Improved Critical Compilations of Selected Atomic Transition Probabilities for Neutral and Singly Ionized Carbon and Nitrogen

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We have undertaken new critical assessments and tabulations of the transition probabilities for important lines of neutral and singly ionized carbon and nitrogen. Our updates primarily address the persistent lower transitions as well as a greatly expanded number of forbidden lines (M1, M2, and E2 lines). For these transitions, sophisticated multiconfiguration Hartree–Fock calculations have been recently carried out, which have yielded data considerably improved and often appreciably different from our 1996 NIST compilation. *© 2007 by the U.S. Secretary of Commerce on behalf of the United States. All rights reserved.* [DOI: 10.1063/1.2740642]

Key words: allowed and forbidden transitions; atomic transition probabilities; *f*-values; line strengths.

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1. Introduction

This compilation is a partial update of the transition probability tables from the National Institute of Standards and Technology (NIST) for the spectra of C I, C II, N I, and N II. Data for these four spectra were previously compiled by us as part of a comprehensive tabulation for the three elements C, N, and O, that was published in 1996 (Wiese *et al.*[1]). We have carried out this new compilation for three main reasons: First, user interest in the data for these four spectra continues to be strong, especially from astronomers. In view of the greatly increased resolving power of recent space spectrometers such as those on the Hubble, FUSE, and Spitzer, space observatories, and the resulting much more detailed spectral observations, demands for accurate transition probabilities are increasing. Also, plasma physicists have increased needs for reliable spectral data, in order to perform more detailed laboratory plasma modeling and diagnostics. Second, data of significantly better quality have become available for the persistent transitions in these spectra, and for numerous transitions, the numerical values have changed significantly. Third, data available for the electric-dipole-forbidden lines of the types M1, M2, and E2 were very limited at the time of the publication of our previous tables in 1996, but have now greatly increased. Thus, an update of the transition probability data for the four above cited spectra appears to be timely.

Our 1996 data volume for C, N, and O was primarily based on the very extensive calculational results of the OPACITY Project.[2] This was a coordinated undertaking by an international group of about 20 atomic structure theoreticians, who collaborated in the 1980s and early 1990s on large-scale calculations of the principal types of atomic data—collisional and radiative—that were needed to determine stellar opacities. Their approach to calculate atomic transition probabilities is different from the widely used variational multiconfiguration Hartree–Fock (MCHF) or Dirac–Fock approximations.[3] The OPACITY Project team developed an extension of the close-coupling (CC) method, with which they treated the case of an $N+1$ electron system, with one highly excited bound (negative energy) electron that undergoes a transition to a lower bound state in the field of a target ion of N electrons. Considerable care and effort was devoted to generate accurate target wave functions with such multiconfiguration codes as CIV3 and SUPERSTRUCTURE. For the numerical solution of the CC approximation, the R-matrix method was applied, which was developed by members of the OPACITY team. The OPACITY Project calculations were carried out to the multiplet level only, so that data for individual spectral lines (i.e., fine structure data) could be obtained only by applying the well-known LS-coupling fractions. We have done this on a large scale in our 1996 compilation (Wiese *et al.*[1]). But this adds a significant source of uncertainties for the weaker lines in multiplets, as was expected, and as recent experiments and more detailed calculations have confirmed.

In order to examine and assess this and other aspects of the OPACITY data, we continued to monitor the literature for new transition probability data. For this literature search, we utilized the comprehensive NIST Bibliography on Atomic Transition Probabilities.[4] Indeed, we found from new, very detailed MCHF calculations and from recent lifetime and emission experiments that the OPACITY data are often not as accurate as we had estimated on the basis of the limited available comparison data at the time of our previous compilation, that is, pre-1996. This statement applies especially to neutral and singly ionized carbon and nitrogen.

We have thus carried out a partial update for the transition probabilities of these four spectra, utilizing the results of sophisticated MCHF calculations that were performed by Froese Fischer and co-workers in the last six years.[5–7] Their multiconfiguration treatment has been very extensive, with wave function expansions containing up to 20 000 configuration state functions (CSFs). Also, they included relativistic effects of the Breit–Pauli type, i.e., spin–orbit, spin–spin, and spin–other-orbit interactions as well as mass correction and Darwin terms. Thus, they obtained transition probabilities for individual lines including many intersystem and forbidden lines (E2, M1, and M2). The latter were completely missing in the OPACITY results for C and N.

Froese Fischer and co-workers presented their results in the "dipole length" form of the line strength, but they also calculated the "dipole velocity" form. Ideally, these two different formulations of the same quantity should agree, so that the differences remaining between the two are good indicators of the accuracy. They have listed the difference between the length and velocity results in percent. Indeed, in the best cases, the differences are quite small, about 1%–2%.

These new MCHF calculations[5–7] are significantly more sophisticated and have been done in a more detailed manner than earlier calculations which were similar in spirit. Froese Fischer *et al.* also made use of the strong increase in computer power that is now available. Only a few high-accuracy experimental results and another theoretical result are available to closely test these calculations, especially the results for weaker transitions. Thus, it is difficult to assess the new data by comparisons. Nevertheless, several meaningful comparisons are possible: First, a few comparisons with recent lifetime data are available, which are shown in Tables 1 and 2. One group of lifetime measurements[8–14] (Table 1) is from levels which radiatively decay by LS-allowed, strong transitions to lower levels. These lifetime measurements have all been performed with laser-induced fluorescence techniques, i.e., selective excitation, and thus are expected to be quite accurate. But, as the short lifetimes indicate, strong transitions are principally involved here, for which even less advanced calculations usually deliver very good results. Thus, this test is not very sensitive. In Table 2, four radiative decay rates for long-lived states are shown[15–17] from which only intersystem transitions to lower levels occur. The agreement is remarkably close, but not perfect.

Second, another useful comparison can be carried out with the recent calculations of Corrégé and Hibbert[18] for C II. They used the CIV3 code, which is also a sophisticated multiconfiguration atomic structure code, and they applied it in a similarly detailed manner, with up to 6000 CSFs. They calculated the line strengths in both the dipole-length as well as the dipole-velocity form, too, as in the work of Froese Fischer and co-workers. The agreement achieved between these two formulations is also good, but not as good as the results of Tachiev and Froese Fischer. (For 15 available comparisons, the differences between Corrégé and Hibbert's dipole-length and velocity results are better than that of Froese Fischer only for one case, otherwise it is always somewhat worse.) It is thus useful to compare these two sophisticated calculations, which is done in Fig. 1. It is seen that over a wide range of line strengths, the agreement between the two calculations is excellent, with the difference never larger than 6%, even for the very weak transitions. To put this into perspective, we also show a graphical comparison of the new tables with our 1996 tabulation for C II, which was mainly based on the Opacity Project calculations[19] combined with *LS*-coupling fractions (Fig. 2). The two graphical comparisons of Figs. 1 and 2 clearly show a drastic improvement in the quality of the most recent data. (It has to be noted, that the scales of Figs. 1 and 2 are quite different in order to accommodate the large discrepancies experienced for Fig. 2).

TABLE 1. Atomic lifetimes τ (ns) for *LS*-allowed lines.

Spectrum	Level	τ: MCHF (energy adjusted)	τ experiment	Experimental reference
C I	$2p3s\ ^1P^\circ_1$	2.72	2.7±0.2	8
N I	$2p^23p\ ^4D^\circ_{7/2}$	37.9	44±2	9
			43±3	10
	$2p^23p\ ^4S^\circ_{3/2}$	24.1	26.0±1.5	9
			23.3±2.3	11
N II	$2p3d\ ^1F^\circ$	0.257	0.249±0.004	12
	$2p3s\ ^1P^\circ$	0.262	0.267±0.010	12
	$2p3d\ ^1D^\circ$	0.349	0.346±0.012	13
	$2p3d\ ^3P^\circ_2$	0.390	0.457±0.020	13
	$2p3d\ ^3D^\circ_1$	0.230	0.209±0.007	14
	$2p3d\ ^3D^\circ_2$	0.231	0.219±0.007	14
	$2p3d\ ^3D^\circ_3$	0.231	0.217±0.005	14
	$2p3d\ ^1P^\circ$	0.372	0.410±0.017	14

TABLE 2. Decay rates (s^{-1}) for intersystem (weak) transitions.

Spectrum	Level	MCHF (energy adjusted)	Experiment	Experimental reference
C II	$2s2p^2\ ^4P_{5/2}$	44.34	45.35±0.15	15
			50.0±2.5	16
	$2s2p^2\ ^4P_{3/2}$	9.89	9.61±0.05	15
			9.0±1.0	16
	$2s2p^2\ ^4P_{1/2}$	127.68	125.8±0.9	15
			130.0±5.5	16
N II	$2s2p^3\ ^5S^\circ_2$	178.5	170.1±0.9	17

Third, we have made a comparison of the results of two emission experiments for N I by Musielok *et al.*[20] for the $3s-3p$ transitions and by Bridges[21] for the $3s-3p$ and $3p-3d$ transitions with the Tachiev and Froese Fischer MCHF data (Fig. 3). The emission data are normalized to the lifetime measurements of Bengtsson *et al.*,[9] Copeland *et al.*,[10] and Catherinot and Sy,[11] shown in Table 1. As all $3p$ levels are in a narrow energy range, the plasma source conditions do not enter significantly into other $3s-3p$ measurements, which are thus akin to reliable "branching fraction" measurements. The $3p-3d$ transitions are connected to the $3s-3p$ results via a partial local thermodynamic equilibrium model, resulting in somewhat higher uncertainties. (In contrast, the comparisons between earlier experiments and calculations done in our 1996 compilation exhibit much larger differences for the weak lines.) This comparison, with the largest disagreement being 33%, also confirms the high quality of the new MCHF data.

Finally, the recent precision observations of the N I $2p^3\ ^4S-2p^3\ ^2D$ ground-state doublet in the nightglow, achieved with very sensitive instrumentation, provide a rare test for the calculated line strengths of extremely weak forbidden lines. The radiative decay from the two ^2D levels to

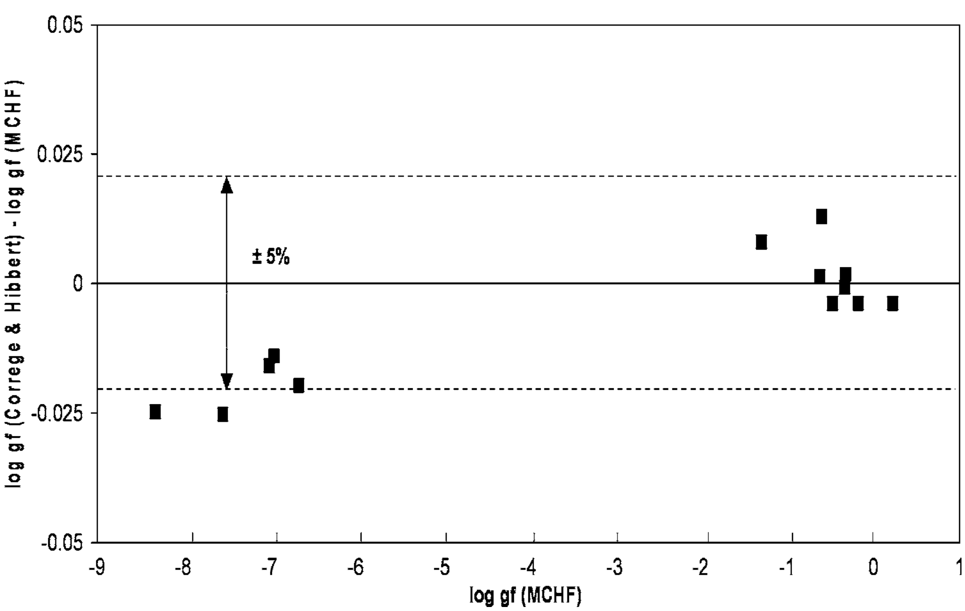

FIG. 1. Comparison of multiconfiguration calculations for C II by Corrégé and Hibbert,[18] performed with the CIV-3 code, with the more extensive MCHF calculations by Tachiev and Froese Fischer,[5,7] used in this compilation. Because of the excellent agreement, the vertical scale is greatly expanded.

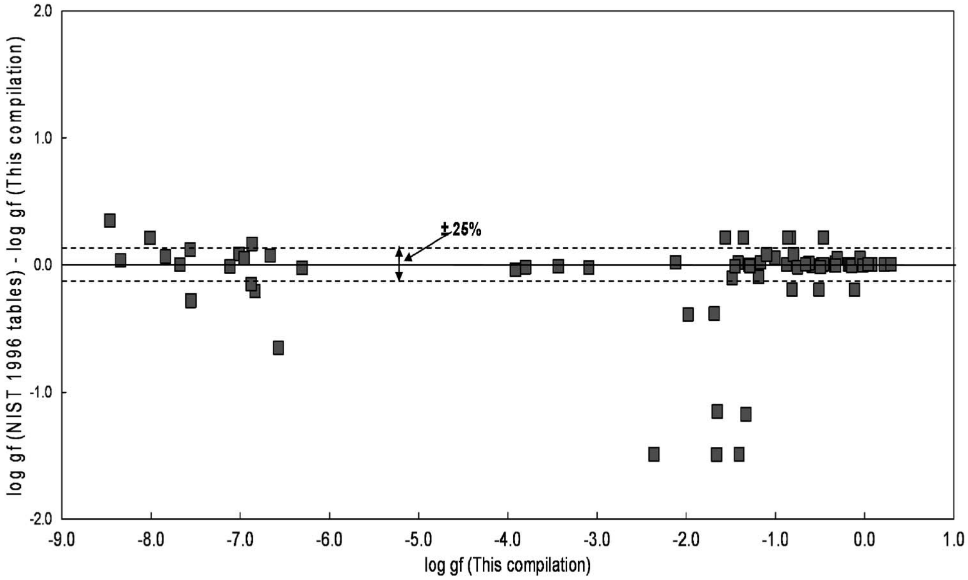

FIG. 2. A comparison of this compilation for the spectrum of C II with the results of our previous compilation of 1996,[1] which was mainly based on the Opacity Project[2] calculations.

the ^4S term via M1 and E2 transitions has very long lifetimes, from 0.6 days to 1.5 days for the four contributing components.[22] The measured intensity ratio of the 519.8 nm line to the 520.0 nm line has been determined as 1.759 ± 0.014, whereas the calculated ratio from Froese, Fischer, and Tachiev[5] is 1.788, i.e., it differs by only 1.6%.

In summary, these above-discussed comparisons lend much support to the new MCHF results. However, these recent calculations are not nearly as extensive as the OPACITY data. They cover only transitions within principal quantum numbers $n=2$ and 3, but they include nevertheless many of the strong, persistent lines between the lower excited levels and the ground level and numerous intersystem and forbidden lines. The new results differ often considerably from the earlier OPACITY data. As these MCHF calculations are much more detailed, show for the great majority convincingly small differences between the dipole-length and dipole-velocity forms, and agree much better with the few available experimental data, an update of the C I, C II, N I, and N II spectra with this higher quality material is clearly useful.

2. List of Symbols

Symbols for indication of data accuracy:

- A = uncertainty less than ±3%
- B = uncertainty less than ±10%
- C = uncertainty less than ±25%
- D = uncertainty less than ±50%
- E = uncertainty greater than ±50%, but within factors of 3

Symbols used for table headings:

- λ = wavelength (Å)
- E_i = lower energy level (cm^{-1})
- E_k = upper energy level (cm^{-1})
- g_i = statistical weight of the lower level
- g_k = statistical weight of the upper level
- A_{ki} = atomic transition probability for spontaneous emission (in 10^8 s^{-1}) for all E1 (allowed: electric dipole) transitions, and (in s^{-1}) for all M1, M2, and E2 transitions
- f_{ik} = (absorption) oscillator strength

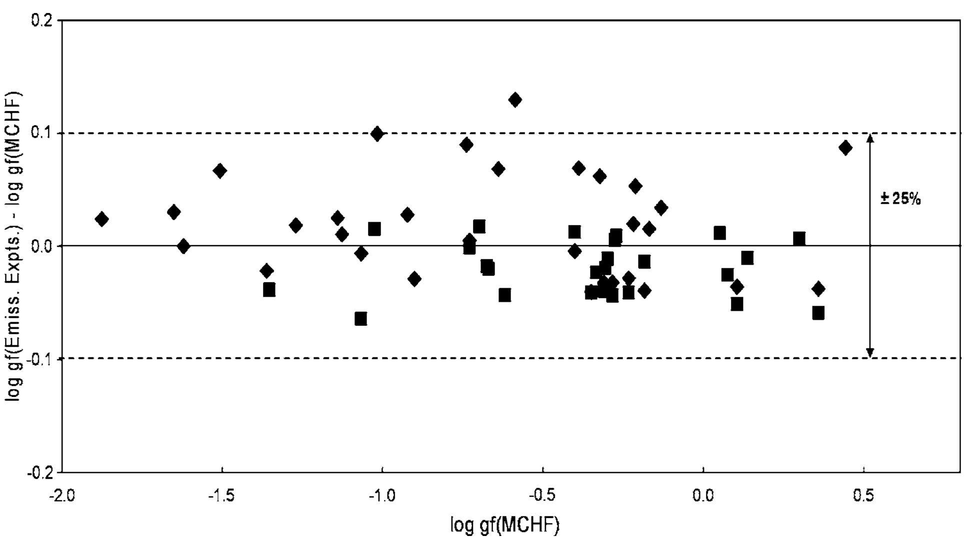

FIG. 3. Comparison of this compilation, based on recent MCHF calculations,[5,7] with the results of two recent emission experiments[20,21] for N I, which have their absolute scales normalized to the lifetimes listed in Table 1.[9–11] The diamonds show the results of Bridges[21] and the squares depict the results of Musielok *et al.*[20]

S = line strength in atomic units; formulas and values for these quantities in SI units are as follows:

For E1 transitions,
$a_0^2 e^2 = 7.188_3 \times 10^{-59}$ m^{2}C^2,
For E2 transitions,
$a_0^4 e^2 = 2.012_9 \times 10^{-79}$ m^{4}C^2,
For M1 transitions,
$\mu_B^2 = (eh/4\pi me)^2 = 8.600_7 \times 10^{-47}$ J^2 T^{-2},
For M2 transitions,
$\mu_B^2 a_0^2 = 2.408_5 \times 10^{-67}$ J^2 m^2 T^{-2},
where a_0, e, m_e, and h are the Bohr radius, electron charge, electron mass, and Planck constant, respectively, and μ_B is the Bohr magneton.

Note that for E_i and E_k the customary unit for atomic energy levels, used here, is related to the SI unit for energy (J) by 1 cm^{-1} = 1.986×10^{-23} J.

Abbreviations appearing in the column labeled *Type* (forbidden lines only):

M1: magnetic dipole transition,
E2: electric quadrupole transition,
M2: magnetic quadrupole transition.

Special symbols used in the wavelength and energy level columns:

Numbers in italics indicate multiplet values, i.e., weighted averages of line values.

Notation for exponents:

In all tables, we have shown the power of ten by the exponential notation. For example, 3.88E-03 stands for 3.88×10^{-3}.

3. Useful Relations

(1) Statistical weight g: The statistical weight of a level is related to the total angular momentum or quantum number J_L of that level (initial or final state of a line) by

$$g_L = 2J_L + 1.$$

Similarly, the statistical weight of a term (initial or final state of a multiplet) is

$$g_M = (2L+1)(2S+1),$$

where L is the total orbital angular momentum and S is the total spin angular momentum.

(2) Line strength S: The line strength of a multiplet is the sum of the strengths of its component lines, i.e.,

$$S(\text{multiplet}) = \sum S(\text{line})$$

or

$$S(i,k) = \sum_{J_i,J_k} S(J_i,J_k),$$

where k denotes the upper term and i the lower term.

(3) Conversions: For electric dipole (E1-allowed) transitions,

$$A_{ki} = \frac{6.6703 \times 10^{15} g_i}{g_k \lambda^2} f_{ik} = \frac{2.0261 \times 10^{18}}{g_k \lambda^3} S.$$

For magnetic dipole (M1-forbidden) transitions,

$$A_{ki} = \frac{2.6974 \times 10^{13}}{g_k \lambda^3} S.$$

For electric quadrupole (E2-forbidden) transitions,

$$A_{ki} = \frac{1.1199 \times 10^{18}}{g_k \lambda^5} S.$$

For magnetic quadrupole (M2-forbidden) transitions,

$$A_{ki} = \frac{1.4910 \times 10^{13}}{g_k \lambda^5} S.$$

For these conversions, λ is the vacuum wavelength (Å) and g_i and g_k are the statistical weights of the lower and upper level, respectively. The line strength (S), the transition probability (A_{ki}), and the oscillator strength f_{ik} are equivalent quantities that are related by the preceding equations. Line strengths are expressed in atomic units, transition probabilities are expressed in units of s^{-1}, and oscillator strengths are dimensionless quantities. For more detail on these units and conversion factors, we refer the reader to our recent NIST publication, Wiese *et al.*[1]

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5. Carbon

5.1. C I

Ground state: $1s^2 2s^2 2p^2\ ^3P_0$
Ionization energy: 11.260 eV (90 820.42 cm^{-1})

5.1.1. C I Allowed Transitions

TABLE 3. List of tabulated lines for allowed transitions of C I

Wavelength (Å)	Multiplet No.
In vacuum	
1 121.45	52
1 121.52	53
1 121.64	52
1 121.66	52
1 121.71	50
1 121.73	53
1 121.76	52
1 121.92	50
1 122.00	52
1 122.00	49
1 122.07	53
1 122.10	52
1 122.18	51
1 122.26	50
1 122.33	49
1 122.34	49
1 122.45	49
1 122.52	48
1 122.65	49
1 122.72	48
1 122.77	48
1 122.79	47
1 122.99	49
1 123.07	48
1 123.11	47
1 123.12	46
1 123.13	47
1 123.46	46
1 128.07	44
1 128.17	45
1 128.25	44
1 128.28	44
1 128.38	45
1 128.41	44
1 128.48	42
1 128.63	44
1 128.69	42
1 128.72	45
1 128.75	44
1 128.82	41
1 128.90	43
1 129.03	42
1 129.08	40
1 129.13	41
1 129.16	41
1 129.20	41
1 129.32	40
1 129.40	41
1 129.42	40
1 129.53	40
1 129.59	40
1 129.62	39
1 129.75	41
1 129.87	40
1 129.92	39
1 129.97	39
1 130.17	38
1 130.52	38
1 138.38	37
1 138.56	37
1 138.56	36
1 138.60	37
1 138.74	37
1 138.77	36
1 138.95	37
1 139.09	34
1 139.09	37
1 139.12	36
1 139.30	34
1 139.43	35
1 139.51	33
1 139.65	34
1 139.77	32
1 139.79	33
1 139.81	33
1 139.86	33
1 140.01	33
1 140.01	32
1 140.12	32
1 140.22	32
1 140.32	32
1 140.36	33
1 140.36	31
1 140.57	32
1 140.64	31
1 140.71	31
1 141.33	30
1 141.68	30
1 155.81	29
1 155.98	29
1 156.03	29
1 156.18	28
1 156.20	29
1 156.39	29
1 156.40	28
1 156.56	29
1 156.76	28

TABLE 3. List of tabulated lines for allowed transitions of C I—Continued

Wavelength (Å)	Multiplet No.
1 157.19	26
1 157.33	27
1 157.41	26
1 157.77	26
1 157.77	25
1 157.91	25
1 158.02	25
1 158.03	24
1 158.13	25
1 158.32	24
1 158.40	24
1 158.49	25
1 158.54	24
1 158.67	24
1 158.73	23
1 158.91	24
1 158.97	23
1 159.09	23
1 160.51	22
1 160.88	22
1 188.83	21
1 188.99	21
1 189.07	21
1 189.25	21
1 189.45	21
1 189.63	21
1 190.02	20
1 190.25	20
1 190.64	20
1 191.84	19
1 192.22	18
1 192.45	18
1 192.83	18
1 193.01	17
1 193.03	17
1 193.24	17
1 193.26	17
1 193.39	17
1 193.65	17
1 193.68	15
1 194.00	15
1 194.06	15
1 194.23	15
1 194.30	16
1 194.41	15
1 194.49	16
1 194.61	15
1 194.69	16
1 197.87	14
1 198.26	14
1 260.74	13
1 260.93	13
1 261.00	13
1 261.12	13
1 261.43	13
1 261.55	13
1 270.14	12
1 270.41	12
1 270.84	12
1 274.11	11
1 276.48	10
1 276.75	10
1 277.19	10
1 277.25	9
1 277.28	9
1 277.51	9
1 277.55	9
1 277.72	9
1 277.95	9
1 279.06	8
1 279.23	8
1 279.50	8
1 279.89	7
1 280.14	7
1 280.33	7
1 280.40	7
1 280.60	7
1 280.85	7
1 287.61	6
1 288.06	6
1 328.83	5
1 329.09	5
1 329.10	5
1 329.12	5
1 329.58	5
1 329.60	5
1 459.03	62
1 463.34	61
1 467.40	60
1 467.88	59
1 468.11	59
1 468.41	59
1 470.09	58
1 470.45	58
1 471.55	57
1 472.23	57
1 481.76	56
1 560.31	4
1 560.68	4
1 560.71	4
1 561.34	4
1 561.37	4
1 561.44	4
1 613.38	3
1 613.80	3
1 614.51	3

TABLE 3. List of tabulated lines for allowed transitions of C I—Continued

Wavelength (Å)	Multiplet No.
1 656.27	2
1 656.93	2
1 657.01	2
1 657.38	2
1 657.91	2
1 658.12	2
1 733.98	69
1 751.83	68
1 763.91	67
1 765.37	66
1 770.89	65
1 930.90	55
1 992.01	54
1 993.62	54
In air	
2 478.56	64
2 582.90	63
2 964.84	1
2 967.21	1

This update for the transition probabilities of allowed (E1) lines of neutral carbon, provided in Table 4 with a finding list presented in Table 3, is based on very recent work by Froese Fischer and co-workers,[6,24,32], all of which is included in their website,[27] "The MCHF/MCDHF Collection." In 2006, Froese Fischer[24] published the results of sophisticated MCHF calculations with Breit–Pauli relativistic terms for transitions between lower quantum states with very detailed consideration of correlation between the four outer electrons and the $1s^2$ core. These are the most advanced calculations of their kind and supersede earlier, similar calculations based on less detailed treatments. The wave functions of the various atomic eigenstates are built from very large numbers of configuration state functions and include all Breit–Pauli relativistic corrections, such as spin–orbit, spin–other-orbit, spin–spin interactions and the Darwin and mass-correction terms. Froese Fischer[24] calculated the atomic transition probabilities fully *ab initio*, i.e., with calculated transition energies. Earlier, Zatsarinny and Froese Fischer[6,27] undertook frozen-core spline calculations for additional transitions between the ground state and high-lying states close to the ionization energy, for which this method is particularly suited.

All of these calculations were done both in the dipole length and dipole velocity formalisms, but only the length values were tabulated. Ideally, these two representations of the transition integral should, of course, produce identical numerical results for the transition probabilities. But even in these sophisticated calculations, some differences between the length and velocity values must be expected, and this in turn may serve as an indicator of accuracy. These differences are all tabulated on the website. For strong transitions, they are quite small (labeled as "T" in the website and given in percent), normally a few percent or even less than 1%. The differences increase, sometimes drastically, for many of the weaker lines, as one would expect. We have treated the "T" numbers as a qualitative, not a quantitative, measure and assume that for larger T's, the velocity value is much more uncertain than the (always tabulated) length value.

Also, we have always started from the tabulated line strengths and calculated energy-adjusted A- and f-values for our tabulation, i.e., A- and f-values adjusted to the more accurate experimental energy values. Most "dipole length-dipole velocity" differences are smaller for these than for the *ab initio* values. Some comparisons with lifetime and emission experiments[8,26,29] could be made, and these show excellent to fair agreement.

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TABLE 4. C I: Allowed Transitions

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å)	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
1	$2p^2-2s2p^3$	$^3P-^5S^\circ$												
			2 967.21	2 968.08	43.40	–	33 735.20	5–5	2.1E−07	2.8E−08	1.4E−06	−6.86	D	24
			2 964.84	2 965.70	16.40	–	33 735.20	3–5	8.6E−08	1.9E−08	5.5E−07	−7.25	D	24
2	$2p^2-2p3s$	$^3P-^3P^\circ$		*1 657.2*	*29.6*	–	60 373.0	9–9	3.47E+00	1.43E−01	7.02E+00	0.110	A	24
				1 657.01	43.40	–	60 393.14	5–5	2.61E+00	1.07E−01	2.93E+00	−0.271	A	24
				1 657.38	16.40	–	60 352.63	3–3	8.66E−01	3.57E−02	5.84E−01	−0.971	A	24
				1 658.12	43.40	–	60 352.63	5–3	1.44E+00	3.57E−02	9.75E−01	−0.748	A	24
				1 657.91	16.40	–	60 333.43	3–1	3.47E+00	4.76E−02	7.80E−01	−0.845	A	24
				1 656.27	16.40	–	60 393.14	3–5	8.72E−01	5.98E−02	9.78E−01	−0.746	A	24
				1 656.93	0.00	–	60 352.63	1–3	1.16E+00	1.43E−01	7.81E−01	−0.844	A	24
3	$2p^2-2p3s$	$^3P-^1P^\circ$												
				1 613.38	0.00	–	61 981.82	1–3	3.64E−04	4.26E−05	2.26E−04	−4.371	B	24
				1 613.80	16.40	–	61 981.82	3–3	2.80E−04	1.09E−05	1.74E−04	−4.484	B	24
				1 614.51	43.40	–	61 981.82	5–3	2.96E−04	6.95E−06	1.85E−04	−4.459	B	24
4	$2s^22p^2-2s2p^3$	$^3P-^3D^\circ$		*1 561.1*	*29.6*	–	*64 088.8*	9–15	1.17E+00	7.15E−02	3.31E+00	−0.191	A	24
				1 561.44	43.40	–	64 086.92	5–7	1.17E+00	6.01E−02	1.54E+00	−0.522	A	24
				1 560.68	16.40	–	64 090.95	3–5	8.82E−01	5.37E−02	8.28E−01	−0.793	A	24
				1 560.31	0.00	–	64 089.85	1–3	6.54E−01	7.16E−02	3.68E−01	−1.145	A	24
				1 561.34	43.40	–	64 090.95	5–5	2.93E−01	1.07E−02	2.75E−01	−1.271	A	24
				1 560.71	16.40	–	64 089.85	3–3	4.89E−01	1.79E−02	2.76E−01	−1.271	A	24
				1 561.37	43.40	–	64 089.85	5–3	3.25E−02	7.12E−04	1.83E−02	−2.448	A	24
5	$2s^22p^2-2s2p^3$	$^3P-^3P^\circ$		*1 329.3*	*29.6*	–	*75 254.9*	9–9	2.19E+00	5.81E−02	2.29E+00	−0.281	B	24
				1 329.58	43.40	–	75 255.27	5–5	1.64E+00	4.36E−02	9.54E−01	−0.662	B	24
				1 329.12	16.40	–	75 253.97	3–3	5.55E−01	1.47E−02	1.93E−01	−1.355	B	24
				1 329.60	43.40	–	75 253.97	5–3	9.19E−01	1.46E−02	3.20E−01	−1.136	B	24
				1 329.09	16.40	–	75 256.12	3–1	2.22E+00	1.96E−02	2.57E−01	−1.231	B	24
				1 329.10	16.40	–	75 255.27	3–5	5.39E−01	2.38E−02	3.12E−01	−1.147	B	24
				1 328.83	0.00	–	75 253.97	1–3	7.31E−01	5.80E−02	2.54E−01	−1.236	B	24
6	$2p^2-2p3d$	$^3P-^1D^\circ$												
				1 288.06	43.40	–	77 679.82	5–5	6.6E−04	1.65E−05	3.51E−04	−4.083	C	24
				1 287.61	16.40	–	77 679.82	3–5	1.49E−03	6.16E−05	7.84E−04	−3.733	B	24
7	$2p^2-2p4s$	$^3P-^3P^\circ$		*1 280.4*	*29.6*	–	*78 132.9*	9–9	9.44E−01	2.32E−02	8.80E−01	−0.680	B+	24
				1 280.33	43.40	–	78 148.09	5–5	6.38E−01	1.57E−02	3.30E−01	−1.106	B+	24
				1 280.40	16.40	–	78 116.74	3–3	1.87E−01	4.61E−03	5.83E−02	−1.859	B+	24
				1 280.85	43.40	–	78 116.74	5–3	3.62E−01	5.34E−03	1.13E−01	−1.573	B+	24
				1 280.60	16.40	–	78 104.98	3–1	8.82E−01	7.23E−03	9.14E−02	−1.664	B+	24
				1 279.89	16.40	–	78 148.09	3–5	3.43E−01	1.40E−02	1.77E−01	−1.376	B+	24
				1 280.14	0.00	–	78 116.74	1–3	3.55E−01	2.61E−02	1.10E−01	−1.583	B+	24
8	$2p^2-2p3d$	$^3P-^3F^\circ$												
				1 279.23	43.40	–	78 215.51	5–7	1.1E−01	3.9E−03	8.2E−02	−1.71	D	24
				1 279.06	16.40	–	78 199.07	3–5	4.0E−02	1.6E−03	2.1E−02	−2.31	D	24
				1 279.50	43.40	–	78 199.07	5–5	2.2E−02	5.5E−04	1.2E−02	−2.56	D	24
9	$2p^2-2p3d$	$^3P-^3D^\circ$		*1 277.5*	*29.6*	–	*78 309.8*	9–15	2.29E+00	9.32E−02	3.53E+00	−0.076	A	24
				1 277.55	43.40	–	78 318.25	5–7	2.28E+00	7.79E−02	1.64E+00	−0.409	A	24
				1 277.28	16.40	–	78 307.63	3–5	1.70E+00	6.92E−02	8.73E−01	−0.683	A	24
				1 277.25	0.00	–	78 293.49	1–3	1.26E+00	9.23E−02	3.88E−01	−1.035	A	24

