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THE SPECTRUM AND TERM ANALYSIS OF Co II

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ABSTRACT

High-resolution spectra of singly ionized cobalt have been recorded by Fourier transform spectrometry in the region 1420–33333 Å (70422–3000 cm^{−1}) with cobalt–neon and cobalt–argon hollow cathode lamps as sources. Most of the Co II lines exhibit broadening due to hyperfine structure, but the wavenumber uncertainty for the center of gravity of the strongest lines is less than 0.002 cm^{−1}. Of the previously listed energy levels of Co II, 215 have been revised and six have been discarded. In addition, 171 new levels have been found of which 125 are reported here for the first time. The number of classified lines has doubled with wavenumbers and classifications being presented for 2373 Co II lines, of which 1242 involve the new levels.

Subject headings: atomic data — line: identification — line: profiles

1. INTRODUCTION

New measurements and analysis of singly ionized transition elements are relevant both to atomic physics and to astrophysics. In order to interpret stellar spectra, one requires complete and accurate energy levels and wavelengths particularly for the iron group elements, which are responsible for the majority of observed stellar spectral lines. The “singly ionized” stage is the dominating ionization stage of transition elements in the atmospheres of stars of spectral classes B–G, and especially in the ultraviolet wavelength region stellar spectra are dominated by lines from second (singly ionized) spectra of the iron group elements (Johansson 1995).

Analysis of high-resolution stellar spectra obtained with the *Hubble Space Telescope’s* (HST) Goddard High Resolution Spectrograph (GHRS) has highlighted the inadequacy of older compilations of laboratory atomic data for the singly ionized iron group elements especially in the ultraviolet spectral region.

In recent years, using the technique of Fourier transform (FT) spectroscopy, high-resolution laboratory spectra have been recorded at Imperial College of neutral and singly ionized Fe (Nave, Johansson, & Thorne 1997; Nave 1994), Cr, V, and Co. An analysis of neutral cobalt (Pickering & Thorne 1996) resulted in improvements in accuracy of at least an order of magnitude for wavelengths and energy levels, as well as many new energy levels and newly identified transitions. In this work new accurate laboratory data are presented for singly ionized cobalt together with an extensive term analysis of the spectrum.

The first analysis of Co II was carried out by Meggers (1928), who measured the spectrum between 2150 and 5000 Å, found eight multiplets, and identified 14 Co II lines in the solar spectrum. Findlay (1930) found the $3d^8\ ^3F$ ground state when he extended the observations to 1940 Å. An arc source was used, and photographic observation led to a line list with wavenumbers listed to 0.1 cm^{−1}. Findlay also cor-

rected some of the level assignments of Meggers using Zeeman effect data.

The analysis was extended by Hagar (1951) and by Velasco & Adames (1966) to include terms from the configurations $3d^64s^2$, $3d^64s4p$, and $3d^75s$. Velasco & Adames (1966) give a table of 1500 observed lines and 450 classified lines.

Iglesias (1972, 1979) extended the analysis to include terms of the configurations $3d^76s$, $7s$, $5p$, $4d$, $5d$, $6d$, and $7d$. She commented that of the second spectra of the iron group elements one of the most incompletely known spectra was that of Co II. In her analysis Iglesias used both DC and pulsed hollow cathode spectra, which were photographically recorded using grating spectrographs. Iglesias lists 1200 classified lines between 1020 and 9492 Å (97966–10535 cm^{−1}). The wavenumbers are given to two decimal places (the uncertainty is given as approximately 0.1–0.01 cm^{−1}), and the intensities are eye estimates. The resulting energy level uncertainties range from probably, at best, 50 mK (1 mK = 0.001 cm^{−1}) to several hundred mK.

The most recent compilation of energy levels for Co II is that of Sugar & Corliss (1985; hereafter S+C), and these are in fact those of Iglesias. S+C include the leading percentages calculated for the $3d^74p$ levels by Roth (1969), and for the $3d^8$, $3d^74s$, and $3d^64s^2$ levels by Shadmi, Oreg, & Stein (1968).

Developments in the techniques of FT spectrometry have made it possible to record a broadband spectrum with a previously unachievable accuracy. These techniques have been exploited to improve and extend knowledge of the Co II spectrum and term system. In this paper we present wavelengths of 2373 Co II classified spectral emission lines recorded on FT spectrometers at very high resolution in the region 1420–33333 Å (70422–3000 cm^{−1}). The wavelength measurements are an order of magnitude more accurate than previous work. They have been used to derive revised values for 215 of the known energy levels, and in addition

FIG. 1.—Section of high-resolution UV FT Co II spectra showing identified lines: (a) Co-Ne spectrum and (b) Co-Ar spectrum

171 new levels have been found, 46 of which [the $3d^7(^4F)4f$ levels] have already been reported (Pickering 1997). As a result, the number of identified lines has almost doubled.

2. EXPERIMENTAL DETAILS

The laboratory spectra used in this analysis were recorded using two instruments: the $f/25$ vacuum UV FT spectrometer at Imperial College (ICFTS) London (Thorne et al. 1987) for the region $16000\text{--}70422\text{ cm}^{-1}$ ($6250\text{--}1420\text{ \AA}$); and the $f/55$ IR-visible FT spectrometer at the National Solar Observatory (NSOFTS), Kitt Peak, Tucson, AZ (Brault 1976) for the region $3000\text{--}16000\text{ cm}^{-1}$ ($33333\text{--}6250\text{ \AA}$).

The visible-VUV spectra were obtained with the ICFTS using a water-cooled DC hollow cathode lamp as a light source, run in either neon or argon as carrier gas (Pickering 1994). This source gives spectra of Co II and Co I as well as the neutral and singly ionized spectra of the particular carrier gas. The metal case of the lamp formed the anode, and the cathode was an open-ended cylinder of pure (99.995%) cobalt, 35 mm long and 8 mm in bore. The optimum running pressures and currents were found to be 3 mbar, 750 mA in Ne, and 0.9 mbar, 700 mA in Ar. The resolution of the ICFTS spectra ranged from 0.05 cm^{-1} in the UV spectral region to 0.035 cm^{-1} in the visible spectral region.

Figure 1 shows a small section of the Co-Ne and Co-Ar UV FT spectra for the region $45590\text{--}45665\text{ cm}^{-1}$ ($2189\text{--}2193\text{ \AA}$). This clearly demonstrates the vast improvement in quality of spectrum: Iglesias (1979) gives the wavenumbers and classifications for two lines in this region; 45595.67 cm^{-1} classified as $a^5P_3\text{--}z^5P_2$, and 45633.77 cm^{-1} classified as $a^5P_2\text{--}z^5P_1$. In the Co-Ne FT spectrum of Figure 1, 14 individual, resolved lines are seen of which 12 are classified and only two very weak lines remain unidentified. The transitions from higher lying energy levels were visible only in the Co-Ne spectrum, probably a result of a charge transfer process causing the higher levels to be populated when neon is used as the carrier gas.

The NSOFTS infrared (IR) spectra were also obtained using a cooled hollow cathode lamp as the source. The three spectra used in this work were recorded by W. Whaling, J. W. Brault, and B. Cardon. The regions covered and filler gases used were (i) $2500\text{--}11000\text{ cm}^{-1}$ in Ne; (ii) $8700\text{--}17000\text{ cm}^{-1}$ in He, and (iii) $8900\text{--}30000\text{ cm}^{-1}$ in Ne with resolutions of 0.0139 cm^{-1} , 0.0364 cm^{-1} and 0.05 cm^{-1} , respectively.

The wavenumber, wavelength, integrated intensity, and signal-to-noise ratio (SNR) of the observed spectral lines were determined using the DECOMP and GREMLIN programs developed by J. W. Brault (private communication).

It has been shown by Brault (1987) that the uncertainty in the position of the center of a properly resolved line is given by the full width at half-maximum of the line divided by twice the SNR. The determination of the wavenumber for a transition is complicated in the case of cobalt by the presence of hyperfine structure splitting (hfs) (Pickering 1996). The usual method of carrying out a least-squares fit of a Voigt profile to each line was not suitable for the cobalt transitions, where the line profiles are determined by the hfs of the levels involved in the transitions. Instead, the center of gravity (COG) of each line was found, and the uncertainty for most lines is given approximately by the line width divided by the SNR (Pickering & Thorne 1996). The uncertainties for the weaker lines are frequently even larger;

it is possible to estimate these from the differences between observed wavenumbers and those derived from the fitted energy level system.

The uncertainty in the absolute wavenumber of an observed spectral line depends not only on the precision with which its center can be measured but also on the uncertainty in the absolute calibration. The starting point for the latter is the fact that the wavenumber scale of FT spectra is linear, and in principle to establish an absolute wavenumber scale, only one standard line is required. However, the procedure used in practice at IC is to carry out the calibration using 26 Ar II standard lines in the blue region measured interferometrically by Norlén (1973) in the visible region and then to carry this calibration through further into the UV and IR using overlapping spectra (Learner & Thorne 1988).

The combined uncertainty of the wavenumber calibration and line position determination is estimated to be approximately 1 mK (0.001 cm^{-1}) for strong isolated spectral lines. In the UV this uncertainty is higher (4 mK) because of cumulative errors in calibrating overlapping spectra. A full discussion of the contributions to these uncertainties is given by Learner & Thorne (1988).

Spectra obtained with the ICFTS were put on a consistent relative intensity scale by calibrating the spectrometer with tungsten and deuterium lamps in the visible and UV spectral regions, respectively, using the overlap region to put the two calibrations on the same scale. However, owing to different conditions in the source, for example different carrier gases, the intensities of lines may vary, and so the intensities of the classified Co II lines given in Table 1 should be considered only as a rough guide (see § 3). Table 1 contains merged line lists of spectra taken with different source carrier gases: Ar and Ne. Thus, a variation of up to 30% in the intensity of a particular transition may be found between the intensity of the classified Co II line given in Table 1 and the actual intensities of lines measured in the individual spectra with different source carrier gases. No intensity calibration was available for the IR spectra taken with the NSOFTS.

3. THE SPECTRUM OF Co II

Tables 1 and 2 give the classified lines of Co II in the visible-UV and IR regions, respectively. In the first column the logarithm of the integrated intensity of each line is given to two decimal places. It should be noted that the lines in Table 2 are not intensity calibrated and are thus on a different intensity scale from those in Table 1. The intensities are given as a rough guide only, and lines from the three different IR spectra are on different intensity scales. Lines from these IR spectra have been annotated as *i*, *ii* or *iii* in order to differentiate between them, where this description refers to the spectra listed in Section 2.

The second column gives the observed SNR of the line. The third column is a rough guide to the overall width of the line patterns. Further details of the line patterns and hyperfine structure will be published in the future. Wavelengths, determined using the observed wavenumbers in column (5), are given in the fourth column. For wavelengths greater than $2000\text{ \AA}$, air wavelengths are given, the conversion being carried out using the formula of Edlén (1966) for the dispersion of air:

$$\lambda(\text{air}) = \frac{10^8}{\sigma} \left(1 + 8342.13 \times 10^{-8} + \frac{15997}{3.89 \times 10^9 - \sigma^2} + \frac{2406030}{1.3 \times 10^{10} - \sigma^2} \right)^{-1},$$

where σ is the vacuum wavenumber and $\lambda(\text{air})$ is the air wavelength in Å. In the IR spectral region this formula is in agreement to within 1 mÅ with more recent measurements (Peck & Reader 1972), and at shorter wavelengths the difference is quite insignificant. The observed center-of-gravity wavenumbers are shown in the fifth column. The differences between the observed wavenumbers and the wavenumbers derived from the measured energy levels (see § 4) are given in the sixth column. The next column contains the configuration, term designation, and J -value of each energy level involved in the transition. In the final column any blends with other lines are noted.

The tables contain 2373 classified Co II lines, with wavelengths an order of magnitude more accurate than in previous work. The number of classified lines is double that of the previous list in Iglesias (1979).

During the course of this term analysis, several Co I transitions were observed that had not previously been reported in Pickering & Thorne (1996) as a result of being blended. These are listed in Table 3.

4. THE IDENTIFICATION OF LINES, CORRECTION OF PREVIOUSLY KNOWN ENERGY LEVELS, AND SEARCH FOR NEW LEVELS

Wavenumbers of observed lines were compared with wavenumbers derived from measured energy levels (known as Ritz wavenumbers). Initially for this purpose the energy levels listed in S + C were used, and the majority of these levels were confirmed; six levels were discarded since there were no confirming transitions and the correct levels are found in this work. Following initial line identification, a revision of the energy levels was carried out using the observed transitions in FTS spectra and a least-squares fitting program, ELCALC (Radziemski et al. 1972). In this calculation, each line is given a weighting inversely proportional to the square of the uncertainty in the COG wavenumber. For this purpose, we have replaced the precision criterion for a single isolated line (Brault 1987) by the overall width of the hyperfine pattern divided by the SNR, a procedure justified by the internal consistency.

The revised energy level values have an order of magnitude higher accuracy than those of S + C, and the difference between the two sets was sometimes as much as 600 mK. In Figure 2 these differences are plotted against level energy. A mean energy level shift was found: the revised values are on average 161 mK lower than those of S + C.

The optimized energy level values were then used to calculate the Ritz wavenumbers. The discrepancies between these calculated wavenumbers and observed wavenumbers are shown in the sixth column of the line list Tables 1 and 2. For the strong lines these discrepancies are mostly of the order of a few mK, but for the weaker lines the discrepancies are frequently larger (see § 2).

Once the known energy levels had been revised, it was possible to search for new energy levels using the unidentified lines in the observed spectra. In addition to the 46 new $3d^7(^4F)4f$ levels already reported (Pickering 1998), a further

FIG. 2.—Co II energy level difference between this work and that of S + C.

125 new energy levels were found, resulting in a total of 1242 newly classified lines. Details of these new levels are given in § 5. In the infrared region, which had previously not been observed beyond 10535 cm^{-1} , many $4d-5p$ transitions were seen.

The calculated predictions of energy levels made by two of us (A. J. J. R. and P. H. M. U.) (see § 7) were used as a guide to the configuration and term identities of the new energy levels of this work. The predictions of transition intensities also calculated were used as an additional confirmation of the level identifications. These calculated transition probabilities are given in Raassen, Pickering, & Uylings (1998).

The revised energy levels together with the new energy levels found in this work are listed in Tables 4, 5, 6, and 7. The appropriate configuration, term designation, and J -value is given together with the relative uncertainty of each energy level value, which ranges from 1 mK to as much as 30 or 40 mK for a handful of levels with weak transitions. Approximately 70% of the levels have an uncertainty of less than 4 mK. Level eigenvector compositions are given in Tables 4, 5, and 7 based on the calculations of A. J. J. R. and P. H. M. U. For Table 6, the calculations of Pickering (1998) are used.

Table 7 gives details of the revisions of labeling made in this paper to the levels of S + C: three levels that only had configuration descriptions are now fully classified; and for 16 levels, the S + C labels were changed. Theoretical energy level value predictions of transition intensities supported the changes. In addition, six of the S + C energy levels were discarded and these are also listed in Table 7. A further 35 S + C levels, listed in Table 8, were not observed either because they are incorrect or because the levels were not populated with the hollow cathode source.

The convention for term notation is the same as that in S + C, where the lowest even parity LS term of multiplicity M and orbital angular momentum L is labeled as $a^M L$, and the next lowest as $b^M L$, and so on. Similarly, the label of the lowest odd-parity term is $z^M L$, and the next lowest is $y^M L$, and so on. For newly found levels the alphabetic prefix has been omitted because it is not particularly useful for mainly

high-lying levels for which the multiplet groups overlap. Occasionally it was not possible to assign a term designation or even a configuration to a level, especially when some of the higher lying levels are not adequately described by the *LS* coupling scheme and there is much mixing of configurations. In such cases the level has been labeled with its energy value in wavenumbers, with a superscript to indicate whether the level is odd or even.

For the new $3d^7(^4F)4f$ levels, presented in Pickering (1998), level labels of the *LS* coupling scheme are not meaningful. These levels fall in closely spaced pairs and are arranged according to the fine-structure splitting of the parent term $3d^7\ ^4F$ in Co III. The *JK* coupling scheme is a good representation of this pair structure. In this coupling scheme the energy levels are designated by the notation $J_c[K]J$, where J_c is the total angular momentum quantum number of the electron core (the *J*-value of the particular parent level). *K* is obtained through coupling of the orbital angular momentum of the valence electron to J_c , and *J* is obtained through addition of the spin of the valence electron. Eigenvector compositions found using the Cowan computer code (Cowan 1981) and the *JK* coupling scheme are given in Table 6.

