°$–^2D	5/2–5/2	6–6	2.40E−07	4.31E−11	9.33E−11	−9.587	B	2,LS
111.173	3 011 500	3 911 000	$2s2p(^3P°)3d$–$2s^25d$	$^2P°$–^2D	3/2–3/2	4–4	1.82E−01	3.38E−05	4.95E−05	−3.869	E	2,LS
111.173	3 011 500	3 911 000	$2s2p(^3P°)3d$–$2s^25d$	$^2P°$–^2D	3/2–5/2	4–6	1.09E+00	3.04E−04	4.45E−04	−2.915	D	2,LS
111.645	3 015 300	3 911 000	$2s2p(^3P°)3d$–$2s^25d$	$^2P°$–^2D	1/2–3/2	2–4	9.02E−01	3.37E−04	2.48E−04	−3.171	D	2,LS
114.679?	3 061 000	3 933 000?	$2s2p(^1P°)^3P$–$2s2p(^1P°)4d$	^2D–$^2F°$	3/2–5/2	4–6	7.95E+02	2.35E−01	3.55E−01	−0.027	B	2,LS
114.679?	3 061 000	3 933 000?	$2s2p(^1P°)^3P$–$2s2p(^1P°)4d$	^2D–$^2F°$	5/2–7/2	6–8	8.52E+02	2.24E−01	5.07E−01	0.128	B	2,LS
114.679?	3 061 000	3 933 000?	$2s2p(^1P°)^3P$–$2s2p(^1P°)4d$	^2D–$^2F°$	5/2–5/2	6–6	5.68E+01	1.12E−02	2.54E−02	−1.173	C	2,LS
127.747	3 128 200	3 911 000	$2s2p(^1P°)3d$–$2s^25d$	$^2F°$–^2D	5/2–5/2	6–6	9.20E−03	2.25E−06	5.68E−06	−4.870	E	2,LS
127.747	3 128 200	3 911 000	$2s2p(^1P°)3d$–$2s^25d$	$^2F°$–^2D	5/2–3/2	6–4	1.93E−01	3.15E−05	7.95E−05	−3.724	E	2,LS
127.747	3 128 200	3 911 000	$2s2p(^1P°)3d$–$2s^25d$	$^2F°$–^2D	7/2–5/2	8–6	1.84E−01	3.37E−05	1.13E−04	−3.569	E	2,LS
128.966?	2 956 600	3 732 000?	$2s2p(^3P°)3d$–$2s2p(^3P°)4p$	$^2D°$–^2D	5/2–5/2	6–6	1.16E+01	2.90E−03	7.39E−03	−1.759	D	2,LS
129.820	3 140 700	3 911 000	$2s2p(^1P°)3d$–$2s^25d$	$^2D°$–^2D	5/2–3/2	6–4	8.13E−02	1.37E−05	3.51E−05	−4.085	E	2,LS
129.820	3 140 700	3 911 000	$2s2p(^1P°)3d$–$2s^25d$	$^2D°$–^2D	5/2–5/2	6–6	7.56E−01	1.91E−04	4.90E−04	−2.941	D	2,LS
136.277?	2 998 200	3 732 000?	$2s2p(^3P°)3d$–$2s2p(^3P°)4p$	$^2F°$–^2D	5/2–5/2	6–6	5.42E+00	1.51E−03	4.07E−03	−2.043	D	2,LS
137.817?	3 006 400	3 732 000?	$2s2p(^3P°)3d$–$2s2p(^3P°)4p$	$^2F°$–^2D	7/2–5/2	8–6	1.05E+02	2.25E−02	8.17E−02	−0.745	C	2,LS
138.793?	3 011 500	3 732 000?	$2s2p(^3P°)3d$–$2s2p(^3P°)4p$	$^2P°$–^2D	3/2–5/2	4–6	1.26E+01	5.45E−03	9.96E−03	−1.662	D	2,LS
140.706	3 061 000	3 771 700	$2s2p(^1P°)^3P$–$2s2p(^3P°)4d$	^2D–$^2F°$	5/2–7/2	6–8	1.78E+01	7.04E−03	1.96E−02	−1.374	D	2,LS
141.703	3 061 000	3 766 700	$2s2p(^1P°)^3P$–$2s2p(^3P°)4d$	^2D–$^2F°$	3/2–5/2	4–6	1.62E+01	7.33E−03	1.37E−02	−1.533	D	2,LS
141.703	3 061 000	3 766 700	$2s2p(^1P°)^3P$–$2s2p(^3P°)4d$	^2D–$^2F°$	5/2–5/2	6–6	1.16E+00	3.49E−04	9.77E−04	−2.679	D	2,LS
165.618?	3 128 200	3 732 000?	$2s2p(^1P°)3d$–$2s2p(^3P°)4p$	$^2F°$–^2D	7/2–5/2	8–6	3.53E−01	1.09E−04	4.75E−04	−3.059	D	2,LS
165.618?	3 128 200	3 732 000?	$2s2p(^1P°)3d$–$2s2p(^3P°)4p$	$^2F°$–^2D	5/2–5/2	6–6	1.77E−02	7.29E−06	2.39E−05	−4.359	E	2,LS
169.119?	3 140 700	3 732 000?	$2s2p(^1P°)3d$–$2s2p(^3P°)4p$	$^2D°$–^2D	5/2–5/2	6–6	1.50E+00	6.42E−04	2.15E−03	−2.414	D	2,LS
170.445	2 956 600	3 543 300	$2s2p(^3P°)3d$–$2s^24d$	$^2D°$–^2D	5/2–5/2	6–6	2.32E−03	1.01E−06	3.40E−06	−5.218	E	2,LS