TABLE 4. C I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å)	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
				1 277.72	43.40	–	78 307.63	5–5	6.30E−01	1.54E−02	3.24E−01	−1.113	A	24
				1 277.51	16.40	–	78 293.49	3–3	9.24E−01	2.26E−02	2.85E−01	−1.169	A	24
				1 277.95	43.40	–	78 293.49	5–3	5.94E−02	8.72E−04	1.84E−02	−2.360	B+	24
10	$2p^2$–$2p4s$	^{3}P–^{1}P°												
				1 277.19	43.40	–	78 340.28	5–3	1.81E−02	2.66E−04	5.59E−03	−2.876	C+	24
				1 276.75	16.40	–	78 340.28	3–3	9.38E−02	2.29E−03	2.89E−02	−2.163	C+	24
				1 276.48	0.00	–	78 340.28	1–3	5.04E−02	3.69E−03	1.55E−02	−2.433	C+	24
11	$2p^2$–$2p3d$	^{3}P–^{1}F°												
				1 274.11	43.40	–	78 529.62	5–7	1.20E−02	4.10E−04	8.60E−03	−2.688	C+	24
12	$2p^2$–$2p3d$	^{3}P–^{1}P°												
				1 270.84	43.40	–	78 731.27	5–3	4.2E−05	6.1E−07	1.3E−05	−5.51	D	24
				1 270.41	16.40	–	78 731.27	3–3	2.14E−03	5.2E−05	6.5E−04	−3.81	C	24
				1 270.14	0.00	–	78 731.27	1–3	4.54E−03	3.29E−04	1.38E−03	−3.483	B	24
13	$2p^2$–$2p3d$	^{3}P–^{3}P°		*1 261.3*	*29.6*	–	*79 314.9*	9–9	1.77E+00	4.21E−02	1.57E+00	−0.421	B	24
				1 261.55	43.40	–	79 310.85	5–5	1.34E+00	3.20E−02	6.65E−01	−0.795	B	24
				1 261.00	16.40	–	79 318.78	3–3	4.68E−01	1.11E−02	1.39E−01	−1.476	B	24
				1 261.43	43.40	–	79 318.78	5–3	7.51E−01	1.07E−02	2.23E−01	−1.270	B	24
				1 260.93	16.40	–	79 323.16	3–1	1.81E+00	1.44E−02	1.79E−01	−1.365	B	24
				1 261.12	16.40	–	79 310.85	3–5	4.00E−01	1.59E−02	1.98E−01	−1.322	B	24
				1 260.74	0.00	–	79 318.78	1–3	5.70E−01	4.07E−02	1.69E−01	−1.390	B	24
14	$2p^2$–$2p4d$	^{3}P–^{1}D°												
				1 198.26	43.40	–	83 497.62	5–5	6.8E−04	1.45E−05	2.87E−04	−4.138	C	32
				1 197.87	16.40	–	83 497.62	3–5	2.04E−03	7.3E−05	8.6E−04	−3.66	C	32
15	$2p^2$–$2p5s$	^{3}P–^{3}P°		*1 194.1*	*29.6*	–	*83 772.5*	9–9	5.07E−01	1.08E−02	3.84E−01	−1.011	A	32
				1 194.06	43.40	–	83 791.04	5–5	2.98E−01	6.37E−03	1.25E−01	−1.497	B+	32
				1 194.23	16.40	–	83 752.41	3–3	8.34E−02	1.78E−03	2.10E−02	−2.272	A	32
				1 194.61	43.40	–	83 752.41	5–3	1.77E−01	2.27E−03	4.47E−02	−1.945	A	32
				1 194.41	16.40	–	83 740.06	3–1	4.40E−01	3.14E−03	3.70E−02	−2.026	A	32
				1 193.68	16.40	–	83 791.04	3–5	2.54E−01	9.06E−03	1.07E−01	−1.566	A	32
				1 194.00	0.00	–	83 752.41	1–3	1.94E−01	1.25E−02	4.90E−02	−1.905	A	32
16	$2p^2$–$2p4d$	^{3}P–^{3}F°												
				1 194.49	43.40	–	83 761.26	5–7	6.77E−02	2.03E−03	3.99E−02	−1.994	B+	32
				1 194.30	16.40	–	83 747.39	3–5	4.10E−02	1.46E−03	1.73E−02	−2.358	B+	32
				1 194.69	43.40	–	83 747.39	5–5	3.43E−03	7.33E−05	1.44E−03	−3.436	B+	32
17	$2p^2$–$2p4d$	^{3}P–^{3}D°		*1 193.2*	*29.6*	–	*83 839.5*	9–15	1.12E+00	3.97E−02	1.40E+00	−0.447	B+	32
				1 193.24	43.40	–	83 848.83	5–7	1.11E+00	3.32E−02	6.52E−01	−0.780	B+	32
				1 193.01	16.40	–	83 838.08	3–5	7.91E−01	2.81E−02	3.31E−01	−1.074	B+	32
				1 193.03	0.00	–	83 820.13	1–3	6.39E−01	4.09E−02	1.61E−01	−1.388	B+	32
				1 193.39	43.40	–	83 838.08	5–5	3.46E−01	7.39E−03	1.45E−01	−1.432	B+	32
				1 193.26	16.40	–	83 820.13	3–3	4.29E−01	9.16E−03	1.08E−01	−1.561	B+	32
				1 193.65	43.40	–	83 820.13	5–3	2.25E−02	2.89E−04	5.67E−03	−2.841	B+	32
18	$2p^2$–$2p5s$	^{3}P–^{1}P°												
				1 192.83	43.40	–	83 877.31	5–3	2.19E−02	2.80E−04	5.50E−03	−2.854	B	32
				1 192.45	16.40	–	83 877.31	3–3	7.6E−02	1.62E−03	1.91E−02	−2.313	C	32
				1 192.22	0.00	–	83 877.31	1–3	2.15E−02	1.37E−03	5.4E−03	−2.86	C	32

TABLE 4. C I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å)	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
19	$2p^2$–$2p4d$	^{3}P–^{1}F°												
				1 191.84	43.40	–	83 947.43	5–7	2.91E−02	8.67E−04	1.70E−02	−2.363	C+	32
20	$2p^2$–$2p4d$	^{3}P–^{1}P°												
				1 190.64	43.40	–	84 032.15	5–3	1.26E−04	1.61E−06	3.15E−05	−5.095	C	32
				1 190.25	16.40	–	84 032.15	3–3	4.79E−03	1.02E−04	1.20E−03	−3.515	C+	32
				1 190.02	0.00	–	84 032.15	1–3	9.06E−03	5.77E−04	2.26E−03	−3.239	C+	32
21	$2p^2$–$2p4d$	^{3}P–^{3}P°		*1 189.3*	*29.6*	–	*84 109.4*	9–9	6.65E−01	1.41E−02	4.97E−01	−0.897	B	32
				1 189.63	43.40	–	84 103.10	5–5	5.28E−01	1.12E−02	2.19E−01	−1.252	B	32
				1 189.07	16.40	–	84 116.09	3–3	2.01E−01	4.27E−03	5.01E−02	−1.893	B	32
				1 189.45	43.40	–	84 116.09	5–3	2.96E−01	3.77E−03	7.37E−02	−1.725	B	32
				1 188.99	16.40	–	84 121.22	3–1	7.18E−01	5.07E−03	5.96E−02	−1.818	B	32
				1 189.25	16.40	–	84 103.10	3–5	1.09E−01	3.86E−03	4.53E−02	−1.937	B	32
				1 188.83	0.00	–	84 116.09	1–3	1.95E−01	1.24E−02	4.86E−02	−1.906	B	32
22	$2p^2$–$2p5d$	^{3}P–^{1}D°												
				1 160.88	43.40	–	86 185.20	5–5	1.19E−03	2.40E−05	4.58E−04	−3.92	C	32
				1 160.51	16.40	–	86 185.20	3–5	3.27E−03	1.10E−04	1.26E−03	−3.481	C	32
23	$2p^2$–$2p5d$	^{3}P–^{3}F°												
				1 158.97	43.40	–	86 327.16	5–7	7.22E−02	2.04E−03	3.88E−02	−1.992	C+	32
				1 158.73	16.40	–	86 317.64	3–5	5.11E−02	1.72E−03	1.96E−02	−2.289	C+	32
				1 159.09	43.40	–	86 317.64	5–5	3.55E−03	7.1E−05	1.36E−03	−3.447	C	32
24	$2p^2$–$2p6s$	^{3}P–^{3}P°		*1 158.5*	*29.6*	–	*86 351.6*	9–9	3.17E−01	6.38E−03	2.19E−01	−1.241	B	32
				1 158.40	43.40	–	86 369.60	5–5	8.20E−02	1.65E−03	3.14E−02	−2.084	C+	32
				1 158.54	16.40	–	86 331.63	3–3	3.36E−02	6.76E−04	7.73E−03	−2.693	C+	32
				1 158.91	43.40	–	86 331.63	5–3	8.37E−02	1.01E−03	1.93E−02	−2.296	C+	32
				1 158.67	16.40	–	86 321.94	3–1	2.19E−01	1.47E−03	1.68E−02	−2.356	B	32
				1 158.03	16.40	–	86 369.60	3–5	3.10E−01	1.04E−02	1.19E−01	−1.506	B	32
				1 158.32	0.00	–	86 331.63	1–3	1.09E−01	6.56E−03	2.50E−02	−2.183	B	32
25	$2p^2$–$2p5d$	^{3}P–^{3}D°		*1 158.0*	*29.6*	–	*86 387.9*	9–15	5.44E−01	1.82E−02	6.26E−01	−0.785	B	32
				1 158.02	43.40	–	86 397.80	5–7	5.57E−01	1.57E−02	2.99E−01	−1.106	B+	32
				1 157.77	16.40	–	86 389.38	3–5	2.62E−01	8.78E−03	1.00E−01	−1.579	B+	32
				1 157.91	0.00	–	86 362.52	1–3	3.52E−01	2.12E−02	8.09E−02	−1.673	B+	32
				1 158.13	43.40	–	86 389.38	5–5	2.58E−01	5.19E−03	9.90E−02	−1.586	B+	32
				1 158.13	16.40	–	86 362.52	3–3	1.98E−01	3.98E−03	4.55E−02	−1.923	B+	32
				1 158.49	43.40	–	86 362.52	5–3	6.3E−03	7.6E−05	1.45E−03	−3.420	C	32
26	$2p^2$–$2p6s$	^{3}P–^{1}P°												
				1 157.77	43.40	–	86 416.55	5–3	2.50E−02	3.01E−04	5.74E−03	−2.822	C+	32
				1 157.41	16.40	–	86 416.55	3–3	7.50E−02	1.51E−03	1.72E−02	−2.345	C+	32
				1 157.19	0.00	–	86 416.55	1–3	1.45E−02	8.72E−04	3.32E−03	−3.059	C+	32
27	$2p^2$–$2p5d$	^{3}P–^{1}F°												
				1 157.33	43.40	–	86 449.19	5–7	3.99E−02	1.12E−03	2.14E−02	−2.251	C+	32
28	$2p^2$–$2p5d$	^{3}P–^{1}P°												
				1 156.76	43.40	–	86 491.41	5–3	3.3E−04	3.9E−06	7.5E−05	−4.71	D	32
				1 156.40	16.40	–	86 491.41	3–3	8.1E−03	1.63E−04	1.86E−03	−3.311	C	32
				1 156.18	0.00	–	86 491.41	1–3	1.35E−02	8.09E−04	3.08E−03	−3.092	C+	32
29	$2p^2$–$2p5d$	^{3}P–^{3}P°		*1 156.3*	*29.6*	–	*86 512.8*	9–9	3.20E−01	6.41E−03	2.20E−01	−1.239	B	32

TABLE 4. C I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å)	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
				1 156.56	43.40	–	86 506.70	5–5	2.69E−01	5.40E−03	1.03E−01	−1.569	B	32
				1 156.03	16.40	–	86 519.47	3–3	1.14E−01	2.28E−03	2.60E−02	−2.166	B	32
				1 156.39	43.40	–	86 519.47	5–3	1.51E−01	1.81E−03	3.45E−02	−2.042	B	32
				1 155.98	16.40	–	86 523.16	3–1	3.74E−01	2.50E−03	2.85E−02	−2.125	B	32
				1 156.20	16.40	–	86 506.70	3–5	2.39E−02	8.00E−04	9.13E−03	−2.620	C+	32
				1 155.81	0.00	–	86 519.47	1–3	8.21E−02	4.93E−03	1.88E−02	−2.307	C+	32
30	$2p^2$–$2p6d$	^{3}P–^{1}D°												
				1 141.68	43.40	–	87 633.75	5–5	2.03E−03	3.97E−05	7.5E−04	−3.70	C	32
				1 141.33	16.40	–	87 633.75	3–5	4.48E−03	1.46E−04	1.64E−03	−3.359	C	32
31	$2p^2$–$2p6d$	^{3}P–^{3}F°												
				1 140.64	43.40	–	87 713.38	5–7	6.29E−02	1.72E−03	3.22E−02	−2.066	C+	32
				1 140.36	16.40	–	87 708.21	3–5	6.39E−02	2.08E−03	2.34E−02	−2.206	C+	32
				1 140.71	43.40	–	87 708.21	5–5	1.95E−03	3.80E−05	7.1E−04	−3.72	C	32
32	$2p^2$–$2p7s$	^{3}P–^{3}P°		*1 140.2*	*29.6*	–	*87 737.3*	9–9	1.80E−01	3.51E−03	1.18E−01	−1.501	B	32
				1 140.12	43.40	–	87 753.73	5–5	1.84E−01	3.59E−03	6.73E−02	−1.746	B	32
				1 140.22	16.40	–	87 718.56	3–3	1.47E−02	2.86E−04	3.22E−03	−3.066	C+	32
				1 140.57	43.40	–	87 718.56	5–3	4.17E−02	4.88E−04	9.17E−03	−2.612	C+	32
				1 140.32	16.40	–	87 711.37	3–1	1.15E−01	7.48E−04	8.42E−03	−2.649	B	32
				1 139.77	16.40	–	87 753.73	3–5	4.63E−02	1.50E−03	1.69E−02	−2.346	C+	32
				1 140.01	0.00	–	87 718.56	1–3	6.10E−02	3.57E−03	1.34E−02	−2.448	C+	32
33	$2p^2$–$2p6d$	^{3}P–^{3}D°		*1 139.8*	*29.6*	–	*87 767.4*	9–15	2.94E−01	9.55E−03	3.23E−01	−1.066	B	32
				1 139.81	43.40	–	87 777.17	5–7	2.96E−01	8.07E−03	1.51E−01	−1.394	B	32
				1 139.51	16.40	–	87 773.09	3–5	2.72E−01	8.82E−03	9.93E−02	−1.577	B	32
				1 139.79	0.00	–	87 735.3	1–3	2.11E−01	1.23E−02	4.62E−02	−1.910	B	32
				1 139.86	43.40	–	87 773.09	5–5	1.30E−02	2.53E−04	4.74E−03	−2.898	C+	32
				1 140.01	16.40	–	87 735.3	3–3	9.45E−02	1.84E−03	2.07E−02	−2.258	C+	32
				1 140.36	43.40	–	87 735.3	5–3	1.09E−03	1.28E−05	2.40E−04	−4.194	C	32
34	$2p^2$–$2p7s$	^{3}P–^{1}P°												
				1 139.65	43.40	–	87 789.63	5–3	2.26E−02	2.64E−04	4.95E−03	−2.880	C+	32
				1 139.30	16.40	–	87 789.63	3–3	6.24E−02	1.22E−03	1.37E−02	−2.438	C+	32
				1 139.09	0.00	–	87 789.63	1–3	9.3E−03	5.4E−04	2.04E−03	−3.265	C	32
35	$2p^2$–$2p6d$	^{3}P–^{1}F°												
				1 139.43	43.40	–	87 806.93	5–7	4.31E−02	1.18E−03	2.20E−02	−2.231	C+	32
36	$2p^2$–$2p6d$	^{3}P–^{1}P°												
				1 139.12	43.40	–	87 830.17	5–3	3.6E−04	4.2E−06	7.8E−05	−4.68	D	32
				1 138.77	16.40	–	87 830.17	3–3	9.9E−03	1.93E−04	2.17E−03	−3.238	C	32
				1 138.56	0.00	–	87 830.17	1–3	1.70E−02	9.92E−04	3.72E−03	−3.003	C+	32
37	$2p^2$–$2p6d$	^{3}P–^{3}P°		*1 138.8*	*29.6*	–	*87 837.9*	9–9	1.84E−01	3.57E−03	1.21E−01	−1.493	B	32
				1 139.09	43.40	–	87 832.54	5–5	1.60E−01	3.11E−03	5.84E−02	−1.808	B	32
				1 138.60	16.40	–	87 843.91	3–3	7.31E−02	1.42E−03	1.60E−02	−2.371	C+	32
				1 138.95	43.40	–	87 843.91	5–3	8.98E−02	1.05E−03	1.96E−02	−2.281	C+	32
				1 138.56	16.40	–	87 846.9	3–1	2.31E−01	1.50E−03	1.68E−02	−2.348	B	32
				1 138.74	16.40	–	87 832.54	3–5	1.86E−03	6.0E−05	6.8E−04	−3.74	C	32
				1 138.38	0.00	–	87 843.91	1–3	4.13E−02	2.41E−03	9.03E−03	−2.618	C+	32
38	$2p^2$–$2p7d$	^{3}P–^{1}D°												
				1 130.52	43.40	–	88 498.62	5–5	3.04E−03	5.8E−05	1.08E−03	−3.54	C	32

TABLE 4. C I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å)	E_i (cm^{-1})		E_k (cm^{-1})	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
				1 130.17	16.40	–	88 498.62	3–5	4.77E−03	1.52E−04	1.70E−03	−3.341	C	32
39	$2p^2$–$2p7d$	^{3}P–^{3}F°												
				1 129.92	43.40	–	88 544.9	5–7	4.84E−02	1.30E−03	2.41E−02	−2.188	C+	32
				1 129.62	16.40	–	88 541.4	3–5	7.29E−02	2.32E−03	2.59E−02	−2.157	C+	32
				1 129.97	43.40	–	88 541.4	5–5	4.7E−04	9.0E−06	1.7E−04	−4.35	D	32
40	$2p^2$–$2p8s$	^{3}P–^{3}P°		*1 129.5*	*29.6*	–	*88 568.0*	9–9	1.00E−01	1.92E−03	6.42E−02	−1.763	B	32
				1 129.42	43.40	–	88 584.26	5–5	1.19E−01	2.29E−03	4.25E−02	−1.942	B	32
				1 129.53	16.40	–	88 549.06	3–3	7.2E−03	1.38E−04	1.54E−03	−3.382	C	32
				1 129.87	43.40	–	88 549.06	5–3	2.22E−02	2.55E−04	4.75E−03	−2.894	C+	32
				1 129.59	16.40	–	88 543.76	3–1	6.41E−02	4.09E−04	4.56E−03	−2.911	C+	32
				1 129.08	16.40	–	88 584.26	3–5	9.9E−03	3.16E−04	3.52E−03	−3.024	C	32
				1 129.32	0.00	–	88 549.06	1–3	3.46E−02	1.99E−03	7.38E−03	−2.702	C+	32
41	$2p^2$–$2p7d$	^{3}P–^{3}D°		*1 129.1*	*29.6*	–	*88 596.5*	9–15	1.71E−01	5.46E−03	1.83E−01	−1.309	B	32
				1 129.13	43.40	–	88 606.8	5–7	1.70E−01	4.56E−03	8.47E−02	−1.642	B	32
				1 128.82	16.40	–	88 604.75	3–5	1.61E−01	5.12E−03	5.70E−02	−1.814	B	32
				1 129.20	0.00	–	88 558.6	1–3	1.35E−01	7.72E−03	2.87E−02	−2.113	B	32
				1 129.16	43.40	–	88 604.75	5–5	4.97E−03	9.5E−05	1.77E−03	−3.323	C	32
				1 129.40	16.40	–	88 558.6	3–3	4.86E−02	9.30E−04	1.04E−02	−2.554	C+	32
				1 129.75	43.40	–	88 558.6	5–3	4.8E−05	5.5E−07	1.0E−05	−5.56	D	32
42	$2p^2$–$2p8s$	^{3}P–^{1}P°												
				1 129.03	43.40	–	88 615.01	5–3	1.82E−02	2.08E−04	3.87E−03	−2.982	C+	32
				1 128.69	16.40	–	88 615.01	3–3	4.79E−02	9.15E−04	1.02E−02	−2.562	C+	32
				1 128.48	0.00	–	88 615.01	1–3	6.0E−04	3.42E−04	1.27E−03	−3.467	C	32
43	$2p^2$–$2p7d$	^{3}P–^{1}F°												
				1 128.90	43.40	–	88 625.00	5–7	3.98E−02	1.06E−03	1.98E−02	−2.274	C	32
44	$2p^2$–$2p7d$	^{3}P–^{3}P°		*1 128.5*	*29.6*	–	*88 641.4*	9–9	1.18E−01	2.25E−03	7.53E−02	−1.693	B	32
				1 128.75	43.40	–	88 636.8	5–5	1.02E−01	1.94E−03	3.61E−02	−2.013	B	32
				1 128.28	16.40	–	88 646.6	3–3	4.96E−02	9.47E−04	1.06E−02	−2.547	C+	32
				1 128.63	43.40	–	88 646.6	5–3	5.80E−02	6.65E−04	1.24E−02	−2.478	C+	32
				1 128.25	16.40	–	88 649.1	3–1	1.55E−01	9.88E−04	1.10E−02	−2.528	B	32
				1 128.41	16.40	–	88 636.8	3–5	7.3E−04	2.3E−05	2.6E−04	−4.16	D	32
				1 128.07	0.00	–	88 646.6	1–3	2.37E−02	1.36E−03	5.03E−03	−2.868	C+	32
45	$2p^2$–$2p7d$	^{3}P–^{1}P°												
				1 128.72	43.40	–	88 639.02	5–3	2.4E−04	2.7E−06	5.1E−05	−4.86	D	32
				1 128.38	16.40	–	88 639.02	3–3	9.6E−04	1.83E−04	2.04E−03	−3.261	C	32
				1 128.17	0.00	–	88 639.02	1–3	1.83E−02	1.05E−03	3.88E−03	−2.980	C+	32
46	$2p^2$–$2p8d$	^{3}P–^{1}D°												
				1 123.46	43.40	–	89 054.16	5–5	3.75E−03	7.1E−05	1.31E−03	−3.450	C	32
				1 123.12	16.40	–	89 054.16	3–5	3.79E−03	1.19E−04	1.32E−03	−3.446	C	32
47	$2p^2$–$2p8d$	^{3}P–^{3}F°												
				1 123.11	43.40	–	89 082.1	5–7	3.58E−02	9.47E−04	1.75E−02	−2.325	C+	32
				1 122.79	16.40	–	89 079.9	3–5	7.25E−02	2.29E−03	2.53E−02	−2.164	C+	32
				1 123.13	43.40	–	89 079.9	5–5	5.4E−08	1.0E−09	1.9E−08	−8.29	E	32
48	$2p^2$–$2p9s$	^{3}P–^{3}P°												

TABLE 4. C I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å)	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
				1 122.72	16.40	–	89 085.41	3–3	3.96E−03	7.5E−05	8.3E−04	−3.65	C	32
				1 123.07	43.40	–	89 085.41	5–3	1.27E−02	1.44E−04	2.66E−03	−3.144	C+	32
				1 122.77	16.40	–	89 081.62	3–1	3.78E−02	2.38E−04	2.64E−03	−3.146	C+	32
				1 122.52	0.00	–	89 085.41	1–3	2.03E−02	1.15E−03	4.26E−03	−2.939	C+	32
49	$2p^2$–$2p8d$	^{3}P–^{3}D°		*1 122.3*	*29.6*	–	*89 132.9*	9–15	1.02E−01	3.22E−03	1.07E−01	−1.538	B	32
				1 122.33	43.40	–	89 143.9	5–7	1.06E−01	2.80E−03	5.17E−02	−1.854	B	32
				1 122.00	16.40	–	89 142.66	3–5	8.49E−02	2.67E−03	2.96E−02	−2.097	C+	32
				1 122.45	0.00	–	89 091.1	1–3	9.04E−02	5.12E−03	1.89E−02	−2.291	C+	32
				1 122.34	43.40	–	89 142.66	5–5	3.41E−03	6.4E−05	1.19E−03	−3.492	C	32
				1 122.65	16.40	–	89 091.1	3–3	2.73E−02	5.15E−04	5.71E−03	−2.811	C+	32
				1 122.99	43.40	–	89 091.1	5–3	4.1E−05	4.6E−07	8.6E−06	−5.63	D	32
50	$2p^2$–$2p9s$	^{3}P–^{1}P°												
				1 122.26	43.40	–	89 149.35	5–3	1.41E−02	1.59E−04	2.94E−03	−3.099	C+	32
				1 121.92	16.40	–	89 149.35	3–3	3.60E−02	6.78E−04	7.52E−03	−2.691	C+	32
				1 121.71	0.00	–	89 149.35	1–3	3.97E−03	2.25E−04	8.3E−04	−3.65	C	32
51	$2p^2$–$2p8d$	^{3}P–^{1}F°												
				1 122.18	43.40	–	89 155.70	5–7	3.38E−02	8.93E−04	1.65E−02	−2.350	C+	32
52	$2p^2$–$2p8d$	^{3}P–^{3}P°		*1 121.9*	*29.6*	–	*89 165.8*	9–9	8.17E−02	1.54E−03	5.12E−02	−1.858	C+	32
				1 122.10	43.40	–	89 162.2	5–5	6.71E−02	1.27E−03	2.34E−02	−2.198	C+	32
				1 121.66	16.40	–	89 170.0	3–3	3.50E−02	6.59E−04	7.30E−03	−2.704	C+	32
				1 122.00	43.40	–	89 170.0	5–3	3.96E−02	4.48E−04	8.28E−03	−2.650	C+	32
				1 121.64	16.40	–	89 171.5	3–1	1.10E−01	6.91E−04	7.66E−03	−2.683	C+	32
				1 121.76	16.40	–	89 162.2	3–5	4.26E−03	1.34E−04	1.48E−03	−3.396	C	32
				1 121.45	0.00	–	89 170.0	1–3	1.48E−02	8.40E−04	3.10E−03	−3.076	C+	32
53	$2p^2$–$2p8d$	^{3}P–^{1}P°												
				1 122.07	43.40	–	89 164.74	5–3	1.2E−04	1.4E−06	2.5E−05	−5.17	D	32
				1 121.73	16.40	–	89 164.74	3–3	8.1E−03	1.53E−04	1.70E−03	−3.337	C	32
				1 121.52	0.00	–	89 164.74	1–3	1.74E−02	9.85E−04	3.63E−03	−3.007	C+	32
54	$2p^2$–$2p3s$	^{1}D–^{3}P°												
				1 993.62	10 192.63	–	60 352.63	5–3	8.23E−04	2.94E−05	9.65E−04	−3.832	B	24
				1 992.01	10 192.63	–	60 393.14	5–5	7.7E−06	4.6E−07	1.5E−05	−5.64	D	24
55	$2p^2$–$2p3s$	^{1}D–^{1}P°		1 930.90	10 192.63	–	61 981.82	5–3	3.39E+00	1.14E−01	3.62E+00	−0.245	A	24
56	$2p^2$–$2p3d$	^{1}D–^{1}D°		1 481.76	10 192.63	–	77 679.82	5–5	3.45E−01	1.14E−02	2.77E−01	−1.246	B	24
57	$2p^2$–$2p4s$	^{1}D–^{3}P°												
				1 471.55	10 192.63	–	78 148.09	5–5	2.25E−04	7.32E−06	1.77E−04	−4.437	C+	24
				1 472.23	10 192.63	–	78 116.74	5–3	7.79E−03	1.52E−04	3.68E−03	−3.120	A	24
58	$2p^2$–$2p3d$	^{1}D–^{3}F°												
				1 470.09	10 192.63	–	78 215.51	5–7	1.41E−02	6.41E−04	1.55E−02	−2.494	A	24
				1 470.45	10 192.63	–	78 199.07	5–5	5.37E−04	1.74E−05	4.22E−04	−4.060	C+	24
59	$2p^2$–$2p3d$	^{1}D–^{3}D°												
				1 467.88	10 192.63	–	78 318.25	5–7	4.9E−03	2.2E−04	5.3E−03	−2.96	D	24
				1 468.11	10 192.63	–	78 307.63	5–5	9.4E−05	3.0E−06	7.4E−05	−4.82	D	24
				1 468.41	10 192.63	–	78 293.49	5–3	2.4E−02	4.7E−04	1.1E−02	−2.63	D	24
60	$2p^2$–$2p4s$	^{1}D–^{1}P°		1 467.40	10 192.63	–	78 340.28	5–3	5.49E−01	1.06E−02	2.57E−01	−1.274	A	24

TABLE 4. C I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å)	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
61	$2p^2$–$2p3d$	^{1}D–^{1}F°		1 463.34	10 192.63	–	78 529.62	5–7	1.79E+00	8.03E−02	1.94E+00	−0.396	B+	24
62	$2p^2$–$2p3d$	^{1}D–^{1}P°		1 459.03	10 192.63	–	78 731.27	5–3	5.45E−01	1.04E−02	2.51E−01	−1.282	B	24
63	$2p^2$–$2p3s$	^{1}S–^{3}P°												
			2 582.90	2 583.67	21 648.01	–	60 352.63	1–3	5.80E−05	1.74E−05	1.48E−04	−4.759	C+	24
64	$2p^2$–$2p3s$	^{1}S–^{1}P°	2 478.56	2 479.31	21 648.01	–	61 981.82	1–3	2.80E−01	7.73E−02	6.31E−01	−1.112	C+	24
65	$2p^2$–$2p4s$	^{1}S–^{3}P°												
				1 770.89	21 648.01	–	78 116.74	1–3	1.07E−04	1.51E−05	8.8E−05	−4.82	C	24
66	$2p^2$–$2p3d$	^{1}S–^{3}D°												
				1 765.37	21 648.01	–	78 293.49	1–3	7.8E−03	1.1E−03	6.3E−03	−2.96	D	24
67	$2p^2$–$2p4s$	^{1}S–^{1}P°		1 763.91	21 648.01	–	78 340.28	1–3	2.44E−02	3.42E−03	1.99E−02	−2.466	C	24
68	$2p^2$–$2p3d$	^{1}S–^{1}P°		1 751.83	21 648.01	–	78 731.27	1–3	8.38E−01	1.16E−01	6.67E−01	−0.937	B+	24
69	$2p^2$–$2p3d$	^{1}S–^{3}P°												
				1 733.98	21 648.01	–	79 318.78	1–3	1.5E−04	2.1E−05	1.2E−04	−4.68	D	24

5.1.2. C I Forbidden Transitions

TABLE 5. List of tabulated lines for forbidden transitions of C I

Wavelength (Å)	Multiplet No.
In vacuum	
1 328.81	8
1 329.10	8
1 329.12	8
1 329.56	8
1 329.58	8
1 329.60	8
1 536.96	12
1 536.98	12
1 537.01	12
1 560.28	7
1 560.68	7
1 560.71	7
1 560.78	7
1 561.34	7
1 561.37	7
1 561.44	7
1 613.80	6
1 614.51	6
1 655.82	5
1 657.01	5
1 657.38	5
1 658.65	5
1 855.35	11
1 855.38	11
1 855.48	11
1 865.42	14
1 992.01	10
1 993.62	10
1 994.38	10
In air	
2 407.74	15
2 407.82	15
2 580.20	13
2 963.40	4
2 964.84	4
2 967.21	4
4 621.57	3
4 627.35	3
6 699.74	19
6 708.37	19
6 708.95	19
6 726.27	19
6 726.65	19
6 727.24	19
8 727.13	9
8 951.42	20
8 952.46	20
8 953.77	20
8 953.97	20
8 954.65	20
8 954.81	20
8 955.69	20
9 808.32	2
9 824.13	2
9 850.26	2
26 606.0	18
26 742.7	18
26 750.6	18

TABLE 5. List of tabulated lines for forbidden transitions of C I—Continued

Wavelength (Å)	Multiplet No.
26 771.5	18
27 035.7	18
27 043.7	18
27 065.2	18
Wave number (cm^{-1})	
16.40	1
19.20	16
27.00	1
40.51	16
43.40	1
1 588.68	17
1 629.19	17
1 648.39	17

This update, provided in Table 6, with a finding list presented in Table 5, which is based on the recent sophisticated MCHF calculations of Froese Fischer[24] and Tachiev and Froese Fischer,[34] enlarges the tabulation to 72 lines, including some M2 transitions. For further details, see the general introduction. The tables, by Froese Fischer[24] and Tachiev and Froese Fischer,[34] contain additional lines, which are, however, extremely weak, so that we have not tabulated them. Our previous compilation in 1996[1] included only 12 M1 and E2 lines for C I.