5. THE ENERGY LEVEL STRUCTURE

Details of the term structure of the transition elements are described by Johansson & Cowley (1988). The observed levels in Co II belong to two configuration systems. The "normal" system consists of $3d^7(^M L)nl$ subconfigurations, which are built on the parent terms ($^M L$) in Co III, and transitions involving these levels dominate the emission spectrum of Co II. The subconfigurations $3d^6(^M L)4s nl$ in the "doubly excited" system are built on the ($^M L$) grandparent terms in Co IV. No transitions were observed in this work between levels of this doubly excited system, possibly because the levels are not populated with a hollow cathode source run in continuous mode.

A schematic diagram of the Co II normal term system is shown in Figure 3. The normal system of configurations, $3d^7(^M L)nl$ was fairly well known for $nl = 4s$ and $4p$ and was only fragmentarily known for $nl = 4d$ and $5s$. The dramatic improvement in the knowledge of the Co II level system is clear with the 171 new energy levels. In particular using many strong previously unidentified UV spectral lines, the levels of $nl = 4d$, $5s$ are found. In the subconfiguration $3d^7(^4F)nl$ levels of $nl = 4f$, $5p$, $5d$, and $6s$ are also found. The top part of the diagram displays all terms of the parent configuration $3d^7$ in Co III as a function of energy. Vertical lines from each of these parent terms lead down to boxes representing levels in the daughter configuration. The height of these boxes indicates the energy span of these subconfigurations. For the $3d^8$ configuration, shown at the far left of the diagram, terms are not assigned to a particular parent term.

5.1. The Even Levels of the Normal System

5.1.1. The $3d^8$ and $3d^7(^M L)4s$ Configurations

Almost all of the levels of the configurations $3d^7(^M L)4s$ and $3d^8$ are listed in the compilation of S + C, although the level $3d^8\ a\ ^1G_4$ was incorrect and is found at 18973.726 cm^{-1} in this work. The $3d^8\ ^1S_0$ level is still missing. The $(^2F)4s$ levels were not included in the level fitting procedure with all the other levels since no linking transitions were

FIG. 3.—The gross structure of the "normal" system of configurations, $3d^7(^M L)nl$, in Co II relative to the term structure of the parent configuration $3d^7$ in Co III.

observed. Details of the $(^2F)4s$ levels are given in § 5.3. No levels based on the highest parent term in Co III, $3d^7(b^2D)$, are known.

5.1.2. The Even $3d^7(^M L)5s$ and $4d$ Subconfigurations

All levels of the $3d^7(^4F)5s$ are reported in the S + C compilation together with 33 of the 38 $3d^7(^4F)4d$ levels, a further three levels being discarded. In this work the remaining five levels of the $3d^7(^4F)4d$ subconfiguration are given.

For subconfigurations based on higher parent terms, only three levels for both the $3d^7(^4P)5s$ and $3d^7(^2G)5s$ subconfigurations were listed in S + C. No other $5s$ levels based on higher parent terms were known, and no $4d$ levels were known for any other than the lowest parent term (4F).

To summarize the new $4d$ and $5s$ levels of the higher parent terms found in this work:

$(^4P)4d$: Twenty-one of the 22 levels found, and only the 3P_1 level is missing.

$(^4P)5s$: Now complete with three new levels found.

$(^2G)4d$: Eighteen of the 20 levels found, and only the 3D_1 and 3I_7 levels are missing.

$(^2G)5s$: Now complete with the e^1G_4 level from S + C being discarded and the correct level found.

$(^2P)4d$: All 12 levels found.

$(^2P)5s$: Three new levels found, and only the 3P_0 level is missing.

$(^2H)4d$: Eighteen of the 20 levels found, and only 3K_8 and 1I_7 are missing.

$(^2H)5s$: All four levels found.

$(a\ ^2D)4d$: Sixteen of the 18 levels found, and only 1S_0 and 3G_5 are missing.

$(a\ ^2D)5s$: All four levels found.

No levels of the $(^2F)4d$, $5s$ and $(b^2D)4d$, $5s$ subconfigurations were found.

5.1.3. The Even $3d^7(^4F)5d, 6s, 7s, 6d,$ and $7d$ Subconfigurations

S + C list four $(^4F)6s$ levels, of which two now have different *LS* labels, and the remaining four levels of the subconfiguration are also found.

For the $(^4F)5d$ subconfiguration, S + C give eight levels all of which are confirmed although there are some label changes. A further six levels are found, which have been assigned *LS* labels although there is much mixing predicted in the calculations (see § 7). In addition, two levels, 111436^e and 113191^e, are probably of the $(^4F)5d$ subconfiguration, but the mixing is too great with $4d$ levels based on higher parent terms, and no appropriate level label could be determined.

S + C list a handful of levels of the $3d^7(^4F)7s, 6d,$ and $7d$ subconfigurations, but no transitions from these were observed either because they are not populated in the hollow cathode or because they may be incorrect. They are listed in Table 8.

5.2. The Odd Levels of the Normal System

5.2.1. The $3d^7(^M L)4p$ Configuration

The $(^4F)4p, (^4P)4p, (^2G)4p, (^2P)4p, (^2H)4p,$ and $(a^2D)4p$ subconfigurations are complete with most of the S + C levels being confirmed. The $(a^2D)4p \times ^3P_0$ level from S + C was discarded and the correct level found at 115785.536 cm^{-1} . The last remaining unknown level was found, $(^2P)4p^1S_0$. Three of the S + C levels had no *LS* labels, and these were assigned. Since no transitions to levels of different parentage are seen, the $(^2F)4p$ levels could not be placed on the same energy scale as all the other levels and details of these $(^2F)4p$ levels are given in § 5.3. No levels based on the highest parent term in Co III, $3d^7(b^2D)$, are known.

5.2.2. The $3d^7(^M L)5p$ and $4f$ Configurations

In the $3d^7(^4F)5p$ subconfiguration 21 of the 24 levels are known with the $^5D_{1,0}$ and 3D_1 levels still missing. Several label changes to those given in S + C are made. Four new levels of the $3d^7(^4P)5p$ subconfiguration are found. Forty-six of the 48 levels of the $3d^7(^4F)4f$ subconfiguration are found (Pickering 1998).

5.3. The $(^2F)4s$ and $(^2F)4p$ Levels

The $(^2F)4s$ and $(^2F)4p$ levels were not included in the level fitting procedure with all the other levels since no linking transitions were observed to levels of different parentage. Thus they could not be placed on the same energy scale as all the other levels. They were fitted separately and are listed relative to the level c^3F_2 fixed at 40771.110 cm^{-1} , the value given in S + C. The errors given for these level values include an error relative to this fixed c^3F_2 level, as well as a relative uncertainty x in the position of these 2F levels with respect to the main level system, which may be as much as several hundred mK. Of the $(^2F)4s$ and $(^2F)4p$ levels reported in S + C, all were found except for the a^1F_3 level and two of the $(^2F)4p$ levels, the unobserved S + C levels being listed in Table 8. Some $4p$ levels are unknown; the $(^2F)4p^3F_2, ^1G_4,$ and 1D_2 levels are still missing.

5.4. The Doubly Excited Levels

Only doubly excited levels of the lowest parent, a^5D , were listed in S + C. In this work no transitions were observed between doubly excited levels possibly because the

upper $4s4p$ levels were not excited in the hollow cathode lamp. However, a few transitions from the levels of the normal system were observed to three of the $3d^64s^2a^5D$ levels, and so these could be confirmed. The remaining doubly excited levels given in S + C are listed in Table 8, but these are unconfirmed.

6. TRANSITIONS AND SELECTION RULES

Many of the intermediate and high-lying energy levels in Co II are of mixed configurations. As a result, many more transitions are observed than would be expected in pure *LS* coupling. The only selection rules that appear to apply are those of electric dipole radiation, i.e., a change of parity and $\Delta J = 0, \pm 1$ (but not $J = 0 \rightarrow J = 0$). The strongest observed lines lie in the ultraviolet spectral region and are transitions between levels of the same multiplicity with $\Delta L = 0, \pm 1$ (but not $L = 0 \rightarrow L = 0$), as expected from *LS* selection rules. In general the strongest transitions in a particular multiplet are those with levels of the greatest *J* for which the *J*-value changes in the same direction as the value of *L*. The transitions with $\Delta J = 0$ are weaker, and the weakest are those for changes of *J* in the opposite direction to the changes in the value of *L*.

Apart from these strong transitions there are many lines that do not obey the *LS* selection rules. These "intercombination" lines are transitions between levels of differing multiplicities or with $\Delta L > 1$. The fact that a greater number of lines is observed than allowed by the *LS* selection rules facilitates the confirmation of new energy levels because of the large number of transitions to each new level.

7. THEORETICAL CALCULATIONS USING AN ORTHOGONAL OPERATOR METHOD

The calculations used in this work to predict energy level values and transition probabilities and to give eigenvector compositions were made using the orthogonal operator method. This orthogonal operator method can be seen as a continuation of the Slater-Condon theory of atomic spectra. In the Slater-Condon theory, the Coulomb interaction between the electrons is described by means of the Slater *F*- and *G*-integrals, while the magnetic interaction due to the motion of the nucleus in the rest frame of an electron is translated into the well-known spin-orbit interaction. These interactions, however, are not orthogonal, which implies that adding another interaction to the system would influence the values of all previous interaction constants.

Roughly a decade ago, this system was orthogonalized (Judd, Hansen, & Raassen 1982; Hansen, Uylings, & Raassen 1988). As the parameters in the new operator set are as independent as possible, the fits are highly stabilized, which offers the possibility of including new operators that account for small interactions such as higher order or pure relativistic effects. As a result, the mean error σ of the fit is reduced by an order of magnitude in a physically significant way.

Although the method is semiempirical in character, ab initio calculations do constitute an important part of the procedure, especially to describe relativistic, e.g., fine-structure effects. Even without varying its additional parameters, the orthogonal operator method still provides an improved description of complex spectra (Raassen & Uylings 1996), in view of the required eigenvector accuracy obtained.

FIG. 4.—Ultraviolet (ICFTS) Co II line exhibiting hyperfine structure. The observed and fitted line profiles (*dashed line*), hyperfine components, and transition diagram for the Co II 2653.7133 Å (37671.833 cm^{-1}) transition.

With respect to the classical Slater-Condon type calculations of transition probabilities, the differences are twofold: First, as the level positions and thereby the spacing between them are described in more detail, one may

suppose that the corresponding eigenvectors are more accurate. These eigenvectors are used to transform the transition probabilities in pure LS coupling to the real intermediate coupling scheme. Second, the transition integrals calculated

FIG. 5.—Observed *HST* and synthetic (*dashed curve*) spectrum of χ Lupi showing (i) the predicted Co II transition involving the old incorrect a^1G_4 level and (ii) the transition, which has since been identified, in Co II to the newly found a^1G_4 level.

by means of MCDF are corrected for the effect of core polarization. We find that this correction, which is commonly a reduction of the transition integral, improves the agreement with absolute transition probabilities from experiment.

After completing the fitting procedure, eigenvalues and eigenvectors are obtained from the diagonalization of the Hamiltonian. The eigenvectors yield the composition of the actual state in terms of pure LS coupling, i.e., the LS term fractions. They are used to transform the pure LS transition matrix into the factual transition probabilities in intermediate coupling. The angular part of the LS transition matrix is calculated from straightforward Racah algebra, and the radial transition integral is obtained from the MCDF program (Parpia, Froese Fischer, & Grant 1996). In summary, the semiempirical method thus consists of the following steps:

1. Fitting eigenvalues of a model Hamiltonian containing adjustable parameters to the experimental energies.
2. Obtaining eigenvectors from a diagonalization of this Hamiltonian at the end of the fitting procedure.
3. Using theoretical (Hartree-Fock) values for the radial transition integrals to obtain line strengths in pure LS coupling.
4. Transforming these LS -values by means of the semiempirical eigenvectors to the final $\log(gf)$ or A -values.

For more details on the method and for information on the parameter values and their behavior, we refer to a recently published overview article on $d^{N-1}p$ configurations (Uylings & Raassen 1996).

8. HYPERFINE STRUCTURE IN Co II

In the spectral analysis of sharp-lined stars, it is important to account for the hfs when producing synthetic spectra. For example, if a line that is being used to determine an elemental abundance happens to be a blend with a line that has hfs, then the accuracy of the abundance determined will depend on how well the hfs of the blending line is

allowed for. This was highlighted in recent work on estimates of the age of the Galaxy where knowledge of the hfs of certain Co I lines (Pickering & Semeniuk 1995) proved to be crucial to the result.

The observed cobalt lines exhibit varying amounts of hfs, depending on the size of the A and B splitting factors of the levels involved in a particular transition. For the majority of Co II lines, the hfs is seen as a general asymmetrical broadening of the line profile. Resolution is limited by the Doppler widths of the lines (the instrumental width in all spectra was at least a factor of 4 smaller than the Doppler width), and in some cases where the A factors are large there is partial resolution of the pattern. The observed pattern widths can be as broad as 800 mK. In Figure 1 there are two examples of transitions exhibiting line profiles with a characteristic “flag” pattern, where one of the levels involved has a much larger A splitting factor than the other. The other Co II transitions in this spectral region show relatively modest broadening due to hfs. In general, as expected, it is the transitions to the lower $4s$ levels that show pronounced line broadening. Pickering (1996) presented the results of an extended measurement of the hfs of 82% of the Co I energy levels involving the analysis of over 1000 line profiles, and an extensive analysis of the hfs of the Co II levels is currently being undertaken by J. C. Pickering at IC, the results of which will be presented in a future publication. There are no previous reports of measurements of hfs splitting factors in Co II.

The hfs analysis in progress makes use of a program developed by J. Brault and R. Engleman that fits observed transition line profiles using information of the I -value, J -values, the known intensity ratios of the transition components (Kuhn 1962), the widths of the components, the COG of the pattern, and the A and B hfs splitting factors of the levels. If the hfs splitting factors and J -values are known for one of the levels, then they may be unambiguously determined for the other level using this fitting program. During the analysis of Co I hfs, it was found that even when the hfs patterns were not resolved into individual peaks, it was still possible to measure the A splitting factors accurately.

An example of an ultraviolet Co II line exhibiting hfs is shown in Figure 4. The A factors for the $3d^7(^4P)4s\ a^5P$ levels have been found from transitions to the $3d^7(^4P)4p\ z^5S_2$ level whose A factor was small, approximately 5 mK. The errors, in this case, are a few mK. These hfs factors are given in Table 9.

9. EXAMPLE OF AN ASTROPHYSICAL APPLICATION

An example of a recent astrophysical application of this Co II work is seen in the analysis of the spectrum of the chemically peculiar star χ Lupi, obtained using the *HST*'s GHRS (Leckrone et al. 1998). In a synthetic spectrum fit to the observed spectrum, it was noticeable that lines involving the $a\ ^1G_4$ level were predicted to be strong but were not seen although χ Lupi is known to contain Co II (Zethson et al. 1998). In this paper the $a\ ^1G_4$ level is found, and the old level value is discarded as incorrect. As a direct result a problem discovered in the stellar spectrum of χ Lupi has now been solved. Figure 5 shows two sections of *HST* spectrum of χ Lupi (D. Leckrone et al. 1997, private communication). The bold line represents the observed stellar spectrum, while the dotted line is the synthetic spectrum calculated using known energy levels of atomic species. In the left-hand panel of Figure 5, a strong line of Co II is predicted around 185.33 nm using the incorrect $a\ ^1G_4$ level value, and it is not observed. In the right-hand panel of Figure 5, the spectral feature at 184.59 nm was unidentified, but it is in fact now known to be the Co II transition $3d^8\ a\ ^1G_4 - 3d^7(^2H)4p\ y\ ^1G_4$.

10. FUTURE WORK

Spectra in the VUV region beyond the limit of the IC FTS have been recorded by one of us (S. J.) with the 10.7 m normal incidence spectrograph at the National Institute of Standards and Technology, Gaithersburg, MD, using a water-cooled hollow cathode lamp. The spectra were

acquired using various carrier gases and mixtures: Ne, Ne + He, Ar, Ar + He, and Ar + He + Ne. The plate factor is $0.78\ \text{\AA}\ \text{mm}^{-1}$. Analysis of these spectra, calibrated using Ritz wavenumbers generated from the energy levels in this work, should yield values of the doubly excited energy levels.

11. SUMMARY

In the previous compilation of Co II energy levels, S + C listed 256 levels. The total number of known Co II levels is now 386, of which 171 have been newly found. The number of classified lines has doubled with a total of 2373 classified lines being presented, of which 1242 involve the new levels presented in this work and 326 involve levels that have been reassigned configuration or term labels. In this work six of the levels listed in S + C have been discarded as incorrect, and several previously unlabeled levels have been assigned configuration and term labels; a further 35 S + C levels are not observed.

Relatively few significant levels remain unknown. It is principally the doubly excited levels of the $3d^6(^5D)4s(^6D)4p$ and $3d^6(^5D)4s(^4D)4p$ configurations which are noticeably absent.