11. S XIII

$Z=16$

Be I isoelectronic sequence

Ground state $1s^2 2s^2\ {}^1S_0$

Ionization energy 5 260 000 cm^{-1} (652.2 eV)

Data are tabulated for 103 transitions in the range 23–167 Å. Transition probabilities for the $2s2p-2s3s$, $2s2p-2s3d$, $2s2p-2p3p$, and $2p^2-2p3d$ transition arrays are taken from MBPT calculations.[1] Transition probabilities for the $2p^2-2s3p$ transitions are mean values of MBPT[1] and results obtained by Eissner and Tully with atomic structure code SUPERSTRUCTURE.[2] Remaining results are taken from the OP.[3] Multiplet average results from OP have been decomposed into fine-structure components assuming LS coupling, as indicated by the notation LS in the reference column. For the intercombination line $2s^2\ {}^1S_0-2s3p\ {}^3P^\circ_1$(32.191 Å) we give the mean of results from MBPT,[1] SUPERSTRUCTURE,[2] and a $1/Z$ expansion method.[4]

References

[1]U. I. Safronova, A. Derevianko, M. S. Safronova, and W. R. Johnson, J. Phys. B: At. Mol. Phys. **32**, 3527 (1999). Complete data listing from private communication 9 March 2000.
[2]W. E. Eissner and J. A. Tully, Astron. Astrophys. **253**, 625 (1992).
[3]http://legacy.gsfc.nasa.gov/topbase/(Downloaded 23 August 1995).
[4]Yu. I. Ralchenko and L. A. Vainshtein, Phys. Rev. A **52**, 2449 (1995).