References for C I Forbidden Transitions

[1]W. L. Wiese, J. R. Fuhr, and T. M. Deters, *Atomic Transition Probabilities of Carbon, Nitrogen, and Oxygen, A Critical Data Compilation*, J. Phys. Chem. Ref. Data, Monograph 7 (1996).

[24]C. Froese Fischer, J. Phys. B **39**, 2159 (2006).

[34]G. Tachiev and C. Froese Fischer, The MCHF/MCDHF Collection, http://atoms.vuse.vanderbilt.edu/.

TABLE 6. C I: Forbidden Transitions

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	Type	A_{ki} (s^{-1})	S (a.u.)	Acc.	Source
1	$2s^22p^2-2s^22p^2$	$^3P-^3P$											
				27.00 cm^{-1}	16.40	–	43.40	3–5	M1	2.65E−07	2.50E+00	A	24
				27.00 cm^{-1}	16.40	–	43.40	3–5	E2	3.62E−15	1.13E+01	B+	24
				16.40 cm^{-1}	0.00	–	16.40	1–3	M1	7.93E−08	2.00E+00	A	24
				43.40 cm^{-1}	0.00	–	43.40	1–5	E2	1.72E−14	5.00E+00	B+	24
2	$2s^22p^2-2s^22p^2$	$^3P-^1D$											
			9 850.26	9 852.96	43.40	–	10 192.63	5–5	M1	2.17E−04	3.84E−05	C+	24
			9 850.26	9 852.96	43.40	–	10 192.63	5–5	E2	1.07E−06	4.45E−04	B	24
			9 824.13	9 826.82	16.40	–	10 192.63	3–5	M1	7.28E−05	1.28E−05	C+	24
			9 824.13	9 826.82	16.40	–	10 192.63	3–5	E2	1.48E−07	6.1E−07	C	24
			9 808.32	9 811.01	0.00	–	10 192.63	1–5	E2	5.9E−08	2.39E−05	C	24
3	$2s^22p^2-2s^22p^2$	$^3P-^1S$											
			4 627.35	4 628.64	43.40	–	21 648.01	5–1	E2	2.15E−05	4.08E−05	C	24
			4 621.57	4 622.86	16.40	–	21 648.01	3–1	M1	2.32E−03	8.49E−06	C+	24
4	$2s^22p^2-2s2p^3$	$^3P-^5S^\circ$											
			2 967.21	2 968.08	43.40	–	33 735.20	5–5	M2	5.7E−04	4.4E+01	D	34
			2 964.84	2 965.70	16.40	–	33 735.20	3–5	M2	7.3E−04	5.6E+01	D	34
			2 963.40	2 964.26	0.00	–	33 735.20	1–5	M2	3.3E−04	2.5E+01	D	34
5	$2s^22p^2-2s^22p(^2P^\circ)3s$	$^3P-^3P^\circ$											
				1 657.01	43.40	–	60 393.14	5–5	M2	3.07E−03	1.28E+01	C	34
				1 657.38	16.40	–	60 352.63	3–3	M2	2.30E−03	5.8E+00	C	34
				1 658.65	43.40	–	60 333.43	5–1	M2	2.28E−03	1.92E+00	C	34
				1 655.82	0.00	–	60 393.14	1–5	M2	4.47E−04	1.87E+00	C	34
6	$2s^22p^2-2s^22p(^2P^\circ)3s$	$^3P-^1P^\circ$											
				1 614.51	43.40	–	61 981.82	5–3	M2	4.25E−03	9.4E+00	C	34
				1 613.80	16.40	–	61 981.82	3–3	M2	1.36E−03	2.99E+00	C	34
7	$2s^22p^2-2s2p^3$	$^3P-^3D^\circ$											
				1 561.44	43.40	–	64 086.92	5–7	M2	2.24E−02	9.8E+01	C	34

TABLE 6. C I: Forbidden Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	Type	A_{ki} (s^{-1})	S (a.u.)	Acc.	Source
				1 560.78	16.40	–	64 086.92	3–7	M2	8.5E−03	3.68E+01	C	34
				1 560.68	16.40	–	64 090.95	3–5	M2	1.05E−02	3.25E+01	C	34
				1 560.28	0.00	–	64 090.95	1–5	M2	8.5E−03	2.63E+01	C	34
				1 561.34	43.40	–	64 090.95	5–5	M2	6.9E−05	2.13E−01	C	34
				1 560.71	16.40	–	64 089.85	3–3	M2	3.11E−03	5.8E+00	C	34
				1 561.37	43.40	–	64 089.85	5–3	M2	2.58E−03	4.81E+00	C	34
8	$2s^22p^2-2s2p^3$	$^3P-^3P^\circ$											
				1 329.58	43.40	–	75 255.27	5–5	M2	4.64E−02	6.5E+01	C	34
				1 329.12	16.40	–	75 253.97	3–3	M2	1.63E−02	1.36E+01	C	34
				1 329.56	43.40	–	75 256.12	5–1	M2	1.02E−02	2.85E+00	C	34
				1 329.60	43.40	–	75 253.97	5–3	M2	2.22E−03	1.85E+00	C	34
				1 328.81	0.00	–	75 255.27	1–5	M2	2.06E−03	2.86E+00	C	34
				1 329.10	16.40	–	75 255.27	3–5	M2	1.33E−03	1.85E+00	C	34
9	$2s^22p^2-2s^22p^2$	$^1D-^1S$											
			8 727.13	8 729.52	10 192.63	–	21 648.01	5–1	E2	5.99E−01	2.71E+01	B	34
10	$2s^22p^2-2s^22p(^2P^\circ)3s$	$^1D-^3P^\circ$											
				1 992.01	10 192.63	–	60 393.14	5–5	M2	9.0E−04	9.5E+00	C	34
				1 994.38	10 192.63	–	60 333.43	5–1	M2	2.53E−03	5.4E+00	C	34
				1 993.62	10 192.63	–	60 352.63	5–3	M2	1.91E−03	1.21E+01	C	34
11	$2s^22p^2-2s2p^3$	$^1D-^3D^\circ$											
				1 855.48	10 192.63	–	64 086.92	5–7	M2	1.07E−02	1.10E+02	C	34
				1 855.35	10 192.63	–	64 090.95	5–5	M2	9.4E−03	6.9E+01	C	34
				1 855.38	10 192.63	–	64 089.85	5–3	M2	4.01E−03	1.78E+01	C	34
12	$2s^22p^2-2s2p^3$	$^1D-^3P^\circ$											
				1 536.98	10 192.63	–	75 255.27	5–5	M2	3.53E−03	1.02E+01	C	34
				1 537.01	10 192.63	–	75 253.97	5–3	M2	7.4E−03	1.28E+01	C	34
				1 536.96	10 192.63	–	75 256.12	5–1	M2	9.8E−03	5.7E+00	C	34
13	$2s^22p^2-2s^22p(^2P^\circ)3s$	$^1S-^3P^\circ$											
			2 580.20	2 580.97	21 648.01	–	60 393.14	1–5	M2	4.6E−04	1.8E+01	D	34
14	$2s^22p^2-2s2p^3$	$^1S-^3P^\circ$											
				1 865.42	21 648.01	–	75 255.27	1–5	M2	9.8E−03	7.4E+01	C	34
15	$2s2p^3-2s2p^3$	$^5S-^3P^\circ$											
			2 407.74	2 408.47	33 735.20	–	75 255.27	5–5	M1	1.24E−03	3.22E−06	C	34
			2 407.82	2 408.55	33 735.20	–	75 253.97	5–3	M1	6.9E−04	1.07E−06	C	34
16	$2s^22p(^2P^\circ)3s-$ $2s^22p(^2P^\circ)3s$	$^3P^\circ-^3P^\circ$											
				40.51 cm^{-1}	60 352.63	–	60 393.14	3–5	M1	8.96E−07	2.50E+00	A	34
				19.20 cm^{-1}	60 333.43	–	60 352.63	1–3	M1	1.27E−07	2.00E+00	A	34
17	$2s^22p(^2P^\circ)3s-$ $2s^22p(^2P^\circ)3s$	$^3P^\circ-^1P^\circ$											
				1 588.68 cm^{-1}	60 393.14	–	61 981.82	5–3	M1	2.8E−05	7.7E−04	D	34
				1 629.19 cm^{-1}	60 352.63	–	61 981.82	3–3	M1	1.8E−05	4.6E−04	D	34
				1 648.39 cm^{-1}	60 333.43	–	61 981.82	1–3	M1	2.5E−05	6.2E−04	D	34
18	$2s^22p(^2P^\circ)3s-2s2p^3$	$^3P^\circ-^3D^\circ$											

TABLE 6. C I: Forbidden Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i–g_k	Type	A_{ki} (s^{-1})	S (a.u.)	Acc.	Source
			27 065.2	3 693.78 cm^{-1}	60 393.14	–	64 086.92	5–7	E2	3.1E−04	2.8E+01	D	34
			26 771.5	3 734.29 cm^{-1}	60 352.63	–	64 086.92	3–7	E2	1.6E−04	1.4E+01	D	34
			26 742.7	3 738.32 cm^{-1}	60 352.63	–	64 090.95	3–5	E2	4.2E−05	2.6E+00	D	34
			26 606.0	3 757.52 cm^{-1}	60 333.43	–	64 090.95	1–5	E2	1.7E−04	1.0E+01	D	34
			27 035.7	3 697.81 cm^{-1}	60 393.14	–	64 090.95	5–5	E2	2.7E−04	1.8E+01	D	34
			26 750.6	3 737.22 cm^{-1}	60 352.63	–	64 089.85	3–3	E2	3.7E−04	1.4E+01	D	34
			27 043.7	3 696.71 cm^{-1}	60 393.14	–	64 089.85	5–3	E2	1.2E−04	4.5E+00	D	34
19	$2s^22p(^2P^\circ)3s-2s2p^3$	$^3P^\circ-^3P^\circ$											
			6 726.65	6 728.51	60 393.14	–	75 255.27	5–5	E2	1.43E+00	8.83E+01	B	34
			6 708.95	6 710.81	60 352.63	–	75 253.97	3–3	E2	1.04E+00	3.78E+01	B	34
			6 727.24	6 729.10	60 393.14	–	75 253.97	5–3	E2	3.04E+00	1.13E+02	B	34
			6 726.27	6 728.13	60 393.14	–	75 256.12	5–1	E2	4.05E+00	4.98E+01	B	34
			6 708.37	6 710.22	60 352.63	–	75 255.27	3–5	E2	1.88E+00	1.14E+02	B	34
			6 699.74	6 701.59	60 333.43	–	75 255.27	1–5	E2	8.46E−01	5.11E+01	B	34
20	$2s2p^3-2s2p^3$	$^3D^\circ-^3P^\circ$											
			8 951.42	8 953.87	64 086.92	–	75 255.27	7–5	E2	4.9E−01	1.3E+02	D	34
			8 952.46	8 954.92	64 086.92	–	75 253.97	7–3	E2	4.1E−01	6.3E+01	D	34
			8 955.69	8 958.15	64 090.95	–	75 253.97	5–3	E2	7.4E−02	1.1E+01	D	34
			8 953.97	8 956.42	64 090.95	–	75 256.12	5–1	E2	8.8E−01	4.5E+01	D	34
			8 954.65	8 957.11	64 090.95	–	75 255.27	5–5	E2	3.0E−01	7.8E+01	D	34
			8 954.81	8 957.27	64 089.85	–	75 253.97	3–3	E2	3.9E−01	6.1E+01	D	34
			8 953.77	8 956.22	64 089.85	–	75 255.27	3–5	E2	7.8E−02	2.0E+01	D	34

[a]Wavelengths (Å) are always given unless cm^{-1} is indicated.

5.2. C II

Boron isoelectronic sequence
Ground state: $1s^22s^22p\ ^2P^\circ_{1/2}$
Ionization energy: 24.383 eV (196 664.7 cm^{-1})

5.2.1. C II Allowed Transitions

TABLE 7. List of tabulated lines for allowed transitions of C II

Wavelength (Å)	Multiplet No.
In vacuum	
687.053	6
687.345	6
687.352	6
806.384	9
806.533	9
806.568	9
806.677	9
806.687	9
806.830	9
806.861	9
858.092	5
858.559	5
903.623	4
903.962	4
904.142	4
904.480	4

TABLE 7. List of tabulated lines for allowed transitions of C II—Continued

Wavelength (Å)	Multiplet No.
1 009.86	8
1 010.08	8
1 010.37	8
1 036.34	3
1 037.02	3
1 065.89	13
1 065.92	13
1 066.13	13
1 126.99	7
1 127.13	7
1 127.27	7
1 127.41	7
1 127.63	7
1 323.86	12
1 323.91	12
1 323.95	12
1 324.00	12
1 334.53	2
1 335.66	2
1 335.71	2
1 384.00	16
1 384.36	16
1 490.38	11
1 490.44	11
1 720.46	20

TABLE 7. List of tabulated lines for allowed transitions of C II—Continued

Wavelength (Å)	Multiplet No.
1 721.01	20
1 721.68	20
1 722.24	20
1 760.40	10
1 760.47	10
1 760.82	10
1 915.32	23
1 916.01	23
In air	
2 195.51	15
2 323.50	1
2 324.69	1
2 325.40	1
2 326.93	1
2 328.12	1
2 509.13	19
2 511.74	19
2 512.06	19
2 836.71	14
2 837.60	14
3 183.50	18
3 187.70	18
3 922.08	22
4 309.31	25
4 309.58	25
4 312.80	25
4 735.46	17
4 737.97	17
4 744.77	17
4 747.28	17
6 578.05	21
6 582.88	21
7 231.33	24
7 236.42	24
7 237.17	24

This update, provided in Table 8, with a finding list presented in Table 7, is based on the MCHF Breit–Pauli calculations by Tachiev and Froese Fischer.[31] These are the most advanced calculations of this kind and supersede earlier, similar calculations based on less detailed treatments. The wave functions of the various atomic eigenstates are built from very large numbers of configuration state functions and include the Breit–Pauli relativistic corrections, such as spin–orbit, spin–other-orbit, spin–spin interactions and the Darwin and mass-correction terms.

Tachiev and Froese Fischer calculated the atomic transition probabilities in two slightly differing versions, either fully *ab initio*, i.e., with calculated transition energies, or with the transition energies adjusted to the more accurate experimental energy values. Also, they did the calculations both in the dipole length and dipole velocity formalisms, but tabulated the length values only. Ideally, these two representations of the transition integral should, of course, produce identical numerical results for the transition probabilities. But even in these sophisticated calculations, some differences between the length and velocity values had to be expected, and this in turn may serve as an indicator of accuracy. For strong transitions, these differences (labeled as T in their tables and given in percent) are quite small, normally a few percent or even less than 1%. The differences increase, sometimes drastically, for most of the weaker lines, as one would expect. We have treated the T numbers as a qualitative, not a quantitative, measure and assume that for larger T's, the velocity value is much more uncertain than the (always tabulated) length value. Also, we have always selected the energy-adjusted *A*- and *f*-values for our tabulation, as most dipole length-dipole velocity differences are smaller for these than for the *ab initio* values.

Several comparisons with accurate lifetime experiments[15,16,30] could be made, (see Table 2 of the general introduction) and these show very good agreement. Also, recent similarly sophisticated calculations by Corrégé and Hibbert[18] are in excellent agreement—always within ±6%—with the data we have tabulated here, for the strong as well as very weak intersystem lines. This is clearly seen in the graphical comparison displayed as Fig. 1 of the general introduction. To put this remarkable accomplishment into perspective, we also show there, as Fig. 2, a graphical comparison between this new tabulation and our 1996 compilation[1] for C II, which was mainly based on the Opacity Project calculations[2] combined with *LS*-coupling fractions. These two graphical comparisons clearly show the drastic improvement in the quality of the most recent data (even the scales of Figs. 1 and 2 had to be made quite different in order to accommodate the large discrepancies occurring in Fig. 2).

The results of Tachiev and Froese Fischer[31] exhibit somewhat smaller "dipole length-dipole velocity" differences than those of Corrégé and Hibbert[18]—an indication of better accuracy—and they include more transitions. We have therefore used the Tachiev and Froese Fischer data only.

References for C II Allowed Transitions

[1]W. L. Wiese, J. R. Fuhr, and T. M. Deters, *Atomic Transition Probabilities of Carbon, Nitrogen, and Oxygen, A Critical Data Compilation*, J. Phys. Chem. Ref. Data, Monograph No. 7 (1996).

[2]The Opacity Project Team, *The Opacity Project*, (Institute of Physics, Bristol, England, 1995), Vol. I.

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[18]G. Corrégé and A. Hibbert, J. Phys. B **35**, 1211 (2002).

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[31]G. Tachiev and C. Froese Fischer, J. Phys. B **33**, 2419 (2000).

TABLE 8. C II: Allowed Transitions

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å)	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source[a]
1	$2s^22p-2s2p^2$	$^2P^\circ-^4P$												
			2 325.40	2 326.11	63.42	–	43 053.6	4–6	4.43E−07	5.40E−08	1.65E−06	−6.666	A	15, 16, 31
			2 323.50	2 324.21	0.00	–	43 025.3	2–4	1.40E−08	2.27E−09	3.48E−08	−8.342	A	15(n), 16(n)
			2 326.93	2 327.64	63.42	–	43 025.3	4–4	8.49E−08	6.90E−09	2.11E−07	−7.559	A	15(n), 16(n)
			2 324.69	2 325.40	0.00	–	43 003.3	2–2	5.99E−07	4.86E−08	7.44E−07	−7.013	A	15(n), 16(n)
			2 328.12	2 328.84	63.42	–	43 003.3	4–2	6.78E−07	2.76E−08	8.45E−07	−6.958	A	15(n), 16(n)
2	$2s^22p-2s2p^2$	$^2P^\circ-^2D$		*1 335.3*	*42.3*	–	*74 931.1*	6–10	2.88E+00	1.28E−01	3.39E+00	−0.113	A	30
				1 335.71	63.42	–	74 930.10	4–6	2.88E+00	1.15E−01	2.03E+00	−0.335	A	30
				1 334.53	0.00	–	74 932.62	2–4	2.41E+00	1.29E−01	1.13E+00	−0.589	A	30
				1 335.66	63.42	–	74 932.62	4–4	4.76E−01	1.27E−02	2.24E−01	−1.293	A	30
3	$2s^22p-2s2p^2$	$^2P^\circ-^2S$		*1 036.8*	*42.3*	–	96 493.74	6–2	2.20E+01	1.18E−01	2.42E+00	−0.150	A	30
				1 037.02	63.42	–	96 493.74	4–2	1.46E+01	1.18E−01	1.61E+00	−0.328	A	30
				1 036.34	0.00	–	96 493.74	2–2	7.38E+00	1.19E−01	8.11E−01	−0.624	A	30
4	$2s^22p-2s2p^2$	$^2P^\circ-^2P$		*904.08*	*42.3*	–	*110 651.8*	6–6	4.07E+01	4.98E−01	8.90E+00	0.476	A	30
				904.142	63.42	–	110 665.56	4–4	3.39E+01	4.15E−01	4.94E+00	0.220	A	30
				903.962	0.00	–	110 624.17	2–2	2.70E+01	3.31E−01	1.97E+00	−0.179	A	30
				904.480	63.42	–	110 624.17	4–2	1.36E+01	8.36E−02	9.96E−01	−0.476	A	30
				903.623	0.00	–	110 665.56	2–4	6.78E+00	1.66E−01	9.87E−01	−0.479	A	30
5	$2s^22p-2s^23s$	$^2P^\circ-^2S$		*858.40*	*42.3*	–	116 537.65	6–2	4.42E+00	1.63E−02	2.76E−01	−1.011	B	30
				858.559	63.42	–	116 537.65	4–2	2.93E+00	1.62E−02	1.83E−01	−1.189	B	30
				858.092	0.00	–	116 537.65	2–2	1.49E+00	1.64E−02	9.28E−02	−1.484	B	30
6	$2s^22p-2s^23d$	$^2P^\circ-^2D$		*687.25*	*42.3*	–	*145 550.1*	6–10	2.82E+01	3.33E−01	4.52E+00	0.301	A	30
				687.345	63.42	–	145 550.70	4–6	2.82E+01	3.00E−01	2.71E+00	0.079	A	30
				687.053	0.00	–	145 549.27	2–4	2.35E+01	3.33E−01	1.51E+00	−0.177	A	30
				687.352	63.42	–	145 549.27	4–4	4.70E+00	3.33E−02	3.02E−01	−0.875	A	30
7	$2s2p^2-2s^23p$	$^4P-^2P^\circ$												
				1 127.63	43 053.60	–	131 735.52	6–4	1.78E−06	2.26E−08	5.04E−07	−6.867	B	30
				1 127.41	43 025.30	–	131 724.37	4–2	9.06E−08	8.63E−10	1.28E−08	−8.462	B	30
				1 127.27	43 025.30	–	131 735.52	4–4	1.91E−07	3.64E−09	5.41E−08	−7.836	B	30
				1 127.13	43 003.30	–	131 724.37	2–2	5.55E−07	1.06E−08	7.84E−08	−7.675	B	30
				1 126.99	43 003.30	–	131 735.52	2–4	1.01E−06	3.84E−08	2.85E−07	−7.115	B	30
8	$2s2p^2-2p^3$	$^4P-^4S^\circ$		*1 010.2*	*43 035.8*	–	142 027.1	12–4	3.38E+01	1.73E−01	6.89E+00	0.316	A	30
				1 010.37	43 053.60	–	142 027.1	6–4	1.69E+01	1.73E−01	3.44E+00	0.015	A	30
				1 010.08	43 025.30	–	142 027.1	4–4	1.13E+01	1.73E−01	2.30E+00	−0.161	A	30
				1 009.86	43 003.30	–	142 027.1	2–4	5.65E+00	1.73E−01	1.15E+00	−0.462	A	30
9	$2s2p^2$ $-2s2p(^3P^\circ)3s$	$^4P-^4P^\circ$		*806.62*	*69 609.8*	–	*121 529.5*	12–12	8.42E+00	8.21E−02	2.62E+00	−0.006	B	30
				806.568	43 053.6	–	167 035.71	6–6	5.89E+00	5.75E−02	9.16E−01	−0.462	B	30
				806.677	43 025.3	–	166 990.73	4–4	1.12E+00	1.09E−02	1.16E−01	−1.359	B	30
				806.687	43 003.3	–	166 967.13	2–2	1.40E+00	1.37E−02	7.27E−02	−1.563	B	30
				806.861	43 053.6	–	166 990.73	6–4	3.79E+00	2.46E−02	3.93E−01	−0.830	B	30
				806.830	43 025.3	–	166 967.13	4–2	7.01E+00	3.42E−02	3.64E−01	−0.864	B	30
				806.384	43 025.3	–	167 035.71	4–6	2.53E+00	3.70E−02	3.92E−01	−0.830	B	30
				806.533	43 003.3	–	166 990.73	2–4	3.51E+00	6.84E−02	3.63E−01	−0.864	B	30
10	$2s2p^2-2s^23p$	$^2D-^2P^\circ$		*1 760.5*	*74 931.1*	–	*131 731.8*	10–6	4.09E−01	1.14E−02	6.60E−01	−0.943	A	30

TABLE 8. C II: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å)	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source[a]
				1 760.40	74 930.10	–	131 735.52	6–4	3.68E−01	1.14E−02	3.96E−01	−1.165	A	30
				1 760.82	74 932.62	–	131 724.37	4–2	4.09E−01	9.50E−03	2.20E−01	−1.420	A	30
				1 760.47	74 932.62	–	131 735.52	4–4	4.08E−02	1.90E−03	4.40E−02	−2.120	A	30
11	$2s2p^2-2p^3$	^{2}D–^{4}S°												
				1 490.38	74 930.10	–	142 027.1	6–4	2.02E−06	4.47E−08	1.32E−06	−6.57	C	30
				1 490.44	74 932.62	–	142 027.1	4–4	7.3E−08	2.44E−09	4.79E−08	−8.010	C	30
12	$2s2p^2-2p^3$	^{2}D–^{2}D°		*1 323.9*	*74 931.1*	–	*150 463.6*	10–10	4.88E+00	1.28E−01	5.58E+00	0.108	A	30
				1 323.95	74 930.10	–	150 461.58	6–6	4.55E+00	1.20E−01	3.13E+00	−0.144	A	30
				1 323.91	74 932.62	–	150 466.69	4–4	4.38E+00	1.15E−01	2.01E+00	−0.337	A	30
				1 323.86	74 930.10	–	150 466.69	6–4	4.94E−01	8.66E−03	2.27E−01	−1.284	A	30
				1 324.00	74 932.62	–	150 461.58	4–6	3.27E−01	1.29E−02	2.25E−01	−1.288	A	30
13	$2s2p^2-2p^3$	^{2}D–^{2}P°		*1 066.0*	*74 931.1*	–	*168 742.0*	10–6	1.45E+01	1.48E−01	5.19E+00	0.170	A	30
				1 065.89	74 930.10	–	168 748.30	6–4	1.30E+01	1.48E−01	3.11E+00	−0.052	A	30
				1 066.13	74 932.62	–	168 729.53	4–2	1.45E+01	1.23E−01	1.73E+00	−0.307	A	30
				1 065.92	74 932.62	–	168 748.30	4–4	1.44E+00	2.45E−02	3.44E−01	−1.008	A	30
14	$2s2p^2-2s^23p$	^{2}S–^{2}P°	*2 837.0*	*2 837.8*	96 493.74	–	*131 731.8*	2–6	3.30E−01	1.19E−01	2.23E+00	−0.622	B+	30
			2 836.71	2 837.54	96 493.74	–	131 735.52	2–4	3.30E−01	7.96E−02	1.49E+00	−0.798	B+	30
			2 837.60	2 838.44	96 493.74	–	131 724.37	2–2	3.29E−01	3.98E−02	7.44E−01	−1.099	B+	30
15	$2s2p^2-2p^3$	^{2}S–^{4}S°												
			2 195.51	2 196.19	96 493.74	–	142 027.1	2–4	9.7E−08	1.40E−08	2.03E−07	−7.55	C	30
16	$2s2p^2-2p^3$	^{2}S–^{2}P°		*1 384.1*	96 493.74	–	*168 742.0*	2–6	4.00E−01	3.45E−02	3.14E−01	−1.161	B	30
				1 384.00	96 493.74	–	168 748.30	2–4	4.07E−01	2.34E−02	2.13E−01	−1.331	B	30
				1 384.36	96 493.74	–	168 729.53	2–2	3.88E−01	1.11E−02	1.02E−01	−1.652	B	30
17	$2s2p^2-2s^23p$	^{2}P–^{2}P°	*4 742.5*	*4 743.8*	*73 777.0*	–	*87 823.7*	6–6	7.19E−04	2.43E−04	2.27E−02	−2.837	B+	30
			4 744.77	4 746.09	110 665.56	–	131 735.52	4–4	5.98E−04	2.02E−04	1.26E−02	−3.092	B+	30
			4 737.97	4 739.29	110 624.17	–	131 724.37	2–2	5.47E−04	1.84E−04	5.75E−03	−3.434	B+	30
			4 747.28	4 748.61	110 665.56	–	131 724.37	4–2	2.33E−04	3.94E−05	2.46E−03	−3.802	B+	30
			4 735.46	4 736.79	110 624.17	–	131 735.52	2–4	9.05E−05	6.09E−05	1.90E−03	−3.915	B+	30
18	$2s2p^2-2p^3$	^{2}P–^{4}S°												
			3 187.70	3 188.62	110 665.56	–	142 027.1	4–4	8.09E−07	1.23E−07	5.18E−06	−6.307	B	30
			3 183.50	3 184.42	110 624.17	–	142 027.1	2–4	2.40E−07	7.31E−08	1.53E−06	−6.835	B	30
19	$2s2p^2-2p^3$	^{2}P–^{2}D°	*2 511.1*	*2 511.8*	*110 651.8*	–	*150 463.6*	6–10	5.62E−01	8.86E−02	4.40E+00	−0.274	A	30
			2 512.06	2 512.81	110 665.56	–	150 461.58	4–6	5.61E−01	7.97E−02	2.64E+00	−0.497	A	30
			2 509.13	2 509.88	110 624.17	–	150 466.69	2–4	4.71E−01	8.90E−02	1.47E+00	−0.750	A	30
			2 511.74	2 512.49	110 665.56	–	150 466.69	4–4	9.27E−02	8.77E−03	2.90E−01	−1.455	A	30
20	$2s2p^2-2p^3$	^{2}P–^{2}P°		*1 721.5*	*36 874.7*	–	*112 498.9*	6–6	5.19E+00	2.30E−01	7.84E+00	0.141	B	30
				1 721.68	110 665.56	–	168 748.30	4–4	4.33E+00	1.92E−01	4.36E+00	−0.114	B	30
				1 721.01	110 624.17	–	168 729.53	2–2	3.46E+00	1.54E−01	1.74E+00	−0.513	B	30
				1 722.24	110 665.56	–	168 729.53	4–2	1.72E+00	3.82E−02	8.67E−01	−0.816	B	30
				1 720.46	110 624.17	–	168 748.30	2–4	8.65E−01	7.68E−02	8.70E−01	−0.814	B	30
21	$2s^23s-2s^23p$	^{2}S–^{2}P°	*6 579.7*	*6 581.5*	116 537.65	–	*131 731.8*	2–6	3.66E−01	7.14E−01	3.09E+01	0.155	A	30
			6 578.05	6 579.87	116 537.65	–	131 735.52	2–4	3.67E−01	4.76E−01	2.06E+01	−0.021	A	30
			6 582.88	6 584.70	116 537.65	–	131 724.37	2–2	3.66E−01	2.38E−01	1.03E+01	−0.323	A	30

TABLE 8. C II: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å)	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source[a]
22	$2s^23s-2p^3$	^{2}S–^{4}S°												
			3 922.08	3 923.19	116 537.65	–	142 027.1	2–4	1.44E−07	6.64E−08	1.71E−06	−6.877	B	30
23	$2s^23s-2p^3$	^{2}S–^{2}P°		*1 915.5*	116 537.65	–	*156 407.0*	2–6	9.41E−02	1.55E−02	1.96E−01	−1.508	B	30
				1 915.32	116 537.65	–	168 748.30	2–4	9.36E−02	1.03E−02	1.30E−01	−1.686	B	30
				1 916.01	116 537.65	–	168 729.53	2–2	9.50E−02	5.23E−03	6.60E−02	−1.981	B	30
24	$2s^23p-2s^23d$	^{2}P°–^{2}D	*7 234.8*	*7 236.8*	*131 731.8*	–	*145 550.1*	6–10	4.18E−01	5.47E−01	7.81E+01	0.516	A	30
			7 236.42	7 238.41	131 735.52	–	145 550.70	4–6	4.18E−01	4.92E−01	4.69E+01	0.294	A	30
			7 231.33	7 233.33	131 724.37	–	145 549.27	2–4	3.49E−01	5.47E−01	2.60E+01	0.039	A	30
			7 237.17	7 239.16	131 735.52	–	145 549.27	4–4	6.96E−02	5.47E−02	5.21E+00	−0.660	A	30
25	$2s^23d-2p^3$	^{2}D–^{2}P°	*4 310.6*	*4 311.8*	*145 550.1*	–	*168 742.0*	10–6	3.91E−02	6.55E−03	9.29E−01	−1.184	C+	30
			4 309.58	4 310.79	145 550.70	–	168 748.30	6–4	3.52E−02	6.54E−03	5.57E−01	−1.406	C+	30
			4 312.80	4 314.02	145 549.27	–	168 729.53	4–2	3.92E−02	5.47E−03	3.11E−01	−1.660	C+	30
			4 309.31	4 310.53	145 549.27	–	168 748.30	4–4	3.92E−03	1.09E−03	6.19E−02	−2.360	C+	30

[a]The character "n" in the source column denotes that the source was normalized to a scale different from that of the author.