Almost all of the strongest Co II lines in the visible region have now been identified. There remain a number of weak unidentified lines in the ultraviolet and infrared that may be either Co I or Co II.

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TABLE 1
Co II VISIBLE UV LINE LIST

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O - C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)	
1.78.....	7	94	6118.7180	16338.770	-0.001	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (4.5)[4.5] ₅	
1.98.....	10	104	6112.5458	16355.268	0.001	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (4.5)[5.5] ₅	
1.85.....	7	115	6110.5538	16360.600	0.004	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (4.5)[4.5] ₄	
1.62.....	7	74	6099.1739	16391.126	-0.011	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (4.5)[3.5] ₄	
1.36.....	4	74	6099.0811	16391.375	0.000	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (4.5)[3.5] ₃	
2.18.....	18	125	6064.5442	16484.721	0.050	$3d^7(^4F)4d$	e^3P_2	-	$3d^7(^4F)4f$ (4.5)[2.5] ₂	Ne
1.85.....	5	219	6051.0850	16521.387	0.020	$3d^7(^4F)4d$	e^3P_2	-	$3d^7(^4F)4f$ (4.5)[1.5] ₁	
1.95.....	16	102	6031.8299	16574.127	-0.002	$3d^7(^4F)4d$	f^3F_3	-	$3d^7(^4F)4f$ (3.5)[3.5] ₄	
1.72.....	6	155	6019.4902	16608.103	-0.033	$3d^7(^4F)4d$	f^3F_3	-	$3d^7(^4F)4f$ (3.5)[2.5] ₃	
1.67.....	4	215	6013.5055	16624.631	0.028	$3d^7(^4F)4d$	f^3F_3	-	$3d^7(^4P)5p$ ⁵ D ₄	
2.30.....	33	125	6006.3470	16644.445	0.055	$3d^7(^4F)4d$	e^3P_1	-	$3d^7(^4P)5p$ ⁵ D ₂	DI
1.88.....	12	182	5940.4853	16828.979	-0.017	$3d^7(^4F)4d$	f^3F_2	-	$3d^7(^4F)4f$ (2.5)[2.5] ₃	DI
1.67.....	6	240	5930.0794	16858.510	0.008	$3d^7(^4F)4d$	f^3F_2	-	$3d^7(^4F)4f$ (2.5)[1.5] ₂	
1.41.....	5	172	5914.7758	16902.128	0.048	$3d^7(^4F)4d$	e^3P_0	-	$3d^7(^4F)4f$ (2.5)[0.5] ₁	
1.52.....	11	120	5828.9754	17150.919	0.007	$3d^7(^4F)4d$	e^3P_1	-	$3d^7(^4F)4f$ (2.5)[2.5] ₂	
1.36.....	9	99	5826.8478	17157.181	-0.022	$3d^7(^4F)4d$	e^3P_1	-	$3d^7(^4F)4f$ (2.5)[1.5] ₁	
1.48.....	9	136	5820.9244	17174.640	0.025	$3d^7(^4F)4d$	f^3F_3	-	$3d^7(^4F)4f$ (2.5)[4.5] ₄	D
1.48.....	9	136	5820.9244	17174.640	0.189	$3d^7(^4F)5p$ ⁵ D ₄	-	$3d^7(^4F)5d$ ⁵ H ₅	D	
1.75.....	16	141	5818.5197	17181.738	-0.020	$3d^7(^4F)4d$	f^3F_3	-	$3d^7(^4F)4f$ (2.5)[3.5] ₃	
2.04.....	35	148	5816.6994	17187.115	0.000	$3d^7(^4F)4d$	f^3F_3	-	$3d^7(^4F)4f$ (2.5)[3.5] ₄	UP
1.64.....	13	132	5816.0428	17189.055	-0.001	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (3.5)[4.5] ₄	
2.18.....	54	115	5811.6693	17201.991	0.005	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (3.5)[5.5] ₅	
1.59.....	14	115	5811.0162	17203.924	-0.002	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (3.5)[3.5] ₄	
2.02.....	15	296	5798.5617	17240.875	0.000	$3d^7(^4F)4d$	f^3F_2	-	$3d^7(^4F)4f$ (1.5)[2.5] ₃	
1.55.....	13	115	5793.4162	17256.188	0.000	$3d^7(^4F)4d$	e^3P_2	-	$3d^7(^4F)4f$ (3.5)[3.5] ₃	
1.86.....	18	173	5781.3523	17292.196	0.065	$3d^7(^4F)4d$	e^3P_2	-	$3d^7(^4F)4f$ (3.5)[2.5] ₂	D
1.86.....	18	173	5781.3523	17292.196	-0.283	$3d^7(^4F)4d$	f^3F_2	-	$3d^7(^4F)4f$ (1.5)[1.5] ₂	D
1.75.....	12	207	5771.8484	17320.669	-0.008	$3d^7(^4F)4d$	e^3P_0	-	$3d^7(^4F)4f$ (1.5)[1.5] ₁	
1.48.....	11	122	5771.4679	17321.811	0.009	$3d^7(^4F)4d$	e^3P_2	-	$3d^7(^4F)4f$ (3.5)[1.5] ₁	
1.15.....	5	120	5769.5788	17327.482	-0.020	$3d^7(^4F)4d$	e^3P_2	-	$3d^7(^4P)5p$ ⁵ D ₃	
1.08.....	5	123	5725.5330	17460.779	0.011	$3d^7(^4F)4d$	e^3P_1	-	$3d^7(^4P)5p$ ³ D ₂	
1.92.....	39	104	5689.3133	17571.938	0.001	$3d^7(^4F)4d$	f^3F_3	-	$3d^7(^4F)4f$ (1.5)[3.5] ₄	
1.72.....	11	227	5688.1795	17575.441	-0.057	$3d^7(^4F)4d$	e^3P_1	-	$3d^7(^4F)4f$ (1.5)[2.5] ₂	U
1.49.....	7	219	5675.0857	17615.991	0.003	$3d^7(^4F)4d$	f^3F_3	-	$3d^7(^4F)4f$ (1.5)[2.5] ₃	
1.39.....	5	244	5670.3810	17630.607	-0.037	$3d^7(^4F)4d$	e^3P_1	-	$3d^7(^4F)4f$ (1.5)[1.5] ₂	
1.63.....	10	219	5668.6338	17636.041	-0.019	$3d^7(^4F)4d$	e^3P_1	-	$3d^7(^4F)4f$ (1.5)[1.5] ₁	
1.78.....	34	96	5616.4222	17799.988	-0.002	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (2.5)[4.5] ₄	
1.55.....	16	122	5611.0883	17816.908	-0.004	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (2.5)[3.5] ₄	
1.38.....	11	125	5601.3003	17848.042	0.001	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (2.5)[5.5] ₅	
1.02.....	4	155	5599.5001	17853.780	-0.034	$3d^7(^4F)5p$ ³ G ₃	-	$3d^7(^2H)4d$ ³ F ₃		
1.59.....	17	124	5593.8173	17871.918	-0.003	$3d^7(^4F)4d$	e^3P_2	-	$3d^7(^4F)4f$ (2.5)[3.5] ₃	
1.45.....	14	112	5591.9040	17878.033	0.010	$3d^7(^4F)4d$	e^3P_2	-	$3d^7(^4F)4f$ (2.5)[2.5] ₂	
0.85.....	6	68	5577.6464	17923.732	-0.046	$3d^7(^4F)4d$	e^3P_2	-	$3d^7(^4F)4f$ (2.5)[1.5] ₂	
1.32.....	4	149	5527.1952	18087.335	0.031	$3d^7(^4F)4d$	e^3H_4	-	$3d^7(^4F)4f$ (3.5)[2.5] ₃	I
0.96.....	4	179	5517.8807	18117.867	0.000	$3d^7(^4F)4d$	e^3D_2	-	$3d^7(^4F)4f$ (4.5)[2.5] ₃	
1.44.....	9	179	5517.7865	18118.177	-0.003	$3d^7(^4F)4d$	e^3D_2	-	$3d^7(^4F)4f$ (4.5)[2.5] ₂	
1.55.....	14	158	5506.6352	18154.866	-0.010	$3d^7(^4F)4d$	e^3D_2	-	$3d^7(^4F)4f$ (4.5)[1.5] ₁	
1.26.....	9	131	5505.2775	18159.344	-0.015	$3d^7(^4F)4d$	e^3G_4	-	$3d^7(^4F)4f$ (4.5)[4.5] ₅	
1.66.....	18	155	5500.2747	18175.860	0.005	$3d^7(^4F)4d$	e^3G_4	-	$3d^7(^4F)4f$ (4.5)[5.5] ₅	
1.47.....	9	197	5498.6672	18181.174	-0.010	$3d^7(^4F)4d$	e^3G_4	-	$3d^7(^4F)4f$ (4.5)[4.5] ₄	
1.49.....	8	252	5489.4200	18211.801	0.076	$3d^7(^4F)4d$	e^3G_4	-	$3d^7(^4F)4f$ (4.5)[3.5] ₄	D
1.49.....	8	252	5489.4200	18211.801	-0.162	$3d^7(^4F)4d$	e^3G_4	-	$3d^7(^4F)4f$ (4.5)[3.5] ₃	D
1.29.....	6	206	5474.4140	18261.721	-0.008	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)4f$ (1.5)[4.5] ₅	
1.08.....	5	147	5471.6912	18270.808	0.008	$3d^7(^4F)4d$	e^5G_2	-	$3d^7(^4F)4f$ (4.5)[1.5] ₁	
1.14.....	6	142	5461.1240	18306.161	0.010	$3d^7(^4F)4d$	e^3P_2	-	$3d^7(^4F)4f$ (1.5)[2.5] ₃	
1.31.....	6	227	5437.6969	18385.029	0.002	$3d^7(^4F)4d$	e^3H_6	-	$3d^7(^4F)4f$ (4.5)[6.5] ₆	
1.56.....	13	186	5426.7599	18422.081	0.055	$3d^7(^4F)5p$ ³ F ₄	-	$3d^7(^2H)4d$ ³ F ₄	DI	
1.52.....	8	282	5426.5723	18422.718	-0.017	$3d^7(^4F)4d$	e^3G_3	-	$3d^7(^4F)4f$ (3.5)[3.5] ₄	
1.11.....	8	105	5423.8279	18432.040	-0.006	$3d^7(^4F)4d$	e^5G_3	-	$3d^7(^4F)4f$ (4.5)[4.5] ₄	
1.29.....	5	262	5416.5702	18456.736	-0.006	$3d^7(^4F)4d$	e^3G_3	-	$3d^7(^4F)4f$ (3.5)[2.5] ₃	
0.99.....	5	130	5414.8540	18462.586	-0.001	$3d^7(^4F)4d$	e^5G_3	-	$3d^7(^4F)4f$ (4.5)[3.5] ₄	B
1.30.....	10	130	5414.7886	18462.809	-0.016	$3d^7(^4F)4d$	e^5G_3	-	$3d^7(^4F)4f$ (4.5)[3.5] ₃	B
1.35.....	11	139	5411.7864	18473.051	0.049	$3d^7(^4F)4d$	e^3H_6	-	$3d^7(^4F)4f$ (4.5)[6.5] ₇	D
1.35.....	11	139	5411.7864	18473.051	-0.158	$3d^7(^4F)4d$	e^3G_3	-	$3d^7(^4P)5p$ ⁵ D ₄	D
0.96.....	6	140	5405.2326	18495.450	0.007	$3d^7(^4F)4d$	e^5G_3	-	$3d^7(^4F)4f$ (4.5)[2.5] ₃	B
1.18.....	8	140	5405.1467	18495.743	-0.012	$3d^7(^4F)4d$	e^5G_3	-	$3d^7(^4F)4f$ (4.5)[2.5] ₂	B
2.06.....	77	103	5396.7259	18524.603	-0.002	$3d^7(^4F)4d$	e^3H_6	-	$3d^7(^4F)4f$ (4.5)[7.5] ₇	
1.13.....	5	189	5393.2031	18536.703	-0.012	$3d^7(^4F)4d$	e^3H_3	-	$3d^7(^4F)4f$ (3.5)[3.5] ₄	
1.49.....	8	260	5384.3530	18567.171	0.015	$3d^7(^4F)4d$	e^3H_3	-	$3d^7(^4F)4f$ (3.5)[4.5] ₅	
1.44.....	13	151	5382.6160	18573.163	0.001	$3d^7(^4F)4d$	e^3H_5	-	$3d^7(^4F)4f$ (3.5)[5.5] ₆	
2.37.....	77	201	5369.8707	18617.245	0.003	$3d^7(^4F)4d$	e^5D_2	-	$3d^7(^4F)4f$ (3.5)[3.5] ₃	U