S XIII

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i-J_k	g_i-g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
23.238?	213 182	4 516 500?	$2s2p-2s5d$	$^3P^\circ-{}^3D$	2–3	5–7	3.57E+03	4.05E−02	1.55E−02	−0.694	C	3,LS
24.421?	213 182	4 308 000?	$2s2p-2p4p$	$^3P^\circ-{}^3D$	2–3	5–7	2.48E+03	3.10E−02	1.25E−02	−0.810	C	3,LS
24.590	0	4 066 700	$2s^2-2s4p$	$^1S-{}^1P^\circ$	0–1	1–3	5.92E+03	1.61E−01	1.30E−02	−0.793	B	3,LS
25.760	203 474	4 085 500	$2s2p-2s4d$	$^3P^\circ-{}^3D$	1–2	3–5	6.00E+03	9.95E−02	2.53E−02	−0.525	C	3,LS
25.824	213 182	4 085 500	$2s2p-2s4d$	$^3P^\circ-{}^3D$	2–3	5–7	7.93E+03	1.11E−01	4.72E−02	−0.256	B	3,LS
25.824	213 182	4 085 500	$2s2p-2s4d$	$^3P^\circ-{}^3D$	2–2	5–5	1.98E+03	1.98E−02	8.42E−03	−1.004	C	3,LS
26.139	199 181	4 024 900	$2s2p-2s4s$	$^3P^\circ-{}^3S$	0–1	1–3	1.65E+02	5.06E−03	4.35E−04	−2.296	D	3,LS
26.168	203 474	4 024 900	$2s2p-2s4s$	$^3P^\circ-{}^3S$	1–1	3–3	4.92E+02	5.05E−03	1.31E−03	−1.820	D	3,LS
26.235	213 182	4 024 900	$2s2p-2s4s$	$^3P^\circ-{}^3S$	2–1	5–3	8.14E+02	5.04E−03	2.18E−03	−1.599	D	3,LS
26.342	528 796	4 325 000	$2p^2-2p4d$	$^3P-{}^3D^\circ$	1–2	3–5	8.19E+03	1.42E−01	3.69E−02	−0.371	B	3,LS
26.356	536 856	4 331 000	$2p^2-2p4d$	$^3P-{}^3D^\circ$	2–3	5–7	1.09E+04	1.59E−01	6.90E−02	−0.100	B	3,LS
26.398	536 856	4 325 000	$2p^2-2p4d$	$^3P-{}^3D^\circ$	2–2	5–5	2.72E+03	2.84E−02	1.23E−02	−0.848	C	3,LS
26.709?	589 449	4 333 500?	$2p^2-2p4d$	$^1D-{}^1F^\circ$	2–3	5–7	1.40E+04	2.10E−01	9.23E−02	0.021	B	3,LS
26.988	389 583	4 095 000	$2s2p-2s4d$	$^1P^\circ-{}^1D$	1–2	3–5	6.32E+03	1.15E−01	3.07E−02	−0.462	B	3,LS
28.758	589 449	4 066 700	$2p^2-2s4p$	$^1D-{}^1P^\circ$	2–1	5–3	2.25E+01	1.67E−04	7.91E−05	−3.078	E	3,LS
28.926	0	3 457 100	$2s^2-2p3d$	$^1S-{}^1P^\circ$	0–1	1–3	7.48E+02	2.81E−02	2.68E−03	−1.551	B	1,2
30.914	203 474	3 438 300	$2s2p-2p3p$	$^3P^\circ-{}^1S$	1–0	3–1	2.21E+01	1.06E−04	3.22E−05	−3.499	C	1
31.321	203 474	3 396 200	$2s2p-2p3p$	$^3P^\circ-{}^1D$	1–2	3–5	3.07E+01	7.53E−04	2.33E−04	−2.646	C	1
31.417	213 182	3 396 200	$2s2p-2p3p$	$^3P^\circ-{}^1D$	2–2	5–5	5.63E+01	8.33E−04	4.31E−04	−2.380	C	1
31.555	203 474	3 372 500	$2s2p-2p3p$	$^3P^\circ-{}^3P$	1–2	3–5	1.24E+03	3.08E−02	9.59E−03	−1.035	B	1
31.581?	199 181	3 365 600?	$2s2p-2p3p$	$^3P^\circ-{}^3P$	0–1	1–3	1.09E+03	4.88E−02	5.08E−03	−1.311	B	1
31.624?	203 474	3 365 600?	$2s2p-2p3p$	$^3P^\circ-{}^3P$	1–1	3–3	6.66E+02	9.98E−03	3.12E−03	−1.524	C	1
31.652	213 182	3 372 500	$2s2p-2p3p$	$^3P^\circ-{}^3P$	2–2	5–5	5.21E+03	7.83E−02	4.08E−02	−0.407	B	1
31.676	199 181	3 356 100	$2s2p-2p3p$	$^3P^\circ-{}^3S$	0–1	1–3	1.29E+03	5.82E−02	6.07E−03	−1.235	B	1
31.720	203 474	3 356 100	$2s2p-2p3p$	$^3P^\circ-{}^3S$	1–1	3–3	3.10E+03	4.68E−02	1.47E−02	−0.852	B	1
31.722?	213 182	3 365 600?	$2s2p-2p3p$	$^3P^\circ-{}^3P$	2–1	5–3	4.76E+03	4.30E−02	2.25E−02	−0.667	B	1
31.818	213 182	3 356 100	$2s2p-2p3p$	$^3P^\circ-{}^3S$	2–1	5–3	1.30E+03	1.18E−02	6.19E−03	−1.228	B	1
31.944	213 182	3 343 700	$2s2p-2p3p$	$^3P^\circ-{}^3D$	2–3	5–7	3.79E+03	8.12E−02	4.27E−02	−0.392	B	1
32.049	199 181	3 319 400	$2s2p-2p3p$	$^3P^\circ-{}^1P$	0–1	1–3	3.59E+02	1.66E−02	1.75E−03	−1.781	B	1
32.093	203 474	3 319 400	$2s2p-2p3p$	$^3P^\circ-{}^1P$	1–1	3–3	8.02E+02	1.24E−02	3.92E−03	−1.430	B	1
32.191	0	3 106 500	$2s^2-2s3p$	$^1S-{}^3P^\circ$	0–1	1–3	2.27E+03	1.06E−01	1.12E−02	−0.976	A	1,2,4
32.242	0	3 101 500	$2s^2-2s3p$	$^1S-{}^1P^\circ$	0–1	1–3	1.03E+04	4.82E−01	5.12E−02	−0.317	A	1,2
32.801	389 583	3 438 300	$2s2p-2p3p$	$^1P^\circ-{}^1S$	1–0	3–1	2.00E+03	1.08E−02	3.48E−03	−1.491	B	1
33.260	389 583	3 396 200	$2s2p-2p3p$	$^1P^\circ-{}^1D$	1–2	3–5	1.01E+04	2.80E−01	9.20E−02	−0.076	A	1
33.447	203 474	3 193 300	$2s2p-2s3d$	$^3P^\circ-{}^1D$	1–2	3–5	5.27E+00	1.47E−04	4.86E−05	−3.355	C	1
33.524	389 583	3 372 500	$2s2p-2p3p$	$^1P^\circ-{}^3P$	1–2	3–5	1.67E+02	4.69E−03	1.55E−03	−1.852	C	1
33.602?	389 583	3 365 600?	$2s2p-2p3p$	$^1P^\circ-{}^3P$	1–1	3–3	8.58E+00	1.45E−04	4.82E−05	−3.361	C	1