5.2.2. C II Forbidden Transitions

Our previous compilation for C II in 1996[1] was comprised of only one M1 and one E2 line. This update, provided in Table 9, which is based on the recent sophisticated MCHF calculations of Tachiev and Froese Fischer,[32] enlarges our tabulation to 9 lines and includes five M2 transitions. (For some more discussion on the calculation, see the general introduction.)

References for C II Forbidden Transitions

[1]W. L. Wiese, J. R. Fuhr and T. M. Deters, *Atomic Transition Probabilities of Carbon, Nitrogen, and Oxygen, A Critical Data Compilation*, J. Phys. Chem. Ref. Data, Monograph 7 (1996).

[32]G. Tachiev and C. Froese Fischer, Can. J. Phys. **79**, 955 (2001).

TABLE 9. C II: Forbidden Transitions

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	Type	A_{ki} (s^{-1})	S (a.u.)	Acc.	Source
1	$2s^22p-2s^22p$	^{2}P°–^{2}P°											
				63.42 cm^{-1}	0.00	–	63.42	2–4	M1	2.29E−06	1.33E+00	A	32
				63.42 cm^{-1}	0.00	–	63.42	2–4	E2	1.5E−13	5.1E+00	D	32
2	$2s^22p-2s2p^2$	^{2}P°–^{4}P											
			2 325.40	2 326.11	63.42	–	43 053.6	4–6	M2	2.8E−03	7.7E+01	D	32
			2 321.97	2 322.69	0.00	–	43 053.6	2–6	M2	8.1E−04	2.2E+01	D	32
			2 323.50	2 324.21	0.00	–	43 025.3	2–4	M2	2.2E−03	3.9E+01	D	32
			2 326.93	2 327.64	63.42	–	43 025.3	4–4	M2	1.3E−04	2.4E+00	D	32
			2 328.12	2 328.84	63.42	–	43 003.3	4–2	M2	6.7E−04	6.1E+00	D	32
3	$2s2p^2-2s2p^2$	^{4}P–^{4}P											
				28.3 cm^{-1}	43 025.3	–	43 053.6	4–6	M1	3.7E−07	3.6E+00	D	32
				22.0 cm^{-1}	43 003.3	–	43 025.3	2–4	M1	2.4E−07	3.3E+00	D	32

[a]Wavelengths (Å) are always given unless cm^{-1} is indicated.

6. Nitrogen

6.1. N I

Ground state: $1s^2 2s^2 2p^3\ ^4S^o_{3/2}$
Ionization energy: 14.534 eV (117 225.7 cm^{-1})

6.1.1. N I Allowed Transitions

TABLE 10. List of tabulated lines for allowed transitions of N I

Wavelength (Å)	Multiplet No.
In vacuum	
951.079	12
951.295	12
952.303	11
952.415	11
952.523	11
953.415	10
953.655	10
953.970	10
954.104	9
955.264	8
955.437	8
955.529	7
955.882	7
959.494	6
960.201	6
963.990	5
964.626	5
965.041	5
1 003.37	4
1 003.38	4
1 134.17	3
1 134.41	3
1 134.98	3
1 159.82	2
1 160.94	2
1 163.88	22
1 164.00	22
1 164.21	22
1 164.32	22
1 165.59	21
1 165.72	21
1 165.84	21
1 165.88	21
1 166.00	21
1 166.16	21
1 167.45	19
1 167.50	20
1 167.74	20
1 167.86	20
1 168.22	20
1 168.33	20
1 168.42	19
1 168.54	19
1 169.69	18
1 170.16	18
1 170.28	18
1 170.42	18
1 170.54	18
1 170.67	17
1 171.08	17
1 171.20	17
1 176.51	16
1 176.63	16
1 177.69	16
1 183.28	15
1 183.40	15
1 184.24	15
1 184.36	15
1 184.98	15
1 199.55	1
1 200.22	1
1 200.71	1
1 243.17	14
1 243.18	14
1 243.31	14
1 310.54	32
1 310.94	32
1 310.95	32
1 312.87	31
1 313.07	31
1 313.08	31
1 313.28	31
1 314.97	30
1 314.98	30
1 315.43	30
1 315.44	30
1 316.04	30
1 316.29	29
1 318.50	28
1 318.82	28
1 318.83	28
1 319.00	27
1 319.67	27
1 319.68	27
1 326.56	26
1 326.57	26
1 327.92	26
1 335.18	25
1 336.39	25
1 336.40	25
1 337.19	25
1 337.20	25
1 411.93	24
1 411.94	24
1 411.95	24
1 492.63	13
1 492.82	13
1 494.68	13
1 742.72	23
1 742.73	23
1 745.25	23
1 745.26	23
In air	
6 884.31	38
6 900.36	38

TABLE 10. List of tabulated lines for allowed transitions of N I—Continued

Wavelength (Å)	Multiplet No.
6 901.26	38
6 917.38	38
6 922.71	38
7 380.10	37
7 403.39	37
7 405.68	37
7 421.94	37
7 423.64	36
7 442.30	36
7 447.81	37
7 468.31	36
8 184.86	35
8 188.01	35
8 200.36	35
8 210.72	35
8 216.34	35
8 223.13	35
8 242.39	35
8 567.74	43
8 594.00	43
8 629.24	43
8 655.88	43
8 664.39	55
8 680.28	34
8 683.40	34
8 686.15	34
8 703.25	34
8 711.70	34
8 718.84	34
8 728.90	34
8 747.37	34
8 758.21	54
8 767.35	54
8 843.57	53
8 864.24	53
9 020.69	52
9 028.92	51
9 060.48	51
9 386.81	42
9 392.79	42
9 395.85	50
9 419.39	41
9 460.68	42
9 464.17	50
9 493.77	41
9 658.98	63
9 660.12	63
9 681.27	63
9 694.01	63
9 708.45	33
9 716.46	63
9 740.39	33
9 742.12	63
9 776.90	62
9 786.78	62
9 788.29	62
9 798.56	62
9 810.01	62

TABLE 10. List of tabulated lines for allowed transitions of N I—Continued

Wavelength (Å)	Multiplet No.
9 814.02	62
9 822.75	62
9 834.61	62
9 863.33	62
9 872.15	62
9 883.38	61
9 905.52	61
9 909.22	61
9 912.40	49
9 931.47	61
9 947.07	60
9 956.48	49
9 965.75	61
9 968.51	61
9 980.42	60
9 997.73	60
10 003.0	61
10 017.8	60
10 054.3	61
10 069.2	60
10 105.1	59
10 108.9	59
10 112.5	59
10 114.6	59
10 115.5	58
10 128.3	59
10 138.7	58
10 147.3	59
10 155.1	58
10 164.8	59
10 166.8	59
10 178.5	58
10 200.0	59
10 217.4	58
10 308.0	48
10 354.8	48
10 359.8	71
10 365.7	71
10 375.7	48
10 385.5	71
10 393.2	48
10 401.3	71
10 414.2	48
10 427.1	71
10 500.3	70
10 507.0	70
10 513.4	70
10 520.6	70
10 533.8	70
10 539.6	70
10 549.6	70
10 563.3	70
10 578.3	57
10 603.6	57
10 623.2	69
10 644.0	69
10 645.9	57
10 653.0	69

TABLE 10. List of tabulated lines for allowed transitions of N I—Continued

Wavelength (Å)	Multiplet No.
10 665.0	57
10 673.9	69
10 685.0	40
10 690.7	57
10 693.2	68
10 706.0	40
10 713.5	69
10 718.0	69
10 730.5	68
10 736.3	40
10 757.9	69
10 775.0	68
10 780.8	40
10 802.2	40
10 879.2	67
10 879.8	67
10 884.6	67
10 891.8	66
10 901.6	67
10 913.6	66
10 924.9	67
10 937.7	66
10 947.5	67
10 959.8	66
11 006.2	66
11 180.1	56
11 227.1	56
11 237.6	56
11 266.2	56
11 291.7	56
11 294.3	56
11 313.9	56
11 323.2	56
11 416.6	47
11 430.3	65
11 454.3	65
11 474.1	47
11 505.0	65
11 517.0	47
11 531.5	65
11 556.0	65
11 566.1	46
11 575.6	47
11 601.6	47
11 625.2	46
11 651.5	46
11 911.6	79
11 945.5	79
11 964.1	86
11 998.3	86
12 074.5	86
12 106.6	78
12 109.3	86
12 124.6	78
12 130.0	64
12 142.1	78
12 160.8	85
12 179.0	85

TABLE 10. List of tabulated lines for allowed transitions of N I—Continued

Wavelength (Å)	Multiplet No.
12 186.8	64
12 196.7	85
12 203.9	64
12 231.4	64
12 261.2	85
12 270.8	64
12 274.9	85
12 288.8	77
12 289.2	64
12 293.4	85
12 298.5	64
12 328.8	77
12 381.6	77
12 404.3	76
12 461.3	84
12 469.6	84
12 581.0	84
12 603.4	75
12 633.5	75
12 649.7	74
12 708.9	83
12 711.7	74
12 771.5	83
12 897.3	83
13 381.8	73
13 429.6	39
13 448.1	82
13 464.5	45
13 520.8	73
13 534.6	45
13 544.6	45
13 581.3	39
13 587.7	82
13 588.5	82
13 602.3	94
13 615.6	45
13 624.2	94
13 649.7	45
13 651.6	45
13 668.6	94
13 686.0	45
13 835.0	93
13 857.8	93
13 879.9	93
13 903.6	93
13 926.6	93
14 049.2	92
14 101.4	92
14 119.9	92
14 172.7	92
14 242.6	92
14 272.6	91
14 313.2	72
14 389.1	81
14 454.6	72
14 501.5	90
14 522.8	89
14 532.0	81

TABLE 10. List of tabulated lines for allowed transitions of N I—Continued

Wavelength (Å)	Multiplet No.
14 536.8	90
14 548.5	72
14 549.0	81
14 576.9	90
14 598.4	89
14 604.6	89
14 626.9	81
14 681.1	89
14 695.1	81
14 757.1	44
14 868.9	44
14 952.0	44
14 966.6	44
15 050.9	44
15 095.0	44
15 102.3	44
15 146.7	44
15 496.2	88
15 582.3	88
15 682.9	88
15 771.1	88
16 859.8	87
16 953.2	87
17 056.3	87
17 082.5	87
17 187.3	87
34 758.2	80
34 764.1	80
35 706.3	80
35 712.5	80

This update, provided in Table 11 with a finding list presented in Table 10, is based on the MCHF Breit–Pauli calculations by Tachiev and Froese Fischer.[33] These are the most advanced calculations of their kind and supersede earlier, similar calculations based on less detailed treatments. The wave functions of the various atomic eigenstates are built from very large numbers of configuration state functions and include the Breit–Pauli relativistic corrections, such as spin–orbit, spin–other-orbit, spin–spin interactions and the mass–correction term.

Tachiev and Froese Fischer calculated the atomic transition probabilities in two slightly differing versions, either fully *ab initio*, i.e., with calculated transition energies, or with the transition energies adjusted to the more accurate experimental values. Also, they did the calculations both in the dipole length and dipole velocity formalisms, but tabulated the length values only. Ideally, these two representations of the transition integral should, of course, produce identical numerical results for the transition probabilities. But even in these sophisticated calculations, some differences between the length and velocity values had to be expected, and this in turn may serve as an indicator of accuracy. For strong transitions, these differences (labeled as T in their tables and given in %) are quite small, normally a few percent or even less than 1%. The differences increase, sometimes drastically, for most of the weaker lines, as one would expect. We have treated the T numbers as a qualitative, not a quantitative, measure and assume that for larger T's, the velocity value is much more uncertain than the (always tabulated) length value.

Also, we have always selected the energy-adjusted *A*- and *f*-values for our tabulation, as most dipole length-dipole velocity differences are smaller for these than for the *ab initio* values. This update covers lines in the vacuum ultraviolet and infrared, but contains no material for the visible spectrum for which most experimental data are available. Thus, only few comparisons with experiments[20,21,25] could be made, and these show good agreement, especially for the transitions in the visible and near ultraviolet.[20,21] A graphical comparison of our tabulated data with two emission experiments, Musielok *et al.*[20] and Bridges,[21] is presented in Fig. 3 of the general introduction.

References for N I Allowed Transitions

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[25]C. Goldbach, T. Lüdtke, M. Martin, and G. Nollez, Astron. Astrophys. **266**, 605 (1992).
[33]G. I. Tachiev and C. Froese Fischer, Astron. Astrophys. **385**, 716 (2002).

TABLE 11. N I: Allowed Transitions

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
1	$2s^22p^3-2s^22p^2(^3P)3s$	$^4S^\circ-^4P$		*1 200.0*	0.000	–	*83 335.60*	4–12	4.04E+00	2.62E−01	4.14E+00	0.020	A	33
				1 199.55	0.000	–	83 364.620	4–6	4.07E+00	1.32E−01	2.08E+00	−0.278	A	33
				1 200.22	0.000	–	83 317.830	4–4	4.03E+00	8.69E−02	1.37E+00	−0.459	A	33
				1 200.71	0.000	–	83 284.070	4–2	4.00E+00	4.32E−02	6.83E−01	−0.762	A	33
2	$2s^22p^3-2s^22p^2(^3P)3s$	$^4S^\circ-^2P$												
				1 159.82	0.000	–	86 220.510	4–4	4.94E−04	9.96E−06	1.52E−04	−4.400	A	33
				1 160.94	0.000	–	86 137.350	4–2	2.72E−04	2.75E−06	4.21E−05	−4.958	A	33
3	$2s^22p^3-2s2p^4$	$^4S^\circ-^4P$		*1 134.7*	0.000	–	*88 132.45*	4–12	1.47E+00	8.49E−02	1.27E+00	−0.469	B	33
				1 134.98	0.000	–	88 107.260	4–6	1.44E+00	4.16E−02	6.22E−01	−0.779	B	33
				1 134.41	0.000	–	88 151.170	4–4	1.49E+00	2.87E−02	4.28E−01	−0.941	B	33
				1 134.17	0.000	–	88 170.570	4–2	1.51E+00	1.46E−02	2.18E−01	−1.234	B	33
4	$2s^22p^3-2s^22p^2(^1D)3s$	$^4S^\circ-^2D$												
				1 003.37	0.000	–	99 663.912	4–4	1.86E−06	2.81E−08	3.71E−07	−6.950	B	33
				1 003.38	0.000	–	99 663.427	4–6	8.40E−06	1.90E−07	2.51E−06	−6.119	B	33
5	$2s^22p^3-2s^22p^2(^3P)4s$	$^4S^\circ-^4P$		*964.38*	0.000	–	*103 693.9*	4–12	5.78E−01	2.42E−02	3.07E−01	−1.015	A	33
				963.990	0.000	–	103 735.48	4–6	5.94E−01	1.24E−02	1.58E−01	−1.304	A	33
				964.626	0.000	–	103 667.16	4–4	5.66E−01	7.90E−03	1.00E−01	−1.501	A	33
				965.041	0.000	–	103 622.51	4–2	5.52E−01	3.86E−03	4.90E−02	−1.812	A	33
6	$2s^22p^3-2s^22p^2(^3P)4s$	$^4S^\circ-^2P$												
				959.494	0.000	–	104 221.630	4–4	3.75E−03	5.18E−05	6.55E−04	−3.684	B+	33
				960.201	0.000	–	104 144.820	4–2	1.69E−03	1.16E−05	1.47E−04	−4.332	B+	33
7	$2s^22p^3-2s^22p^2(^3P)3d$	$^4S^\circ-^2P$												
				955.882	0.000	–	104 615.470	4–4	4.29E−03	5.88E−05	7.40E−04	−3.629	B	33
				955.529	0.000	–	104 654.030	4–2	2.63E−03	1.80E−05	2.27E−04	−4.142	B	33
8	$2s^22p^3-2s^22p^2(^3P)3d$	$^4S^\circ-^4F$												
				955.264	0.000	–	104 683.060	4–6	3.37E−03	6.92E−05	8.70E−04	−3.558	B+	33
				955.437	0.000	–	104 664.130	4–4	1.40E−04	1.91E−06	2.41E−05	−5.116	B+	33
9	$2s^22p^3-2s^22p^2(^3P)3d$	$^4S^\circ-^2F$												
				954.104	0.000	–	104 810.360	4–6	1.95E−01	4.00E−03	5.03E−02	−1.796	B+	33
10	$2s^22p^3-2s^22p^2(^3P)3d$	$^4S^\circ-^4P$		*953.77*	0.000	–	*104 846.80*	4–12	1.73E+00	7.07E−02	8.88E−01	−0.549	B	33
				953.970	0.000	–	104 825.110	4–6	1.62E+00	3.31E−02	4.15E−01	−0.879	B	33
				953.655	0.000	–	104 859.73	4–4	1.81E+00	2.47E−02	3.10E−01	−1.006	B	33
				953.415	0.000	–	104 886.10	4–2	1.90E+00	1.29E−02	1.63E−01	−1.286	B	33
11	$2s^22p^3-2s^22p^2(^3P)3d$	$^4S^\circ-^4D$												
				952.303	0.000	–	105 008.55	4–6	1.12E−01	2.29E−03	2.87E−02	−2.039	B	33

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
				952.415	0.000	–	104 996.27	4–4	1.45E−01	1.97E−03	2.47E−02	−2.103	B	33
				952.523	0.000	–	104 984.37	4–2	7.62E−02	5.18E−04	6.50E−03	−2.684	B	33
12	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^4S^\circ-^2D$												
				951.079	0.000	–	105 143.710	4–6	8.29E−03	1.69E−04	2.11E−03	−3.171	B	33
				951.295	0.000	–	105 119.880	4–4	1.71E−03	2.32E−05	2.91E−04	−4.033	B	33
13	$2s^22p^3$ $-2s^22p^2(^3P)3s$	$^2D^\circ-^2P$		*1 493.3*	*19 227.95*	–	*86 192.79*	10–6	3.45E+00	6.91E−02	3.40E+00	−0.160	B+	33
				1 492.63	19 224.464	–	86 220.510	6–4	3.11E+00	6.93E−02	2.04E+00	−0.381	B+	33
				1 494.68	19 233.177	–	86 137.350	4–2	3.46E+00	5.80E−02	1.14E+00	−0.634	B+	33
				1 492.82	19 233.177	–	86 220.510	4–4	3.26E−01	1.09E−02	2.14E−01	−1.360	B+	33
14	$2s^22p^3$ $-2s^22p^2(^1D)3s$	$^2D^\circ-^2D$		*1 243.2*	*19 227.95*	–	*99 663.62*	10–10	3.45E+00	8.00E−02	3.27E+00	−0.097	A	33
				1 243.18	19 224.464	–	99 663.427	6–6	3.22E+00	7.47E−02	1.83E+00	−0.349	A	33
				1 243.31	19 233.177	–	99 663.912	4–4	3.10E+00	7.20E−02	1.18E+00	−0.541	A	33
				1 243.17	19 224.464	–	99 663.912	6–4	3.33E−01	5.14E−03	1.26E−01	−1.511	A	33
				1 243.31	19 233.177	–	99 663.427	4–6	2.36E−01	8.20E−03	1.34E−01	−1.484	A	33
15	$2s^22p^3$ $-2s^22p^2(^3P)4s$	$^2D^\circ-^4P$												
				1 183.28	19 224.464	–	103 735.48	6–6	1.88E−05	3.95E−07	9.2E−06	−5.62	C	33
				1 184.36	19 233.177	–	103 667.16	4–4	3.34E−04	7.01E−06	1.09E−04	−4.552	B	33
				1 184.24	19 224.464	–	103 667.16	6–4	2.45E−03	3.44E−05	8.04E−04	−3.686	B	33
				1 184.98	19 233.177	–	103 622.51	4–2	1.78E−03	1.88E−05	2.93E−04	−4.124	B	33
				1 183.40	19 233.177	–	103 735.48	4–6	2.16E−06	6.8E−08	1.06E−06	−6.56	C	33
16	$2s^22p^3$ $-2s^22p^2(^3P)4s$	$^2D^\circ-^2P$		*1 176.9*	*19 227.95*	–	*104 196.03*	10–6	9.77E−01	1.22E−02	4.71E−01	−0.915	B+	33
				1 176.51	19 224.464	–	104 221.630	6–4	8.52E−01	1.18E−02	2.74E−01	−1.150	B+	33
				1 177.69	19 233.177	–	104 144.820	4–2	1.03E+00	1.07E−02	1.66E−01	−1.369	B+	33
				1 176.63	19 233.177	–	104 221.630	4–4	9.91E−02	2.06E−03	3.19E−02	−2.085	B+	33
17	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2D^\circ-^2P$		*1 171.0*	*19 227.95*	–	*104 628.32*	10–6	1.06E−01	1.30E−03	5.03E−02	−1.885	C+	33
				1 171.08	19 224.464	–	104 615.470	6–4	1.25E−01	1.72E−03	3.97E−02	−1.987	C+	33
				1 170.67	19 233.177	–	104 654.030	4–2	5.86E−02	6.02E−04	9.29E−03	−2.618	C+	33
				1 171.20	19 233.177	–	104 615.470	4–4	3.93E−03	8.08E−05	1.25E−03	−3.491	C+	33
18	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2D^\circ-^4F$												
				1 169.69	19 224.464	–	104 716.950	6–8	2.79E−02	7.62E−04	1.76E−02	−2.340	B+	33
				1 170.28	19 233.177	–	104 683.060	4–6	3.06E−02	9.43E−04	1.45E−02	−2.423	B+	33
				1 170.16	19 224.464	–	104 683.060	6–6	3.03E−03	6.23E−05	1.44E−03	−3.428	B+	33
				1 170.54	19 233.177	–	104 664.130	4–4	1.11E−03	2.29E−05	3.53E−04	−4.039	B+	33
				1 170.42	19 224.464	–	104 664.130	6–4	4.91E−04	6.7E−06	1.56E−04	−4.394	C	33
19	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2D^\circ-^2F$		*1 167.9*	*19 227.95*	–	*104 850.93*	10–14	1.05E+00	2.99E−02	1.15E+00	−0.524	A	33
				1 167.45	19 224.464	–	104 881.350	6–8	1.10E+00	3.01E−02	6.94E−01	−0.743	A	33
				1 168.54	19 233.177	–	104 810.360	4–6	9.32E−01	2.86E−02	4.41E−01	−0.941	A	33
				1 168.42	19 224.464	–	104 810.360	6–6	3.38E−02	6.91E−04	1.60E−02	−2.382	A	33

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
20	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2D^\circ-^4P$												
				1 168.22	19 224.464	–	104 825.110	6–6	1.30E−02	2.66E−04	6.13E−03	−2.798	B+	33
				1 167.86	19 233.177	–	104 859.73	4–4	7.03E−04	1.44E−05	2.21E−04	−4.240	B+	33
				1 167.74	19 224.464	–	104 859.73	6–4	1.17E−04	1.60E−06	3.69E−05	−5.018	C	33
				1 167.50	19 233.177	–	104 886.10	4–2	5.0E−06	5.1E−08	7.9E−07	−6.69	E	33
				1 168.33	19 233.177	–	104 825.110	4–6	1.24E−01	3.81E−03	5.86E−02	−1.817	B+	33
21	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2D^\circ-^4D$												
				1 165.59	19 224.464	–	105 017.600	6–8	1.69E−02	4.60E−04	1.06E−02	−2.560	B	33
				1 165.84	19 233.177	–	105 008.55	4–6	1.99E−03	6.08E−05	9.34E−04	−3.614	B	33
				1 165.72	19 224.464	–	105 008.55	6–6	8.31E−04	1.69E−05	3.90E−04	−3.993	B	33
				1 166.00	19 233.177	–	104 996.27	4–4	6.79E−04	1.38E−05	2.13E−04	−4.257	B	33
				1 165.88	19 224.464	–	104 996.27	6–4	2.43E−04	3.30E−06	7.60E−05	−4.703	B	33
				1 166.16	19 233.177	–	104 984.37	4–2	8.4E−05	8.5E−07	1.31E−05	−5.466	C	33
22	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2D^\circ-^2D$		*1 164.1*	*19 227.95*	–	*105 134.18*	10–10	3.21E−01	6.52E−03	2.50E−01	−1.186	B	33
				1 163.88	19 224.464	–	105 143.710	6–6	3.25E−01	6.60E−03	1.52E−01	−1.402	B	33
				1 164.32	19 233.177	–	105 119.880	4–4	2.82E−01	5.73E−03	8.78E−02	−1.640	B	33
				1 164.21	19 224.464	–	105 119.880	6–4	2.98E−02	4.04E−04	9.29E−03	−2.615	B	33
				1 164.00	19 233.177	–	105 143.710	4–6	2.53E−03	7.70E−05	1.18E−03	−3.512	B	33
23	$2s^22p^3$ $-2s^22p^2(^3P)3s$	$^2P^\circ-^2P$		*1 743.6*	*28 839.18*	–	*86 192.79*	6–6	1.26E+00	5.72E−02	1.97E+00	−0.464	B	33
				1 742.73	28 839.306	–	86 220.510	4–4	1.05E+00	4.80E−02	1.10E+00	−0.717	B	33
				1 745.25	28 838.920	–	86 137.350	2–2	8.35E−01	3.82E−02	4.38E−01	−1.117	B	33
				1 745.26	28 839.306	–	86 137.350	4–2	4.01E−01	9.16E−03	2.11E−01	−1.436	B	33
				1 742.72	28 838.920	–	86 220.510	2–4	2.12E−01	1.93E−02	2.21E−01	−1.414	B	33
24	$2s^22p^3$ $-2s^22p^2(^1D)3s$	$^2P^\circ-^2D$		*1 411.9*	*28 839.18*	–	*99 663.62*	6–10	5.40E−01	2.69E−02	7.50E−01	−0.792	A	33
				1 411.95	28 839.306	–	99 663.427	4–6	5.34E−01	2.39E−02	4.45E−01	−1.019	A	33
				1 411.93	28 838.920	–	99 663.912	2–4	4.46E−01	2.67E−02	2.48E−01	−1.273	A	33
				1 411.94	28 839.306	–	99 663.912	4–4	1.01E−01	3.03E−03	5.64E−02	−1.916	A	33
25	$2s^22p^3$ $-2s^22p^2(^3P)4s$	$^2P^\circ-^4P$												
				1 335.18	28 839.306	–	103 735.48	4–6	3.25E−06	1.30E−07	2.29E−06	−6.283	B	33
				1 336.39	28 838.920	–	103 667.16	2–4	1.02E−04	5.45E−06	4.79E−05	−4.963	B	33
				1 336.40	28 839.306	–	103 667.16	4–4	5.93E−04	1.59E−05	2.80E−04	−4.197	B	33
				1 337.19	28 838.920	–	103 622.51	2–2	3.16E−04	8.48E−06	7.47E−05	−4.771	B	33
				1 337.20	28 839.306	–	103 622.51	4–2	1.22E−04	1.63E−06	2.88E−05	−5.185	B	33
26	$2s^22p^3$ $-2s^22p^2(^3P)4s$	$^2P^\circ-^2P$		*1 327.0*	*28 839.18*	–	*104 196.03*	6–6	9.76E−02	2.58E−03	6.75E−02	−1.811	B	33
				1 326.57	28 839.306	–	104 221.630	4–4	6.71E−02	1.77E−03	3.09E−02	−2.150	B	33
				1 327.92	28 838.920	–	104 144.820	2–2	9.47E−02	2.50E−03	2.19E−02	−2.300	B	33
				1 327.92	28 839.306	–	104 144.820	4–2	4.43E−02	5.86E−04	1.02E−02	−2.630	B	33
				1 326.56	28 838.920	–	104 221.630	2–4	9.72E−03	5.13E−04	4.48E−03	−2.989	B	33
27	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^2P$		*1 319.5*	*28 839.18*	–	*104 628.32*	6–6	7.27E−01	1.90E−02	4.94E−01	−0.944	B+	33
				1 319.68	28 839.306	–	104 615.470	4–4	5.76E−01	1.50E−02	2.62E−01	−1.220	B+	33

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
				1 319.00	28 838.920	–	104 654.030	2–2	4.59E−01	1.20E−02	1.04E−01	−1.621	B+	33
				1 319.00	28 839.306	–	104 654.030	4–2	2.28E−01	2.97E−03	5.16E−02	−1.925	B+	33
				1 319.67	28 838.920	–	104 615.470	2–4	1.70E−01	8.90E−03	7.73E−02	−1.750	B+	33
28	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^4F$												
				1 318.50	28 839.306	–	104 683.060	4–6	1.36E−04	5.30E−06	9.21E−05	−4.673	B+	33
				1 318.82	28 838.920	–	104 664.130	2–4	1.45E−05	7.6E−07	6.6E−06	−5.82	C	33
				1 318.83	28 839.306	–	104 664.130	4–4	1.00E−02	2.62E−04	4.55E−03	−2.980	B+	33
29	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^2F$												
				1 316.29	28 839.306	–	104 810.360	4–6	1.12E−02	4.36E−04	7.55E−03	−2.759	B	33
30	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^4P$												
				1 316.04	28 839.306	–	104 825.110	4–6	1.06E−03	4.11E−05	7.13E−04	−3.784	B	33
				1 315.43	28 838.920	–	104 859.73	2–4	3.65E−03	1.89E−04	1.64E−03	−3.422	B	33
				1 315.44	28 839.306	–	104 859.73	4–4	7.40E−04	1.92E−05	3.33E−04	−4.114	B	33
				1 314.97	28 838.920	–	104 886.10	2–2	1.14E−03	2.96E−05	2.57E−04	−4.227	B	33
				1 314.98	28 839.306	–	104 886.10	4–2	6.83E−04	8.85E−06	1.53E−04	−4.451	B	33
31	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^4D$												
				1 312.87	28 839.306	–	105 008.55	4–6	5.53E−04	2.14E−05	3.71E−04	−4.067	B	33
				1 313.07	28 838.920	–	104 996.27	2–4	2.79E−03	1.44E−04	1.25E−03	−3.540	B	33
				1 313.08	28 839.306	–	104 996.27	4–4	7.66E−05	1.98E−06	3.43E−05	−5.101	B	33
				1 313.28	28 838.920	–	104 984.37	2–2	2.37E−03	6.12E−05	5.29E−04	−3.912	B	33
				1 313.28	28 839.306	–	104 984.37	4–2	1.15E−03	1.48E−05	2.57E−04	−4.227	B	33
32	$2s^22p^3$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^2D$		*1 310.7*	*28 839.18*	–	*105 134.18*	6–10	7.73E−01	3.32E−02	8.59E−01	−0.701	B	33
				1 310.54	28 839.306	–	105 143.710	4–6	7.68E−01	2.97E−02	5.12E−01	−0.926	B	33
				1 310.94	28 838.920	–	105 119.880	2–4	6.05E−01	3.12E−02	2.69E−01	−1.205	B	33
				1 310.95	28 839.306	–	105 119.880	4–4	1.75E−01	4.51E−03	7.79E−02	−1.743	B	33
33	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^4P-^2S^\circ$												
			9 740.39	9 743.06	83 317.830	–	93 581.550	4–2	9.03E−05	6.42E−05	8.24E−03	−3.590	B+	33
			9 708.45	9 711.11	83 284.070	–	93 581.550	2–2	3.18E−05	4.50E−05	2.88E−03	−4.046	B+	33
34	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^4P-^4D^\circ$	*8 691.6*	*8 694.0*	*83 335.60*	–	*94 837.78*	12–20	2.53E−01	4.78E−01	1.64E+02	0.758	B+	33
			8 680.28	8 682.67	83 364.620	–	94 881.820	6–8	2.53E−01	3.81E−01	6.54E+01	0.359	B+	33
			8 683.40	8 685.79	83 317.830	–	94 830.890	4–6	1.88E−01	3.19E−01	3.64E+01	0.105	B+	33
			8 686.15	8 688.54	83 284.070	–	94 793.490	2–4	1.15E−01	2.60E−01	1.49E+01	−0.284	B+	33
			8 718.84	8 721.23	83 364.620	–	94 830.890	6–6	6.54E−02	7.45E−02	1.28E+01	−0.349	B+	33
			8 711.70	8 714.10	83 317.830	–	94 793.490	4–4	1.29E−01	1.46E−01	1.68E+01	−0.233	B+	33
			8 703.25	8 705.64	83 284.070	–	94 770.880	2–2	2.16E−01	2.45E−01	1.40E+01	−0.310	B+	33
			8 747.37	8 749.77	83 364.620	–	94 793.490	6–4	9.65E−03	7.38E−03	1.28E+00	−1.354	B+	33
			8 728.90	8 731.30	83 317.830	–	94 770.880	4–2	3.75E−02	2.14E−02	2.47E+00	−1.067	B+	33
35	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^4P-^4P^\circ$	*8 211.8*	*8 214.1*	*83 335.60*	–	*95 509.86*	12–12	3.09E−01	3.12E−01	1.01E+02	0.573	B+	33
			8 216.34	8 218.59	83 364.620	–	95 532.150	6–6	2.26E−01	2.29E−01	3.72E+01	0.138	B+	33
			8 210.72	8 212.97	83 317.830	–	95 493.690	4–4	5.23E−02	5.29E−02	5.72E+00	−0.675	B+	33