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
2.12.....	73	133	5368.5897	18621.687	0.001	$3d^7(^4F)4d$	e^3H_5	$3d^7(^4F)4f$	(3.5)[6.5] ₆
1.11.....	5	200	5364.4843	18635.938	-0.013	$3d^7(^4F)5p$	3D_3	$3d^7(^2H)4d$	3F_3
1.57.....	10	275	5360.6239	18649.359	-0.003	$3d^7(^4F)4d$	e^3H_4	$3d^7(^4F)4f$	(2.5)[4.5] ₅
1.86.....	20	318	5351.3906	18681.536	-0.013	$3d^7(^4F)4d$	e^3G_5	$3d^7(^4F)4f$	(4.5)[6.5] ₆
1.74.....	28	146	5348.7117	18690.892	0.002	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(4.5)[4.5] ₄
1.19.....	7	160	5346.9720	18696.974	0.024	$3d^7(^4F)4d$	e^5D_2	$3d^7(^4F)4f$	(3.5)[0.5] ₁
1.85.....	25	212	5346.8469	18697.411	-0.001	$3d^7(^4F)4d$	e^3H_4	$3d^7(^4F)4f$	(2.5)[5.5] ₅
2.02.....	65	139	5344.5659	18705.391	0.001	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(4.5)[3.5] ₃
1.74.....	18	109	5339.9885	18721.425	-0.006	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(4.5)[3.5] ₄
1.94.....	44	148	5339.9188	18721.669	0.000	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(4.5)[3.5] ₃
1.22.....	7	183	5339.0585	18724.686	0.007	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(4.5)[4.5] ₅
1.32.....	7	222	5335.1725	18738.324	0.004	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(4.5)[2.5] ₂
1.03.....	2	189	5333.7521	18743.314	0.039	$3d^7(^4F)4d$	e^3G_5	$3d^7(^4F)4f$	(4.5)[5.5] ₆
1.33.....	9	173	5332.8455	18746.501	-0.004	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(4.5)[4.5] ₄
0.92.....	6	99	5331.6745	18750.618	-0.009	$3d^7(^4F)4d$	e^3G_5	$3d^7(^4F)4f$	(4.5)[4.5] ₅
1.18.....	8	122	5330.6354	18754.273	-0.013	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(4.5)[2.5] ₃
1.72.....	33	122	5330.5435	18754.596	-0.003	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(4.5)[2.5] ₂
1.75.....	35	124	5326.9865	18767.119	-0.004	$3d^7(^4F)4d$	e^3G_5	$3d^7(^4F)4f$	(4.5)[5.5] ₅
1.31.....	8	182	5324.7449	18775.020	0.004	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(4.5)[1.5] ₁
1.19.....	8	156	5324.1705	18777.045	0.000	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(4.5)[3.5] ₄
1.22.....	9	156	5324.1030	18777.283	0.000	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(4.5)[3.5] ₃
1.99.....	40	218	5321.7139	18785.713	-0.036	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(4.5)[1.5] ₂
0.92.....	5	124	5314.8651	18809.920	0.020	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(4.5)[2.5] ₃
2.49.....	205	133	5312.6493	18817.765	-0.006	$3d^7(a^2D)4p$	y^1F_3	$3d^7(^4F)4d$	e^5G_4
1.35.....	8	111	5311.9807	18820.134	0.000	$3d^7(^4F)4d$	e^5H_4	$3d^7(^4F)4f$	(3.5)[5.5] ₅
0.99.....	3	113	5297.2375	18872.513	-0.035	$3d^7(^4F)4d$	e^5H_4	$3d^7(^4P)5p$	5D_4
1.04.....	3	126	5293.6574	18885.276	-0.008	$3d^7(^4F)4d$	e^5H_4	$3d^7(^4P)5p$	5D_3
3.17.....	558	239	5280.6266	18931.878	0.070	$3d^7(^4F)4d$	e^3D_2	$3d^7(^4F)4f$	(3.5)[2.5] ₃
1.59.....	17	186	5275.1986	18951.358	-0.003	$3d^7(^4F)4d$	e^3D_2	$3d^7(^4F)4f$	(3.5)[1.5] ₂
1.71.....	17	238	5272.1386	18962.358	0.003	$3d^7(^4F)4d$	e^3D_1	$3d^7(^4F)4f$	(2.5)[1.5] ₂
1.79.....	23	216	5270.1692	18969.444	0.039	$3d^7(^4F)4d$	e^3D_2	$3d^7(^4F)4f$	(3.5)[0.5] ₁
1.79.....	23	216	5270.1692	18969.444	-0.031	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4F)4f$	(3.5)[4.5] ₄
2.99.....	774	117	5266.2981	18983.387	0.237	$3d^7(^4F)4d$	e^3D_1	$3d^7(^4F)4f$	(2.5)[0.5] ₁
1.94.....	15	238	5264.8129	18988.743	-0.023	$3d^7(^4F)5p$	5F_3	$3d^7(^2H)4d$	3F_4
2.12.....	51	209	5259.4421	19008.133	-0.003	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4F)4f$	(3.5)[4.5] ₅
1.63.....	14	247	5259.0223	19009.650	0.006	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4F)4f$	(3.5)[4.5] ₄
2.73.....	96	400	5257.1744	19016.332	-0.078	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4F)4f$	(3.5)[3.5] ₃
1.68.....	23	172	5256.6162	19018.351	-0.001	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4F)4f$	(3.5)[2.5] ₃
1.55.....	9	335	5255.2681	19023.230	0.009	$3d^7(^4F)4d$	e^3G_3	$3d^7(^4F)4f$	(2.5)[4.5] ₄
1.23.....	6	226	5254.9192	19024.493	-0.021	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4F)4f$	(3.5)[3.5] ₄
1.36.....	7	271	5253.3019	19030.350	-0.014	$3d^7(^4F)4d$	e^3G_3	$3d^7(^4F)4f$	(2.5)[3.5] ₃
1.95.....	16	438	5252.5845	19032.949	0.008	$3d^7(^4F)4d$	e^5H_6	$3d^7(^4F)4f$	(4.5)[6.5] ₆
1.32.....	16	107	5252.0708	19034.811	-0.008	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4P)5p$	5D_4
1.69.....	13	297	5251.8189	19035.724	0.003	$3d^7(^4F)4d$	e^3G_3	$3d^7(^4F)4f$	(2.5)[3.5] ₄
1.41.....	17	124	5251.2184	19037.900	-0.005	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4F)4f$	(3.5)[1.5] ₂
2.13.....	91	120	5249.3638	19044.626	0.002	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4F)4f$	(4.5)[5.5] ₅
1.38.....	8	238	5248.5390	19047.619	0.064	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4P)5p$	5D_3
1.72.....	14	305	5247.5765	19051.113	0.008	$3d^7(^4F)4d$	e^3H_4	$3d^7(^4F)4f$	(1.5)[3.5] ₄
1.22.....	6	230	5245.5377	19058.518	-0.003	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4F)4f$	(3.5)[2.5] ₃
1.06.....	5	210	5243.9704	19064.214	0.024	$3d^7(^4F)4d$	e^5P_1	$3d^7(^4F)4f$	(3.5)[1.5] ₂
1.33.....	8	209	5242.8859	19068.157	0.017	$3d^7(^4F)4d$	e^5P_1	$3d^7(^4F)4f$	(3.5)[1.5] ₁
1.75.....	13	365	5241.0115	19074.976	-0.012	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4P)5p$	5D_4
2.14.....	94	122	5239.4958	19080.495	0.001	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4F)4f$	(4.5)[3.5] ₄
0.83.....	5	122	5239.4306	19080.732	0.000	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4F)4f$	(4.5)[3.5] ₃
1.34.....	9	202	5239.0156	19082.243	0.009	$3d^7(^4F)4d$	e^5P_1	$3d^7(^4F)4f$	(3.5)[0.5] ₁
1.34.....	9	202	5239.0156	19082.243	0.022	$3d^7(^4F)4d$	e^3G_3	$3d^7(^4F)4f$	(2.5)[1.5] ₂
1.35.....	19	100	5235.6072	19094.666	-0.001	$3d^7(^4F)4d$	e^5H_6	$3d^7(^4F)4f$	(4.5)[5.5] ₆
1.05.....	10	89	5233.5951	19102.007	-0.012	$3d^7(^4F)4d$	e^5H_6	$3d^7(^4F)4f$	(4.5)[4.5] ₅
2.78.....	367	135	5231.1069	19111.093	-0.007	$3d^7(^4F)4d$	e^3H_4	$3d^7(^4F)4f$	(1.5)[4.5] ₅
1.82.....	47	118	5230.4894	19113.349	0.000	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4F)4f$	(4.5)[2.5] ₃
1.24.....	7	197	5229.0883	19118.470	0.056	$3d^7(^4F)4d$	e^3H_4	$3d^7(^4F)4f$	(1.5)[4.5] ₄
1.24.....	7	197	5229.0883	19118.470	-0.045	$3d^7(^4F)4d$	e^5H_6	$3d^7(^4F)4f$	(4.5)[5.5] ₅
1.35.....	16	119	5228.4212	19120.910	-0.007	$3d^7(^4F)4d$	e^5H_6	$3d^7(^4F)4f$	(4.5)[6.5] ₇
1.35.....	16	119	5228.4212	19120.910	-0.025	$3d^7(^4F)4d$	e^5G_2	$3d^7(^4P)5p$	5D_2
1.83.....	18	316	5223.9723	19137.193	-0.008	$3d^7(^4F)4d$	e^5H_3	$3d^7(^4F)4f$	(2.5)[4.5] ₄
0.99.....	5	169	5220.5449	19149.757	0.056	$3d^7(^4F)4d$	e^5H_3	$3d^7(^4F)4f$	(2.5)[3.5] ₄
1.21.....	10	128	5217.0560	19162.563	-0.010	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(4.5)[3.5] ₃
1.52.....	8	363	5215.9327	19166.690	-0.005	$3d^7(^4F)4d$	e^5H_3	$3d^7(^4F)4f$	(2.5)[2.5] ₃
3.02.....	825	107	5214.3464	19172.521	0.001	$3d^7(^4F)4d$	e^5H_6	$3d^7(^4F)4f$	(4.5)[7.5] ₇
2.01.....	40	212	5212.4221	19179.599	0.001	$3d^7(^4F)4d$	e^3H_5	$3d^7(^4F)4f$	(2.5)[4.5] ₅
1.61.....	21	187	5211.6898	19182.294	-0.017	$3d^7(a^2D)4s$	b^1D_2	$3d^7(^4F)4p$	z^3F_3
1.69.....	16	252	5208.1111	19195.475	0.278	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(4.5)[2.5] ₃

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)	
1.69.....	16	252	5208.1111	19195.475	-0.028	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(4.5)[2.5] ₂	D
1.17.....	5	229	5207.8233	19196.535	0.015	$3d^7(^4F)4d$	e^3H_5	$3d^7(^4F)4f$	(2.5)[3.5] ₄	
1.17.....	7	200	5201.5205	19219.796	0.000	$3d^7(^4F)4d$	e^3D_1	$3d^7(^4F)4f$	(2.5)[0.5] ₁	
1.33.....	5	334	5199.6901	19226.562	0.107	$3d^7(^4F)4d$	e^3D_1	$3d^7(^4F)5p$	³ D ₂	D
1.33.....	5	334	5199.6901	19226.562	-0.091	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(4.5)[1.5] ₂	D
2.86.....	497	124	5199.5131	19227.216	0.000	$3d^7(^4F)4d$	e^3H_5	$3d^7(^4F)4f$	(2.5)[5.5] ₆	
1.13.....	7	154	5199.3887	19227.676	0.027	$3d^7(^4F)4d$	e^3H_5	$3d^7(^4F)4f$	(2.5)[5.5] ₅	
1.68.....	22	179	5198.1653	19232.201	0.002	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(4.5)[1.5] ₁	
0.83.....	4	151	5193.8071	19248.339	0.064	$3d^7(^4F)5p$	³ G ₅	$3d^7(^2H)4d$	³ F ₄	
1.67.....	29	138	5191.9221	19255.327	0.001	$3d^7(^4F)4d$	e^5D_2	$3d^7(^4F)4f$	(2.5)[2.5] ₃	
1.28.....	11	150	5190.5229	19260.518	0.012	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4F)4f$	(3.5)[4.5] ₄	
1.62.....	26	139	5186.5207	19275.380	0.004	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4F)4f$	(3.5)[3.5] ₄	
1.06.....	9	114	5186.0254	19277.221	-0.005	$3d^7(^4F)4d$	e^5D_0	$3d^7(^4F)4f$	(2.5)[1.5] ₁	
1.41.....	13	164	5185.3117	19279.874	-0.015	$3d^7(^4F)4d$	e^5H_5	$3d^7(^4F)4f$	(3.5)[4.5] ₅	
1.63.....	34	107	5183.9790	19284.831	-0.001	$3d^7(^4F)4d$	e^5D_2	$3d^7(^4F)4f$	(2.5)[1.5] ₂	
2.05.....	76	127	5181.4285	19294.323	-0.004	$3d^7(^4F)4d$	e^5H_5	$3d^7(^4F)4f$	(3.5)[5.5] ₅	
1.01.....	5	163	5178.3940	19305.629	0.001	$3d^7(^4F)4d$	e^5D_2	$3d^7(^4F)4f$	(2.5)[0.5] ₁	
2.24.....	97	154	5177.5200	19308.888	0.001	$3d^7(^4F)4d$	e^3H_6	$3d^7(^4F)4f$	(3.5)[5.5] ₆	
1.81.....	43	184	5177.3804	19309.409	0.026	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4F)4f$	(3.5)[2.5] ₃	DI
2.44.....	46	513	5176.9487	19311.019	0.002	$3d^7(^4F)4d$	e^5G_5	$3d^7(^4F)4f$	(4.5)[6.5] ₆	
0.88.....	6	116	5175.2687	19317.288	-0.031	$3d^7(^4F)4d$	e^3H_6	$3d^7(^4F)4f$	(3.5)[5.5] ₅	
1.49.....	14	183	5172.9759	19325.850	0.000	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4P)5p$	⁵ D ₄	
1.33.....	10	187	5172.1498	19328.936	0.000	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4F)4f$	(3.5)[1.5] ₂	
2.90.....	621	111	5170.6834	19334.418	-0.001	$3d^7(^4F)4d$	e^5H_5	$3d^7(^4F)4f$	(3.5)[6.5] ₆	
1.55.....	18	175	5169.8652	19337.478	-0.008	$3d^7(^4F)4d$	e^5D_0	$3d^7(^4F)4f$	(2.5)[0.5] ₁	
1.16.....	6	213	5168.8708	19341.198	0.013	$3d^7(^4F)4d$	e^3D_1	$3d^7(^4F)4f$	(1.5)[2.5] ₂	
1.46.....	22	112	5167.5570	19346.116	-0.003	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(4.5)[4.5] ₄	
1.22.....	11	130	5164.5411	19357.413	0.001	$3d^7(^4F)4d$	e^3H_6	$3d^7(^4F)4f$	(3.5)[6.5] ₆	
3.01.....	766	126	5163.1507	19362.625	-0.002	$3d^7(^4F)4d$	e^3H_6	$3d^7(^4F)4f$	(3.5)[6.5] ₇	
1.80.....	48	115	5160.4540	19372.743	0.000	$3d^7(^4F)4d$	e^5G_5	$3d^7(^4F)4f$	(4.5)[5.5] ₆	
1.90.....	64	185	5159.4112	19376.659	0.000	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(4.5)[3.5] ₄	B
1.60.....	32	185	5159.3518	19376.882	-0.015	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(4.5)[3.5] ₃	B
2.36.....	115	170	5158.4989	19380.086	-0.009	$3d^7(^4F)4d$	e^5G_5	$3d^7(^4F)4f$	(4.5)[4.5] ₅	I
2.36.....	100	205	5154.1057	19396.605	0.274	$3d^7(^4F)4d$	e^3D_1	$3d^7(^4F)4f$	(1.5)[1.5] ₂	DI
2.36.....	100	205	5154.1057	19396.605	0.014	$3d^7(^4F)4d$	e^5G_5	$3d^7(^4F)4f$	(4.5)[5.5] ₅	DI
1.38.....	16	134	5152.7595	19401.672	-0.075	$3d^7(^4F)4d$	e^3D_1	$3d^7(^4F)4f$	(1.5)[1.5] ₁	
1.74.....	40	118	5152.6932	19401.922	0.002	$3d^7(^4F)4d$	e^5G_5	$3d^7(^4F)4f$	(4.5)[4.5] ₄	
1.45.....	25	101	5152.5899	19402.311	-0.002	$3d^7(^4F)4d$	e^5H_7	$3d^7(^4F)4f$	(4.5)[5.5] ₆	
2.09.....	86	189	5150.6758	19409.521	0.006	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(4.5)[2.5] ₃	B
1.79.....	39	189	5150.6026	19409.797	-0.030	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(4.5)[2.5] ₂	B
1.97.....	26	312	5147.7522	19420.544	0.001	$3d^7(^4F)4d$	e^3G_3	$3d^7(^4F)4f$	(1.5)[3.5] ₄	
1.65.....	17	232	5147.2184	19422.558	-0.002	$3d^7(^4F)4d$	e^5H_4	$3d^7(^4F)4f$	(2.5)[4.5] ₄	
2.54.....	185	165	5145.6278	19428.562	-0.001	$3d^7(^4F)4d$	e^5H_7	$3d^7(^4F)4f$	(4.5)[6.5] ₇	I
1.74.....	14	345	5145.3200	19429.724	0.004	$3d^7(^4F)4d$	e^3G_3	$3d^7(^4F)4f$	(1.5)[3.5] ₃	D
1.74.....	14	345	5145.3200	19429.724	0.021	$3d^7(^4F)4d$	e^5H_4	$3d^7(^4F)4f$	(2.5)[3.5] ₃	D
0.84.....	6	103	5144.5928	19432.471	0.010	$3d^7(^4F)4d$	e^5G_5	$3d^7(^4F)4f$	(4.5)[3.5] ₄	
1.68.....	21	203	5143.9080	19435.058	-0.002	$3d^7(^4F)4d$	e^5H_4	$3d^7(^4F)4f$	(2.5)[3.5] ₄	
2.10.....	84	133	5142.3420	19440.976	-0.001	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(4.5)[1.5] ₂	
1.70.....	14	316	5136.1055	19464.582	-0.012	$3d^7(^4F)4d$	e^3G_3	$3d^7(^4F)4f$	(1.5)[2.5] ₃	
2.81.....	481	117	5135.6814	19466.189	0.000	$3d^7(^4F)4d$	e^5H_4	$3d^7(^4F)4f$	(2.5)[5.5] ₅	
1.29.....	13	131	5131.9943	19480.175	0.009	$3d^7(^4F)4d$	e^5H_7	$3d^7(^4F)4f$	(4.5)[7.5] ₇	
2.36.....	134	152	5129.9725	19487.852	0.000	$3d^7(^4F)4d$	e^3G_3	$3d^7(^4F)4f$	(1.5)[4.5] ₄	
3.14.....	1154	107	5129.2024	19490.778	0.000	$3d^7(^4F)4d$	e^5H_7	$3d^7(^4F)4f$	(4.5)[7.5] ₈	
1.13.....	10	123	5125.3512	19505.423	-0.007	$3d^7(^4F)4d$	e^3D_2	$3d^7(^4F)4f$	(2.5)[3.5] ₃	
0.91.....	5	159	5124.2004	19509.804	-0.001	$3d^7(a^2D)4p$	y^1F_3	$3d^7(^4F)4d$	e^3D_2	D
0.91.....	5	159	5124.2004	19509.804	-0.033	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(3.5)[3.5] ₃	D
0.90.....	5	160	5123.7452	19511.537	0.005	$3d^7(^4F)4d$	e^3D_2	$3d^7(^4F)4f$	(2.5)[2.5] ₂	
1.63.....	32	118	5121.6939	19519.351	0.001	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(3.5)[4.5] ₄	
2.13.....	93	128	5119.9194	19526.117	0.000	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(3.5)[3.5] ₃	
2.26.....	123	115	5117.7980	19534.210	-0.010	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(3.5)[3.5] ₄	B
1.96.....	41	301	5117.7158	19534.524	0.001	$3d^7(^4F)4d$	e^5H_3	$3d^7(^4F)4f$	(1.5)[3.5] ₄	B
0.87.....	4	151	5113.9506	19548.906	-0.027	$3d^7(^4F)4d$	e^5D_2	$3d^7(^4P)5p$	³ D ₂	
2.00.....	62	140	5113.1558	19551.945	-0.003	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(3.5)[2.5] ₃	I
1.69.....	37	119	5110.5125	19562.058	0.006	$3d^7(a^2D)4p$	x^3P_2	$3d^7(^4F)4d$	e^3D_3	D
1.69.....	37	119	5110.5125	19562.058	-0.001	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(3.5)[2.5] ₂	D
2.38.....	86	290	5108.9016	19568.226	-0.001	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(3.5)[2.5] ₃	DI
2.04.....	77	127	5108.0467	19571.501	0.000	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(3.5)[1.5] ₂	
2.51.....	246	117	5107.5366	19573.455	-0.001	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(3.5)[4.5] ₅	
1.26.....	12	133	5107.1388	19574.980	0.016	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(3.5)[4.5] ₄	D
1.26.....	12	133	5107.1388	19574.980	-0.052	$3d^7(^4F)4d$	e^5H_3	$3d^7(^4F)4f$	(1.5)[2.5] ₂	D
2.17.....	54	246	5106.3951	19577.831	0.000	$3d^7(^4F)4d$	e^5D_1	$3d^7(^4F)4f$	(1.5)[2.5] ₂	
2.32.....	101	185	5104.5705	19584.829	-0.002	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4F)4f$	(2.5)[4.5] ₄	