S XIII—Continued

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i–J_k	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
33.710	389 583	3 356 100	$2s2p-2p3p$	$^1P°-^3S$	1–1	3–3	2.54E+02	4.33E−03	1.44E−03	−1.887	C	1
33.806	199 181	3 157 200	$2s2p-2s3d$	$^3P°-^3D$	0–1	1–3	1.42E+04	7.29E−01	8.11E−02	−0.137	A	1
33.852	203 474	3 157 500	$2s2p-2s3d$	$^3P°-^3D$	1–2	3–5	1.90E+04	5.45E−01	1.82E−01	−0.214	A	1
33.856	203 474	3 157 200	$2s2p-2s3d$	$^3P°-^3D$	1–1	3–3	1.06E+04	1.82E−01	6.09E−02	−0.263	A	1
33.951	213 182	3 158 600	$2s2p-2s3d$	$^3P°-^3D$	2–3	5–7	2.52E+04	6.09E−01	3.40E−01	0.483	A	1
33.964	213 182	3 157 500	$2s2p-2s3d$	$^3P°-^3D$	2–2	5–5	6.30E+03	1.09E−01	6.09E−02	−0.264	A	1
33.967	213 182	3 157 200	$2s2p-2s3d$	$^3P°-^3D$	2–1	5–3	7.02E+02	7.29E−03	4.08E−03	−1.438	C	1
34.085	523 237	3 457 100	$2p^2-2p3d$	$^3P-^1P°$	0–1	1–3	1.13E+02	5.90E−03	6.62E−04	−2.229	C	1
34.149	528 796	3 457 100	$2p^2-2p3d$	$^3P-^1P°$	1–1	3–3	4.15E+01	7.25E−04	2.45E−04	−2.663	C	1
34.535	528 796	3 424 400	$2p^2-2p3d$	$^3P-^3P°$	1–2	3–5	3.60E+01	1.07E−03	3.66E−04	−2.492	C	1
34.632	536 856	3 424 400	$2p^2-2p3d$	$^3P-^3P°$	2–2	5–5	1.85E+04	3.33E−01	1.90E−01	0.221	A	1
34.694	528 796	3 411 100	$2p^2-2p3d$	$^3P-^3D°$	1–2	3–5	2.71E+04	8.14E−01	2.79E−01	0.388	A	1
34.748	536 856	3 414 700	$2p^2-2p3d$	$^3P-^3D°$	2–3	5–7	3.11E+04	7.89E−01	4.51E−01	0.596	A	1
34.792	536 856	3 411 100	$2p^2-2p3d$	$^3P-^3D°$	2–2	5–5	1.34E+03	2.44E−02	1.40E−02	−0.914	B	1
34.872	589 449	3 457 100	$2p^2-2p3d$	$^1D-^1P°$	2–1	5–3	1.14E+03	1.25E−02	7.18E−03	−1.204	B	1
35.274	589 449	3 424 400	$2p^2-2p3d$	$^1D-^3P°$	2–2	5–5	5.42E+02	1.01E−02	5.87E−03	−1.296	B	1
35.395	589 449	3 414 700	$2p^2-2p3d$	$^1D-^3D°$	2–3	5–7	3.56E+01	9.35E−04	5.45E−04	−2.330	C	1
35.440	589 449	3 411 100	$2p^2-2p3d$	$^1D-^3D°$	2–2	5–5	8.75E+01	1.65E−03	9.61E−04	−2.084	C	1
35.558	199 181	3 011 500	$2s2p-2s3s$	$^3P°-^3S$	0–1	1–3	5.43E+02	3.09E−02	3.61E−03	−1.511	B	1
35.612	203 474	3 011 500	$2s2p-2s3s$	$^3P°-^3S$	1–1	3–3	1.63E+03	3.10E−02	1.09E−02	−1.031	B	1