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
			8 200.36	8 202.61	83 284.070	–	95 475.310	2–2	4.68E−02	4.72E−02	2.55E+00	−1.025	B+	33
			8 242.39	8 244.66	83 364.620	–	95 493.690	6–4	1.31E−01	8.91E−02	1.45E+01	−0.272	B+	33
			8 223.13	8 225.39	83 317.830	–	95 475.310	4–2	2.62E−01	1.33E−01	1.44E+01	−0.275	B+	33
			8 184.86	8 187.11	83 317.830	–	95 532.150	4–6	8.21E−02	1.24E−01	1.34E+01	−0.305	B+	33
			8 188.01	8 190.26	83 284.070	–	95 493.690	2–4	1.25E−01	2.52E−01	1.36E+01	−0.298	B+	33
36	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^4P-^4S^\circ$	*7 452.2*	*7 454.2*	*83 335.60*	–	*96 750.840*	12–4	3.72E−01	1.03E−01	3.04E+01	0.093	B+	33
			7 468.31	7 470.37	83 364.620	–	96 750.840	6–4	1.96E−01	1.09E−01	1.61E+01	−0.183	B+	33
			7 442.30	7 444.35	83 317.830	–	96 750.840	4–4	1.19E−01	9.93E−02	9.73E+00	−0.401	B+	33
			7 423.64	7 425.69	83 284.070	–	96 750.840	2–4	5.64E−02	9.33E−02	4.56E+00	−0.729	B+	33
37	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^4P-^2D^\circ$												
			7 405.68	7 407.72	83 364.620	–	96 864.050	6–6	4.39E−05	3.61E−05	5.28E−03	−3.664	B	33
			7 421.94	7 423.99	83 317.830	–	96 787.680	4–4	1.63E−04	1.35E−04	1.32E−02	−3.269	B	33
			7 447.81	7 449.87	83 364.620	–	96 787.680	6–4	1.49E−04	8.26E−05	1.22E−02	−3.305	B	33
			7 380.10	7 382.13	83 317.830	–	96 864.050	4–6	1.94E−05	2.37E−05	2.31E−03	−4.023	C	33
			7 403.39	7 405.43	83 284.070	–	96 787.680	2–4	1.14E−04	1.87E−04	9.10E−03	−3.428	B	33
38	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^4P-^2P^\circ$												
			6 922.71	6 924.62	83 364.620	–	97 805.840	6–4	7.0E−06	3.34E−06	4.57E−04	−4.70	C	33
			6 917.38	6 919.29	83 317.830	–	97 770.180	4–2	8.7E−07	3.11E−07	2.83E−05	−5.91	C	33
			6 900.36	6 902.26	83 317.830	–	97 805.840	4–4	1.27E−05	9.1E−06	8.3E−04	−4.440	C	33
			6 901.26	6 903.16	83 284.070	–	97 770.180	2–2	8.1E−07	5.8E−07	2.6E−05	−5.93	D	33
			6 884.31	6 886.21	83 284.070	–	97 805.840	2–4	2.90E−06	4.12E−06	1.87E−04	−5.084	C	33
39	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^2P-^2S^\circ$	*13 530*	*7 388.76* cm^{-1}	*86 192.79*	–	*93 581.550*	6–2	8.82E−02	8.07E−02	2.16E+01	−0.315	C+	33
			13 581.3	7 361.040 cm^{-1}	86 220.510	–	93 581.550	4–2	5.73E−02	7.93E−02	1.42E+01	−0.499	C+	33
			13 429.6	7 444.200 cm^{-1}	86 137.350	–	93 581.550	2–2	3.09E−02	8.37E−02	7.40E+00	−0.776	C+	33
40	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^2P-^4P^\circ$												
			10 736.3	9 311.640 cm^{-1}	86 220.510	–	95 532.150	4–6	3.23E−05	8.39E−05	1.19E−02	−3.474	C+	33
			10 685.0	9 356.340 cm^{-1}	86 137.350	–	95 493.690	2–4	9.41E−06	3.22E−05	2.27E−03	−4.191	C+	33
			10 780.8	9 273.180 cm^{-1}	86 220.510	–	95 493.690	4–4	1.2E−09	2.0E−09	2.9E−07	−8.10	E	33
			10 706.0	9 337.960 cm^{-1}	86 137.350	–	95 475.310	2–2	3.64E−05	6.26E−05	4.42E−03	−3.902	C+	33
			10 802.2	9 254.800 cm^{-1}	86 220.510	–	95 475.310	4–2	5.01E−05	4.39E−05	6.24E−03	−3.756	C+	33
41	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^2P-^4S^\circ$												
			9 493.77	9 496.38	86 220.510	–	96 750.840	4–4	4.06E−06	5.49E−06	6.87E−04	−4.658	C+	33
			9 419.39	9 421.97	86 137.350	–	96 750.840	2–4	2.93E−04	7.79E−04	4.84E−02	−2.807	C+	33
42	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^2P-^2D^\circ$	*9 395.3*	*9 397.9*	*86 192.79*	–	*96 833.50*	6–10	2.51E−01	5.53E−01	1.03E+02	0.521	B	33
			9 392.79	9 395.37	86 220.510	–	96 864.050	4–6	2.51E−01	4.98E−01	6.17E+01	0.300	B	33
			9 386.81	9 389.38	86 137.350	–	96 787.680	2–4	2.13E−01	5.64E−01	3.48E+01	0.052	B	33
			9 460.68	9 463.27	86 220.510	–	96 787.680	4–4	3.73E−02	5.00E−02	6.24E+00	−0.699	B	33
43	$2s^22p^2(^3P)3s$ $-2s^22p^2(^3P)3p$	$^2P-^2P^\circ$	*8 617.5*	*8 619.8*	*86 192.79*	–	*97 793.95*	6–6	3.16E−01	3.52E−01	5.99E+01	0.324	B+	33
			8 629.24	8 631.61	86 220.510	–	97 805.840	4–4	2.67E−01	2.98E−01	3.39E+01	0.077	B+	33
			8 594.00	8 596.36	86 137.350	–	97 770.180	2–2	2.09E−01	2.31E−01	1.31E+01	−0.335	B+	33

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
			8 655.88	8 658.26	86 220.510	–	97 770.180	4–2	1.07E−01	6.02E−02	6.86E+00	−0.619	B+	33
			8 567.74	8 570.09	86 137.350	–	97 805.840	2–4	4.86E−02	1.07E−01	6.04E+00	−0.670	B+	33
44	$2s2p^4$ $-2s^22p^2(^3P)3p$	$^4P-^4D^\circ$	*14 909*	*6 705.33* cm^{-1}	*88 132.45*	–	*94 837.78*	12–20	9.99E−03	5.55E−02	3.27E+01	−0.176	B	33
			14 757.1	6 774.560 cm^{-1}	88 107.260	–	94 881.820	6–8	1.06E−02	4.61E−02	1.35E+01	−0.558	B	33
			14 966.6	6 679.720 cm^{-1}	88 151.170	–	94 830.890	4–6	7.05E−03	3.55E−02	7.01E+00	−0.847	B	33
			15 095.0	6 622.920 cm^{-1}	88 170.570	–	94 793.490	2–4	4.07E−03	2.78E−02	2.76E+00	−1.255	B	33
			14 868.9	6 723.630 cm^{-1}	88 107.260	–	94 830.890	6–6	2.82E−03	9.35E−03	2.75E+00	−1.251	B	33
			15 050.9	6 642.320 cm^{-1}	88 151.170	–	94 793.490	4–4	4.92E−03	1.67E−02	3.32E+00	−1.175	B	33
			15 146.7	6 600.310 cm^{-1}	88 170.570	–	94 770.880	2–2	7.71E−03	2.65E−02	2.65E+00	−1.275	B	33
			14 952.0	6 686.230 cm^{-1}	88 107.260	–	94 793.490	6–4	4.31E−04	9.63E−04	2.85E−01	−2.238	B	33
			15 102.3	6 619.710 cm^{-1}	88 151.170	–	94 770.880	4–2	1.46E−03	2.50E−03	4.97E−01	−2.000	B	33
45	$2s2p^4$ $-2s^22p^2(^3P)3p$	$^4P-^4P^\circ$	*13 551*	*7 377.41* cm^{-1}	*88 132.45*	–	*95 509.86*	12–12	7.0E−03	1.93E−02	1.03E+01	−0.64	C	33
			13 464.5	7 424.890 cm^{-1}	88 107.260	–	95 532.150	6–6	5.5E−03	1.51E−02	4.01E+00	−1.043	C	33
			13 615.6	7 342.520 cm^{-1}	88 151.170	–	95 493.690	4–4	1.31E−03	3.65E−03	6.5E−01	−1.84	C	33
			13 686.0	7 304.740 cm^{-1}	88 170.570	–	95 475.310	2–2	9.1E−04	2.57E−03	2.32E−01	−2.289	C	33
			13 534.6	7 386.430 cm^{-1}	88 107.260	–	95 493.690	6–4	2.94E−03	5.4E−03	1.44E+00	−1.491	C	33
			13 649.7	7 324.140 cm^{-1}	88 151.170	–	95 475.310	4–2	5.70E−03	8.0E−03	1.43E+00	−1.497	C	33
			13 544.6	7 380.980 cm^{-1}	88 151.170	–	95 532.150	4–6	1.69E−03	7.0E−03	1.24E+00	−1.55	C	33
			13 651.6	7 323.120 cm^{-1}	88 170.570	–	95 493.690	2–4	2.59E−03	1.45E−02	1.30E+00	−1.54	C	33
46	$2s2p^4$ $-2s^22p^2(^3P)3p$	$^4P-^4S^\circ$	*11 600*	*8 618.39* cm^{-1}	*88 132.45*	–	*96 750.840*	12–4	4.39E−02	2.95E−02	1.35E+01	−0.450	B	33
			11 566.1	8 643.580 cm^{-1}	88 107.260	–	96 750.840	6–4	2.32E−02	3.11E−02	7.10E+00	−0.729	B	33
			11 625.2	8 599.670 cm^{-1}	88 151.170	–	96 750.840	4–4	1.41E−02	2.85E−02	4.36E+00	−0.943	B	33
			11 651.5	8 580.270 cm^{-1}	88 170.570	–	96 750.840	2–4	6.63E−03	2.70E−02	2.07E+00	−1.267	B	33
47	$2s2p^4$ $-2s^22p^2(^3P)3p$	$^4P-^2D^\circ$												
			11 416.6	8 756.790 cm^{-1}	88 107.260	–	96 864.050	6–6	8.1E−07	1.6E−06	3.6E−04	−5.02	D+	33
			11 575.6	8 636.510 cm^{-1}	88 151.170	–	96 787.680	4–4	7.8E−06	1.6E−05	2.4E−03	−4.20	D+	33
			11 517.0	8 680.420 cm^{-1}	88 107.260	–	96 787.680	6–4	2.3E−05	3.0E−05	6.9E−03	−3.74	D+	33
			11 474.1	8 712.880 cm^{-1}	88 151.170	–	96 864.050	4–6	1.6E−05	4.8E−05	7.2E−03	−3.72	D+	33
			11 601.6	8 617.110 cm^{-1}	88 170.570	–	96 787.680	2–4	2.8E−05	1.1E−04	8.8E−03	−3.64	D+	33
48	$2s2p^4$ $-2s^22p^2(^3P)3p$	$^4P-^2P^\circ$												
			10 308.0	9 698.580 cm^{-1}	88 107.260	–	97 805.840	6–4	2.91E−06	3.10E−06	6.3E−04	−4.73	C	33
			10 393.2	9 619.010 cm^{-1}	88 151.170	–	97 770.180	4–2	5.4E−06	4.35E−06	6.0E−04	−4.76	C	33
			10 354.8	9 654.670 cm^{-1}	88 151.170	–	97 805.840	4–4	2.50E−05	4.02E−05	5.5E−03	−3.79	C	33
			10 414.2	9 599.610 cm^{-1}	88 170.570	–	97 770.180	2–2	6.5E−06	1.05E−05	7.2E−04	−4.68	C	33
			10 375.7	9 635.270 cm^{-1}	88 170.570	–	97 805.840	2–4	3.00E−06	9.7E−06	6.6E−04	−4.71	C	33
49	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)4s$	$^4S^\circ-^4P$												
			9 912.40	9 915.12	93 581.550	–	103 667.16	2–4	1.3E−04	4.0E−04	2.6E−02	−3.10	D	33
			9 956.48	9 959.21	93 581.550	–	103 622.51	2–2	9.1E−05	1.4E−04	8.9E−03	−3.57	D	33
50	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)4s$	$^2S^\circ-^2P$	*9 418.5*	*9 421.1*	93 581.550	–	*104 196.03*	2–6	1.3E−03	5.2E−03	3.2E−01	−1.98	D	33
			9 395.85	9 398.43	93 581.550	–	104 221.630	2–4	1.8E−04	4.8E−04	3.0E−02	−3.02	D	33
			9 464.17	9 466.77	93 581.550	–	104 144.820	2–2	3.50E−03	4.70E−03	2.93E−01	−2.027	C	33

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
51	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^2S°-^2P$	*9 049.9*	*9 052.4*	93 581.550	–	*104 628.32*	2–6	3.21E−01	1.18E+00	7.0E+01	0.374	C	33
			9 060.48	9 062.96	93 581.550	–	104 615.470	2–4	3.21E−01	7.9E−01	4.72E+01	0.199	C	33
			9 028.92	9 031.40	93 581.550	–	104 654.030	2–2	3.20E−01	3.92E−01	2.33E+01	−0.106	C	33
52	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^2S°-^4F$												
			9 020.69	9 023.17	93 581.550	–	104 664.130	2–4	3.68E−03	9.0E−03	5.3E−01	−1.75	C	33
53	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^2S°-^4P$												
			8 864.24	8 866.68	93 581.550	–	104 859.73	2–4	9.8E−04	2.32E−03	1.35E−01	−2.334	C	33
			8 843.57	8 846.00	93 581.550	–	104 886.10	2–2	7.5E−04	8.9E−04	5.2E−02	−2.75	C	33
54	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^2S°-^4D$												
			8 758.21	8 760.62	93 581.550	–	104 996.27	2–4	2.62E−04	6.0E−04	3.47E−02	−2.92	C	33
			8 767.35	8 769.76	93 581.550	–	104 984.37	2–2	1.22E−03	1.40E−03	8.1E−02	−2.55	C	33
55	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^2S°-^2D$												
			8 664.39	8 666.77	93 581.550	–	105 119.880	2–4	1.63E−03	3.67E−03	2.09E−01	−2.134	C	33
56	$2s^22p^2(^3P)3p-2s^22p^2(^3P)4s$	$^4D°-^4P$	*11 289*	*8 856.1* cm^{-1}	*94 837.78*	–	*103 693.9*	20–12	1.50E−01	1.72E−01	1.28E+02	0.536	C+	33
			11 291.7	8 853.66 cm^{-1}	94 881.820	–	103 735.48	8–6	1.20E−01	1.72E−01	5.11E+01	0.138	C+	33
			11 313.9	8 836.27 cm^{-1}	94 830.890	–	103 667.16	6–4	1.00E−01	1.28E−01	2.87E+01	−0.114	C+	33
			11 323.2	8 829.02 cm^{-1}	94 793.490	–	103 622.51	4–2	8.19E−02	7.88E−02	1.18E+01	−0.502	C+	33
			11 227.1	8 904.59 cm^{-1}	94 830.890	–	103 735.48	6–6	2.30E−02	4.36E−02	9.67E+00	−0.583	C+	33
			11 266.2	8 873.67 cm^{-1}	94 793.490	–	103 667.16	4–4	4.58E−02	8.71E−02	1.29E+01	−0.458	C+	33
			11 294.3	8 851.63 cm^{-1}	94 770.880	–	103 622.51	2–2	7.69E−02	1.47E−01	1.09E+01	−0.531	C+	33
			11 180.1	8 941.99 cm^{-1}	94 793.490	–	103 735.48	4–6	2.21E−03	6.22E−03	9.15E−01	−1.604	C+	33
			11 237.6	8 896.28 cm^{-1}	94 770.880	–	103 667.16	2–4	6.64E−03	2.52E−02	1.86E+00	−1.298	C+	33
57	$2s^22p^2(^3P)3p-2s^22p^2(^3P)4s$	$^4D°-^2P$												
			10 645.9	9 390.740 cm^{-1}	94 830.890	–	104 221.630	6–4	1.7E−04	2.0E−04	4.1E−02	−2.93	D	33
			10 690.7	9 351.330 cm^{-1}	94 793.490	–	104 144.820	4–2	1.3E−04	1.2E−04	1.6E−02	−3.34	D	33
			10 603.6	9 428.140 cm^{-1}	94 793.490	–	104 221.630	4–4	2.9E−05	5.0E−05	6.9E−03	−3.70	D	33
			10 665.0	9 373.940 cm^{-1}	94 770.880	–	104 144.820	2–2	3.5E−05	6.0E−05	4.2E−03	−3.92	D	33
			10 578.3	9 450.750 cm^{-1}	94 770.880	–	104 221.630	2–4	3.6E−06	1.2E−05	8.4E−04	−4.62	D	33
58	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^4D°-^2P$												
			10 217.4	9 784.580 cm^{-1}	94 830.890	–	104 615.470	6–4	4.34E−05	4.54E−05	9.2E−03	−3.57	C	33
			10 138.7	9 860.540 cm^{-1}	94 793.490	–	104 654.030	4–2	2.08E−04	1.61E−04	2.15E−02	−3.192	C	33
			10 178.5	9 821.980 cm^{-1}	94 793.490	–	104 615.470	4–4	1.63E−04	2.53E−04	3.39E−02	−2.99	C	33
			10 115.5	9 883.150 cm^{-1}	94 770.880	–	104 654.030	2–2	7.6E−04	1.16E−03	7.7E−02	−2.63	C	33
			10 155.1	9 844.590 cm^{-1}	94 770.880	–	104 615.470	2–4	4.35E−03	1.35E−02	9.0E−01	−1.57	C	33
59	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^4D°-^4F$	*10 117*	*9 881.80* cm^{-1}	*94 837.78*	–	*104 719.58*	20–28	3.83E−01	8.24E−01	5.49E+02	1.217	B	33
			10 114.6	9 883.95 cm^{-1}	94 881.820	–	104 765.77	8–10	3.90E−01	7.48E−01	1.99E+02	0.777	B	33
			10 112.5	9 886.060 cm^{-1}	94 830.890	–	104 716.950	6–8	3.41E−01	6.98E−01	1.40E+02	0.622	B	33
			10 108.9	9 889.570 cm^{-1}	94 793.490	–	104 683.060	4–6	3.02E−01	6.94E−01	9.24E+01	0.443	B	33

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
			10 105.1	9 893.250 cm^{-1}	94 770.880	–	104 664.130	2–4	2.81E−01	8.60E−01	5.72E+01	0.235	B	33
			10 164.8	9 835.130 cm^{-1}	94 881.820	–	104 716.950	8–8	3.83E−02	5.94E−02	1.59E+01	−0.323	B	33
			10 147.3	9 852.170 cm^{-1}	94 830.890	–	104 683.060	6–6	7.32E−02	1.13E−01	2.27E+01	−0.169	B	33
			10 128.3	9 870.640 cm^{-1}	94 793.490	–	104 664.130	4–4	9.84E−02	1.51E−01	2.02E+01	−0.218	B	33
			10 200.0	9 801.240 cm^{-1}	94 881.820	–	104 683.060	8–6	2.39E−03	2.79E−03	7.51E−01	−1.651	B	33
			10 166.8	9 833.240 cm^{-1}	94 830.890	–	104 664.130	6–4	5.64E−03	5.83E−03	1.17E+00	−1.456	B	33
60	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^4D^\circ-^2F$												
			9 997.73	9 999.530 cm^{-1}	94 881.820	–	104 881.350	8–8	4.85E−03	7.3E−03	1.92E+00	−1.235	C	33
			10 017.8	9 979.470 cm^{-1}	94 830.890	–	104 810.360	6–6	1.07E−02	1.60E−02	3.17E+00	−1.017	C	33
			10 069.2	9 928.540 cm^{-1}	94 881.820	–	104 810.360	8–6	2.78E−04	3.17E−04	8.4E−02	−2.60	C	33
			9 947.07	9 949.79	94 830.890	–	104 881.350	6–8	6.1E−03	1.21E−02	2.37E+00	−1.140	C	33
			9 980.42	9 983.16	94 793.490	–	104 810.360	4–6	4.86E−03	1.09E−02	1.43E+00	−1.361	C	33
61	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^4D^\circ-^4P$	*9 988.2*	*9 991.0*	*94 837.78*	–	*104 846.82*	20–12	2.48E−02	2.23E−02	1.47E+01	−0.351	C	33
			10 054.3	9 943.290 cm^{-1}	94 881.820	–	104 825.110	8–6	8.22E−03	9.34E−03	2.48E+00	−1.126	C+	33
			9 968.51	9 971.24	94 830.890	–	104 859.73	6–4	2.23E−03	2.22E−03	4.37E−01	−1.88	C	33
			9 905.52	9 908.24	94 793.490	–	104 886.10	4–2	1.83E−03	1.34E−03	1.75E−01	−2.269	C	33
			10 003.0	9 994.220 cm^{-1}	94 830.890	–	104 825.110	6–6	1.39E−02	2.09E−02	4.14E+00	−0.901	B	33
			9 931.47	9 934.20	94 793.490	–	104 859.73	4–4	2.02E−02	2.98E−02	3.90E+00	−0.923	B	33
			9 883.38	9 886.09	94 770.880	–	104 886.10	2–2	1.83E−02	2.68E−02	1.75E+00	−1.270	B	33
			9 965.75	9 968.48	94 793.490	–	104 825.110	4–6	3.48E−03	7.78E−03	1.02E+00	−1.507	B	33
			9 909.22	9 911.93	94 770.880	–	104 859.73	2–4	4.07E−03	1.20E−02	7.82E−01	−1.620	B	33
62	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^4D^\circ-^4D$	*9 830.6*	*9 833.3*	*94 837.78*	–	*105 007.30*	20–20	1.02E−01	1.47E−01	9.53E+01	0.469	B	33
			9 863.33	9 866.04	94 881.820	–	105 017.600	8–8	1.03E−01	1.50E−01	3.90E+01	0.080	B	33
			9 822.75	9 825.44	94 830.890	–	105 008.55	6–6	5.74E−02	8.30E−02	1.61E+01	−0.303	B	33
			9 798.56	9 801.25	94 793.490	–	104 996.27	4–4	3.33E−02	4.80E−02	6.20E+00	−0.717	B	33
			9 788.29	9 790.97	94 770.880	–	104 984.37	2–2	3.83E−02	5.51E−02	3.55E+00	−0.958	B	33
			9 872.15	9 874.86	94 881.820	–	105 008.55	8–6	2.97E−02	3.25E−02	8.46E+00	−0.585	B	33
			9 834.61	9 837.31	94 830.890	–	104 996.27	6–4	4.50E−02	4.35E−02	8.46E+00	−0.583	B	33
			9 810.01	9 812.70	94 793.490	–	104 984.37	4–2	5.42E−02	3.91E−02	5.06E+00	−0.806	B	33
			9 814.02	9 816.71	94 830.890	–	105 017.600	6–8	7.00E−03	1.35E−02	2.61E+00	−1.092	B	33
			9 786.78	9 789.47	94 793.490	–	105 008.55	4–6	1.18E−02	2.54E−02	3.28E+00	−0.992	B	33
			9 776.90	9 779.58	94 770.880	–	104 996.27	2–4	1.40E−02	4.02E−02	2.59E+00	−1.095	B	33
63	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^4D^\circ-^2D$												
			9 742.12	9 744.79	94 881.820	–	105 143.710	8–6	4.91E−07	5.2E−07	1.35E−04	−5.377	C	33
			9 716.46	9 719.13	94 830.890	–	105 119.880	6–4	1.34E−04	1.27E−04	2.43E−02	−3.119	C	33
			9 694.01	9 696.67	94 830.890	–	105 143.710	6–6	6.3E−04	8.8E−04	1.69E−01	−2.276	C	33
			9 681.27	9 683.93	94 793.490	–	105 119.880	4–4	8.1E−04	1.14E−03	1.46E−01	−2.341	C	33
			9 658.98	9 661.63	94 793.490	–	105 143.710	4–6	8.7E−05	1.83E−04	2.33E−02	−3.136	C	33
			9 660.12	9 662.77	94 770.880	–	105 119.880	2–4	2.49E−04	7.0E−04	4.44E−02	−2.86	C	33
64	$2s^22p^2(^3P)3p-2s^22p^2(^3P)4s$	$^4P^\circ-^4P$	*12 216*	*8 184.0* cm^{-1}	*95 509.86*	–	*103 693.9*	12–12	9.99E−02	2.24E−01	1.08E+02	0.429	B+	33
			12 186.8	8 203.33 cm^{-1}	95 532.150	–	103 735.48	6–6	7.40E−02	1.65E−01	3.97E+01	−0.005	B+	33
			12 231.4	8 173.47 cm^{-1}	95 493.690	–	103 667.16	4–4	1.58E−02	3.55E−02	5.72E+00	−0.848	B+	33
			12 270.8	8 147.20 cm^{-1}	95 475.310	–	103 622.51	2–2	1.48E−02	3.35E−02	2.71E+00	−1.174	B+	33
			12 289.2	8 135.01 cm^{-1}	95 532.150	–	103 667.16	6–4	3.90E−02	5.89E−02	1.43E+01	−0.451	B+	33
			12 298.5	8 128.82 cm^{-1}	95 493.690	–	103 622.51	4–2	7.69E−02	8.72E−02	1.41E+01	−0.457	B+	33
			12 130.0	8 241.79 cm^{-1}	95 493.690	–	103 735.48	4–6	3.06E−02	1.01E−01	1.62E+01	−0.393	B+	33

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
			12 203.9	8 191.85 cm^{-1}	95 475.310	–	103 667.16	2–4	4.23E−02	1.89E−01	1.52E+01	−0.423	B+	33
65	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)4s$	$^4P^\circ-^2P$												
			11 505.0	8 689.480 cm^{-1}	95 532.150	–	104 221.630	6–4	5.7E−05	7.5E−05	1.72E−02	−3.344	C	33
			11 556.0	8 651.130 cm^{-1}	95 493.690	–	104 144.820	4–2	6.0E−05	6.0E−05	9.1E−03	−3.62	C	33
			11 454.3	8 727.940 cm^{-1}	95 493.690	–	104 221.630	4–4	6.0E−06	1.2E−05	1.8E−03	−4.33	D	33
			11 531.5	8 669.510 cm^{-1}	95 475.310	–	104 144.820	2–2	1.56E−04	3.11E−04	2.36E−02	−3.206	C	33
			11 430.3	8 746.320 cm^{-1}	95 475.310	–	104 221.630	2–4	2.93E−04	1.15E−03	8.6E−02	−2.64	C	33
66	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4P^\circ-^2P$												
			11 006.2	9 083.320 cm^{-1}	95 532.150	–	104 615.470	6–4	2.99E−05	3.62E−05	7.9E−03	−3.66	C	33
			10 913.6	9 160.340 cm^{-1}	95 493.690	–	104 654.030	4–2	5.6E−05	4.98E−05	7.2E−03	−3.70	C	33
			10 959.8	9 121.780 cm^{-1}	95 493.690	–	104 615.470	4–4	4.19E−04	7.5E−04	1.09E−01	−2.52	C	33
			10 891.8	9 178.720 cm^{-1}	95 475.310	–	104 654.030	2–2	1.31E−03	2.33E−03	1.67E−01	−2.332	C	33
			10 937.7	9 140.160 cm^{-1}	95 475.310	–	104 615.470	2–4	3.61E−04	1.30E−03	9.3E−02	−2.59	C	33
67	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4P^\circ-^4F$												
			10 884.6	9 184.800 cm^{-1}	95 532.150	–	104 716.950	6–8	1.44E−03	3.41E−03	7.33E−01	−1.689	B+	33
			10 879.2	9 189.370 cm^{-1}	95 493.690	–	104 683.060	4–6	1.42E−03	3.77E−03	5.40E−01	−1.822	B+	33
			10 879.8	9 188.820 cm^{-1}	95 475.310	–	104 664.130	2–4	1.92E−04	6.83E−04	4.90E−02	−2.864	B+	33
			10 924.9	9 150.910 cm^{-1}	95 532.150	–	104 683.060	6–6	1.06E−04	1.89E−04	4.09E−02	−2.944	B+	33
			10 901.6	9 170.440 cm^{-1}	95 493.690	–	104 664.130	4–4	1.55E−04	2.76E−04	3.97E−02	−2.957	B+	33
			10 947.5	9 131.980 cm^{-1}	95 532.150	–	104 664.130	6–4	9.86E−06	1.18E−05	2.56E−03	−4.149	B+	33
68	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4P^\circ-^2F$												
			10 693.2	9 349.200 cm^{-1}	95 532.150	–	104 881.350	6–8	4.10E−03	9.39E−03	1.98E+00	−1.249	B	33
			10 730.5	9 316.670 cm^{-1}	95 493.690	–	104 810.360	4–6	1.29E−02	3.34E−02	4.72E+00	−0.874	B	33
			10 775.0	9 278.210 cm^{-1}	95 532.150	–	104 810.360	6–6	3.17E−03	5.52E−03	1.18E+00	−1.480	B	33
69	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4P^\circ-^4P$	*10 707*	*9 336.96* cm^{-1}	*95 509.86*	–	*104 846.82*	12–12	1.18E−01	2.03E−01	8.57E+01	0.386	B	33
			10 757.9	9 292.960 cm^{-1}	95 532.150	–	104 825.110	6–6	3.92E−02	6.81E−02	1.45E+01	−0.389	B+	33
			10 673.9	9 366.04 cm^{-1}	95 493.690	–	104 859.73	4–4	2.2E−05	3.8E−05	5.3E−03	−3.82	D	33
			10 623.2	9 410.79 cm^{-1}	95 475.310	–	104 886.10	2–2	5.40E−02	9.14E−02	6.39E+00	−0.738	B+	33
			10 718.0	9 327.58 cm^{-1}	95 532.150	–	104 859.73	6–4	3.75E−02	4.31E−02	9.13E+00	−0.587	B+	33
			10 644.0	9 392.41 cm^{-1}	95 493.690	–	104 886.10	4–2	6.75E−02	5.74E−02	8.04E+00	−0.639	B+	33
			10 713.5	9 331.420 cm^{-1}	95 493.690	–	104 825.110	4–6	7.16E−02	1.85E−01	2.61E+01	−0.131	B+	33
			10 653.0	9 384.42 cm^{-1}	95 475.310	–	104 859.73	2–4	9.03E−02	3.07E−01	2.16E+01	−0.211	B+	33
70	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4P^\circ-^4D$	*10 526*	*9 497.44* cm^{-1}	*95 509.86*	–	*105 007.30*	12–20	2.57E−01	7.12E−01	2.96E+02	0.931	B+	33
			10 539.6	9 485.450 cm^{-1}	95 532.150	–	105 017.600	6–8	2.54E−01	5.65E−01	1.18E+02	0.530	B+	33
			10 507.0	9 514.86 cm^{-1}	95 493.690	–	105 008.55	4–6	1.32E−01	3.28E−01	4.54E+01	0.118	B+	33
			10 500.3	9 520.96 cm^{-1}	95 475.310	–	104 996.27	2–4	6.54E−02	2.16E−01	1.50E+01	−0.364	B+	33
			10 549.6	9 476.40 cm^{-1}	95 532.150	–	105 008.55	6–6	1.23E−01	2.06E−01	4.30E+01	0.092	B+	33
			10 520.6	9 502.58 cm^{-1}	95 493.690	–	104 996.27	4–4	1.59E−01	2.64E−01	3.66E+01	0.024	B+	33
			10 513.4	9 509.06 cm^{-1}	95 475.310	–	104 984.37	2–2	1.91E−01	3.17E−01	2.19E+01	−0.198	B+	33
			10 563.3	9 464.12 cm^{-1}	95 532.150	–	104 996.27	6–4	3.33E−02	3.72E−02	7.76E+00	−0.652	B+	33
			10 533.8	9 490.68 cm^{-1}	95 493.690	–	104 984.37	4–2	7.55E−02	6.28E−02	8.72E+00	−0.600	B+	33
71	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4P^\circ-^2D$												