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
2.02.....	60	155	5103.7715	19587.895	0.001	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(3.5)[5.5] ₅
1.89.....	56	124	5103.3415	19589.545	0.000	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(3.5)[0.5] ₁
2.08.....	89	120	5103.2660	19589.835	0.001	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(3.5)[3.5] ₄
1.83.....	32	190	5101.3014	19597.379	0.048	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4F)4f$	(2.5)[3.5] ₄
1.83.....	32	190	5101.3014	19597.379	-0.051	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4P)5p$	⁵ D ₃
2.15.....	81	157	5100.7744	19599.404	0.000	$3d^7(^4F)4d$	e^3G_5	$3d^7(^4F)4f$	(3.5)[4.5] ₅
1.59.....	19	190	5100.3766	19600.933	0.021	$3d^7(^4F)4d$	e^3G_5	$3d^7(^4F)4f$	(3.5)[4.5] ₄
2.52.....	205	147	5100.1375	19601.851	0.019	$3d^7(^4F)4d$	e^5H_3	$3d^7(^4F)4f$	(1.5)[4.5] ₄
2.76.....	441	117	5099.2122	19605.408	-0.002	$3d^7(^4F)4d$	e^3G_5	$3d^7(^4F)4f$	(3.5)[5.5] ₆
1.12.....	5	233	5097.6094	19611.572	0.011	$3d^7(^4F)4d$	f^5F_1	$3d^7(^4F)4f$	(3.5)[2.5] ₂
1.95.....	60	131	5097.0192	19613.844	0.002	$3d^7(^4F)4d$	e^3G_5	$3d^7(^4F)4f$	(3.5)[5.5] ₅
1.92.....	64	117	5096.8941	19614.325	0.000	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4F)4f$	(2.5)[2.5] ₃
2.51.....	152	192	5095.2691	19620.580	0.002	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4F)4f$	(2.5)[4.5] ₅
2.02.....	52	185	5095.0689	19621.351	-0.003	$3d^7(^4F)4d$	e^5G_2	$3d^7(^4F)4f$	(2.5)[3.5] ₃
1.42.....	20	121	5094.4305	19623.810	-0.031	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(3.5)[2.5] ₃
0.93.....	5	157	5094.2739	19624.413	0.052	$3d^7(^4F)4d$	e^5P_1	$3d^7(^4F)4f$	(2.5)[2.5] ₂
1.29.....	7	260	5094.1226	19624.996	-0.004	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4F)4f$	(2.5)[4.5] ₄
1.85.....	26	245	5093.4805	19627.470	0.014	$3d^7(^4F)4d$	e^5G_2	$3d^7(^4F)4f$	(2.5)[2.5] ₂
1.79.....	23	244	5092.2291	19632.293	0.150	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4F)4f$	(2.5)[3.5] ₃
1.79.....	23	244	5092.2291	19632.293	-0.038	$3d^7(^4F)4d$	e^5D_2	$3d^7(^4F)4f$	(1.5)[3.5] ₃
2.14.....	84	149	5092.0489	19632.988	0.011	$3d^7(^4F)4d$	e^5D_1	$3d^7(^4F)4f$	(1.5)[1.5] ₂
0.93.....	4	177	5091.8543	19633.738	-0.009	$3d^7(^4F)4d$	e^5G_2	$3d^7(^4F)4f$	(2.5)[1.5] ₁
1.82.....	44	138	5091.5799	19634.797	0.002	$3d^7(^4F)4d$	e^5P_3	$3d^7(^4F)4f$	(4.5)[4.5] ₄
2.07.....	38	281	5090.8728	19637.524	0.024	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4F)4f$	(2.5)[3.5] ₄
2.07.....	38	281	5090.8728	19637.524	-0.010	$3d^7(^2H)4p$	y^3H_4	$3d^7(^4F)4d$	e^5H_5
1.56.....	27	121	5090.1520	19640.305	-0.004	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4P)5p$	⁵ D ₄
1.01.....	6	156	5089.8661	19641.408	0.071	$3d^7(^4F)4d$	e^3H_5	$3d^7(^4F)4f$	(1.5)[4.5] ₅
1.01.....	6	156	5089.8661	19641.408	-0.021	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4P)5p$	⁵ D ₂
2.00.....	33	270	5089.2663	19643.723	0.018	$3d^7(^4F)4d$	e^5G_2	$3d^7(^4F)4f$	(2.5)[2.5] ₃
2.00.....	33	270	5089.2663	19643.723	-0.108	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4F)4f$	(2.5)[1.5] ₂
1.32.....	12	226	5083.6730	19665.335	-0.001	$3d^7(^4F)4d$	e^5P_3	$3d^7(^4F)4f$	(4.5)[3.5] ₄
2.17.....	59	226	5083.6204	19665.539	-0.035	$3d^7(^4F)4d$	e^5P_3	$3d^7(^4F)4f$	(4.5)[3.5] ₃
1.18.....	8	175	5083.4313	19666.270	0.014	$3d^7(^4F)4d$	e^3G_5	$3d^7(^4P)5p$	⁵ D ₄
2.25.....	152	107	5083.1896	19667.205	0.000	$3d^7(^4F)4d$	e^5D_2	$3d^7(^4F)4f$	(1.5)[2.5] ₃
1.86.....	62	105	5082.4373	19670.117	0.000	$3d^7(^4F)4d$	e^5P_1	$3d^7(^4F)4f$	(2.5)[1.5] ₂
1.31.....	6	304	5081.6382	19673.209	-0.002	$3d^7(^4F)4d$	e^5G_2	$3d^7(^4F)4f$	(2.5)[1.5] ₂
1.90.....	35	208	5077.0646	19690.931	0.000	$3d^7(^4F)4d$	f^5F_1	$3d^7(^4P)5p$	⁵ D ₂
1.90.....	35	208	5077.0646	19690.931	0.019	$3d^7(^4F)4d$	e^5P_1	$3d^7(^4F)4f$	(2.5)[0.5] ₁
2.09.....	58	200	5075.1969	19698.178	-0.013	$3d^7(^4F)4d$	e^5P_3	$3d^7(^4F)4f$	(4.5)[2.5] ₃
1.94.....	41	200	5075.1139	19698.500	-0.004	$3d^7(^4F)4d$	e^5P_3	$3d^7(^4F)4f$	(4.5)[2.5] ₂
1.55.....	7	458	5073.2538	19705.722	0.017	$3d^7(^4F)4d$	e^5G_6	$3d^7(^4F)4f$	(4.5)[6.5] ₆
1.75.....	18	277	5069.8856	19718.814	0.005	$3d^7(^4F)4d$	e^5D_2	$3d^7(^4F)4f$	(1.5)[1.5] ₂
2.43.....	153	160	5067.0998	19729.655	0.001	$3d^7(^4F)4d$	e^5P_3	$3d^7(^4F)4f$	(4.5)[1.5] ₂
1.41.....	11	218	5060.3174	19756.098	0.015	$3d^7(^4F)4d$	e^5D_0	$3d^7(^4F)4f$	(1.5)[1.5] ₁
2.58.....	309	114	5057.4158	19767.433	0.002	$3d^7(^4F)4d$	e^5G_6	$3d^7(^4F)4f$	(4.5)[5.5] ₆
1.69.....	41	110	5055.5351	19774.786	0.003	$3d^7(^4F)4d$	e^5G_6	$3d^7(^4F)4f$	(4.5)[4.5] ₅
1.49.....	27	104	5051.3215	19791.281	0.002	$3d^7(^4F)4d$	e^5G_6	$3d^7(^4F)4f$	(4.5)[5.5] ₅
2.94.....	765	104	5050.7092	19793.681	0.000	$3d^7(^4F)4d$	e^5G_6	$3d^7(^4F)4f$	(4.5)[6.5] ₇
1.26.....	8	217	5044.0241	19819.914	0.032	$3d^7(^4F)4d$	e^5H_4	$3d^7(^4F)4f$	(1.5)[3.5] ₄
1.49.....	21	138	5037.5781	19845.275	-0.009	$3d^7(^4F)4d$	e^5G_6	$3d^7(^4F)4f$	(4.5)[7.5] ₇
2.06.....	66	162	5029.8253	19875.863	0.001	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4F)4f$	(2.5)[4.5] ₄
1.65.....	39	108	5029.5594	19876.914	0.009	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4F)4f$	(3.5)[4.5] ₅
1.65.....	39	108	5029.5594	19876.914	0.058	$3d^7(^2H)4s$	a^3H_5	$3d^7(^4F)4p$	z^5G_5
2.57.....	281	123	5029.1817	19878.407	0.011	$3d^7(^4F)4d$	f^5F_4	$3d^7(^4F)4f$	(4.5)[4.5] ₅
2.57.....	281	123	5029.1817	19878.407	-0.006	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4F)4f$	(3.5)[4.5] ₄
2.06.....	81	133	5028.8075	19879.886	0.009	$3d^7(^4F)4d$	e^5H_4	$3d^7(^4F)4f$	(1.5)[4.5] ₅
1.05.....	5	185	5028.1180	19882.612	-0.004	$3d^7(a^2D)4p$	y^1P_1	$3d^7(^4F)4d$	e^3P_1
2.05.....	54	185	5028.0196	19883.001	-0.004	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4F)4f$	(2.5)[3.5] ₃
1.51.....	28	106	5027.4701	19885.174	-0.005	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4F)4f$	(3.5)[3.5] ₃
0.99.....	5	167	5026.9678	19887.161	-0.030	$3d^7(^4F)4d$	e^5H_4	$3d^7(^4F)4f$	(1.5)[4.5] ₄
2.18.....	114	124	5026.6645	19888.361	-0.001	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4F)4f$	(2.5)[3.5] ₄
1.23.....	9	179	5026.4764	19889.105	-0.002	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4F)4f$	(2.5)[2.5] ₂
2.34.....	171	119	5025.9113	19891.342	-0.001	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4F)4f$	(3.5)[5.5] ₅
1.24.....	14	115	5025.6640	19892.320	-0.011	$3d^7(^4F)4d$	e^5H_5	$3d^7(^4F)4f$	(2.5)[4.5] ₅
1.30.....	16	113	5025.4231	19893.274	-0.009	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4F)4f$	(3.5)[3.5] ₄
1.35.....	16	129	5025.0150	19894.890	-0.002	$3d^7(^4F)4d$	f^5F_4	$3d^7(^4F)4f$	(4.5)[5.5] ₅
2.29.....	127	143	5023.6693	19900.219	-0.002	$3d^7(^4F)4d$	f^5F_4	$3d^7(^4F)4f$	(4.5)[4.5] ₄
2.31.....	129	148	5022.5165	19904.786	0.000	$3d^7(^4F)4d$	e^3D_2	$3d^7(^4F)4f$	(1.5)[3.5] ₃
1.26.....	14	118	5016.8462	19927.284	-0.006	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4F)4f$	(3.5)[2.5] ₃
2.21.....	84	186	5015.9676	19930.774	0.012	$3d^7(^4F)4d$	f^5F_4	$3d^7(^4F)4f$	(4.5)[3.5] ₄
1.90.....	42	186	5015.9114	19930.997	-0.003	$3d^7(^4F)4d$	f^5F_4	$3d^7(^4F)4f$	(4.5)[3.5] ₃
1.08.....	5	209	5015.0990	19934.226	0.009	$3d^7(^4F)4d$	e^5P_1	$3d^7(^4P)5p$	³ D ₂