35.667	389 583	3 193 300	$2s2p-2s3d$	$^1P°-^1D$	1–2	3–5	1.64E+04	5.22E−01	1.84E−01	0.195	A	1
35.736	213 182	3 011 500	$2s2p-2s3s$	$^3P°-^3S$	2–1	5–3	2.73E+03	3.14E−02	1.84E−02	−0.805	B	1
36.128	389 583	3 157 500	$2s2p-2s3d$	$^1P°-^3D$	1–2	3–5	6.71E+00	2.19E−04	7.81E−05	−3.183	C	1
36.132	389 583	3 157 200	$2s2p-2s3d$	$^1P°-^3D$	1–1	3–3	8.58E+00	1.68E−04	5.99E−05	−3.298	C	1
38.140	389 583	3 011 500	$2s2p-2s3s$	$^1P°-^3S$	1–1	3–3	1.59E+00	3.47E−05	1.31E−05	−3.982	E	1
38.711	523 237	3 106 500	$2p^2-2s3p$	$^3P-^3P°$	0–1	1–3	2.01E+01	1.35E−03	1.72E−04	−2.869	C	1,2
38.786	523 237	3 101 500	$2p^2-2s3p$	$^3P-^1P°$	0–1	1–3	3.82E+00	2.59E−04	3.30E−05	−3.588	C	1,2
38.794	528 796	3 106 500	$2p^2-2s3p$	$^3P-^3P°$	1–1	3–3	1.15E+01	2.60E−04	9.97E−05	−3.108	C	1,2
38.870	528 796	3 101 500	$2p^2-2s3p$	$^3P-^1P°$	1–1	3–3	4.02E+00	9.11E−05	3.50E−05	−3.564	D	1,2
38.916	536 856	3 106 500	$2p^2-2s3p$	$^3P-^3P°$	2–1	5–3	9.17E+00	1.25E−04	8.00E−05	−3.204	C	1,2
38.992	536 856	3 101 500	$2p^2-2s3p$	$^3P-^1P°$	2–1	5–3	3.02E+01	4.13E−04	2.65E−04	−2.685	C	1,2
39.729	589 449	3 106 500	$2p^2-2s3p$	$^1D-^3P°$	2–1	5–3	1.74E+02	2.47E−03	1.62E−03	−1.908	C	1,2
39.808	589 449	3 101 500	$2p^2-2s3p$	$^1D-^1P°$	2–1	5–3	5.74E+02	8.19E−03	5.37E−03	−1.388	C	1,2
85.215	3 157 500	4 331 000	$2s3d-2p4d$	$^3D-^3D°$	2–3	5–7	6.56E−01	1.00E−04	1.40E−04	−3.301	E	3,LS
85.295	3 158 600	4 331 000	$2s3d-2p4d$	$^3D-^3D°$	3–3	7–7	5.22E+00	5.69E−04	1.12E−03	−2.400	E	3,LS
85.631	3 157 200	4 325 000	$2s3d-2p4d$	$^3D-^3D°$	1–2	3–5	8.73E−01	1.60E−04	1.35E−04	−3.319	E	3,LS
85.653	3 157 500	4 325 000	$2s3d-2p4d$	$^3D-^3D°$	2–2	5–5	4.04E+00	4.44E−04	6.26E−04	−2.654	E	3,LS
85.734	3 158 600	4 325 000	$2s3d-2p4d$	$^3D-^3D°$	3–2	7–5	9.02E−01	7.10E−05	1.40E−04	−3.304	E	3,LS
87.704?	3 193 300	4 333 500?	$2s3d-2p4d$	$^1D-^1F°$	2–3	5–7	2.64E+01	4.26E−03	6.15E−03	−1.672	D	3,LS
90.465?	3 411 100	4 516 500?	$2p3d-2s5d$	$^3D°-^3D$	2–3	5–7	2.17E+02	3.73E−06	5.55E−06	−4.729	E	3,LS
90.761?	3 414 700	4 516 500?	$2p3d-2s5d$	$^3D°-^3D$	3–3	7–7	1.72E−01	2.12E−05	4.43E−05	−3.829	E	3,LS
91.567?	3 424 400	4 516 500?	$2p3d-2s5d$	$^3P°-^3D$	2–3	5–7	1.10E+01	1.93E−03	2.91E−03	−2.015	D	3,LS