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
			10 401.3	9 611.560 cm^{-1}	95 532.150	–	105 143.710	6–6	6.5E−07	1.06E−06	2.18E−04	−5.196	C	33
			10 385.5	9 626.190 cm^{-1}	95 493.690	–	105 119.880	4–4	3.66E−04	5.92E−04	8.10E−02	−2.626	B	33
			10 427.1	9 587.730 cm^{-1}	95 532.150	–	105 119.880	6–4	1.80E−06	1.96E−06	4.03E−04	−4.930	B	33
			10 359.8	9 650.020 cm^{-1}	95 493.690	–	105 143.710	4–6	9.26E−04	2.24E−03	3.05E−01	−2.048	B	33
			10 365.7	9 644.570 cm^{-1}	95 475.310	–	105 119.880	2–4	6.05E−04	1.95E−03	1.33E−01	−2.409	B	33
72	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)4s$	$^4S^\circ-^4P$	*14 399*	*6 943.0* cm^{-1}	96 750.840	–	103 693.9	4–12	1.13E−02	1.05E−01	1.99E+01	−0.376	C+	33
			14 313.2	6 984.64 cm^{-1}	96 750.840	–	103 735.48	4–6	1.20E−02	5.53E−02	1.04E+01	−0.655	C+	33
			14 454.6	6 916.32 cm^{-1}	96 750.840	–	103 667.16	4–4	1.08E−02	3.38E−02	6.43E+00	−0.869	C+	33
			14 548.5	6 871.67 cm^{-1}	96 750.840	–	103 622.51	4–2	1.01E−02	1.61E−02	3.08E+00	−1.191	C+	33
73	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)4s$	$^4S^\circ-^2P$												
			13 381.8	7 470.790 cm^{-1}	96 750.840	–	104 221.630	4–4	5.2E−06	1.40E−05	2.46E−03	−4.252	C	33
			13 520.8	7 393.980 cm^{-1}	96 750.840	–	104 144.820	4–2	1.11E−04	1.52E−04	2.72E−02	−3.215	C	33
74	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4S^\circ-^2P$												
			12 711.7	7 864.630 cm^{-1}	96 750.840	–	104 615.470	4–4	6.70E−04	1.62E−03	2.72E−01	−2.188	C+	33
			12 649.7	7 903.190 cm^{-1}	96 750.840	–	104 654.030	4–2	1.37E−04	1.64E−04	2.74E−02	−3.183	C+	33
75	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4S^\circ-^4F$												
			12 603.4	7 932.220 cm^{-1}	96 750.840	–	104 683.060	4–6	2.69E−04	9.63E−04	1.60E−01	−2.414	C+	33
			12 633.5	7 913.290 cm^{-1}	96 750.840	–	104 664.130	4–4	3.22E−06	7.70E−06	1.28E−03	−4.511	C+	33
76	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4S^\circ-^2F$												
			12 404.3	8 059.520 cm^{-1}	96 750.840	–	104 810.360	4–6	1.72E−02	5.97E−02	9.76E+00	−0.622	B	33
77	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4S^\circ-^4P$	*12 348*	*8 095.98* cm^{-1}	96 750.840	–	*104 846.82*	4–12	1.21E−01	8.33E−01	1.35E+02	0.523	B	33
			12 381.6	8 074.270 cm^{-1}	96 750.840	–	104 825.110	4–6	1.09E−01	3.76E−01	6.14E+01	0.178	B	33
			12 328.8	8 108.89 cm^{-1}	96 750.840	–	104 859.73	4–4	1.30E−01	2.96E−01	4.81E+01	0.074	B	33
			12 288.8	8 135.26 cm^{-1}	96 750.840	–	104 886.10	4–2	1.41E−01	1.60E−01	2.59E+01	−0.194	B	33
78	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4S^\circ-^4D$												
			12 106.6	8 257.71 cm^{-1}	96 750.840	–	105 008.55	4–6	1.04E−02	3.43E−02	5.47E+00	−0.863	B	33
			12 124.6	8 245.43 cm^{-1}	96 750.840	–	104 996.27	4–4	1.31E−02	2.89E−02	4.61E+00	−0.938	B	33
			12 142.1	8 233.53 cm^{-1}	96 750.840	–	104 984.37	4–2	6.66E−03	7.36E−03	1.18E+00	−1.531	B	33
79	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^4S^\circ-^2D$												
			11 911.6	8 392.870 cm^{-1}	96 750.840	–	105 143.710	4–6	3.28E−04	1.05E−03	1.64E−01	−2.378	B	33
			11 945.5	8 369.040 cm^{-1}	96 750.840	–	105 119.880	4–4	2.56E−04	5.48E−04	8.62E−02	−2.659	B	33
80	$2s^22p^2(^3P)3p$ $-2s^22p^2(^1D)3s$	$^2D^\circ-^2D$	*35 325*	*2 830.12* cm^{-1}	*96 833.50*	–	*99 663.62*	10–10	8.0E−05	1.49E−03	1.73E+00	−1.83	C	33
			35 712.5	2 799.377 cm^{-1}	96 864.050	–	99 663.427	6–6	7.2E−05	1.38E−03	9.7E−01	−2.082	C	33
			34 758.2	2 876.232 cm^{-1}	96 787.680	–	99 663.912	4–4	7.4E−05	1.34E−03	6.1E−01	−2.272	C	33
			35 706.3	2 799.862 cm^{-1}	96 864.050	–	99 663.912	6–4	7.8E−06	1.0E−04	7.0E−02	−3.222	C	33
			34 764.1	2 875.747 cm^{-1}	96 787.680	–	99 663.427	4–6	6.1E−06	1.67E−04	7.6E−02	−3.176	C	33

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
81	$2s^22p^2(^3P)3p-2s^22p^2(^3P)4s$	$^2D^\circ-^4P$												
			14 549.0	6 871.43 cm^{-1}	96 864.050	–	103 735.48	6–6	6.4E−06	2.0E−05	5.8E−03	−3.91	D	33
			14 532.0	6 879.48 cm^{-1}	96 787.680	–	103 667.16	4–4	5.3E−05	1.7E−04	3.2E−02	−3.18	D	33
			14 695.1	6 803.11 cm^{-1}	96 864.050	–	103 667.16	6–4	7.3E−05	1.6E−04	4.6E−02	−3.02	D	33
			14 626.9	6 834.83 cm^{-1}	96 787.680	–	103 622.51	4–2	2.0E−05	3.1E−05	6.0E−03	−3.90	D	33
			14 389.1	6 947.80 cm^{-1}	96 787.680	–	103 735.48	4–6	8.4E−06	3.9E−05	7.4E−03	−3.81	D	33
82	$2s^22p^2(^3P)3p-2s^22p^2(^3P)4s$	$^2D^\circ-^2P$	*13 579*	*7 362.53* cm^{-1}	*96 833.50*	–	*104 196.03*	10–6	7.33E−02	1.22E−01	5.44E+01	0.085	C+	33
			13 587.7	7 357.580 cm^{-1}	96 864.050	–	104 221.630	6–4	6.31E−02	1.17E−01	3.13E+01	−0.155	C+	33
			13 588.5	7 357.140 cm^{-1}	96 787.680	–	104 144.820	4–2	8.26E−02	1.14E−01	2.05E+01	−0.340	C+	33
			13 448.1	7 433.950 cm^{-1}	96 787.680	–	104 221.630	4–4	5.50E−03	1.49E−02	2.64E+00	−1.224	C+	33
83	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^2D^\circ-^2P$	*12 826*	*7 794.82* cm^{-1}	*96 833.50*	–	*104 628.32*	10–6	3.47E−02	5.14E−02	2.17E+01	−0.289	C+	33
			12 897.3	7 751.420 cm^{-1}	96 864.050	–	104 615.470	6–4	3.23E−02	5.37E−02	1.37E+01	−0.492	C+	33
			12 708.9	7 866.350 cm^{-1}	96 787.680	–	104 654.030	4–2	2.60E−02	3.15E−02	5.28E+00	−0.899	C+	33
			12 771.5	7 827.790 cm^{-1}	96 787.680	–	104 615.470	4–4	6.63E−03	1.62E−02	2.73E+00	−1.188	C+	33
84	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^2D^\circ-^2F$	*12 469*	*8 017.43* cm^{-1}	*96 833.50*	–	*104 850.93*	10–14	2.06E−01	6.72E−01	2.76E+02	0.827	B	33
			12 469.6	8 017.300 cm^{-1}	96 864.050	–	104 881.350	6–8	2.18E−01	6.79E−01	1.67E+02	0.610	B	33
			12 461.3	8 022.680 cm^{-1}	96 787.680	–	104 810.360	4–6	1.82E−01	6.35E−01	1.04E+02	0.405	B	33
			12 581.0	7 946.310 cm^{-1}	96 864.050	–	104 810.360	6–6	7.07E−03	1.68E−02	4.17E+00	−0.997	B	33
85	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^2D^\circ-^4D$												
			12 261.2	8 153.550 cm^{-1}	96 864.050	–	105 017.600	6–8	4.30E−03	1.29E−02	3.14E+00	−1.110	C	33
			12 160.8	8 220.87 cm^{-1}	96 787.680	–	105 008.55	4–6	4.01E−04	1.33E−03	2.14E−01	−2.273	C	33
			12 274.9	8 144.50 cm^{-1}	96 864.050	–	105 008.55	6–6	2.39E−04	5.4E−04	1.31E−01	−2.489	C	33
			12 179.0	8 208.59 cm^{-1}	96 787.680	–	104 996.27	4–4	1.32E−04	2.94E−04	4.72E−02	−2.93	C	33
			12 293.4	8 132.22 cm^{-1}	96 864.050	–	104 996.27	6–4	8.8E−09	1.3E−08	3.2E−06	−7.10	E	33
			12 196.7	8 196.69 cm^{-1}	96 787.680	–	104 984.37	4–2	1.34E−04	1.49E−04	2.39E−02	−3.225	C	33
86	$2s^22p^2(^3P)3p-2s^22p^2(^3P)3d$	$^2D^\circ-^2D$	*12 044*	*8 300.68* cm^{-1}	*96 833.50*	–	*105 134.18*	10–10	6.22E−02	1.35E−01	5.36E+01	0.131	B+	33
			12 074.5	8 279.660 cm^{-1}	96 864.050	–	105 143.710	6–6	6.30E−02	1.38E−01	3.29E+01	−0.082	B+	33
			11 998.3	8 332.200 cm^{-1}	96 787.680	–	105 119.880	4–4	5.21E−02	1.13E−01	1.78E+01	−0.347	B+	33
			12 109.3	8 255.830 cm^{-1}	96 864.050	–	105 119.880	6–4	7.57E−03	1.11E−02	2.66E+00	−1.176	B+	33
			11 964.1	8 356.030 cm^{-1}	96 787.680	–	105 143.710	4–6	6.09E−04	1.96E−03	3.09E−01	−2.106	B+	33
87	$2s^22p^2(^3P)3p-2s^22p^2(^3P)4s$	$^2P^\circ-^4P$												
			16 859.8	5 929.64 cm^{-1}	97 805.840	–	103 735.48	4–6	5.1E−07	3.3E−06	7.2E−04	−4.89	D	33
			16 953.2	5 896.98 cm^{-1}	97 770.180	–	103 667.16	2–4	1.2E−05	1.0E−04	1.1E−02	−3.70	D	33
			17 056.3	5 861.32 cm^{-1}	97 805.840	–	103 667.16	4–4	4.7E−05	2.0E−04	4.6E−02	−3.09	D	33
			17 082.5	5 852.33 cm^{-1}	97 770.180	–	103 622.51	2–2	2.8E−05	1.2E−04	1.4E−02	−3.61	D	33
			17 187.3	5 816.67 cm^{-1}	97 805.840	–	103 622.51	4–2	9.9E−06	2.2E−05	5.0E−03	−4.06	D	33
88	$2s^22p^2(^3P)3p-2s^22p^2(^3P)4s$	$^2P^\circ-^2P$	*15 616*	*6 402.08* cm^{-1}	*97 793.95*	–	*104 196.03*	6–6	7.5E−02	2.8E−01	8.5E+01	0.22	D+	33
			15 582.3	6 415.790 cm^{-1}	97 805.840	–	104 221.630	4–4	6.5E−02	2.4E−01	4.9E+01	−0.02	D+	33
			15 682.9	6 374.640 cm^{-1}	97 770.180	–	104 144.820	2–2	4.5E−02	1.7E−01	1.7E+01	−0.47	D+	33
			15 771.1	6 338.980 cm^{-1}	97 805.840	–	104 144.820	4–2	2.1E−02	3.9E−02	8.1E+00	−0.80	D+	33

TABLE 11. N I: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
			15 496.2	6 451.450 cm^{-1}	97 770.180	–	104 221.630	2–4	1.5E−02	1.1E−01	1.1E+01	−0.68	D+	33
89	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^2P$	*14 628*	*6 834.37* cm^{-1}	*97 793.95*	–	*104 628.32*	6–6	2.33E−02	7.47E−02	2.16E+01	−0.348	B	33
			14 681.1	6 809.630 cm^{-1}	97 805.840	–	104 615.470	4–4	1.28E−02	4.13E−02	7.99E+00	−0.782	B	33
			14 522.8	6 883.850 cm^{-1}	97 770.180	–	104 654.030	2–2	2.20E−02	6.95E−02	6.65E+00	−0.857	B	33
			14 598.4	6 848.190 cm^{-1}	97 805.840	–	104 654.030	4–2	1.09E−02	1.74E−02	3.35E+00	−1.157	B	33
			14 604.6	6 845.290 cm^{-1}	97 770.180	–	104 615.470	2–4	5.87E−03	3.76E−02	3.61E+00	−1.124	B	33
90	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^4F$												
			14 536.8	6 877.220 cm^{-1}	97 805.840	–	104 683.060	4–6	1.6E−05	7.7E−05	1.5E−02	−3.51	D	33
			14 501.5	6 893.950 cm^{-1}	97 770.180	–	104 664.130	2–4	1.2E−05	7.5E−05	7.1E−03	−3.82	D	33
			14 576.9	6 858.290 cm^{-1}	97 805.840	–	104 664.130	4–4	4.4E−04	1.4E−03	2.7E−01	−2.25	D	33
91	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^2F$												
			14 272.6	7 004.520 cm^{-1}	97 805.840	–	104 810.360	4–6	1.17E−03	5.4E−03	1.01E+00	−1.67	C	33
92	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^4P$												
			14 242.6	7 019.270 cm^{-1}	97 805.840	–	104 825.110	4–6	9.9E−05	4.50E−04	8.4E−02	−2.74	C	33
			14 101.4	7 089.55 cm^{-1}	97 770.180	–	104 859.73	2–4	4.75E−04	2.84E−03	2.63E−01	−2.246	C	33
			14 172.7	7 053.89 cm^{-1}	97 805.840	–	104 859.73	4–4	1.28E−04	3.86E−04	7.2E−02	−2.81	C	33
			14 049.2	7 115.92 cm^{-1}	97 770.180	–	104 886.10	2–2	1.62E−04	4.80E−04	4.44E−02	−3.018	C	33
			14 119.9	7 080.26 cm^{-1}	97 805.840	–	104 886.10	4–2	1.12E−04	1.68E−04	3.12E−02	−3.173	C	33
93	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^4D$												
			13 879.9	7 202.71 cm^{-1}	97 805.840	–	105 008.55	4–6	9.5E−05	4.14E−04	7.6E−02	−2.78	C	33
			13 835.0	7 226.09 cm^{-1}	97 770.180	–	104 996.27	2–4	3.93E−04	2.26E−03	2.06E−01	−2.345	C	33
			13 903.6	7 190.43 cm^{-1}	97 805.840	–	104 996.27	4–4	5.1E−07	1.48E−06	2.70E−04	−5.229	C	33
			13 857.8	7 214.19 cm^{-1}	97 770.180	–	104 984.37	2–2	2.74E−04	7.9E−04	7.2E−02	−2.80	C	33
			13 926.6	7 178.53 cm^{-1}	97 805.840	–	104 984.37	4–2	1.26E−04	1.83E−04	3.37E−02	−3.134	C	33
94	$2s^22p^2(^3P)3p$ $-2s^22p^2(^3P)3d$	$^2P^\circ-^2D$	*13 620*	*7 340.23* cm^{-1}	*97 793.95*	–	*105 134.18*	6–10	1.34E−01	6.21E−01	1.67E+02	0.571	B	33
			13 624.2	7 337.870 cm^{-1}	97 805.840	–	105 143.710	4–6	1.33E−01	5.54E−01	9.95E+01	0.346	B	33
			13 602.3	7 349.700 cm^{-1}	97 770.180	–	105 119.880	2–4	1.07E−01	5.91E−01	5.30E+01	0.073	B	33
			13 668.6	7 314.040 cm^{-1}	97 805.840	–	105 119.880	4–4	2.91E−02	8.14E−02	1.47E+01	−0.487	B	33

[a]Wavelengths (Å) are always given unless cm^{-1} is indicated.

6.1.2. N I Forbidden Transitions

TABLE 12. List of tabulated lines for forbidden transitions of N I

Wavelength (Å)	Multiplet No.
In vacuum	
1 134.17	4
1 134.41	4
1 134.98	4
1 159.82	3
1 160.94	3
1 243.17	10

TABLE 12. List of tabulated lines for forbidden transitions of N I—Continued

Wavelength (Å)	Multiplet No.
1 243.18	10
1 243.31	10
1 243.31	10
1 411.93	13
1 411.94	13
1 411.94	13
1 411.95	13
1 450.41	9

TABLE 12. List of tabulated lines for forbidden transitions of N I—Continued

Wavelength (Å)	Multiplet No.
1 450.59	9
1 450.82	9
1 451.00	9
1 451.74	9
1 451.92	9
1 492.63	8
1 492.82	8
1 494.48	8
1 494.68	8
1 559.09	7
1 559.30	7
1 560.22	7
1 560.44	7
1 561.05	7
1 561.26	7
1 685.45	12
1 685.99	12
1 686.00	12
1 687.24	12
1 687.25	12
1 834.00	11
1 834.01	11
1 835.57	11
1 835.59	11
1 836.72	11
In air	
3 466.50	2
3 466.54	2
5 197.90	1
5 200.26	1
6 103.38	15
6 115.98	15
6 116.16	15
6 133.72	15
7 390.83	17
7 436.55	17
7 436.81	17
10 397.7	6
10 398.2	6
10 407.2	6
10 407.6	6
20 459.0	14
20 540.5	14
20 601.3	14
20 684.0	14
20 727.5	14
20 801.9	14
20 873.6	14
20 886.2	14
21 079.5	14
Wave number (cm^{-1})	
0.485	18
8.713	5
83.160	16

Our previous compilation in 1996[1] included only seventeen M1 and E2 lines for N I. This update, provided in Table 13 with a finding list presented in Table 12, which is based on the recent sophisticated MCHF calculations of Tachiev and Froese Fischer,[33] enlarges the tabulation to 71 lines, including some M2 transitions. (For further details, see the general introduction.) The work of Tachiev and Froese Fischer[33] contains additional lines, which are, however, extremely weak, so that we have not tabulated them.

References for N I Forbidden Transitions

[1]W. L. Wiese, J. R. Fuhr, and T. M. Deters, *Atomic Transition Probabilities of Carbon, Nitrogen, and Oxygen, A Critical Data Compilation*, J. Phys. Chem. Ref. Data, Monograph 7 (1996).

[33]G. Tachiev and C. Froese Fischer, Astron. Astrophys. **385**, 716 (2002).

TABLE 13. N I: Forbidden Transitions

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})	E_k (cm^{-1})	g_i–g_k	Type	A_{ki} (s^{-1})	S (a.u.)	Acc.	Source
1	$2s^22p^3-2s^22p^3$	$^4S^\circ-^2D^\circ$										
			5 200.26	5 201.71	0.000	19 224.464	4–6	E2	6.59E−06	1.35E−04	B	33
			5 200.26	5 201.71	0.000	19 224.464	4–6	M1	9.71E−07	3.04E−08	B	33
			5 197.90	5 199.35	0.000	19 233.177	4–4	E2	4.34E−06	5.89E−05	B	33
			5 197.90	5 199.35	0.000	19 233.177	4–4	M1	1.60E−05	3.33E−07	B	33
2	$2s^22p^3-2s^22p^3$	$^4S^\circ-^2P^\circ$										
			3 466.50	3 467.49	0.000	28 839.306	4–4	M1	6.5E−03	4.0E−05	D	33
			3 466.54	3 467.54	0.000	28 838.920	4–2	M1	2.6E−03	8.1E−06	D	33
3	$2s^22p^3-2s^22p^2(^3P)3s$	$^4S^\circ-^2P$										
				1 159.82	0.000	86 220.510	4–4	M2	5.1E−03	2.87E+00	C	33
				1 160.94	0.000	86 137.350	4–2	M2	1.00E−02	2.83E+00	C	33
4	$2s^22p^3-2s2p^4$	$^4S^\circ-^4P$										
				1 134.98	0.000	88 107.260	4–6	M2	7.9E−02	6.0E+01	C	33
				1 134.41	0.000	88 151.170	4–4	M2	5.9E−02	3.00E+01	C	33
				1 134.17	0.000	88 170.570	4–2	M2	1.85E−02	4.66E+00	C	33
5	$2s^22p^3-2s^22p^3$	$^2D^\circ-^2D^\circ$										
				8.713 cm^{-1}	19 224.464	19 233.177	6–4	M1	1.07E−08	2.40E+00	A	33
6	$2s^22p^3-2s^22p^3$	$^2D^\circ-^2P^\circ$										
			10 398.2	9 614.456 cm^{-1}	19 224.464	28 838.920	6–2	E2	3.45E−02	7.5E+00	C	33
			10 397.7	9 614.842 cm^{-1}	19 224.464	28 839.306	6–4	M1	1.02E−03	1.71E−04	C	33
			10 397.7	9 614.842 cm^{-1}	19 224.464	28 839.306	6–4	E2	6.0E−02	2.62E+01	C	33
			10 407.6	9 605.743 cm^{-1}	19 233.177	28 838.920	4–2	M1	1.13E−03	9.5E−05	C	33
			10 407.6	9 605.743 cm^{-1}	19 233.177	28 838.920	4–2	E2	5.2E−02	1.13E+01	C	33
			10 407.2	9 606.129 cm^{-1}	19 233.177	28 839.306	4–4	M1	1.81E−03	3.04E−04	C	33
			10 407.2	9 606.129 cm^{-1}	19 233.177	28 839.306	4–4	E2	2.56E−02	1.12E+01	C	33
7	$2s^22p^3-2s^22p^2(^3P)3s$	$^2D^\circ-^4P$										
				1 559.09	19 224.464	83 364.620	6–6	M2	3.3E−04	1.2E+00	D	33
				1 560.44	19 233.177	83 317.830	4–4	M2	5.0E−04	1.2E+00	D	33
				1 561.05	19 224.464	83 284.070	6–2	M2	1.2E−04	1.5E−01	D	33
				1 560.22	19 224.464	83 317.830	6–4	M2	3.4E−04	8.5E−01	D	33
				1 561.26	19 233.177	83 284.070	4–2	M2	1.1E−03	1.4E+00	D	33
				1 559.30	19 233.177	83 364.620	4–6	M2	6.4E−05	2.4E−01	D	33
8	$2s^22p^3-2s^22p^2(^3P)3s$	$^2D^\circ-^2P$										
				1 494.48	19 224.464	86 137.350	6–2	M2	1.4E−03	1.4E+00	D	33
				1 492.63	19 224.464	86 220.510	6–4	M2	5.6E−04	1.1E+00	D	33
				1 494.68	19 233.177	86 137.350	4–2	M2	7.3E−05	7.3E−02	D	33
				1 492.82	19 233.177	86 220.510	4–4	M2	1.4E−04	2.7E−01	D	33
9	$2s^22p^3-2s2p^4$	$^2D^\circ-^4P$										
				1 451.74	19 224.464	88 107.260	6–6	M2	1.12E−02	2.90E+01	C	33
				1 451.00	19 233.177	88 151.170	4–4	M2	1.61E−02	2.79E+01	C	33
				1 450.41	19 224.464	88 170.570	6–2	M2	4.01E−03	3.45E+00	C	33
				1 450.82	19 224.464	88 151.170	6–4	M2	1.12E−02	1.93E+01	C	33
				1 450.59	19 233.177	88 170.570	4–2	M2	3.24E−02	2.79E+01	C	33
				1 451.92	19 233.177	88 107.260	4–6	M2	2.90E−03	7.5E+00	C	33
10	$2s^22p^3-2s^22p^2(^1D)3s$	$^2D^\circ-^2D$										

TABLE 13. N I: Forbidden Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})	E_k (cm^{-1})	g_i g_k	Type	A_{ki} (s^{-1})	S (a.u.)	Acc.	Source
				1 243.18	19 224.464 –	99 663.427	6–6	M2	6.0E−03	7.1E+00	C	33
				1 243.31	19 233.177 –	99 663.912	4–4	M2	1.10E−03	8.8E−01	C	33
				1 243.17	19 224.464 –	99 663.912	6–4	M2	5.4E−03	4.30E+00	C	33
				1 243.31	19 233.177 –	99 663.427	4–6	M2	3.59E−03	4.29E+00	C	33
11	$2s^22p^3-2s^22p^2(^3P)3s$	$^2P^\circ-^4P$										
				1 834.00	28 838.920 –	83 364.620	2–6	M2	1.18E−03	9.9E+00	C	33
				1 834.01	28 839.306 –	83 364.620	4–6	M2	4.11E−03	3.43E+01	C	33
				1 835.57	28 838.920 –	83 317.830	2–4	M2	3.08E−03	1.72E+01	C	33
				1 835.59	28 839.306 –	83 317.830	4–4	M2	1.90E−04	1.06E+00	C	33
				1 836.72	28 839.306 –	83 284.070	4–2	M2	9.4E−04	2.64E+00	C	33
12	$2s^22p^3-2s2p^4$	$^2P^\circ-^4P$										
				1 687.24	28 838.920 –	88 107.260	2–6	M2	1.62E−03	8.9E+00	C	33
				1 687.25	28 839.306 –	88 107.260	4–6	M2	5.7E−03	3.12E+01	C	33
				1 685.99	28 838.920 –	88 151.170	2–4	M2	4.47E−03	1.63E+01	C	33
				1 686.00	28 839.306 –	88 151.170	4–4	M2	2.60E−04	9.5E−01	C	33
				1 685.45	28 839.306 –	88 170.570	4–2	M2	1.51E−03	2.75E+00	C	33
13	$2s^22p^3-2s^22p^2(^1D)3s$	$^2P^\circ-^2D$										
				1 411.94	28 838.920 –	99 663.427	2–6	M2	3.15E−03	7.1E+00	C	33
				1 411.95	28 839.306 –	99 663.427	4–6	M2	3.06E−03	6.9E+00	C	33
				1 411.93	28 838.920 –	99 663.912	2–4	M2	1.7E−04	2.6E−01	D	33
				1 411.94	28 839.306 –	99 663.912	4–4	M2	7.7E−04	1.2E+00	D	33
14	$2s^22p^2(^3P)3s-2s2p^4$	$^4P-^4P$										
			21 079.5	4 742.640 cm^{-1}	83 364.620 –	88 107.260	6–6	M1	6.6E−03	1.4E−02	D	33
			21 079.5	4 742.640 cm^{-1}	83 364.620 –	88 107.260	6–6	E2	1.7E−05	3.9E−01	D	33
			20 684.0	4 833.340 cm^{-1}	83 317.830 –	88 151.170	4–4	M1	2.8E−03	3.6E−03	D	33
			20 684.0	4 833.340 cm^{-1}	83 317.830 –	88 151.170	4–4	E2	2.5E−05	3.4E−01	D	33
			20 459.0	4 886.500 cm^{-1}	83 284.070 –	88 170.570	2–2	M1	1.2E−03	7.4E−04	D	33
			20 801.9	4 805.950 cm^{-1}	83 364.620 –	88 170.570	6–2	E2	6.3E−05	4.4E−01	D	33
			20 886.2	4 786.550 cm^{-1}	83 364.620 –	88 151.170	6–4	E2	4.2E−05	6.0E−01	D	33
			20 601.3	4 852.740 cm^{-1}	83 317.830 –	88 170.570	4–2	M1	7.3E−05	4.7E−05	D	33
			20 601.3	4 852.740 cm^{-1}	83 317.830 –	88 170.570	4–2	E2	8.1E−06	5.4E−02	D	33
			20 873.6	4 789.430 cm^{-1}	83 317.830 –	88 107.260	4–6	M1	5.9E−04	1.2E−03	D	33
			20 873.6	4 789.430 cm^{-1}	83 317.830 –	88 107.260	4–6	E2	3.0E−05	6.4E−01	D	33
			20 727.5	4 823.190 cm^{-1}	83 284.070 –	88 107.260	2–6	E2	2.3E−05	4.8E−01	D	33
			20 540.5	4 867.100 cm^{-1}	83 284.070 –	88 151.170	2–4	M1	4.8E−04	6.1E−04	D	33
			20 540.5	4 867.100 cm^{-1}	83 284.070 –	88 151.170	2–4	E2	4.2E−06	5.5E−02	D	33
15	$2s^22p^2(^3P)3s-$ $2s^22p^2(^1D)3s$	$^4P-^2D$										
			6 133.72	6 135.42	83 364.620 –	99 663.427	6–6	M1	2.2E−03	1.1E−04	D	33
			6 115.98	6 117.67	83 317.830 –	99 663.912	4–4	M1	8.1E−04	2.8E−05	D	33
			6 116.16	6 117.86	83 317.830 –	99 663.427	4–6	M1	4.4E−04	2.2E−05	D	33
			6 103.38	6 105.06	83 284.070 –	99 663.912	2–4	M1	2.1E−04	7.1E−06	D	33
16	$2s^22p^2(^3P)3s-$ $2s^22p^2(^3P)3s$	$^2P-^2P$										
				83.160 cm^{-1}	86 137.350 –	86 220.510	2–4	M1	5.17E−06	1.33E+00	A	33
17	$2s^22p^2(^3P)3s-$ $2s^22p^2(^1D)3s$	$^2P-^2D$										
			7 436.81	7 438.86	86 220.510 –	99 663.427	4–6	M1	5.0E−04	4.6E−05	D	33

TABLE 13. N I: Forbidden Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	Type	A_{ki} (s^{-1})	S (a.u.)	Acc.	Source
			7 390.83	7 392.86	86 137.350	–	99 663.912	2–4	M1	4.3E−04	2.6E−05	D	33
			7 436.55	7 438.59	86 220.510	–	99 663.912	4–4	M1	1.4E−03	8.3E−05	D	33
18	$2s^22p^2(^1D)3s-2s^22p^2(^1D)3s$	$^2D-^2D$											
				0.485 cm^{-1}	99 663.427	–	99 663.912	6–4	M1	1.85E−12	2.40E+00	B+	33

[a]Wavelengths (Å) are always given unless cm^{-1} is indicated.