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.58.....	11	320	5014.6239	19936.114	-0.004	$3d^7(^4F)4d$	e^3D_2	$3d^7(^4F)4f$	(1.5)[2.5] ₂
0.97.....	5	160	5014.3244	19937.305	-0.007	$3d^7(^4F)4d$	e^5G_2	$3d^7(^4P)5p$	³ D ₂
2.12.....	111	111	5013.6599	19939.948	-0.001	$3d^7(^4F)4d$	e^5H_5	$3d^7(^4F)4f$	(2.5)[5.5] ₆
0.82.....	6	111	5013.5507	19940.382	0.000	$3d^7(^4F)4d$	e^5H_5	$3d^7(^4F)4f$	(2.5)[5.5] ₅
1.77.....	31	182	5012.7035	19943.752	-0.005	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4P)5p$	⁵ D ₄
1.14.....	8	165	5009.5060	19956.481	-0.012	$3d^7(^4F)4d$	e^5D_4	$3d^7(^4P)5p$	⁵ D ₃
1.29.....	14	127	5009.4255	19956.802	0.000	$3d^7(^4F)4d$	e^5H_6	$3d^7(^4F)4f$	(3.5)[5.5] ₆
2.14.....	87	150	5007.7156	19963.617	0.000	$3d^7(^4F)4d$	f^5F_4	$3d^7(^4F)4f$	(4.5)[2.5] ₃
1.89.....	31	233	5006.8666	19967.002	-0.018	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(3.5)[3.5] ₃
1.96.....	36	236	5003.0704	19982.152	-0.001	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4F)4f$	(1.5)[3.5] ₄
0.69.....	3	82	5000.8012	19991.219	-0.045	$3d^7(^4F)4d$	e^3D_2	$3d^7(^4F)4f$	(1.5)[1.5] ₂
2.08.....	46	246	4997.8652	20002.963	0.000	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(3.5)[2.5] ₂
2.11.....	110	109	4995.9720	20010.543	0.000	$3d^7(^4F)4d$	e^5H_6	$3d^7(^4F)4f$	(3.5)[6.5] ₇
1.90.....	37	204	4993.4378	20020.698	-0.012	$3d^7(^4F)4d$	e^5G_2	$3d^7(^4F)4f$	(1.5)[3.5] ₃
1.54.....	29	112	4992.0665	20026.198	-0.006	$3d^7(^4F)4d$	e^5D_3	$3d^7(^4F)4f$	(1.5)[2.5] ₃
1.87.....	34	209	4990.4627	20032.633	-0.001	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(3.5)[1.5] ₁
1.32.....	7	293	4989.0441	20038.329	-0.005	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4P)5p$	⁵ D ₃
1.37.....	9	237	4986.9560	20046.720	-0.008	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(3.5)[0.5] ₁
1.54.....	28	200	4986.4019	20048.947	0.000	$3d^7(^4F)4d$	e^5P_1	$3d^7(^4F)4f$	(1.5)[2.5] ₂
1.18.....	4	358	4985.6367	20052.024	-0.018	$3d^7(^4F)4d$	e^5G_2	$3d^7(^4F)4f$	(1.5)[2.5] ₂
1.82.....	12	537	4979.4331	20077.006	-0.009	$3d^7(^4F)4d$	f^5F_5	$3d^7(^4F)4f$	(4.5)[6.5] ₆
1.52.....	24	133	4978.1166	20082.315	-0.002	$3d^7(^4F)4d$	e^3G_4	$3d^7(^4F)4f$	(1.5)[4.5] ₅
1.52.....	24	133	4978.1166	20082.315	-0.018	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4P)5p$	⁵ D ₂
1.14.....	7	191	4972.7055	20104.168	0.075	$3d^7(^4F)4d$	e^5P_1	$3d^7(^4F)4f$	(1.5)[1.5] ₂
1.34.....	10	218	4971.3818	20109.520	0.011	$3d^7(^4F)4d$	e^5P_1	$3d^7(^4F)4f$	(1.5)[1.5] ₁
1.72.....	38	131	4967.4170	20125.571	0.001	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(2.5)[3.5] ₃
1.62.....	29	138	4965.9143	20131.661	-0.011	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(2.5)[2.5] ₂
0.85.....	8	88	4965.1644	20134.701	-0.005	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(2.5)[4.5] ₄
1.21.....	11	146	4964.3555	20137.982	0.019	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(2.5)[1.5] ₁
2.67.....	378	119	4964.1684	20138.741	0.000	$3d^7(^4F)4d$	f^5F_5	$3d^7(^4F)4f$	(4.5)[5.5] ₆
0.71.....	3	160	4963.4084	20141.825	-0.024	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(2.5)[3.5] ₃
2.38.....	188	123	4962.3569	20146.093	0.000	$3d^7(^4F)4d$	f^5F_5	$3d^7(^4F)4f$	(4.5)[4.5] ₅
1.27.....	15	117	4962.0839	20147.201	-0.005	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(2.5)[3.5] ₄
1.24.....	15	112	4961.9098	20147.908	-0.013	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(2.5)[2.5] ₃
1.24.....	15	112	4961.9098	20147.908	-0.043	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(2.5)[2.5] ₂
2.28.....	150	121	4958.2965	20162.590	0.001	$3d^7(^4F)4d$	f^5F_5	$3d^7(^4F)4f$	(4.5)[5.5] ₅
1.02.....	6	158	4957.9018	20164.196	-0.004	$3d^7(^4F)4d$	e^3D_3	$3d^7(^4F)4f$	(2.5)[2.5] ₃
1.85.....	38	120	4956.9888	20167.909	-0.009	$3d^7(^4F)4d$	f^5F_5	$3d^7(^4F)4f$	(4.5)[4.5] ₄
1.90.....	60	128	4955.3508	20174.576	-0.002	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(3.5)[4.5] ₄
1.51.....	19	162	4954.6524	20177.420	-0.007	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(2.5)[1.5] ₂
1.77.....	40	142	4953.6888	20181.345	0.000	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(3.5)[3.5] ₃
2.16.....	103	135	4952.5710	20185.899	0.001	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(2.5)[4.5] ₅
1.14.....	12	113	4951.4875	20190.316	-0.004	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(2.5)[4.5] ₄
1.93.....	26	316	4949.7359	20197.461	0.008	$3d^7(^4F)4d$	f^5F_1	$3d^7(^4F)4f$	(2.5)[2.5] ₂
1.93.....	26	316	4949.7359	20197.461	-0.002	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(2.5)[3.5] ₃
2.12.....	94	133	4949.5002	20198.423	0.199	$3d^7(^4F)4d$	e^5P_2	$3d^7(^4F)4f$	(2.5)[0.5] ₁
2.12.....	94	133	4949.5002	20198.423	-0.036	$3d^7(^4F)4d$	f^5F_5	$3d^7(^4F)4f$	(4.5)[3.5] ₄
2.12.....	94	133	4949.5002	20198.423	-0.048	$3d^7(a^2D)4p$	e^3P_2	$3d^7(^4F)4d$	e^3D_2
1.57.....	26	135	4948.4218	20202.825	0.005	$3d^7(^4F)4d$	e^5G_4	$3d^7(^4F)4f$	(2.5)[3.5] ₄
1.65.....	16	263	4948.2004	20203.728	-0.016	$3d^7(^4F)4d$	f^5F_1	$3d^7(^4F)4f$	(2.5)[1.5] ₁
1.48.....	24	124	4944.8823	20217.285	-0.002	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(3.5)[2.5] ₂
1.73.....	34	153	4943.3736	20223.456	0.000	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(3.5)[2.5] ₃
1.68.....	30	152	4942.0495	20228.874	0.002	$3d^7(^4F)4d$	e^5G_5	$3d^7(^4F)4f$	(3.5)[4.5] ₅
1.32.....	8	294	4941.6655	20230.446	0.066	$3d^7(^4F)4d$	e^5G_5	$3d^7(^4F)4f$	(3.5)[4.5] ₄
2.21.....	143	108	4940.5828	20234.879	0.001	$3d^7(^4F)4d$	e^5G_5	$3d^7(^4F)4f$	(3.5)[5.5] ₆
1.73.....	30	171	4939.3501	20239.929	0.007	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4P)5p$	⁵ D ₄
1.55.....	22	157	4938.5970	20243.015	0.007	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4F)4f$	(3.5)[1.5] ₂
1.34.....	17	121	4938.5259	20243.307	-0.003	$3d^7(^4F)4d$	e^5G_5	$3d^7(^4F)4f$	(3.5)[5.5] ₅
1.49.....	18	167	4936.2448	20252.662	0.003	$3d^7(^4F)4d$	f^5F_3	$3d^7(^4P)5p$	⁵ D ₃
1.35.....	22	101	4934.5852	20259.473	0.009	$3d^7(^4F)4d$	e^3G_5	$3d^7(^4F)4f$	(2.5)[5.5] ₆
1.50.....	22	139	4931.2541	20273.158	-0.026	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4F)4f$	(1.5)[3.5] ₄
0.88.....	4	208	4921.6148	20312.864	0.009	$3d^7(a^2D)4s$	b^1D_2	$3d^7(^4F)4p$	z^3D_2
0.84.....	5	131	4914.9325	20340.481	-0.012	$3d^7(^4F)4d$	e^5G_3	$3d^7(^4F)4f$	(1.5)[4.5] ₄
1.30.....	9	226	4885.4461	20463.245	-0.010	$3d^7(^4F)4d$	e^5P_3	$3d^7(^4F)4f$	(3.5)[4.5] ₄
1.30.....	9	221	4883.8333	20470.003	-0.018	$3d^7(^4F)4d$	e^5P_3	$3d^7(^4F)4f$	(3.5)[3.5] ₃
0.93.....	5	182	4875.2539	20506.025	0.061	$3d^7(^4F)4d$	e^5P_3	$3d^7(^4F)4f$	(3.5)[2.5] ₂
0.94.....	4	198	4874.9499	20507.304	-0.005	$3d^7(^4F)4d$	f^5F_1	$3d^7(^4P)5p$	³ D ₂
1.45.....	12	231	4857.0782	20582.760	0.007	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(2.5)[3.5] ₃
1.50.....	26	153	4855.6270	20588.911	0.056	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(2.5)[2.5] ₂
1.12.....	13	126	4847.8276	20622.035	-0.004	$3d^7(^4F)4d$	f^5F_1	$3d^7(^4F)4f$	(1.5)[2.5] ₂
1.03.....	5	220	4847.4828	20623.502	-0.058	$3d^7(^4F)4d$	e^5G_6	$3d^7(^4F)4f$	(3.5)[4.5] ₅
0.87.....	4	194	4844.8594	20634.669	0.059	$3d^7(^4F)4d$	f^5F_2	$3d^7(^4F)4f$	(2.5)[1.5] ₂

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.05.....	8	137	4833.4641	20683.316	0.010	$3d^7(^4F)4d$	e^5G_6	—	$3d^7(^4F)4f$ (3.5)[6.5] ₇
1.39.....	6	213	4831.1504	20693.222	0.001	$3d^64s^2$	a^5D_4	—	y^5D_4
0.80.....	3	122	4829.1169	20701.935	0.009	$3d^64s^2$	a^5D_2	—	z^3S_1
1.76.....	32	181	4823.2348	20727.182	0.009	$3d^7(^4F)4d$	f^5F_4	—	$3d^7(^4F)4f$ (3.5)[4.5] ₅
1.50.....	15	205	4822.8868	20728.677	-0.004	$3d^7(^4F)4d$	f^5F_4	—	$3d^7(^4F)4f$ (3.5)[4.5] ₄
1.01.....	7	149	4819.8866	20741.580	-0.031	$3d^7(^4F)4d$	f^5F_4	—	$3d^7(^4F)4f$ (3.5)[5.5] ₅
0.91.....	4	189	4811.5368	20777.573	0.015	$3d^7(^4F)4d$	f^5F_4	—	$3d^7(^4F)4f$ (3.5)[2.5] ₃
0.95.....	5	180	4808.6825	20789.906	-0.028	$3d^7(^4F)4d$	f^5F_3	—	$3d^7(^4F)4f$ (2.5)[4.5] ₄
1.13.....	7	202	4807.7385	20793.988	-0.037	$3d^7(^4F)4d$	f^5F_4	—	$3d^7(^4F)5p$ ⁵ D ₄
0.83.....	5	143	4805.7861	20802.436	0.002	$3d^7(^4F)4d$	f^5F_3	—	$3d^7(^4F)4f$ (2.5)[3.5] ₄
0.74.....	5	112	4785.8851	20888.937	0.005	$3d^7(^4F)4d$	e^5G_5	—	$3d^7(^4F)4f$ (2.5)[5.5] ₆
0.94.....	4	240	4764.6418	20982.069	-0.040	$3d^7(^4F)4d$	f^5F_2	—	$3d^7(^4F)4f$ (1.5)[3.5] ₃
0.91.....	5	160	4761.7436	20994.840	-0.030	$3d^7(^4F)4d$	f^5F_5	—	$3d^7(^4F)4f$ (3.5)[4.5] ₅
1.23.....	16	108	4760.3752	21000.875	-0.001	$3d^7(^4F)4d$	f^5F_5	—	$3d^7(^4F)4f$ (3.5)[5.5] ₆
0.97.....	5	181	4758.4558	21009.346	0.038	$3d^7(^4F)4d$	f^5F_5	—	$3d^7(^4F)4f$ (3.5)[5.5] ₅
2.08.....	61	234	4756.7228	21017.000	0.017	$3d^7(^4F)4d$	f^5F_2	—	$3d^7(^4F)4f$ (1.5)[2.5] ₃
0.58.....	5	76	4749.4170	21049.329	-0.071	$3d^7(^4F)4d$	f^5F_5	—	$3d^7(^4F)4f$ (3.5)[6.5] ₆
0.86.....	6	124	4742.8174	21078.618	0.007	$3d^7(^4F)4d$	e^5P_3	—	$3d^7(^4F)4f$ (2.5)[4.5] ₄
1.22.....	5	323	4736.2077	21108.035	-0.070	$3d^7(^4F)4d$	e^5P_3	—	$3d^7(^4F)4f$ (2.5)[2.5] ₃
1.10.....	9	140	4684.8093	21339.613	-0.002	$3d^7(^4F)4d$	f^5F_4	—	$3d^7(^4F)4f$ (2.5)[4.5] ₅
0.76.....	4	146	4681.0971	21356.536	-0.001	$3d^7(^4F)4d$	f^5F_4	—	$3d^7(^4F)4f$ (2.5)[3.5] ₄
0.73.....	3	82	4623.7908	21621.220	0.060	$3d^7(^2H)4p$	x^3G_4	—	$3d^7(^4F)4d$ e^5P_3
1.29.....	6	168	4622.1002	21629.128	-0.053	$3d^64s^2$	a^5D_2	—	$3d^7(^4P)4p$ z^5P_2
1.78.....	44	170	4566.6120	21891.937	0.066	$3d^7(^2G)4s$	b^1G_4	—	$3d^7(^4F)4p$ z^5D_3
1.51.....	7	254	4559.3011	21927.040	0.000	$3d^64s^2$	a^5D_2	—	$3d^7(^4P)4p$ z^5P_1
0.94.....	7	140	4550.0807	21971.473	-0.034	$3d^7(^2G)4p$	y^3F_4	—	$3d^7(^4F)5s$ e^3F_4
1.22.....	5	177	4537.9544	22030.184	0.002	$3d^64s^2$	a^5D_3	—	$3d^7(^4P)4p$ z^5P_3
1.65.....	9	264	4533.2191	22053.196	0.014	$3d^64s^2$	a^5D_3	—	$3d^7(^4P)4p$ z^5P_2
1.12.....	9	181	4500.5573	22213.239	-0.070	$3d^7(a^2D)4s$	a^3D_3	—	$3d^7(^4F)4p$ z^3F_4
1.06.....	3	185	4499.2348	22219.769	-0.078	$3d^7(^2P)4s$	c^3P_1	—	$3d^7(^4F)4p$ z^5D_2
1.32.....	8	137	4482.6733	22301.859	0.020	$3d^64s^2$	a^5D_3	—	$3d^7(^4P)4p$ y^3D_2
1.12.....	4	336	4418.4667	22625.931	0.002	$3d^7(^4P)4p$	y^5D_4	—	$3d^7(^4F)5s$ e^5F_5
1.82.....	19	302	4413.9047	22649.316	0.012	$3d^64s^2$	a^5D_4	—	$3d^7(^4P)4p$ z^5P_3
0.89.....	5	156	4353.7308	22962.352	-0.028	$3d^7(^2P)4s$	c^3P_2	—	$3d^7(^4F)4p$ z^5D_1
1.23.....	3	291	4284.1508	23335.283	-0.050	$3d^7(^2H)4p$	z^3I_6	—	$3d^7(^4F)4d$ e^5H_5
0.91.....	3	142	4282.1734	23346.058	-0.007	$3d^7(a^2D)4p$	w^3D_3	—	$3d^7(^4F)4d$ e^5H_3
1.00.....	5	218	4282.1584	23346.140	0.020	$3d^7(^4P)4p$	y^5D_3	—	$3d^7(^4F)5s$ e^5F_4
0.86.....	4	109	4280.7144	23354.015	-0.009	$3d^7(^2F)4s$	c^3F_4	—	$3d^7(^2G)4p$ z^1G_4
1.62.....	4	564	4160.6526	24027.917	0.023	$3d^7(a^2D)4s$	a^3D_3	—	$3d^7(^4F)4p$ z^3D_3
1.49.....	7	243	4145.1374	24117.851	-0.001	$3d^7(a^2D)4s$	a^3D_2	—	$3d^7(^4F)4p$ z^3D_2
1.16.....	4	201	4096.5997	24403.601	0.054	$3d^7(^2F)4s$	c^3F_2	—	$3d^7(^2G)4p$ y^3G_3
1.34.....	4	230	3983.0155	25099.507	0.013	$3d^7(^2P)4s$	a^1P_1	—	$3d^7(^4F)4p$ z^3D_1
1.41.....	7	303	3944.3782	25345.364	0.072	$3d^7(^2G)4p$	z^1H_5	—	$3d^7(^4F)4d$ e^5G_6
1.56.....	22	165	3892.9522	25680.170	-0.004	$3d^7(^4F)5s$	e^5F_1	—	$3d^7(^4F)4f$ (2.5)[2.5] ₂
1.19.....	9	135	3787.3401	26396.259	0.000	$3d^7(^2P)4p$	z^3P_1	—	$3d^7(^4F)4d$ e^5P_2
1.71.....	4	262	3783.7446	26421.341	0.057	$3d^7(^2G)4p$	y^3F_4	—	$3d^7(^4F)4d$ f^5F_5
1.82.....	9	268	3777.0820	26467.946	-0.064	$3d^7(^4F)5s$	e^3F_4	—	$3d^7(^4F)4f$ (1.5)[3.5] ₃
0.99.....	4	93	3769.5800	26520.620	-0.002	$3d^7(^2P)4p$	z^3P_2	—	$3d^7(^4F)4d$ e^5G_2
1.83.....	5	525	3754.6814	26625.851	-0.016	$3d^7(^2P)4s$	c^3P_2	—	$3d^7(^4F)4p$ z^3D_3
2.21.....	46	316	3754.3467	26628.224	-0.035	$3d^7(^4P)4p$	y^3P_1	—	$3d^7(^4F)4d$ e^5D_0
1.61.....	7	230	3714.7390	26912.136	0.064	$3d^7(^2G)4p$	y^3F_2	—	$3d^7(^4F)4d$ e^5G_2
1.61.....	7	230	3714.7390	26912.136	-0.019	$3d^7(^4F)5s$	e^5F_5	—	$3d^7(^4F)4f$ (3.5)[4.5] ₅
1.61.....	7	230	3714.7390	26912.136	-0.071	$3d^7(^2P)4s$	c^3P_1	—	$3d^7(^4F)4p$ z^3D_2
2.53.....	95	353	3641.6717	27452.092	0.046	$3d^7(a^2D)4p$	x^3P_1	—	$3d^7(^4P)5s$ ³ P ₁
1.95.....	14	514	3621.2006	27607.279	0.034	$3d^7(^4P)4s$	a^5P_3	—	$3d^7(^4F)4p$ z^5F_4
1.67.....	9	466	3577.9916	27940.664	0.057	$3d^7(^4P)4s$	a^5P_2	—	$3d^7(^4F)4p$ z^5F_3
1.72.....	6	371	3568.8018	28012.610	0.013	$3d^7(^2F)4s$	c^3F_4	—	$3d^7(a^2D)4p$ w^3D_3
1.16.....	6	202	3566.9677	28027.013	0.011	$3d^7(^2G)4s$	a^3G_4	—	$3d^7(^4F)4p$ z^3G_3
1.55.....	5	292	3535.9135	28273.154	0.001	$3d^7(^4P)4s$	b^3P_0	—	$3d^7(^4F)4p$ z^3D_1
1.41.....	8	268	3532.0507	28304.074	0.043	$3d^7(^2H)4p$	y^1G_4	—	$3d^7(^2G)5s$ f^3G_4
1.68.....	17	272	3530.5508	28316.098	0.006	$3d^7(^4P)4p$	y^3D_2	—	$3d^7(^4F)4d$ e^5P_1
1.68.....	12	316	3507.7769	28499.932	0.039	$3d^7(^2G)4s$	a^3G_3	—	$3d^7(^4F)4p$ z^3F_2
2.62.....	62	641	3501.7455	28549.019	-0.304	$3d^7(^4P)4s$	a^5P_3	—	$3d^7(^4F)4p$ z^5D_4
1.78.....	10	503	3497.3342	28585.028	-0.097	$3d^7(^2F)4s$	c^3F_2	—	$3d^7(^2H)4p$ x^3G_3
2.46.....	60	460	3480.0138	28727.294	0.034	$3d^7(^2G)4p$	z^3H_4	—	$3d^7(^4F)4d$ e^3G_3
1.97.....	20	445	3446.3763	29007.671	-0.005	$3d^7(^4P)4s$	a^5P_2	—	$3d^7(^4F)4p$ z^5D_3
0.97.....	5	167	3438.2453	29076.269	-0.068	$3d^7(^4P)4p$	y^5D_4	—	$3d^7(^4F)4d$ e^5P_3
1.58.....	11	304	3423.8257	29198.722	-0.002	$3d^7(^4P)4s$	a^5P_1	—	$3d^7(^4F)4p$ z^5D_2
2.64.....	96	444	3420.7909	29224.625	0.058	$3d^7(^2H)4p$	y^1G_4	—	$3d^7(^2G)5s$ e^1G_4
2.64.....	96	444	3420.7909	29224.625	-0.066	$3d^7(^2H)4p$	y^3H_4	—	$3d^7(^2G)5s$ f^3G_5
1.66.....	10	400	3415.7699	29267.582	-0.014	$3d^7(^4P)4s$	a^5P_3	—	$3d^7(^4F)4p$ z^5D_3
3.69.....	1635	249	3388.1679	29506.005	0.069	$3d^7(^4P)4s$	a^5P_2	—	$3d^7(^4F)4p$ z^5D_2