100.654	3 101 500	4 095 000	$2s3p-2s4d$	$^1P°-^1D$	1–2	3–5	1.79E+03	4.54E−01	4.51E−01	0.134	B	3,LS
101.286	3 343 700	4 331 000	$2p3p-2p4d$	$^3D-^3D°$	3–3	7–7	4.44E+02	6.83E−02	1.59E−01	−0.320	C	3,LS
101.906	3 343 700	4 325 000	$2p3p-2p4d$	$^3D-^3D°$	3–2	7–5	7.65E+01	8.51E−03	2.00E−02	−1.225	D	3,LS
102.145	3 106 500	4 085 500	$2s3p-2s4d$	$^3P°-^3D$	1–2	3–5	1.55E+03	4.04E−01	4.08E−01	0.084	B	3,LS
104.232?	3 365 600?	4 325 000	$2p3p-2p4d$	$^3P-^3D°$	1–2	3–5	1.15E+03	3.11E−01	3.20E−01	−0.030	B	3,LS
104.330	3 372 500	4 331 000	$2p3p-2p4d$	$^3P-^3D°$	2–3	5–7	1.52E+03	3.48E−01	5.98E−01	0.241	B	3,LS
104.987	3 372 500	4 325 000	$2p3p-2p4d$	$^3P-^3D°$	2–2	5–5	3.74E+02	6.18E−02	1.07E−01	−0.510	C	3,LS
106.689?	3 396 200	4 333 500?	$2p3p-2p4d$	$^1D-^1F°$	2–3	5–7	1.79E+03	4.28E−01	7.52E−01	0.330	B	3,LS
108.885	3 106 500	4 024 900	$2s3p-2s4s$	$^3P°-^3S$	1–1	3–3	2.80E+02	4.97E−02	5.35E−02	−0.827	C	3,LS
111.495?	3 411 100	4 308 000?	$2p3d-2p4p$	$^3D°-^3D$	2–3	5–7	2.47E+00	6.44E−04	1.18E−03	−2.492	E	3,LS
111.944?	3 414 700	4 308 000?	$2p3d-2p4p$	$^3D°-^3D$	3–3	7–7	1.94E+01	3.65E−03	9.42E−03	−1.593	D	3,LS
113.173?	3 424 400	4 308 000?	$2p3d-2p4p$	$^3P°-^3D$	2–3	5–7	4.46E+01	1.20E−02	2.24E−02	−1.222	C	3,LS
114.495	3 193 300	4 066 700	$2s3d-2s4p$	$^1D-^1P°$	2–1	5–3	1.71E+02	2.02E−02	3.81E−02	−0.996	C	3,LS
148.280	3 411 100	4 085 500	$2p3d-2s4d$	$^3D°-^3D$	2–3	5–7	2.21E−03	1.02E−06	2.49E−06	−5.292	E	3,LS
148.280	3 411 100	4 085 500	$2p3d-2s4d$	$^3D°-^3D$	2–2	5–5	1.38E−02	4.56E−06	1.11E−05	−4.642	E	3,LS
149.076	3 414 700	4 085 500	$2p3d-2s4d$	$^3D°-^3D$	3–3	7–7	1.74E−02	5.79E−06	1.99E−05	−4.392	E	3,LS
149.076	3 414 700	4 085 500	$2p3d-2s4d$	$^3D°-^3D$	3–2	7–5	3.05E−03	7.26E−07	2.49E−06	−5.294	E	3,LS
149.142	3 396 200	4 066 700	$2p3p-2s4p$	$^1D-^1P°$	2–1	5–3	5.45E+00	1.09E−03	2.68E−03	−2.264	D	3,LS
151.263	3 424 400	4 085 500	$2p3d-2s4d$	$^3P°-^3D$	2–2	5–5	3.32E+00	1.14E−03	2.84E−03	−2.244	D	3,LS
151.263	3 424 400	4 085 500	$2p3d-2s4d$	$^3P°-^3D$	2–3	5–7	1.33E+01	6.39E−03	1.59E−02	−1.496	D	3,LS