6.2. N II

Carbon isoelectronic sequence
Ground state: $1s^22s^22p^2\ ^3P_0$
Ionization energy: 29.601 eV (238 750.50 cm^{-1})

6.2.1. N II Allowed Transitions

TABLE 14. List of tabulated lines for allowed transitions of N II

Wavelength (Å)	Multiplet No.
In vacuum	
525.983	14
526.118	14
526.345	14
528.529	13
529.355	12
529.413	12
529.491	12
529.637	12
529.722	12
529.867	12
533.511	11
533.581	11
533.650	11
533.729	11
533.815	11
533.884	11
534.637	10
534.872	10
536.300	9
536.365	9
536.536	9
572.069	27
574.650	26
576.060	25
576.232	25
580.802	24
580.904	24
582.156	23
583.925	22
584.128	22
599.644	8
599.819	8
600.115	8
635.197	36
640.121	35
644.634	7
644.837	7
645.178	7
646.209	34
660.286	21
670.296	6
670.515	6
670.884	6
671.016	5
671.386	5
671.411	5
671.630	5
671.773	5
672.001	5
693.774	4
694.169	4
715.254	20
745.841	33
746.984	19
747.606	18
748.369	18
775.965	17
816.740	32
834.070	37
834.740	37
835.163	37
858.376	31
860.205	30
915.612	3
915.962	3
916.012	3
916.020	3
916.701	3
916.710	3
1 064.95	16
1 064.96	16
1 083.99	2
1 084.56	2
1 084.58	2
1 085.53	2
1 085.55	2
1 085.70	2

TABLE 14. List of tabulated lines for allowed transitions of N II—Continued

Wavelength (Å)	Multiplet No.
1 162.50	42
1 275.04	41
1 275.25	41
1 275.28	41
1 276.20	41
1 276.22	41
1 276.80	41
1 299.81	15
1 300.04	15
1 304.77	40
1 304.79	40
1 306.71	29
1 343.34	39
1 343.57	39
1 345.08	39
1 345.31	39
1 345.34	39
1 346.41	39
1 346.44	39
1 381.97	38
1 382.00	38
1 538.57	47
1 627.35	46
1 627.38	46
1 628.90	46
1 628.92	46
1 629.08	46
1 629.83	46
1 675.73	45
1 675.75	45
1 675.92	45
1 678.89	28
1 740.31	44
1 743.20	44
1 743.23	44
1 745.05	44
1 745.08	44
1 745.26	44
1 805.24	43
1 805.28	43
1 805.47	43
In air	
2 139.01	1
2 142.77	1
3 329.70	52
3 408.13	58
3 437.14	64
3 775.61	51
3 919.00	75
3 955.85	57
3 977.31	57
3 995.00	63
4 046.74	50
4 109.59	74
4 114.33	74
4 123.12	74
4 236.36	81

TABLE 14. List of tabulated lines for allowed transitions of N II—Continued

Wavelength (Å)	Multiplet No.
4 319.06	69
4 374.99	73
4 379.58	73
4 393.85	80
4 412.50	80
4 445.03	49
4 447.03	72
4 459.94	79
4 464.13	49
4 465.53	79
4 475.89	79
4 476.27	49
4 477.68	79
4 488.09	79
4 507.56	79
4 564.76	71
4 601.48	56
4 607.15	56
4 613.87	56
4 621.39	56
4 630.54	56
4 643.09	56
4 654.53	62
4 667.21	62
4 674.91	62
4 709.44	90
4 774.24	78
4 779.72	78
4 781.19	78
4 788.14	78
4 793.65	78
4 803.29	78
4 810.30	78
4 860.17	77
4 874.57	77
4 895.12	48
4 897.54	77
4 987.38	89
4 994.37	89
5 001.13	76
5 001.47	76
5 002.70	55
5 005.15	76
5 007.33	89
5 010.62	55
5 016.38	76
5 025.66	76
5 040.71	76
5 045.10	55
5 073.59	61
5 114.28	96
5 123.53	96
5 138.90	96
5 238.18	68
5 355.00	95
5 383.72	88
5 390.69	88
5 452.07	94

TABLE 14. List of tabulated lines for allowed transitions of N II—Continued

Wavelength (Å)	Multiplet No.
5 454.22	94
5 462.58	94
5 478.09	94
5 480.05	94
5 493.23	87
5 495.65	94
5 666.63	54
5 674.00	86
5 676.02	54
5 679.56	54
5 686.21	54
5 710.77	54
5 730.66	54
5 747.30	60
5 767.45	60
5 927.81	93
5 931.78	93
5 940.24	93
5 941.65	93
5 952.39	93
5 960.91	93
6 065.00	92
6 086.54	92
6 284.32	102
6 285.69	91
6 286.11	91
6 309.25	91
6 366.79	53
6 379.62	53
6 433.44	67
6 457.68	67
6 472.43	67
6 482.05	59
6 610.56	101
6 802.17	100
6 826.23	100
7 262.55	66
7 528.12	99
7 545.36	99
7 559.05	99
7 762.24	98
8 089.08	97
8 128.14	97
8 438.7	105
8 687.43	85
9 399.64	104
10 541.2	65
10 909.1	103
13 425.7	84
25 630.3	83
26 019.5	83
46 393.2	70
47 011.7	82

This update, provided in Table 15 with a finding list presented in Table 14, is based on the MCHF Breit–Pauli calculations by Tachiev and Froese Fischer.[32] These are the most advanced calculations of its kind and supersede earlier, similar calculations based on less detailed treatments. The wave functions of the various atomic eigenstates are built from very large numbers of configuration state functions and include the Breit–Pauli relativistic corrections, such as spin–orbit, spin–other-orbit, spin–spin interactions, and the Darwin and mass-correction terms.

Tachiev and Froese Fischer[32] calculated the atomic transition probabilities in two slightly differing versions, either fully *ab initio*, i.e., with calculated transition energies, or with the transition energies adjusted to the more accurate experimental values. Also, they did the calculations both in the dipole length and dipole velocity formalisms, but tabulated the length values only. Ideally, these two representations of the transition integral should, of course, produce identical numerical results for the transition probabilities. But even in these sophisticated calculations, some differences between the length and velocity values had to be expected, and this in turn may serve as an indicator of accuracy. For strong transitions, these differences (labeled as T in their tables and given in %) are quite small, normally a few percent or even less than 1%. The differences increase, sometimes drastically, for most of the weaker lines, as one would expect. We have treated the T numbers as a qualitative, not a quantitative, measure and assume that for larger T's, the velocity value is much more uncertain than the (always tabulated) length value.

Also, we have always selected the energy-adjusted A- and f-values for our tabulation, as most dipole length-dipole velocity differences are smaller for these than for the *ab initio* values. This update covers lines from the far ultraviolet near 500 Å to the infrared, and contains some material for the visible spectrum for which experimental data are also available. Thus, some comparisons with recent lifetime and emission experiments[13,14,17,23,28] could be made, and these show good agreement.

References for N II Allowed Transitions

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TABLE 15. N II: Allowed Transitions

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
1	$2s^22p^2-2s2p^3$	^{3}P$-^5$S$^\circ$												
			2 139.01	2 139.68	48.7	–	46 784.6	3–5	5.15E−07	5.90E−08	1.25E−06	−6.752	B	32
			2 142.77	2 143.45	130.8	–	46 784.6	5–5	1.27E−06	8.72E−08	3.08E−06	−6.361	B	32
2	$2s^22p^2-2s2p^3$	^{3}P$-^3$D$^\circ$		*1 085.1*	*89*	–	*92 244*	9–15	3.73E+00	1.10E−01	3.53E+00	−0.006	A	32
				1 085.70	130.8	–	92 237.2	5–7	3.72E+00	9.20E−02	1.65E+00	−0.337	A	32
				1 084.58	48.7	–	92 250.3	3–5	2.82E+00	8.30E−02	8.89E−01	−0.604	A	32
				1 083.99	0.0	–	92 251.8	1–3	2.10E+00	1.11E−01	3.95E−01	−0.956	A	32
				1 085.55	130.8	–	92 250.3	5–5	9.10E−01	1.61E−02	2.87E−01	−1.095	A	32
				1 084.56	48.7	–	92 251.8	3–3	1.54E+00	2.72E−02	2.92E−01	−1.088	A	32
				1 085.53	130.8	–	92 251.8	5–3	9.96E−02	1.06E−03	1.89E−02	−2.277	A	32
3	$2s^22p^2-2s2p^3$	^{3}P$-^3$P$^\circ$		*916.35*	*89*	–	*109 218*	9–9	1.27E+01	1.60E−01	4.34E+00	0.158	A	32
				916.701	130.8	–	109 217.6	5–5	9.55E+00	1.20E−01	1.82E+00	−0.221	A	32
				916.020	48.7	–	109 216.6	3–3	3.21E+00	4.04E−02	3.66E−01	−0.916	A	32
				916.710	130.8	–	109 216.6	5–3	5.27E+00	3.99E−02	6.01E−01	−0.701	A	32
				915.962	48.7	–	109 223.5	3–1	1.27E+01	5.34E−02	4.83E−01	−0.796	A	32
				916.012	48.7	–	109 217.6	3–5	3.14E+00	6.58E−02	5.95E−01	−0.705	A	32
				915.612	0.0	–	109 216.6	1–3	4.23E+00	1.59E−01	4.80E−01	−0.798	A	32
4	$2s^22p^2-2s2p^3$	^{3}P$-^1$D$^\circ$												
				694.169	130.8	–	144 187.94	5–5	4.14E−04	2.99E−06	3.42E−05	−4.825	C+	32
				693.774	48.7	–	144 187.94	3–5	5.66E−05	6.80E−07	4.66E−06	−5.690	C+	32
5	$2p^2-2p3s$	^{3}P$-^3$P$^\circ$		*671.49*	*89*	–	*149 012.4*	9–9	1.10E+01	7.44E−02	1.48E+00	−0.174	B+	32
				671.386	130.8	–	149 076.52	5–5	8.52E+00	5.76E−02	6.36E−01	−0.541	B+	32
				671.630	48.7	–	148 940.17	3–3	2.53E+00	1.71E−02	1.14E−01	−1.290	B+	32
				672.001	130.8	–	148 940.17	5–3	4.38E+00	1.78E−02	1.97E−01	−1.051	B+	32
				671.773	48.7	–	148 908.59	3–1	1.13E+01	2.56E−02	1.70E−01	−1.115	B+	32
				671.016	48.7	–	149 076.52	3–5	2.84E+00	3.20E−02	2.12E−01	−1.018	B+	32
				671.411	0.0	–	148 940.17	1–3	3.40E+00	6.89E−02	1.52E−01	−1.161	B+	32
6	$2p^2-2p3s$	^{3}P$-^1$P$^\circ$												
				670.884	130.8	–	149 187.80	5–3	3.68E−01	1.49E−03	1.65E−02	−2.127	B+	32
				670.515	48.7	–	149 187.80	3–3	3.02E−01	2.03E−03	1.35E−02	−2.215	B+	32
				670.296	0.0	–	149 187.80	1–3	3.80E−01	7.67E−03	1.69E−02	−2.115	B+	32
7	$2s^22p^2-2s2p^3$	^{3}P$-^3$S$^\circ$		*645.00*	*89*	–	*155 126.73*	9–3	1.07E+02	2.22E−01	4.25E+00	0.301	A	32
				645.178	130.8	–	155 126.73	5–3	5.94E+01	2.22E−01	2.36E+00	0.046	A	32
				644.837	48.7	–	155 126.73	3–3	3.56E+01	2.22E−01	1.42E+00	−0.176	A	32
				644.634	0.0	–	155 126.73	1–3	1.19E+01	2.22E−01	4.72E−01	−0.653	A	32
8	$2s^22p^2-2s2p^3$	^{3}P$-^1$P$^\circ$												
				600.115	130.8	–	166 765.66	5–3	3.15E−04	1.02E−06	1.01E−05	−5.292	B	32
				599.819	48.7	–	166 765.66	3–3	1.69E−03	9.14E−06	5.41E−05	−4.562	B	32
				599.644	0	–	166 765.66	1–3	1.02E−04	1.65E−06	3.27E−06	−5.781	B	32
9	$2p^2-2p3d$	^{3}P$-^3$F$^\circ$												
				536.365	130.8	–	186 570.98	5–7	1.52E−01	9.18E−04	8.11E−03	−2.338	B+	32
				536.300	48.7	–	186 511.58	3–5	6.40E−02	4.60E−04	2.44E−03	−2.860	B+	32
				536.536	130.8	–	186 511.58	5–5	2.35E−02	1.01E−04	8.96E−04	−3.295	B+	32
10	$2p^2-2p3d$	^{3}P$-^1$D$^\circ$												
				534.872	130.8	–	187 091.37	5–5	7.14E−04	3.06E−06	2.70E−05	−4.815	B	32

TABLE 15. N II: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
				534.637	48.7	–	187 091.37	3–5	4.96E−02	3.55E−04	1.87E−03	−2.973	B	32
11	$2p^2-2p3d$	^{3}P–^{3}D°		*533.67*	*89*	–	*187 470.9*	9–15	4.24E+01	3.02E−01	4.77E+00	0.434	B+	32
				533.729	130.8	–	187 491.90	5–7	4.24E+01	2.54E−01	2.23E+00	0.103	B+	32
				533.581	48.7	–	187 461.56	3–5	3.29E+01	2.34E−01	1.23E+00	−0.154	B+	32
				533.511	0.0	–	187 437.56	1–3	2.46E+01	3.15E−01	5.53E−01	−0.502	B+	32
				533.815	130.8	–	187 461.56	5–5	9.35E+00	3.99E−02	3.51E−01	−0.700	B+	32
				533.650	48.7	–	187 437.56	3–3	1.70E+01	7.26E−02	3.83E−01	−0.662	B+	32
				533.884	130.8	–	187 437.56	5–3	9.54E−01	2.45E−03	2.15E−02	−1.912	B+	32
12	$2p^2-2p3d$	^{3}P–^{3}P°		*529.68*	*89*	–	*188 883.5*	9–9	2.44E+01	1.03E−01	1.61E+00	−0.034	B+	32
				529.867	130.8	–	188 857.37	5–5	1.96E+01	8.24E−02	7.19E−01	−0.385	B+	32
				529.491	48.7	–	188 909.17	3–3	6.86E+00	2.88E−02	1.51E−01	−1.063	B+	32
				529.722	130.8	–	188 909.17	5–3	1.04E+01	2.63E−02	2.29E−01	−0.882	B+	32
				529.413	48.7	–	188 937.24	3–1	2.44E+01	3.42E−02	1.79E−01	−0.989	B+	32
				529.637	48.7	–	188 857.37	3–5	4.83E+00	3.39E−02	1.77E−01	−0.993	B+	32
				529.355	0.0	–	188 909.17	1–3	7.17E+00	9.04E−02	1.58E−01	−1.044	B+	32
13	$2p^2-2p3d$	^{3}P–^{1}F°												
				528.529	130.8	–	189 335.16	5–7	1.86E−02	1.09E−04	9.47E−04	−3.264	B	32
14	$2p^2-2p3d$	^{3}P–^{1}P°												
				526.345	130.8	–	190 120.24	5–3	5.91E−03	1.47E−05	1.28E−04	−4.133	B+	32
				526.118	48.7	–	190 120.24	3–3	8.74E−04	3.63E−06	1.88E−05	−4.963	B+	32
				525.983	0.0	–	190 120.24	1–3	3.94E−02	4.90E−04	8.48E−04	−3.310	B+	32
15	$2s^22p^2-2s2p^3$	^{1}D–^{3}D°												
				1 300.04	15 316.2	–	92 237.2	5–7	4.1E−05	1.5E−06	3.1E−05	−5.13	D	32
				1 299.81	15 316.2	–	92 250.3	5–5	7.3E−06	1.9E−07	4.0E−06	−6.03	D	32
16	$2s^22p^2-2s2p^3$	^{1}D–^{3}P°												
				1 064.95	15 316.2	–	109 217.6	5–5	2.30E−05	3.90E−07	6.9E−06	−5.71	C	32
				1 064.96	15 316.2	–	109 216.6	5–3	5.2E−05	5.3E−07	9.2E−06	−5.59	C	32
17	$2s^22p^2-2s2p^3$	^{1}D–^{1}D°		775.965	15 316.2	–	144 187.94	5–5	3.14E+01	2.84E−01	3.62E+00	0.152	A	32
18	$2p^2-2p3s$	^{1}D–^{3}P°												
				747.606	15 316.2	–	149 076.52	5–5	7.17E−05	6.01E−07	7.39E−06	−5.522	C+	32
				748.369	15 316.2	–	148 940.17	5–3	3.81E+00	1.92E−02	2.36E−01	−1.018	A	32
19	$2p^2-2p3s$	^{1}D–^{1}P°		746.984	15 316.2	–	149 187.80	5–3	3.69E+01	1.85E−01	2.28E+00	−0.033	A	32
20	$2s^22p^2-2s2p^3$	^{1}D–^{3}S°												
				715.254	15 316.2	–	155 126.73	5–3	1.06E−03	4.86E−06	5.72E−05	−4.615	B+	32
21	$2s^22p^2-2s2p^3$	^{1}D–^{1}P°		660.286	15 316.2	–	166 765.66	5–3	3.17E+01	1.24E−01	1.35E+00	−0.207	B+	32
22	$2p^2-2p3d$	^{1}D–^{3}F°												
				583.925	15 316.2	–	186 570.98	5–7	2.32E−02	1.66E−04	1.60E−03	−3.081	A	32
				584.128	15 316.2	–	186 511.58	5–5	2.35E−01	1.20E−03	1.16E−02	−2.221	A	32
23	$2p^2-2p3d$	^{1}D–^{1}D°		582.156	15 316.2	–	187 091.37	5–5	2.74E+01	1.39E−01	1.33E+00	−0.158	A	32
24	$2p^2-2p3d$	^{1}D–^{3}D°												
				580.802	15 316.2	–	187 491.90	5–7	1.39E−02	9.82E−05	9.39E−04	−3.309	B+	32
				580.904	15 316.2	–	187 461.56	5–5	1.38E−01	6.97E−04	6.67E−03	−2.458	B+	32

TABLE 15. N II: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
25	$2p^2-2p3d$	^{1}D$-^3$P$^\circ$												
				576.232	15 316.2	–	188 857.37	5–5	3.23E−02	1.61E−04	1.53E−03	−3.095	B+	32
				576.060	15 316.2	–	188 909.17	5–3	4.22E−04	1.06E−06	9.3E−06	−5.275	C	
26	$2p^2-2p3d$	^{1}D$-^1$F$^\circ$		574.650	15 316.2	–	189 335.16	5–7	3.83E+01	2.65E−01	2.51E+00	0.123	A	32
27	$2p^2-2p3d$	^{1}D$-^1$P$^\circ$		572.069	15 316.2	–	190 120.24	5–3	4.2E−03	1.3E−05	1.2E−04	−4.21	D	32
28	$2s^22p^2-2s2p^3$	^{1}S$-^3$D$^\circ$												
				1 678.89	32 688.8	–	92 251.8	1–3	3.62E−06	4.59E−07	2.54E−06	−6.338	B+	32
29	$2s^22p^2-2s2p^3$	^{1}S$-^3$P$^\circ$												
				1 306.71	32 688.8	–	109 216.6	1–3	2.06E−05	1.58E−06	6.8E−06	−5.80	C	32
30	$2p^2-2p3s$	^{1}S$-^3$P$^\circ$												
				860.205	32 688.8	–	148 940.17	1–3	2.65E−02	8.82E−04	2.50E−03	−3.054	C+	32
31	$2p^2-2p3s$	^{1}S$-^1$P$^\circ$		858.376	32 688.8	–	149 187.80	1–3	2.56E−01	8.50E−03	2.40E−02	−2.071	C+	32
32	$2s^22p^2-2s2p^3$	^{1}S$-^3$S$^\circ$												
				816.740	32 688.8	–	155 126.73	1–3	1.85E−04	5.55E−06	1.49E−05	−5.255	B+	32
33	$2s^22p^2-2s2p^3$	^{1}S$-^1$P$^\circ$		745.841	32 688.8	–	166 765.66	1–3	1.35E+01	3.37E−01	8.27E−01	−0.473	B+	32
34	$2p^2-2p3d$	^{1}S$-^3$D$^\circ$												
				646.209	32 688.8	–	187 437.56	1–3	1.43E−02	2.68E−04	5.70E−04	−3.572	B	32
35	$2p^2-2p3d$	^{1}S$-^3$P$^\circ$												
				640.121	32 688.8	–	188 909.17	1–3	2.30E−02	4.24E−04	8.94E−04	−3.372	B	32
36	$2p^2-2p3d$	^{1}S$-^1$P$^\circ$		635.197	32 688.8	–	190 120.24	1–3	2.58E+01	4.69E−01	9.80E−01	−0.329	B+	32
37	$2s2p^3$ $-2s^22p3p$	^{5}S$^\circ-^3$D												
				834.740	46 784.6	–	166 582.45	5–5	2.4E−07	2.5E−09	3.5E−08	−7.90	D	32
				835.163	46 784.6	–	166 521.69	5–3	3.0E−08	1.9E−10	2.6E−09	−9.02	D	32
				834.070	46 784.6	–	166 678.64	5–7	8.1E−07	1.2E−08	1.6E−07	−7.23	D	32
38	$2s2p^3$ $-2s^22p3p$	^{3}D$^\circ-^1$P												
				1 381.97	92 250.3	–	164 610.76	5–3	1.3E−07	2.2E−09	5.1E−08	−7.95	D	32
				1 382.00	92 251.8	–	164 610.76	3–3	7.07E−05	2.03E−06	2.76E−05	−5.216	C+	32
39	$2s2p^3$ $-2s^22p3p$	^{3}D$^\circ-^3$D		*1 344.6*	*92 244*	–	*166 615.2*	15–15	7.18E−02	1.95E−03	1.29E−01	−1.535	C+	32
				1 343.34	92 237.2	–	166 678.64	7–7	6.40E−02	1.73E−03	5.36E−02	−1.917	C+	32
				1 345.31	92 250.3	–	166 582.45	5–5	4.90E−02	1.33E−03	2.95E−02	−2.177	C+	32
				1 346.44	92 251.8	–	166 521.69	3–3	5.28E−02	1.44E−03	1.91E−02	−2.366	C+	32
				1 345.08	92 237.2	–	166 582.45	7–5	1.27E−02	2.46E−04	7.63E−03	−2.764	C+	32
				1 346.41	92 250.3	–	166 521.69	5–3	1.94E−02	3.16E−04	7.01E−03	−2.801	C+	32
				1 343.57	92 250.3	–	166 678.64	5–7	7.55E−03	2.86E−04	6.32E−03	−2.845	C+	32
				1 345.34	92 251.8	–	166 582.45	3–5	1.03E−02	4.64E−04	6.17E−03	−2.856	C+	32
40	$2s2p^3$ $-2s^22p3p$	^{3}D$^\circ-^3$S												
				1 304.77	92 250.3	–	168 892.21	5–3	6.74E−04	1.03E−05	2.22E−04	−4.287	B	32
				1 304.79	92 251.8	–	168 892.21	3–3	2.32E−04	5.92E−06	7.63E−05	−4.750	B	32

TABLE 15. N II: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i–g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
41	$2s2p^3-2s^22p3p$	$^3D^\circ-^3P$		*1 275.6*	*92 244*	–	*170 636.4*	15–9	6.09E−01	8.91E−03	5.62E−01	−0.874	B+	32
				1 275.04	92 237.2	–	170 666.23	7–5	5.10E−01	8.89E−03	2.61E−01	−1.206	B+	32
				1 276.20	92 250.3	–	170 607.89	5–3	4.54E−01	6.65E−03	1.40E−01	−1.478	B+	32
				1 276.80	92 251.8	–	170 572.61	3–1	6.08E−01	4.95E−03	6.24E−02	−1.828	B+	32
				1 275.25	92 250.3	–	170 666.23	5–5	9.34E−02	2.28E−03	4.78E−02	−1.944	B+	32
				1 276.22	92 251.8	–	170 607.89	3–3	1.54E−01	3.75E−03	4.73E−02	−1.948	B+	32
				1 275.28	92 251.8	–	170 666.23	3–5	6.32E−03	2.57E−04	3.23E−03	−3.113	B+	32
42	$2s2p^3-2s^22p3p$	$^3D^\circ-^1S$												
				1 162.50	92 251.8	–	178 273.38	3–1	8.42E−05	5.68E−07	6.53E−06	−5.768	B	32
43	$2s2p^3-2s^22p3p$	$^3P^\circ-^1P$												
				1 805.28	109 217.6	–	164 610.76	5–3	3.05E−05	9.0E−07	2.66E−05	−5.349	C	32
				1 805.24	109 216.6	–	164 610.76	3–3	2.48E−04	1.21E−05	2.16E−04	−4.440	C	32
				1 805.47	109 223.5	–	164 610.76	1–3	4.06E−05	6.0E−06	3.54E−05	−5.225	C	32
44	$2s2p^3-2s^22p3p$	$^3P^\circ-^3D$		*1 742.2*	*109 218*	–	*166 615.2*	9–15	2.21E−01	1.68E−02	8.65E−01	−0.822	B	32
				1 740.31	109 217.6	–	166 678.64	5–7	2.21E−01	1.41E−02	4.03E−01	−1.152	B	32
				1 743.20	109 216.6	–	166 582.45	3–5	1.67E−01	1.27E−02	2.18E−01	−1.421	B	32
				1 745.26	109 223.5	–	166 521.69	1–3	1.23E−01	1.69E−02	9.70E−02	−1.772	B	32
				1 743.23	109 217.6	–	166 582.45	5–5	5.40E−02	2.46E−03	7.06E−02	−1.910	B	32
				1 745.05	109 216.6	–	166 521.69	3–3	9.07E−02	4.14E−03	7.14E−02	−1.906	B	32
				1 745.08	109 217.6	–	166 521.69	5–3	5.97E−03	1.64E−04	4.70E−03	−3.087	B	32
45	$2s2p^3-2s^22p3p$	$^3P^\circ-^3S$		*1 675.8*	*109 218*	–	*168 892.21*	9–3	8.00E−01	1.12E−02	5.57E−01	−0.995	B	32
				1 675.75	109 217.6	–	168 892.21	5–3	4.39E−01	1.11E−02	3.06E−01	−1.256	B	32
				1 675.73	109 216.6	–	168 892.21	3–3	2.70E−01	1.14E−02	1.88E−01	−1.467	B	32
				1 675.92	109 223.5	–	168 892.21	1–3	9.09E−02	1.15E−02	6.33E−02	−1.940	B	32
46	$2s2p^3-2s^22p3p$	$^3P^\circ-^3P$		*1 628.2*	*109 218*	–	*170 636.4*	9–9	3.2E−02	1.3E−03	6.1E−02	−1.95	D	32
				1 627.38	109 217.6	–	170 666.23	5–5	2.4E−02	9.5E−04	2.6E−02	−2.32	D	32
				1 628.90	109 216.6	–	170 607.89	3–3	5.2E−03	2.1E−04	3.3E−03	−3.21	D	32
				1 628.92	109 217.6	–	170 607.89	5–3	2.0E−02	4.7E−04	1.3E−02	−2.63	D	32
				1 629.83	109 216.6	–	170 572.61	3–1	3.2E−02	4.3E−04	6.9E−03	−2.89	D	32
				1 627.35	109 216.6	–	170 666.23	3–5	7.0E−03	4.7E−04	7.5E−03	−2.86	D	32
				1 629.08	109 223.5	–	170 607.89	1–3	7.9E−03	9.5E−04	5.1E−03	−3.02	D	32
47	$2s2p^3-2s^22p3p$	$^3P^\circ-^1D$												
				1 538.57	109 216.6	–	174 212.03	3–5	1.59E−05	9.4E−07	1.43E−05	−5.55	C	32
48	$2s2p^3-2s^22p3p$	$^1D^\circ-^1P$	4 895.12	4 896.48	144 187.94	–	164 610.76	5–3	3.0E−02	6.6E−03	5.3E−01	−1.48	D	32
49	$2s2p^3-2s^22p3p$	$^1D^\circ-^3D$												
			4 445.03	4 446.28	144 187.94	–	166 678.64	5–7	1.20E−06	4.99E−07	3.66E−05	−5.603	B	32
			4 464.13	4 465.38	144 187.94	–	166 582.45	5–5	5.9E−08	1.8E−08	1.3E−06	−7.06	E	32
			4 476.27	4 477.53	144 187.94	–	166 521.69	5–3	3.4E−05	6.1E−06	4.5E−04	−4.51	D	32

TABLE 15. N II: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
50	$2s2p^3-2s^22p3p$	$^1D^\circ-^3S$												
			4 046.74	4 047.88	144 187.94	–	168 892.21	5–3	1.44E−05	2.12E−06	1.42E−04	−4.97	C	32
51	$2s2p^3-2s^22p3p$	$^1D^\circ-^3P$												
			3 775.61	3 776.68	144 187.94	–	170 666.23	5–5	6.6E−06	1.4E−06	8.8E−05	−5.15	D	32
52	$2s2p^3-2s^22p3p$	$^1D^\circ-^1D$	3 329.70	3 330.66	144 187.94	–	174 212.03	5–5	2.0E−02	3.4E−03	1.8E−01	−1.78	D	32
53	$2p3s-2p3p$	$^3P^\circ-^1P$												
			6 379.62	6 381.38	148 940.17	–	164 610.76	3–3	3.52E−02	2.15E−02	1.35E+00	−1.191	B	32
			6 366.79	6 368.55	148 908.59	–	164 610.76	1–3	8.14E−05	1.49E−04	3.12E−03	−3.828	B	32
54	$2p3s-2p3p$	$^3P^\circ-^3D$	*5 679.3*	*5 680.9*	*149 012.4*	–	*166 615.2*	9–15	4.80E−01	3.87E−01	6.51E+01	0.542	A	32
			5 679.56	5 681.13	149 076.52	–	166 678.64	5–7	4.96E−01	3.36E−01	3.14E+01	0.225	A	32
			5 666.63	5 668.20	148 940.17	–	166 582.45	3–5	3.45E−01	2.77E−01	1.55E+01	−0.080	A	32
			5 676.02	5 677.59	148 908.59	–	166 521.69	1–3	2.80E−01	4.05E−01	7.58E+00	−0.392	A	32
			5 710.77	5 712.35	149 076.52	–	166 582.45	5–5	1.17E−01	5.74E−02	5.39E+00	−0.542	A	32
			5 686.21	5 687.79	148 940.17	–	166 521.69	3–3	1.78E−01	8.64E−02	4.85E+00	−0.586	A	32
			5 730.66	5 732.25	149 076.52	–	166 521.69	5–3	1.26E−02	3.73E−03	3.52E−01	−1.730	A	32
55	$2p3s-2p3p$	$^3P^\circ-^3S$	*5 028.8*	*5 030.2*	*149 012.4*	–	168 892.21	9–3	6.30E−01	7.97E−02	1.19E+01	−0.145	B	32
			5 045.10	5 046.51	149 076.52	–	168 892.21	5–3	3.37E−01	7.72E−02	6.41E+00	−0.413	B	32
			5 010.62	5 012.02	148 940.17	–	168 892.21	3–3	2.10E−01	7.91E−02	3.91E+00	−0.625	B	32
			5 002.70	5 004.10	148 908.59	–	168 892.21	1–3	8.33E−02	9.38E−02	1.55E+00	−1.028	B	32
56	$2s2p^3-2s^22p3p$	$^3P^\circ-^3P$	*4 623.2*	*4 624.5*	*149 012.4*	–	*170 636.4*	9–9	9.62E−01	3.08E−01	4.23E+01	0.443	B+	32
			4 630.54	4 631.84	149 076.52	–	170 666.23	5–5	7.48E−01	2.41E−01	1.84E+01	0.080	B+	32
			4 613.87	4 615.16	148 940.17	–	170 607.89	3–3	2.12E−01	6.77E−02	3.09E+00	−0.692	B+	32
			4 643.09	4 644.39	149 076.52	–	170 607.89	5–3	4.39E−01	8.52E−02	6.51E+00	−0.371	B+	32
			4 621.39	4 622.69	148 940.17	–	170 572.61	3–1	9.04E−01	9.65E−02	4.41E+00	−0.538	B+	32
			4 601.48	4 602.77	148 940.17	–	170 666.23	3–5	2.22E−01	1.18E−01	5.35E+00	−0.452	B+	32
			4 607.15	4 608.44	148 908.59	–	170 607.89	1–3	3.15E−01	3.01E−01	4.56E+00	−0.522	B+	32
57	$2s2p^3-2s^22p3p$	$^3P^\circ-^1D$												
			3 977.31	3 978.44	149 076.52	–	174 212.03	5–5	7.79E−05	1.85E−05	1.21E−03	−4.034	B+	32
			3 955.85	3 956.97	148 940.17	–	174 212.03	3–5	1.21E−01	4.72E−02	1.84E+00	−0.849	B+	32
58	$2p3s-2p3p$	$^3P^\circ-^1S$												
			3 408.13	3 409.11	148 940.17	–	178 273.38	3–1	1.91E−01	1.11E−02	3.73E−01	−1.478	B+	32
59	$2p3s-2p3p$	$^1P^\circ-^1P$	6 482.05	6 483.84	149 187.80	–	164 610.76	3–3	2.58E−01	1.63E−01	1.04E+01	−0.311	B+	32
60	$2p3s-2p3p$	$^1P^\circ-^3D$												
			5 747.30	5 748.89	149 187.80	–	166 582.45	3–5	3.27E−02	2.70E−02	1.54E+00	−1.091	B+	32
			5 767.45	5 769.05	149 187.80	–	166 521.69	3–3	2.39E−02	1.19E−02	6.78E−01	−1.447	B+	32
61	$2p3s-2p3p$	$^1P^\circ-^3S$												
			5 073.59	5 075.01	149 187.80	–	168 892.21	3–3	2.43E−02	9.40E−03	4.71E−01	−1.550	B	32
62	$2p3s-2p3p$	$^1P^\circ-^3P$												
			4 654.53	4 655.83	14 9187.80	–	170 666.23	3–5	1.92E−02	1.04E−02	4.78E−01	−1.506	B	32