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)		
1.74.....	16	334	3387.6895	29510.171	0.032	$3d^7(^4P)4s$	a^5P_1	—	$3d^7(^4F)4p$	z^5D_1	
1.46.....	7	350	3370.9201	29656.972	0.020	$3d^7(^4P)4s$	a^5P_1	—	$3d^7(^4F)4p$	z^5D_0	
0.97.....	4	200	3370.4382	29661.212	0.033	$3d^7(^4P)4p$	y^5D_4	—	$3d^7(^4F)4d$	e^5D_4	DI
1.29.....	6	266	3352.7685	29817.527	0.175	$3d^7(^4P)4s$	a^5P_2	—	$3d^7(^4F)4p$	z^5D_1	U
2.54.....	177	197	3319.1554	30119.479	-0.032	$3d^7(^4P)4s$	a^5P_2	—	$3d^7(^4F)4p$	z^5G_3	DI
1.83.....	22	325	3218.9725	31056.844	-0.203	$3d^7(^4P)4p$	y^5D_2	—	$3d^7(^4F)4d$	e^5D_2	U
1.40.....	7	136	3216.7294	31078.501	-0.003	$3d^7(^4P)4p$	z^5P_1	—	$3d^7(^4F)4d$	f^3F_2	Ar
1.41.....	10	214	3202.7331	31214.312	-0.004	$3d^7(^2H)4p$	y^1H_5	—	$3d^64s^2$	1^1G_4	DI
1.09.....	5	197	3198.0787	31259.739	0.081	$3d^7(^4P)4p$	y^5D_2	—	$3d^7(^4F)4d$	e^3G_3	
3.43.....	1219	170	3158.7742	31648.688	0.019	$3d^7(^4P)4p$	y^5D_3	—	$3d^7(^4F)4d$	e^3H_4	M I
2.98.....	400	182	3121.5660	32025.917	0.016	$3d^7(^2P)4p$	z^1D_2	—	$3d^7(^4P)5s$	5^5P_2	M I
1.91.....	29	243	3096.4040	32286.156	0.064	$3d^7(a^2D)4p$	x^3P_1	—	$3d^7(^2P)5s$	1^1P_1	M I
1.05.....	5	172	3069.7757	32566.206	0.018	$3d^7(a^2D)4p$	x^3P_2	—	$3d^7(^2P)5s$	3^3P_2	
1.05.....	4	188	3053.5536	32739.208	-0.007	$3d^7(^2H)4p$	y^1H_5	—	$3d^7(^2H)5s$	3^3H_5	
2.15.....	64	191	3050.4961	32772.022	0.027	$3d^7(^2P)4p$	x^3D_1	—	$3d^7(^4P)5s$	3^3P_1	DI
0.77.....	4	124	3050.1019	32776.257	-0.046	$3d^7(a^2D)4p$	y^1D_2	—	$3d^7(^2P)5s$	1^1P_1	
0.98.....	6	125	3035.1324	32937.905	-0.012	$3d^7(^4F)4p$	z^3D_2	—	$3d^7(^4F)5s$	e^5F_3	
2.16.....	19	467	3034.6623	32943.008	0.003	$3d^7(^2H)4s$	a^1H_5	—	$3d^7(^2G)4p$	y^3F_4	
1.41.....	4	238	3026.6456	33030.260	0.039	$3d^7(^2H)4s$	a^1H_5	—	$3d^7(^2G)4p$	z^3H_6	
1.55.....	14	190	3022.5893	33074.585	-0.012	$3d^7(^4F)4p$	z^3D_3	—	$3d^7(^4F)5s$	e^5F_4	
1.62.....	11	214	3008.8562	33225.538	-0.004	$3d^7(^2H)4s$	a^1H_5	—	$3d^7(^2G)4p$	z^3H_4	
1.52.....	11	226	3004.8650	33269.668	0.012	$3d^7(^2H)4p$	y^1H_5	—	$3d^7(^2G)4d$	3^3H_5	
2.22.....	44	262	2971.3916	33644.442	0.036	$3d^7(^2H)4p$	y^1H_5	—	$3d^7(^2H)5s$	1^1H_5	In
3.20.....	213	458	2954.7273	33834.184	0.000	$3d^7(^2H)4s$	a^1H_5	—	$3d^7(^2G)4p$	z^1G_4	
1.22.....	6	184	2954.1892	33840.347	0.015	$3d^7(^2H)4p$	y^1H_5	—	$3d^7(^2G)4d$	3^1I_5	
1.29.....	7	316	2943.0031	33968.966	0.000	$3d^7(^2H)4p$	y^1G_4	—	$3d^7(^2H)5s$	3^3H_5	BP
2.29.....	74	316	2942.9639	33969.418	0.000	$3d^7(^4F)4p$	z^3D_3	—	$3d^7(^4F)5s$	e^3F_4	BP
1.42.....	4	205	2942.4580	33975.258	0.011	$3d^7(a^2D)4s$	b^1D_2	—	$3d^7(^2G)4p$	y^3G_3	
2.02.....	42	248	2930.2349	34116.975	-0.002	$3d^7(^4F)4p$	z^3D_2	—	$3d^7(^4F)5s$	e^3F_3	
1.87.....	26	275	2918.3830	34255.523	0.008	$3d^7(^4F)4p$	z^3D_1	—	$3d^7(^4F)5s$	e^3F_2	D
1.87.....	26	275	2918.3830	34255.523	0.032	$3d^8$	a^3P_0	—	$3d^7(^4F)4p$	z^5D_1	D
1.12.....	4	235	2917.5622	34265.159	0.023	$3d^7(a^2D)4p$	x^3P_1	—	$3d^7(^4P)4d$	3^3D_2	
1.35.....	6	246	2907.0009	34389.640	-0.041	$3d^7(a^2D)4p$	y^1P_1	—	$3d^7(^2G)4d$	1^1D_2	
1.59.....	5	236	2906.9475	34390.271	-0.036	$3d^7(^2H)4s$	a^1H_5	—	$3d^7(^2G)4p$	z^1H_5	
2.01.....	29	231	2897.7526	34499.391	-0.016	$3d^7(^2H)4p$	y^1G_4	—	$3d^7(^2G)4d$	3^3H_5	
1.17.....	5	207	2895.6214	34524.782	-0.031	$3d^7(^2H)4p$	y^1G_4	—	$3d^7(^2G)4d$	1^1F_3	
2.70.....	75	369	2890.4232	34586.870	0.004	$3d^7(^2H)4s$	a^1H_5	—	$3d^7(^2G)4p$	y^3G_4	
1.35.....	9	157	2883.1486	34674.133	-0.006	$3d^7(^4P)4p$	y^3P_1	—	$3d^7(^4P)5s$	3^3P_2	
1.20.....	2	264	2882.5014	34681.918	0.076	$3d^7(^4F)4p$	z^3F_2	—	$3d^7(^4F)5s$	e^5F_2	
1.67.....	7	442	2880.1355	34710.406	-0.016	$3d^7(^4F)4p$	z^3D_2	—	$3d^7(^4F)5s$	e^3F_2	
1.44.....	5	320	2879.3839	34719.466	-0.066	$3d^7(a^2D)4p$	y^1P_1	—	$3d^7(^2G)4d$	3^3F_2	
1.72.....	13	287	2878.5559	34729.452	-0.057	$3d^7(a^2D)4p$	x^3F_2	—	$3d^7(^4P)4d$	5^5F_3	DI
2.90.....	184	231	2871.2157	34818.233	0.000	$3d^7(a^2D)4s$	b^1D_2	—	$3d^7(^2G)4p$	z^1F_3	
1.75.....	18	283	2869.8791	34834.448	0.014	$3d^7(^4F)4p$	z^3D_3	—	$3d^7(^4F)5s$	e^3F_3	
1.90.....	21	241	2866.6111	34874.158	0.001	$3d^7(^2H)4p$	y^1G_4	—	$3d^7(^2H)5s$	1^1H_5	
1.63.....	12	216	2865.3744	34889.209	0.027	$3d^7(^4F)4p$	z^3F_4	—	$3d^7(^4F)5s$	e^5F_4	
2.21.....	42	272	2862.6027	34922.989	-0.034	$3d^7(^2P)4p$	z^3P_2	—	$3d^7(^4P)5s$	3^3P_2	DI
1.61.....	11	230	2861.5964	34935.270	-0.019	$3d^7(^2H)4p$	y^1H_5	—	$3d^7(^2G)4d$	1^1G_4	
1.20.....	5	188	2861.2796	34939.138	0.004	$3d^7(^4P)4p$	y^3P_1	—	$3d^7(^4P)5s$	3^3P_1	
1.15.....	5	189	2853.9943	35028.322	-0.007	$3d^7(a^2D)4p$	x^3P_0	—	$3d^7(a^2D)5s$	3^3D_1	
1.23.....	5	211	2851.4458	35059.626	0.017	$3d^7(a^2D)4p$	y^1D_2	—	$3d^7(^2G)4d$	3^3D_2	
1.14.....	5	154	2849.4339	35084.380	-0.012	$3d^7(^4P)4p$	y^3P_0	—	$3d^7(^4P)5s$	3^3P_1	
1.11.....	5	155	2848.7688	35092.570	0.006	$3d^7(a^2D)4p$	x^3P_2	—	$3d^7(^4P)4d$	3^3D_3	
1.94.....	35	176	2848.1692	35099.958	-0.004	$3d^7(^4F)4p$	z^3F_3	—	$3d^7(^4F)5s$	e^3F_4	
1.51.....	11	200	2845.1885	35136.727	-0.019	$3d^7(a^2D)4p$	y^1F_3	—	$3d^7(^2G)4d$	1^1F_3	
1.18.....	6	162	2841.7993	35178.631	0.003	$3d^7(a^2D)4p$	y^1F_3	—	$3d^7(^2G)4d$	3^3D_2	
1.03.....	4	150	2841.0446	35187.976	-0.043	$3d^7(^2P)4p$	z^3P_2	—	$3d^7(^4P)5s$	3^3P_1	
1.51.....	13	176	2837.6930	35229.534	-0.001	$3d^7(^4P)4p$	y^3P_1	—	$3d^7(^4P)5s$	3^3P_0	
1.05.....	4	173	2836.9687	35238.527	-0.034	$3d^7(^4F)4p$	z^3G_4	—	$3d^7(^4F)5s$	e^5F_4	
1.19.....	7	161	2834.9428	35263.708	0.005	$3d^7(^4F)4s$	b^3F_3	—	$3d^7(^4F)4p$	z^5F_3	DI
1.13.....	5	164	2831.8021	35302.817	-0.059	$3d^7(^2P)4p$	z^3P_1	—	$3d^7(^4P)5s$	3^3P_2	
1.34.....	4	251	2831.3525	35308.423	-0.011	$3d^7(a^2D)4p$	x^3P_2	—	$3d^7(a^2D)5s$	3^3D_3	
1.24.....	4	119	2829.0869	35336.696	-0.052	$3d^7(a^2D)4s$	a^3D_1	—	$3d^7(^2P)4p$	z^3P_0	
1.21.....	6	207	2827.4999	35356.529	0.007	$3d^7(a^2D)4p$	x^3P_1	—	$3d^7(a^2D)5s$	3^3D_1	
1.80.....	16	308	2825.2360	35384.859	0.010	$3d^7(^4F)4s$	b^3F_4	—	$3d^7(^4F)4p$	z^5F_5	
1.93.....	29	224	2822.9874	35413.044	-0.003	$3d^7(^2H)4p$	y^3H_5	—	$3d^7(^2H)5s$	3^3H_5	
1.66.....	14	248	2822.6918	35416.752	-0.006	$3d^7(^4P)4p$	y^3P_2	—	$3d^7(^4P)5s$	3^3P_2	
1.75.....	22	203	2821.4467	35432.381	0.004	$3d^7(^4F)4p$	z^3F_2	—	$3d^7(^4F)5s$	e^3F_3	
1.40.....	10	201	2821.3631	35433.430	0.006	$3d^7(^2G)4p$	z^1F_3	—	$3d^7(^2G)5s$	f^3G_4	
1.27.....	6	202	2820.4133	35445.362	0.024	$3d^7(^2G)4p$	z^3G_3	—	$3d^7(^4F)5s$	e^3F_4	
1.70.....	19	214	2819.7946	35453.140	0.010	$3d^7(^2H)4p$	y^1G_4	—	$3d^7(^2G)4d$	1^1H_5	
1.15.....	5	233	2819.4007	35458.092	-0.034	$3d^7(^4F)4p$	z^3G_5	—	$3d^7(^4F)5s$	e^5F_5	