S XIII—Continued

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i–J_k	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
156.764	3 457 100	4 095 000	$2p3d$–$2s4d$	^{1}P°–^{1}D	1–2	3–5	1.56E+01	9.55E−03	1.48E−02	−1.543	D	3,LS
159.134	3 438 300	4 066 700	$2p3p$–$2s4p$	^{1}S–^{1}P°	0–1	1–3	8.49E+00	9.67E−03	5.07E−03	−2.015	D	3,LS
166.528	3 424 400	4 024 900	$2p3d$–$2s4s$	^{3}P°–^{3}S	2–1	5–3	1.40E+00	3.50E−04	9.59E−04	−2.757	E	3,LS

12. S XIV

$Z=16$

Li I isoelectronic sequence

Ground state $1s^2 2s\ ^2S_{1/2}$

Ionization energy 5 702 400 cm^{-1} (707.01 eV)

Data are tabulated for 32 transitions in the range 21–96 Å. Transition probabilities for the $2s-np(n=3-4)$, $2p-ns$, $(n=3-5)$, and $2p-nd,(n=3-5)$ arrays are mean values of results obtained by Guennou and Sureau with a direct self-consistent field method (SCF)[1] and results of Zhang *et al.*[2] obtained with relativistic atomic structure and distorted wave collision strength programs. Level values with square brackets are from precise calculations as described in Sec. 1.

References

[1]H. Guennou and A. Sureau, J. Phys. B **20**, 919 (1987).
[2]H. L. Zhang, D. H. Sampson, and C. J. Fontes, At. Data Nucl. Data Tables **44**, 31 (1990).