TABLE 15. N II: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
			4 667.21	4 668.51	149 187.80	–	170 607.89	3–3	2.31E−02	7.53E−03	3.47E−01	−1.646	B	32
			4 674.91	4 676.22	149 187.80	–	170 572.61	3–1	8.54E−02	9.33E−03	4.31E−01	−1.553	B	32
63	$2p3s-2p3p$	$^1P^\circ-^1D$	3 995.00	3 996.13	149 187.80	–	174 212.03	3–5	1.22E+00	4.85E−01	1.92E+01	0.163	A	32
64	$2p2s-2p3p$	$^1P^\circ-^1S$	3 437.14	3 438.13	149 187.80	–	178 273.38	3–1	1.91E+00	1.13E−01	3.84E+00	−0.470	B+	32
65	$2s2p^3$ $-2s^22p3p$	$^3S^\circ-^1P$												
			10 541.2	9 484.03 cm^{-1}	155 126.73	–	164 610.76	3–3	4.17E−06	6.96E−06	7.25E−04	−4.680	B	32
66	$2s2p^3$ $-2s^22p3p$	$^3S^\circ-^3S$												
			7 262.55	7 264.55	155 126.73	–	168 892.21	3–3	1.4E−07	1.1E−07	8.1E−06	−6.47	D	32
67	$2s2p^3$ $-2s^22p3p$	$^3S^\circ-^3P$	*6 445.8*	*6 447.6*	*155 126.73*	–	*170 636.4*	3–9	1.2E−04	2.23−04	1.4E−02	−3.17	D	32
			6 433.44	6 435.21	155 126.73	–	170 666.23	3–5	1.2E−04	1.3E−04	8.0E−03	−3.42	D	32
			6 457.68	6 459.46	155 126.73	–	170 607.89	3–3	1.2E−04	7.3E−05	4.7E−03	−3.66	D	32
			6 472.43	6 474.22	155 126.73	–	170 572.61	3–1	1.1E−04	2.4E−05	1.5E−03	−4.15	D	32
68	$2s2p^3$ $-2s^22p3p$	$^3S^\circ-^1D$												
			5 238.18	5 239.63	155 126.73	–	174 212.03	3–5	3.16E−05	2.17E−05	1.12E−03	−4.186	B	32
69	$2s2p^3$ $-2s^22p3p$	$^3S^\circ-^1S$												
			4 319.06	4 320.28	155 126.73	–	178 273.38	3–1	5.59E−05	5.21E−06	2.22E−04	−4.806	B	32
70	$2s^22p3p$ $-2s2p^3$	$^1P-^1P^\circ$	46 393.2	2 154.90 cm^{-1}	164 610.76	–	166 765.66	3–3	2.1E−04	6.7E−03	3.1E+00	−1.70	D	32
71	$2p3p-2p3d$	$^1P-^3F^\circ$												
			4 564.76	4 566.04	164 610.76	–	186 511.58	3–5	1.65E−02	8.59E−03	3.88E−01	−1.589	B+	32
72	$2p3p-2p3d$	$^1P-^1D^\circ$	4 447.03	4 448.28	164 610.76	–	187 091.37	3–5	1.12E+00	5.55E−01	2.44E+01	0.221	B+	32
73	$2p3p-2p3d$	$^1P-^3D^\circ$												
			4 374.99	4 376.21	164 610.76	–	187 461.56	3–5	6.31E−03	3.02E−03	1.31E−01	−2.043	B+	32
			4 379.58	4 380.82	164 610.76	–	187 437.56	3–3	1.76E−03	5.07E−04	2.19E−02	−2.818	B+	32
74	$2p3p-2p3d$	$^1P-^3P^\circ$												
			4 123.12	4 124.29	164 610.76	–	188 857.37	3–5	4.37E−04	1.86E−04	7.56E−03	−3.254	B+	32
			4 114.33	4 115.50	164 610.76	–	188 909.17	3–3	1.65E−03	4.18E−04	1.70E−02	−2.901	B+	32
			4 109.59	4 110.75	164 610.76	–	188 937.24	3–1	1.2E−06	1.1E−07	4.3E−06	−6.50	D	
75	$2p3p-2p3d$	$^1P-^1P^\circ$	3 919.00	3 920.11	164 610.76	–	190 120.24	3–3	7.56E−01	1.74E−01	6.74E+00	−0.282	B+	32
76	$2p3p-2p3d$	$^3D-^3F^\circ$	*5 004.5*	*5 005.9*	*166 615.2*	–	*186 591.8*	15–21	1.14E+00	5.98E−01	1.48E+02	0.953	A	32
			5 005.15	5 006.55	166 678.64	–	186 652.49	7–9	1.14E+00	5.52E−01	6.37E+01	0.587	A	32
			5 001.47	5 002.87	166 582.45	–	186 570.98	5–7	1.04E+00	5.44E−01	4.48E+01	0.435	A	32
			5 001.13	5 002.53	166 521.69	–	186 511.58	3–5	9.65E−01	6.03E−01	2.98E+01	0.258	A	32
			5 025.66	5 027.06	166 678.64	–	186 570.98	7–7	1.04E−01	3.96E−02	4.58E+00	−0.558	A	32
			5 016.38	5 017.78	166 582.45	–	186 511.58	5–5	1.59E−01	5.99E−02	4.95E+00	−0.524	A	32
			5 040.71	5 042.12	166 678.64	–	186 511.58	7–5	3.65E−03	9.94E−04	1.16E−01	−2.158	A	32
77	$2p3p-2p3d$	$^3D-^1D^\circ$												

TABLE 15. N II: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
			4 897.54	4 898.90	166 678.64	–	187 091.37	7–5	5.6E−06	1.4E−06	1.6E−04	−5.00	D	32
			4 874.57	4 875.93	166 582.45	–	187 091.37	5–5	2.17E−05	7.75E−06	6.22E−04	−4.412	B+	32
			4 860.17	4 861.52	166 521.69	–	187 091.37	3–5	1.87E−02	1.10E−02	5.29E−01	−1.481	B+	32
78	$2p3p-2p3d$	^{3}D–^{3}D$^\circ$	*4 793.5*	*4 794.8*	*166 615.2*	–	*187 470.9*	15–15	3.32E−01	1.14E−01	2.71E+01	0.234	B	32
			4 803.29	4 804.63	166 678.64	–	187 491.90	7–7	3.17E−01	1.10E−01	1.21E+01	−0.115	B	32
			4 788.14	4 789.48	166 582.45	–	187 461.56	5–5	2.50E−01	8.61E−02	6.79E+00	−0.366	B	32
			4 779.72	4 781.06	166 521.69	–	187 437.56	3–3	2.49E−01	8.52E−02	4.02E+00	−0.593	B	32
			4 810.30	4 811.64	166 678.64	–	187 461.56	7–5	4.75E−02	1.18E−02	1.31E+00	−1.084	B	32
			4 793.65	4 794.99	166 582.45	–	187 437.56	5–3	7.73E−02	1.60E−02	1.26E+00	−1.097	B	32
			4 781.19	4 782.53	166 582.45	–	187 491.90	5–7	1.92E−02	9.21E−03	7.25E−01	−1.337	B	32
			4 774.24	4 775.58	166 521.69	–	187 461.56	3–5	3.07E−02	1.75E−02	8.24E−01	−1.280	B	32
79	$2p3p-2p3d$	^{3}D–^{3}P$^\circ$	*4 489.4*	*4 490.7*	*166 615.2*	–	*188 883.5*	15–9	8.2E−02	1.5E−02	3.3E+00	−0.65	D	32
			4 507.56	4 508.82	166 678.64	–	188 857.37	7–5	7.4E−02	1.6E−02	1.7E+00	−0.95	D	32
			4 477.68	4 478.94	166 582.45	–	188 909.17	5–3	6.4E−02	1.2E−02	8.6E−01	−1.24	D	32
			4 459.94	4 461.19	166 521.69	–	188 937.24	3–1	8.0E−02	8.0E−03	3.5E−01	−1.62	D	32
			4 488.09	4 489.35	166 582.45	–	188 857.37	5–5	8.6E−03	2.6E−03	1.9E−01	−1.89	D	32
			4 465.53	4 466.78	166 521.69	–	188 909.17	3–3	1.6E−02	4.8E−03	2.1E−01	−1.85	D	32
			4 475.89	4 477.14	166 521.69	–	188 857.37	3–5	4.0E−04	2.0E−04	8.8E−03	−3.23	D	32
80	$2p3p-2p3d$	^{3}D–^{1}F$^\circ$												
			4 412.50	4 413.74	166 678.64	–	189 335.16	7–7	2.93E−05	8.56E−06	8.71E−04	−4.222	B	32
			4 393.85	4 395.08	166 582.45	–	189 335.16	5–7	5.21E−04	2.11E−04	1.53E−02	−2.976	B	32
81	$2p3p-2p3d$	^{3}D–^{1}P$^\circ$												
			4 236.36	4 237.55	166 521.69	–	190 120.24	3–3	1.93E−03	5.19E−04	2.17E−02	−2.807	B	32
82	$2s2p^3$ $-2s^22p3p$	^{1}P$^\circ$–^{3}S												
			47 011.7	2 126.55 cm^{-1}	166 765.66	–	168 892.21	3–3	4.1E−08	1.4E−06	6.3E−04	−5.39	D	32
83	$2s2p^3$ $-2s^22p3p$	^{1}P$^\circ$–^{3}P												
			25 630.3	3 900.57 cm^{-1}	166 765.66	–	170 666.23	3–5	8.6E−08	1.4E−06	3.6E−04	−5.37	D	32
			26 019.5	3 842.23 cm^{-1}	166 765.66	–	170 607.89	3–3	6.5E−08	6.6E−07	1.7E−04	−5.70	D	32
84	$2s2p^3$ $-2s^22p3p$	^{1}P$^\circ$–^{1}D	13 425.7	7 446.37 cm^{-1}	166 765.66	–	174 212.03	3–5	6.3E−03	2.9E−02	3.8E+00	−1.07	D	32
85	$2s2p^3$ $-2s^22p3p$	^{1}P$^\circ$–^{1}S	8 687.43	8 689.82	166 765.66	–	178 273.38	3–1	1.2E−02	4.4E−03	3.8E−01	−1.88	D	32
86	$2p3p-2p3d$	^{3}S–^{3}F$^\circ$												
			5 674.00	5 675.57	168 892.21	–	186 511.58	3–5	4.8E−07	3.9E−07	2.2E−05	−5.93	B	32
87	$2p3p-2p3d$	^{3}S–^{1}D$^\circ$												
			5 493.23	5 494.76	168 892.21	–	187 091.37	3–5	3.11E−04	2.34E−04	1.27E−02	−3.153	B	32
88	$2p3p-2p3d$	^{3}S–^{3}D$^\circ$												
			5 383.72	5 385.22	168 892.21	–	187 461.56	3–5	3.69E−03	2.67E−03	1.42E−01	−2.096	B+	32
			5 390.69	5 392.19	168 892.21	–	187 437.56	3–3	2.04E−03	8.87E−04	4.73E−02	−2.575	B+	32
89	$2p3p-2p3d$	^{3}S–^{3}P$^\circ$	*5 000.8*	*5 002.2*	*168 892.21*	–	*188 883.5*	3–9	7.28E−01	8.19E−01	4.05E+01	0.390	B+	32
			5 007.33	5 008.73	168 892.21	–	188 857.37	3–5	7.43E−01	4.66E−01	2.31E+01	0.145	B+	32

TABLE 15. N II: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
			4 994.37	4 995.76	168 892.21	–	188 909.17	3–3	7.11E−01	2.66E−01	1.31E+01	−0.098	B+	32
			4 987.38	4 988.77	168 892.21	–	188 937.24	3–1	6.98E−01	8.68E−02	4.28E+00	−0.584	B+	32
90	$2p3p-2p3d$	^{3}S–^{1}P°												
			4 709.44	4 710.75	168 892.21	–	190 120.24	3–3	1.49E−03	4.97E−04	2.31E−02	−2.826	B	32
91	$2p3p-2p3d$	^{3}P–^{3}F°												
			6 285.69	6 287.43	170 666.23	–	186 570.98	5–7	1.10E−03	9.13E−04	9.45E−02	−2.340	A	32
			6 286.11	6 287.85	170 607.89	–	186 511.58	3–5	4.50E−04	4.44E−04	2.76E−02	−2.875	A	32
			6 309.25	6 311.00	170 666.23	–	186 511.58	5–5	1.71E−04	1.02E−04	1.06E−02	−3.292	A	32
92	$2p3p-2p3d$	^{3}P–^{1}D°												
			6 086.54	6 088.23	170 666.23	–	187 091.37	5–5	5.87E−05	3.26E−05	3.27E−03	−3.787	B	32
			6 065.00	6 066.68	170 607.89	–	187 091.37	3–5	2.57E−03	2.36E−03	1.41E−01	−2.150	B	32
93	$2p3p-2p3d$	^{3}P–^{3}D°	*5 938.5*	*5 940.2*	*170 636.4*	–	*187 470.9*	9–15	5.48E−01	4.83E−01	8.51E+01	0.638	A	32
			5 941.65	5 943.30	170 666.23	–	187 491.90	5–7	5.47E−01	4.05E−01	3.97E+01	0.307	A	32
			5 931.78	5 933.43	170 607.89	–	187 461.56	3–5	4.23E−01	3.72E−01	2.18E+01	0.047	A	32
			5 927.81	5 929.46	170 572.61	–	187 437.56	1–3	3.19E−01	5.04E−01	9.84E+00	−0.297	A	32
			5 952.39	5 954.04	170 666.23	–	187 461.56	5–5	1.24E−01	6.60E−02	6.47E+00	−0.481	A	32
			5 940.24	5 941.89	170 607.89	–	187 437.56	3–3	2.22E−01	1.18E−01	6.90E+00	−0.452	A	32
			5 960.91	5 962.56	170 666.23	–	187 437.56	5–3	1.29E−02	4.13E−03	4.05E−01	−1.685	A	32
94	$2p3p-2p3d$	^{3}P–^{3}P°	*5 478.8*	*5 480.3*	*170 636.4*	–	*188 883.5*	9–9	3.36E−01	1.51E−01	2.45E+01	0.134	B+	32
			5 495.65	5 497.18	170 666.23	–	188 857.37	5–5	2.66E−01	1.20E−01	1.09E+01	−0.220	B+	32
			5 462.58	5 464.10	170 607.89	–	188 909.17	3–3	1.11E−01	4.98E−02	2.69E+00	−0.826	B+	32
			5 480.05	5 481.57	170 666.23	–	188 909.17	5–3	1.44E−01	3.89E−02	3.51E+00	−0.711	B+	32
			5 454.22	5 455.73	170 607.89	–	188 937.24	3–1	3.70E−01	5.50E−02	2.97E+00	−0.782	B+	32
			5 478.09	5 479.61	170 607.89	–	188 857.37	3–5	5.22E−02	3.92E−02	2.12E+00	−0.930	B+	32
			5 452.07	5 453.59	170 572.61	–	188 909.17	1–3	9.82E−02	1.31E−01	2.36E+00	−0.881	B+	32
95	$2p3p-2p3d$	^{3}P–^{1}F°												
			5 355.00	5 356.49	170 666.23	–	189 335.16	5–7	7.02E−05	4.23E−05	3.73E−03	−3.675	B+	32
96	$2p3p-2p3d$	^{3}P–^{1}P°												
			5 138.90	5 140.33	170 666.23	–	190 120.24	5–3	3.34E−05	7.9E−06	6.7E−04	−4.402	C	32
			5 123.53	5 124.96	170 607.89	–	190 120.24	3–3	5.69E−05	2.24E−05	1.14E−03	−4.172	B	32
			5 114.28	5 115.71	170 572.61	–	190 120.24	1–3	3.88E−04	4.56E−04	7.68E−03	−3.341	B	32
97	$2p3p-2p3d$	^{1}D–^{3}F°												
			8 089.08	8 091.30	174 212.03	–	186 570.98	5–7	1.01E−04	1.39E−04	1.85E−02	−3.159	C+	32
			8 128.14	8 130.38	174 212.03	–	186 511.58	5–5	5.55E−04	5.50E−04	7.36E−02	−2.561	C+	32
98	$2p3p-2p3d$	^{1}D–^{1}D°	7 762.24	7 764.37	174 212.03	–	187 091.37	5–5	8.49E−02	7.67E−02	9.81E+00	−0.416	B	32
99	$2p3p-2p3d$	^{1}D–^{3}D°												
			7 528.12	7 530.19	174 212.03	–	187 491.90	5–7	6.61E−05	7.86E−05	9.74E−03	−3.406	B	32
			7 545.36	7 547.44	174 212.03	–	187 461.56	5–5	4.53E−04	3.87E−04	4.81E−02	−2.71	C	32
			7 559.05	7 561.13	174 212.03	–	187 437.56	5–3	1.9E−05	9.8E−06	1.2E−03	−4.31	D	32
100	$2p3p-2p3d$	^{1}D–^{3}P°												
			6 826.23	6 828.11	174 212.03	–	188 857.37	5–5	2.49E−04	1.74E−04	1.96E−02	−3.060	C+	32
			6 802.17	6 804.04	174 212.03	–	188 909.17	5–3	1.4E−05	6.0E−06	6.7E−04	−4.53	D	32
101	$2p3p-2p3d$	^{1}D–^{1}F°	6 610.56	6 612.39	174 212.03	–	189 335.16	5–7	6.01E−01	5.52E−01	6.00E+01	0.441	B	32
102	$2p3p-2p3d$	^{1}D–^{1}P°	6 284.32	6 286.06	174 212.03	–	190 120.24	5–3	4.6E−02	1.6E−02	1.7E+00	−1.09	D	32

TABLE 15. N II: Allowed Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i – g_k	A_{ki} (10^8 s^{-1})	f_{ik}	S (a.u.)	log gf	Acc.	Source
103	$2p3p-2p3d$	^{1}S–^{3}D°												
			10 909.1	9 164.18 cm^{-1}	178 273.38	–	187 437.56	1–3	3.08E−05	1.65E−04	5.92E−03	−3.783	B	32
104	$2p3p-2p3d$	^{1}S–^{3}P°												
			9 399.64	9 402.22	178 273.38	–	188 909.17	1–3	1.04E−04	4.12E−04	1.28E−02	−3.385	B	32
105	$2p3p-2p3d$	^{1}S–^{1}P°	8 438.7	8 441.1	178 273.38	–	190 120.24	1–3	1.91E−01	6.11E−01	1.70E+01	−0.214	B	32

[a]Wavelengths (Å) are always given unless cm^{-1} is indicated.

6.2.2. N II Forbidden Transitions

TABLE 16. List of tabulated lines for forbidden transitions of N II

Wavelength (Å)	Multiplet No.
In vacuum	
599.819	11
600.115	11
644.837	10
645.178	10
660.286	19
670.515	9
670.796	8
670.884	9
671.016	8
671.386	8
671.630	8
672.001	8
672.143	8
693.539	7
693.774	7
694.169	7
715.254	18
746.984	17
747.606	16
748.369	16
748.546	16
775.965	15
859.197	22
896.868	21
915.603	6
916.012	6
916.020	6
916.652	6
916.701	6
916.710	6
1 064.88	14
1 064.95	14
1 064.96	14
1 084.01	5
1 084.56	5
1 084.58	5
1 084.73	5
1 085.53	5
1 085.55	5
1 085.70	5
1 299.79	13
1 299.81	13
1 300.04	13
1 306.70	20
1 342.01	26
1 342.03	26
1 590.09	25
1 590.42	25
1 590.46	25
1 601.72	23
1 601.74	23
In air	
2 136.78	4
2 139.01	4
2 142.77	4
2 177.49	28
2 177.53	28
2 177.81	28
2 858.64	27
2 858.73	27
3 062.83	3
3 070.55	3
4 427.90	29
5 754.59	12
5 887.51	24
5 887.86	24
5 890.01	24
5 890.53	24
5 892.06	24
5 892.40	24
5 892.58	24
5 892.93	24
6 527.23	2
6 548.05	2
6 583.45	2
Wave number (cm^{-1})	
48.7	1
82.1	1
130.8	1

Our previous compilation for N II in 1996[1] was quite small, containing only 12 M1 and E2 lines. This update, provided in Table 17 with a finding list presented in Table 16, which is based on the recent sophisticated multiconfiguration Hartree-Fock (MCHF) calculations of Tachiev and Froese Fischer,[32] enlarges this tabulation to 84 lines and includes some M2 transitions. (For more details on these calculations, see the general introduction.) The work of Tachiev and Froese Fischer[32] contains additional transitions, which are, however, so extremely weak, that we have not tabulated them.

References for N II Forbidden Transitions

[1]W. L. Wiese, J. R. Fuhr, and T. M. Deters, *Atomic Transition Probabilities of Carbon, Nitrogen, and Oxygen, A Critical Data Compilation*, J. Phys. Chem. Ref. Data, Monograph 7 (1996).
[32]G. Tachiev and C. Froese Fischer, Can. J. Phys. **79**, 955 (2001).

TABLE 17. N II: Forbidden Transitions

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	Type	A_{ki} (s^{-1})	S (a.u.)	Acc.	Source
1	$2s^22p^2–2s^22p^2$	^{3}P–^{3}P											
				82.1 cm^{-1}	48.7	–	130.8	3–5	M1	7.46E−06	2.50E+00	A	32
				82.1 cm^{-1}	48.7	–	130.8	3–5	E2	2.5E−13	2.9E+00	D	32
				130.8 cm^{-1}	0.0	–	130.8	1–5	E2	1.1E−12	1.3E+00	D	32
				48.7 cm^{-1}	0.0	–	48.7	1–3	M1	2.08E−06	2.00E+00	A	32
2	$2s^22p^2–2s^22p^2$	^{3}P–^{1}D											
			6 583.45	6 585.27	130.8	–	15 316.2	5–5	M1	2.9E−03	1.5E−04	D	32
			6 583.45	6 585.27	130.8	–	15 316.2	5–5	E2	8.7E−06	4.8E−04	D	32
			6 548.05	6 549.86	48.7	–	15 316.2	3–5	M1	9.8E−04	5.1E−05	D	32
			6 548.05	6 549.86	48.7	–	15 316.2	3–5	E2	9.2E−07	5.0E−05	D	32
			6 527.23	6 529.03	0.0	–	15 316.2	1–5	E2	5.3E−07	2.8E−05	D	32
3	$2s^22p^2–2s^22p^2$	^{3}P–^{1}S											
			3 062.83	3 063.72	48.7	–	32 688.8	3–1	M1	3.18E−02	3.40E−05	C	32
			3 070.55	3 071.44	130.8	–	32 688.8	5–1	E2	1.6E−04	3.8E−05	D	32
4	$2s^22p^2–2s2p^3$	^{3}P–^{5}S°											
			2 142.77	2 143.45	130.8	–	46 784.6	5–5	M2	1.65E−03	2.50E+01	C	32
			2 139.01	2 139.68	48.7	–	46 784.6	3–5	M2	2.14E−03	3.22E+01	C	32
			2 136.78	2 137.46	0.0	–	46 784.6	1–5	M2	9.6E−04	1.43E+01	C	32
5	$2s^22p^2–2s2p^3$	^{3}P–^{3}D°											
				1 085.70	130.8	–	92 237.2	5–7	M2	6.3E−02	4.48E+01	C	32
				1 084.73	48.7	–	92 237.2	3–7	M2	2.57E−02	1.82E+01	C	32
				1 084.58	48.7	–	92 250.3	3–5	M2	3.00E−02	1.51E+01	C	32
				1 084.01	0.0	–	92 250.3	1–5	M2	2.59E−02	1.30E+01	C	32
				1 085.55	130.8	–	92 250.3	5–5	M2	7.8E−05	3.94E−02	C	32
				1 084.56	48.7	–	92 251.8	3–3	M2	1.01E−02	3.04E+00	C	32
				1 085.53	130.8	–	92 251.8	5–3	M2	8.0E−03	2.41E+00	C	32
6	$2s^22p^2–2s2p^3$	^{3}P–^{3}P°											
				916.701	130.8	–	109 217.6	5–5	M2	9.6E−02	2.08E+01	C	32
				916.020	48.7	–	109 216.6	3–3	M2	4.47E−02	5.8E+00	C	32
				916.652	130.8	–	109 223.5	5–1	M2	3.52E−02	1.53E+00	C	32
				916.710	130.8	–	109 216.6	5–3	M2	1.98E−03	2.58E−01	C	32
				916.012	48.7	–	109 217.6	3–5	M2	1.14E−03	2.47E−01	C	32
				915.603	0.0	–	109 217.6	1–5	M2	7.1E−03	1.53E+00	C	32
7	$2s^22p^2–2s2p^3$	^{3}P–^{1}D°											
				694.169	130.8	–	144 187.94	5–5	M2	3.21E−01	1.74E+01	C	32
				693.774	48.7	–	144 187.94	3–5	M2	4.15E−01	2.24E+01	C	32
				693.539	0.0	–	144 187.94	1–5	M2	1.84E−01	9.9E+00	C	32
8	$2s^22p^2–2s^22p(^2P°)3s$	^{3}P–^{3}P°											
				671.386	130.8	–	149 076.52	5–5	M2	2.65E−01	1.21E+01	C	32
				671.630	48.7	–	148 940.17	3–3	M2	1.61E−01	4.42E+00	C	32
				672.001	130.8	–	148 940.17	5–3	M2	6.0E−03	1.64E−01	C	32
				672.143	130.8	–	148 908.59	5–1	M2	1.41E−01	1.30E+00	C	32
				671.016	48.7	–	149 076.52	3–5	M2	7.2E−04	3.29E−02	C	32
				670.796	0.0	–	149 076.52	1–5	M2	2.78E−02	1.27E+00	C	32
9	$2s^22p^2–2s^22p(^2P°)3s$	^{3}P–^{1}P°											
				670.884	130.8	–	149 187.80	5–3	M2	1.51E−02	4.13E−01	C	32
				670.515	48.7	–	149 187.80	3–3	M2	1.58E−03	4.31E−02	C	32

TABLE 17. N II: Forbidden Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i g_k	Type	A_{ki} (s^{-1})	S (a.u.)	Acc.	Source
10	$2s^22p^2-2s2p^3$	^{3}P$-^3$S$^\circ$											
				645.178	130.8	–	155 126.73	5–3	M2	2.74E−01	6.2E+00	C	32
				644.837	48.7	–	155 126.73	3–3	M2	9.6E−02	2.15E+00	C	32
11	$2s^22p^2-2s2p^3$	^{3}P$-^1$P$^\circ$											
				600.115	130.8	–	166 765.66	5–3	M2	8.3E−01	1.29E+01	C	32
				599.819	48.7	–	166 765.66	3–3	M2	2.71E−01	4.23E+00	C	32
12	$2s^22p^2-2s^22p^2$	^{1}D$-^1$S											
			5 754.59	5 756.19	15 316.2	–	32 688.8	5–1	E2	1.14E+00	6.4E+00	C	32
13	$2s^22p^2-2s2p^3$	^{1}D$-^3$D$^\circ$											
				1 300.04	15 316.2	–	92 237.2	5–7	M2	3.48E−02	6.1E+01	C	32
				1 299.81	15 316.2	–	92 250.3	5–5	M2	3.06E−02	3.81E+01	C	32
				1 299.79	15 316.2	–	92 251.8	5–3	M2	1.31E−02	9.8E+00	C	32
14	$2s^22p^2-2s2p^3$	^{1}D$-^3$P$^\circ$											
				1 064.95	15 316.2	–	109 217.6	5–5	M2	1.14E−02	5.2E+00	C	32
				1 064.88	15 316.2	–	109 223.5	5–1	M2	3.11E−02	2.85E+00	C	32
				1 064.96	15 316.2	–	109 216.6	5–3	M2	2.36E−02	6.5E+00	C	32
15	$2s^22p^2-2s2p^3$	^{1}D$-^1$D$^\circ$											
				775.965	15 316.2	–	144 187.94	5–5	M2	2.27E−02	2.15E+00	C	32
16	$2s^22p^2-2s^22p(^2$P$^\circ)3s$	^{1}D$-^3$P$^\circ$											
				747.606	15 316.2	–	149 076.52	5–5	M2	7.0E−02	5.5E+00	C	32
				748.369	15 316.2	–	148 940.17	5–3	M2	1.35E−01	6.4E+00	C	32
				748.546	15 316.2	–	148 908.59	5–1	M2	1.95E−01	3.07E+00	C	32
17	$2s^22p^2-2s^22p(^2$P$^\circ)3s$	^{1}D$-^1$P$^\circ$											
				746.984	15 316.2	–	149 187.80	5–3	M2	1.18E−02	5.5E−01	C	32
18	$2s^22p^2-2s2p^3$	^{1}D$-^3$S$^\circ$											
				715.254	15 316.2	–	155 126.73	5–3	M2	5.7E−06	2.2E−04	D	32
19	$2s^22p^2-2s2p^3$	^{1}D$-^1$P$^\circ$											
				660.286	15 316.2	–	166 765.66	5–3	M2	9.9E−04	2.51E−02	C	32
20	$2s^22p^2-2s2p^3$	^{1}S$-^3$P$^\circ$											
				1 306.70	32 688.8	–	109 217.6	1–5	M2	3.11E−02	3.98E+01	C	32
21	$2s^22p^2-2s2p^3$	^{1}S$-^1$D$^\circ$											
				896.868	32 688.8	–	144 187.94	1–5	M2	4.55E−03	8.9E−01	C	32
22	$2s^22p^2-2s^22p(^2$P$)3s$	^{1}S$-^3$P$^\circ$											
				859.197	32 688.8	–	149 076.52	1–5	M2	5.2E−03	8.2E−01	C	32
23	$2s2p^3-2s2p^3$	^{5}S$^\circ-^3$P$^\circ$											
				1 601.72	46 784.6	–	109 217.6	5–5	M1	2.08E−02	1.58E−05	C	32
				1 601.74	46 784.6	–	109 216.6	5–3	M1	1.15E−02	5.3E−06	C	32
24	$2s2p^3-2s2p^3$	^{3}D$^\circ-^3$P$^\circ$											
			5 887.51	5 889.14	92 237.2	–	109 217.6	7–5	M1	2.78E−03	1.05E−04	C	32

TABLE 17. N II: Forbidden Transitions—Continued

No.	Transition array	Mult.	λ_{air} (Å)	λ_{vac} (Å) or σ (cm^{-1})[a]	E_i (cm^{-1})		E_k (cm^{-1})	g_i–g_k	Type	A_{ki} (s^{-1})	S (a.u.)	Acc.	Source
			5 887.51	5 889.14	92 237.2	–	109 217.6	7–5	E2	4.27E−01	1.35E+01	C	32
			5 887.86	5 889.49	92 237.2	–	109 216.6	7–3	E2	3.55E−01	6.8E+00	C	32
			5 892.40	5 894.04	92 250.3	–	109 216.6	5–3	E2	6.3E−02	1.20E+00	C	32
			5 890.01	5 891.64	92 250.3	–	109 223.5	5–1	E2	7.6E−01	4.82E+00	C	32
			5 890.53	5 892.16	92 251.8	–	109 223.5	3–1	M1	3.29E−03	2.49E−05	C	32
			5 892.06	5 893.69	92 250.3	–	109 217.6	5–5	M1	1.98E−03	7.5E−05	C	32
			5 892.06	5 893.69	92 250.3	–	109 217.6	5–5	E2	2.66E−01	8.4E+00	C	32
			5 892.93	5 894.56	92 251.8	–	109 216.6	3–3	M1	3.29E−03	7.5E−05	C	32
			5 892.93	5 894.56	92 251.8	–	109 216.6	3–3	E2	3.41E−01	6.5E+00	C	32
			5 892.58	5 894.21	92 251.8	–	109 217.6	3–5	M1	5.3E−04	2.02E−05	C	32
			5 892.58	5 894.21	92 251.8	–	109 217.6	3–5	E2	6.8E−02	2.17E+00	C	32
25	$2s2p^3-2s2p^3$	$^3D^\circ-^3S^\circ$											
				1 590.09	92 237.2	–	155 126.73	7–3	E2	1.79E−01	4.88E−03	C	32
				1 590.42	92 250.3	–	155 126.73	5–3	E2	1.11E−01	3.03E−03	C	32
				1 590.46	92 251.8	–	155 126.73	3–3	E2	6.1E−02	1.65E−03	C	32
26	$2s2p^3-2s2p^3$	$^3D^\circ-^1P^\circ$											
				1 342.01	92 250.3	–	166 765.66	5–3	M1	1.94E−02	5.2E−06	C	32
				1 342.03	92 251.8	–	166 765.66	3–3	M1	6.5E−03	1.74E−06	C	32
27	$2s2p^3-2s2p^3$	$^3P^\circ-^1D^\circ$											
			2 858.73	2 859.57	109 217.6	–	144 187.94	5–5	M1	6.1E−03	2.63E−05	C	32
			2 858.64	2 859.48	109 216.6	–	144 187.94	3–5	M1	2.02E−03	8.8E−06	C	32
28	$2s2p^3-2s2p^3$	$^3P^\circ-^3S^\circ$											
			2 177.53	2 178.22	109 217.6	–	155 126.73	5–3	M1	2.89E−03	3.32E−06	C	32
			2 177.49	2 178.17	109 216.6	–	155 126.73	3–3	M1	1.72E−03	1.98E−06	C	32
			2 177.81	2 178.50	109 223.5	–	155 126.73	1–3	M1	2.31E−03	2.66E−06	C	32
29	$2s2p^3-2s2p^3$	$^1D^\circ-^1P^\circ$											
			4 427.90	4 429.15	144 187.94	–	166 765.66	5–3	E2	4.09E+00	1.87E+01	C	32

[a]Wavelengths (Å) are always given unless cm^{-1} is indicated.

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