S XIV

λ Ritz (Å)	E_i (cm^{-1})	E_k (cm^{-1})	Configurations	Terms	J_i-J_k	g_i-g_k	A_{ki} ($10^8\ s^{-1}$)	f_{ik}	S (a.u.)	log $g_i f$	Acc.	Ref.
21.660	224 366	[4 841 120]	$1s^2 2p-1s^2 5d$	$^2P°-^2D$	1/2–3/2	2–4	3.23E+03	4.55E−02	6.48E−03	−1.041	A	1,2
21.730	239 429	[4 841 420]	$1s^2 2p-1s^2 5d$	$^2P°-^2D$	3/2–5/2	4–6	3.85E+03	4.09E−02	1.17E−02	−0.786	A	1,2
21.731	239 429	[4 841 120]	$1s^2 2p-1s^2 5d$	$^2P°-^2D$	3/2–3/2	4–4	6.36E+02	4.50E−03	1.29E−03	−1.745	A	1,2
21.748	224 366	[4 822 550]	$1s^2 2p-1s^2 5s$	$^2P°-^2S$	1/2–1/2	2–2	2.24E+02	1.59E−03	2.28E−04	−2.498	A	1,2
21.819	239 429	[4 822 550]	$1s^2 2p-1s^2 5s$	$^2P°-^2S$	3/2–1/2	4–2	4.51E+02	1.61E−03	4.63E−04	−2.191	A	1,2
23.005	0.0	4 346 860	$1s^2 2s-1s^2 4p$	$^2S-^2P°$	1/2–3/2	2–4	3.76E+03	5.96E−02	9.03E−03	−0.924	A	1,2
23.015	0.0	4 344 980	$1s^2 2s-1s^2 4p$	$^2S-^2P°$	1/2–1/2	2–2	3.79E+03	3.01E−02	4.56E−03	−1.221	A	1,2
24.200	224 366	4 356 570	$1s^2 2p-1s^2 4d$	$^2P°-^2D$	1/2–3/2	2–4	6.99E+03	1.23E−01	1.96E−02	−0.610	A	1,2
24.285	239 429	4 357 210	$1s^2 2p-1s^2 4d$	$^2P°-^2D$	1/2–5/2	4–6	8.30E+03	1.10E−01	3.52E−02	−0.356	A	1,2
24.289	239 429	4 356 570	$1s^2 2p-1s^2 4d$	$^2P°-^2D$	3/2–3/2	4–4	1.39E+03	1.23E−02	3.92E−03	−1.309	A	1,2
24.418	224 366	4 319 700	$1s^2 2p-1s^2 4s$	$^2P°-^2S$	1/2–1/2	2–2	4.54E+02	4.06E−03	6.53E−04	−2.090	A	1,2
24.508	239 429	4 319 700	$1s^2 2p-1s^2 4s$	$^2P°-^2S$	3/2–1/2	4–2	9.28E+02	4.18E−03	1.35E−03	−1.777	A	1,2
30.427	0.0	3 286 550	$1s^2 2s-1s^2 3p$	$^2S-^2P°$	1/2–3/2	2–4	8.37E+03	2.32E−01	4.65E−02	−0.333	A	1,2
30.469	0.0	3 282 020	$1s^2 2s-1s^2 3p$	$^2S-^2P°$	1/2–1/2	2–2	8.48E+03	1.18E−01	2.37E−02	−0.627	A	1,2
32.416	224 366	3 309 260	$1s^2 2p-1s^2 3d$	$^2P°-^2D$	1/2–3/2	2–4	2.10E+04	6.63E−01	1.41E−01	0.122	A	1,2
32.560	239 429	3 310 680	$1s^2 2p-1s^2 3d$	$^2P°-^2D$	3/2–5/2	4–6	2.51E+04	5.99E−01	2.57E−01	0.380	A	1,2
32.575	239 429	3 309 260	$1s^2 2p-1s^2 3d$	$^2P°-^2D$	3/2–3/2	4–4	4.19E+03	6.66E−02	2.86E−02	−0.575	A	1,2
33.381	224 366	3 220 100	$1s^2 2p-1s^2 3s$	$^2P°-^2S$	1/2–1/2	2–2	1.14E+03	1.91E−02	4.19E−03	−1.419	A	1,2
33.549	239 429	3 220 100	$1s^2 2p-1s^2 3s$	$^2P°-^2S$	3/2–1/2	4–2	2.33E+03	1.96E−02	8.67E−03	−1.105	A	1,2
64.140	3 282 020	[4 841 120]	$1s^2 3p-1s^2 5d$	$^2P°-^2D$	1/2–3/2	2–4	1.10E+03	1.35E−01	5.71E−02	−0.568	A	1
64.314	3 286 550	[4 841 420]	$1s^2 3p-1s^2 5d$	$^2P°-^2D$	3/2–5/2	4–6	1.32E+03	1.22E−01	1.04E−01	−0.310	A	1
64.326	3 286 550	[4 841 120]	$1s^2 3p-1s^2 5d$	$^2P°-^2D$	3/2–3/2	4–4	2.19E+02	1.36E−02	1.15E−02	−1.264	A	1
64.913	3 282 020	[4 822 550]	$1s^2 3p-1s^2 5s$	$^2P°-^2S$	1/2–1/2	2–2	1.51E+02	9.51E−03	4.06E−03	−1.721	A	1
65.104	3 286 550	[4 822 550]	$1s^2 3p-1s^2 5s$	$^2P°-^2S$	3/2–1/2	4–2	3.08E+02	9.80E−03	8.40E−03	−1.407	A	1
93.062	3 282 020	4 356 570	$1s^2 3p-1s^2 4d$	$^2P°-^2D$	1/2–3/2	2–4	2.23E+03	5.80E−01	3.56E−01	0.065	A	1
93.400	3 286 550	4 357 210	$1s^2 3p-1s^2 4d$	$^2P°-^2D$	3/2–5/2	4–6	2.68E+03	5.26E−01	6.47E−01	0.323	A	1
93.456	3 286 550	4 356 570	$1s^2 3p-1s^2 4d$	$^2P°-^2D$	3/2–3/2	4–4	4.48E+02	5.86E−02	7.21E−02	−0.630	A	1
96.369	3 282 020	4 319 700	$1s^2 3p-1s^2 4s$	$^2P°-^2S$	1/2–1/2	2–2	3.17E+02	4.42E−02	2.80E−02	−1.054	A	1
96.376	3 309 260	4 346 860	$1s^2 3d-1s^2 4p$	$^2D-^2P°$	3/2–3/2	4–4	1.54E+01	2.14E−03	2.71E−03	−2.068	A	1
96.508	3 310 680	4 346 860	$1s^2 3d-1s^2 4p$	$^2D-^2P°$	5/2–3/2	6–4	1.40E+02	1.30E−02	2.48E−02	−1.108	A	1
96.551	3 309 260	4 344 980	$1s^2 3d-1s^2 4p$	$^2D-^2P°$	3/2–1/2	4–2	1.58E+02	1.11E−02	1.41E−02	−1.354	A	1
96.791	3 286 550	4 319 700	$1s^2 3p-1s^2 4s$	$^2P°-^2S$	3/2–1/2	4–2	6.46E+02	4.54E−02	5.78E−02	−0.741	A	1