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.33.....	5	144	2818.0482	35475.109	-0.004	$3d^7(a^2D)4s$	a^3D_2	$3d^7(^4P)4p$	y^3D_3
2.09.....	35	281	2815.9564	35501.460	0.002	$3d^7(^2H)4p$	y^3H_6	$3d^7(^2H)5s$	3H_6
1.91.....	14	287	2815.7463	35504.109	-0.007	$3d^7(a^2D)4s$	a^3D_2	$3d^7(^4P)4p$	y^3D_2
1.66.....	18	249	2810.8535	35565.907	0.015	$3d^7(^4F)4s$	b^3F_4	$3d^7(^4F)4p$	z^5F_4
1.59.....	11	307	2810.5311	35569.987	0.021	$3d^7(^4P)4p$	z^5P_1	$3d^7(^4P)5s$	5P_2
1.11.....	7	115	2807.1753	35612.507	0.008	$3d^7(^4F)4s$	b^3F_3	$3d^7(^4F)4p$	z^5D_4
1.95.....	30	254	2806.9211	35615.732	0.006	$3d^7(^2H)4p$	y^3H_4	$3d^7(^2H)5s$	3H_4
1.15.....	2	171	2804.5472	35645.877	0.026	$3d^7(a^2D)4s$	a^3D_1	$3d^7(^4P)4p$	y^3P_2
1.56.....	13	239	2803.8132	35655.207	0.015	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)5s$	5P_3
1.95.....	36	208	2802.0066	35678.195	0.003	$3d^7(^4P)4p$	z^5P_3	$3d^7(^4P)5s$	5P_3
1.15.....	6	155	2801.7287	35681.735	-0.019	$3d^7(^4P)4p$	y^3P_2	$3d^7(^4P)5s$	3P_1
0.93.....	6	95	2799.3294	35712.316	-0.047	$3d^7(^2H)4p$	y^3H_6	$3d^7(^2H)5s$	3H_5
1.75.....	11	205	2796.1206	35753.296	0.000	$3d^7(a^2D)4s$	a^3D_2	$3d^7(^4P)4p$	y^3D_1
1.61.....	16	146	2795.6175	35759.730	-0.003	$3d^7(a^2D)4s$	a^3D_1	$3d^7(^2P)4p$	z^3P_1
2.15.....	106	195	2793.7212	35784.002	-0.001	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)5s$	e^3F_4
1.62.....	11	155	2789.5356	35837.691	-0.005	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2G)4p$	z^3H_5
0.93.....	3	201	2787.1882	35867.873	0.048	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)5s$	5P_2
2.04.....	7	495	2786.0147	35882.980	0.022	$3d^7(a^2D)4s$	a^3D_3	$3d^7(^4P)4p$	z^5P_2
1.26.....	11	164	2785.6734	35887.376	0.011	$3d^7(^4P)4p$	z^5P_1	$3d^7(^4P)5s$	5P_1
1.86.....	6	380	2785.4251	35890.575	0.021	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2G)4p$	z^3H_4
1.85.....	42	248	2785.4059	35890.823	-0.002	$3d^7(^4P)4p$	z^5P_3	$3d^7(^4P)5s$	5P_2
1.10.....	7	168	2781.8607	35936.560	-0.007	$3d^7(^4P)4p$	y^3D_2	$3d^7(^4P)5s$	5P_1
1.96.....	65	197	2779.6623	35964.980	0.002	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)5s$	e^3F_3
2.72.....	100	435	2776.1989	36009.844	0.001	$3d^7(a^2D)4s$	b^1D_2	$3d^7(^2P)4p$	z^1D_2
2.24.....	75	317	2774.9641	36025.868	0.046	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)5s$	e^3F_2
2.24.....	75	317	2774.9641	36025.868	0.063	$3d^7(a^2D)4s$	a^3D_3	$3d^7(^2G)4p$	y^3F_4
1.15.....	2	240	2774.5862	36030.774	-0.039	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)5s$	e^5F_4
1.15.....	2	240	2774.5862	36030.774	-0.076	$3d^7(^2P)4s$	a^1P_1	$3d^7(^4P)4p$	y^3D_2
1.72.....	20	360	2771.0747	36076.430	-0.013	$3d^7(a^2D)4p$	y^1D_2	$3d^7(a^2D)5s$	1D_2
2.46.....	22	604	2769.0640	36102.625	0.013	$3d^7(a^2D)4s$	a^3D_3	$3d^7(^4P)4p$	y^3D_3
1.31.....	8	253	2768.2399	36113.372	0.019	$3d^7(a^2D)4p$	w^3D_1	$3d^7(^2P)5s$	1P_1
1.82.....	5	440	2766.8402	36131.640	0.025	$3d^7(a^2D)4s$	a^3D_3	$3d^7(^4P)4p$	y^3D_2
2.24.....	147	225	2766.7067	36133.383	0.001	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)5s$	e^3F_4
1.53.....	16	254	2764.2844	36165.045	0.005	$3d^7(^2H)4p$	y^1G_4	$3d^7(^2G)4d$	1G_4
1.77.....	36	184	2762.7427	36185.224	0.000	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)5s$	5P_1
2.15.....	68	228	2761.9613	36195.461	-0.001	$3d^7(a^2D)4p$	y^1F_3	$3d^7(a^2D)5s$	1D_2
1.49.....	5	182	2758.3226	36243.207	-0.005	$3d^7(a^2D)4s$	a^3D_1	$3d^7(^4P)4p$	y^3P_0
1.17.....	5	310	2755.8191	36276.131	0.011	$3d^7(^2G)4p$	z^1H_5	$3d^7(^2G)5s$	f^3G_5
1.81.....	16	265	2755.5241	36280.013	-0.017	$3d^7(^2P)4s$	a^1P_1	$3d^7(^4P)4p$	y^3D_1
1.68.....	23	249	2754.2341	36297.006	-0.024	$3d^7(^2G)4p$	y^3G_4	$3d^7(^2G)5s$	f^3G_4
1.14.....	6	235	2754.0309	36299.684	0.009	$3d^7(^2H)4p$	y^3H_6	$3d^7(^2G)4d$	3H_6
1.92.....	60	247	2753.2214	36310.356	0.002	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)5s$	e^3F_3
1.32.....	12	203	2752.6263	36318.205	-0.033	$3d^7(^2H)4p$	y^3H_5	$3d^7(^2H)5s$	1H_5
1.36.....	7	162	2752.2067	36323.743	0.016	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2G)4p$	z^3H_5
2.04.....	32	404	2749.9186	36353.964	0.004	$3d^7(^2G)4p$	z^1F_3	$3d^7(^2G)5s$	e^1G_4
1.52.....	6	266	2742.0773	36457.917	0.030	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2G)4p$	y^3F_3
1.05.....	7	221	2741.4530	36466.219	0.001	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)5s$	3P_2
1.05.....	7	221	2741.4530	36466.219	0.013	$3d^7(^2H)4p$	y^3H_4	$3d^7(^2G)4d$	3F_4
2.04.....	10	628	2739.5439	36491.630	-0.020	$3d^7(^2H)4s$	a^3H_6	$3d^7(^2G)4p$	z^3H_6
2.08.....	26	444	2738.9748	36499.212	0.015	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2G)4p$	z^1G_4
0.96.....	5	237	2734.9918	36552.363	-0.058	$3d^7(^2P)4p$	z^1P_1	$3d^7(^4P)4d$	3D_2
1.94.....	52	257	2734.5380	36558.428	0.005	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)5s$	e^3F_2
1.88.....	24	191	2733.0182	36578.757	0.003	$3d^7(^2P)4s$	c^3P_0	$3d^7(^4P)4p$	z^3S_1
0.95.....	4	246	2732.3035	36588.325	0.004	$3d^7(a^2D)4p$	y^1D_2	$3d^7(^2G)4d$	3F_2
2.24.....	82	287	2729.0585	36631.828	0.004	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)5s$	f^3G_5
2.17.....	168	210	2727.7781	36649.021	0.002	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)5s$	e^3F_3
2.17.....	168	210	2727.7781	36649.021	-0.050	$3d^7(^2P)4p$	y^3S_1	$3d^7(^4P)4d$	3P_0
1.18.....	12	172	2726.4996	36666.206	0.010	$3d^7(^4P)4p$	z^5P_1	$3d^7(^4P)5s$	3P_2
1.35.....	5	218	2724.0211	36699.566	-0.049	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2G)4p$	y^3G_5
1.37.....	16	202	2723.4444	36707.337	-0.003	$3d^7(a^2D)4p$	y^1F_3	$3d^7(^2G)4d$	3F_2
1.48.....	21	199	2722.8465	36715.396	-0.002	$3d^7(^4P)4p$	y^3D_2	$3d^7(^4P)5s$	3P_2
1.54.....	15	320	2721.6736	36731.219	0.006	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)5s$	3P_1
1.13.....	10	186	2721.0906	36739.087	-0.001	$3d^7(^2P)4p$	x^3D_2	$3d^7(^2P)5s$	3P_1
2.22.....	39	477	2721.0267	36739.951	-0.005	$3d^7(a^2D)4s$	b^1D_2	$3d^7(^4P)4p$	x^3D_2
2.24.....	102	247	2720.6973	36744.398	-0.003	$3d^7(^4P)4p$	y^3D_3	$3d^7(^4P)5s$	3P_2
1.02.....	5	278	2720.0578	36753.036	-0.014	$3d^7(a^2D)4p$	x^3F_4	$3d^7(^4P)4d$	3D_3
1.04.....	8	185	2718.2861	36776.989	0.016	$3d^7(a^2D)4p$	y^1F_3	$3d^7(^2G)4d$	1G_4
1.22.....	11	193	2718.1122	36779.343	-0.029	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)5s$	e^5F_4
0.85.....	5	198	2716.9492	36795.084	0.004	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)5s$	5P_2
1.70.....	17	294	2716.3824	36802.762	0.006	$3d^7(a^2D)4s$	a^3D_2	$3d^7(^4P)4p$	y^3P_2
2.05.....	46	404	2714.4402	36829.094	0.016	$3d^7(^4F)4s$	b^3F_2	$3d^7(^4F)4p$	z^5G_3
2.05.....	46	404	2714.4402	36829.094	0.062	$3d^7(^4F)4s$	b^3F_3	$3d^7(^4F)4p$	z^5D_2

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.47.....	20	236	2714.2081	36832.243	0.000	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)5s$	f^3G_5
2.17.....	84	259	2713.2170	36845.697	-0.003	$3d^7(^2G)4p$	y^3G_3	$3d^7(^2G)5s$	f^3G_3
1.65.....	32	202	2712.9518	36849.298	0.005	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)5s$	f^3G_4
1.28.....	10	247	2712.6021	36854.048	-0.021	$3d^7(^2P)4p$	x^3D_1	$3d^7(^2P)5s$	3P_1
0.86.....	5	214	2712.4100	36856.658	-0.025	$3d^7(^2P)4p$	z^1P_1	$3d^7(^2G)4d$	3D_2
1.58.....	27	202	2711.6994	36866.315	-0.005	$3d^7(^2G)4p$	y^3G_4	$3d^7(^2G)5s$	f^3G_3
1.49.....	12	396	2710.3895	36884.132	0.003	$3d^7(a^2D)4p$	x^3P_2	$3d^7(a^2D)5s$	1D_2
2.01.....	66	232	2710.0606	36888.608	0.000	$3d^7(^2P)4p$	x^3D_3	$3d^7(^2P)5s$	3P_2
2.08.....	135	211	2708.9452	36903.796	-0.003	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)5s$	e^3F_2
2.10.....	40	368	2708.0027	36916.639	0.001	$3d^7(a^2D)4s$	a^3D_2	$3d^7(^2P)4p$	z^3P_1
2.61.....	556	203	2707.3432	36925.632	-0.002	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)5s$	e^3F_4
1.36.....	9	231	2706.8474	36932.394	0.025	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2G)4p$	z^1G_4
2.78.....	620	231	2706.6064	36935.683	-0.001	$3d^7(^2F)4p$	z^3G_6	$3d^7(^4F)5s$	e^3F_5
1.24.....	3	168	2706.3754	36938.835	0.048	$3d^7(^4P)4s$	b^3P_0	$3d^7(^4P)4p$	y^5D_1
1.24.....	3	168	2706.3754	36938.835	-0.032	$3d^7(a^2D)4p$	x^3F_2	$3d^7(^2G)4d$	3D_2
1.78.....	36	284	2705.4149	36951.950	0.013	$3d^7(a^2D)4p$	x^3F_3	$3d^7(^4P)4d$	3D_2
1.69.....	30	257	2704.1716	36968.938	0.018	$3d^7(a^2D)4p$	x^3F_4	$3d^7(a^2D)5s$	3D_3
1.86.....	62	183	2703.3339	36980.392	-0.001	$3d^7(^4P)4p$	y^3D_2	$3d^7(^4P)5s$	3P_1
0.67.....	7	104	2702.8462	36987.065	0.010	$3d^7(^4P)4p$	z^3P_3	$3d^7(^4P)5s$	3P_2
1.59.....	19	241	2702.4179	36992.927	-0.008	$3d^7(^4P)4s$	b^3P_1	$3d^7(^4P)4p$	y^5D_2
2.14.....	193	200	2702.0184	36998.396	-0.002	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)5s$	e^3F_3
2.01.....	67	232	2701.6495	37003.447	0.001	$3d^7(^2G)4p$	y^3F_2	$3d^7(^2G)5s$	f^3G_3
1.38.....	13	274	2700.6821	37016.702	0.000	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)5s$	e^3F_3
1.41.....	11	263	2700.4133	37020.386	-0.001	$3d^7(^2P)4s$	a^1P_1	$3d^7(^2P)4p$	z^3P_0
1.71.....	18	449	2700.3233	37021.620	0.006	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)5s$	3P_0
1.95.....	56	245	2698.2758	37049.711	-0.001	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)5s$	f^3G_4
1.69.....	11	464	2697.8689	37055.299	-0.021	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2G)4p$	z^1H_5
1.31.....	9	348	2697.0454	37066.612	0.032	$3d^7(^4F)4s$	b^3F_2	$3d^7(^4F)4p$	z^5G_2
1.62.....	28	239	2696.2109	37078.084	0.012	$3d^7(a^2D)4p$	x^3F_3	$3d^7(a^2D)5s$	3D_2
2.08.....	94	206	2695.2703	37091.022	0.001	$3d^7(^2G)4p$	y^3F_3	$3d^7(^2G)5s$	f^3G_4
2.61.....	377	180	2694.6790	37099.162	0.002	$3d^7(^4F)4s$	b^3F_3	$3d^7(^4F)4p$	z^5G_4
0.86.....	3	344	2694.1983	37105.780	0.049	$3d^7(^4P)4p$	y^3P_2	$3d^7(^2G)5s$	f^3G_3
0.83.....	8	129	2693.7111	37112.491	0.012	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)5s$	5P_1
1.34.....	13	251	2693.0906	37121.042	0.008	$3d^8$	a^3P_2	$3d^7(^4F)4p$	z^3F_3
2.13.....	44	374	2692.9811	37122.551	-0.008	$3d^7(^2P)4s$	c^3P_1	$3d^7(^4P)4p$	z^3S_1
1.68.....	12	258	2692.2393	37132.779	-0.009	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2G)4p$	y^3G_5
0.90.....	7	180	2691.4578	37143.560	0.001	$3d^7(^2P)4p$	y^3S_1	$3d^7(^4P)4d$	3D_2
1.69.....	19	326	2689.8096	37166.318	-0.006	$3d^7(^4P)4s$	b^3P_2	$3d^7(^4P)4p$	y^5D_3
0.78.....	5	220	2688.5153	37184.211	-0.063	$3d^7(a^2D)4p$	y^1P_1	$3d^7(^2P)4d$	1P_1
0.83.....	6	200	2688.3841	37186.025	0.128	$3d^7(^4P)4s$	b^3P_2	$3d^7(^4P)4p$	y^5D_2
1.36.....	9	411	2686.8154	37207.734	0.009	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)5s$	e^5F_2
1.05.....	10	198	2686.3415	37214.298	-0.018	$3d^7(a^2D)4p$	x^3F_3	$3d^7(^2G)4d$	1F_3
1.94.....	48	307	2686.1057	37217.565	-0.001	$3d^7(^2G)4p$	y^3G_4	$3d^7(^2G)5s$	e^1G_4
1.05.....	12	161	2685.2774	37229.045	-0.005	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)5s$	3P_1
2.60.....	484	207	2684.4138	37241.020	0.000	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)5s$	e^5F_4
1.67.....	35	230	2683.3201	37256.200	0.002	$3d^7(a^2D)4p$	x^3F_3	$3d^7(^2G)4d$	3D_2
1.99.....	83	201	2682.6697	37265.231	0.001	$3d^7(a^2D)4p$	x^3F_4	$3d^7(^2G)4d$	3D_3
2.07.....	32	445	2682.1464	37272.501	0.003	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2G)4p$	y^3G_3
1.50.....	10	229	2681.9072	37275.825	-0.021	$3d^7(^4P)4s$	b^3P_2	$3d^7(^4P)4p$	y^5D_1
2.13.....	51	348	2680.4213	37296.488	-0.003	$3d^7(a^2D)4s$	a^3D_2	$3d^7(^2P)4p$	z^3P_2
1.75.....	41	191	2678.0517	37329.487	-0.003	$3d^7(^2P)4s$	a^1P_1	$3d^7(^4P)4p$	y^3P_2
2.48.....	319	235	2675.8538	37360.147	-0.002	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)5s$	e^5F_3
0.89.....	8	166	2674.5024	37379.024	-0.011	$3d^7(a^2D)4p$	x^3P_1	$3d^7(^2P)4d$	3D_2
2.35.....	181	227	2671.9931	37414.125	0.000	$3d^7(^2G)4p$	z^1H_5	$3d^7(^2G)5s$	e^1G_4
2.01.....	23	634	2670.8419	37430.251	-0.004	$3d^7(a^2D)4s$	a^3D_3	$3d^7(^4P)4p$	y^3P_2
1.02.....	11	177	2670.0817	37440.907	0.022	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)5s$	f^3G_5
0.56.....	4	174	2669.9562	37442.666	0.059	$3d^7(^4F)4s$	b^3F_3	$3d^7(^4F)4p$	z^5G_3
1.69.....	26	243	2669.9060	37443.371	-0.002	$3d^7(^2P)4s$	a^1P_1	$3d^7(^2P)4p$	z^3P_1
2.33.....	179	298	2669.7733	37445.231	0.004	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)5s$	e^5F_2
1.63.....	24	334	2668.0653	37469.202	0.002	$3d^7(^2P)4p$	z^1D_2	$3d^7(^2P)5s$	3P_1
2.13.....	96	369	2666.7396	37487.826	0.000	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)5s$	e^5F_1
1.42.....	11	186	2666.6930	37488.481	-0.011	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2G)4p$	z^1H_5
1.60.....	34	222	2666.5097	37491.059	-0.001	$3d^7(^2P)4p$	x^3D_2	$3d^7(^2P)5s$	1P_1
2.32.....	80	496	2666.1584	37495.998	-0.034	$3d^7(^2H)4s$	a^3H_6	$3d^7(^2G)4p$	y^3G_5
0.83.....	6	199	2664.4876	37519.509	0.012	$3d^7(^2P)4p$	1S_0	$3d^7(^2P)5s$	1P_1
3.08.....	577	418	2663.5310	37532.984	0.001	$3d^7(^4F)4s$	b^3F_4	$3d^7(^4F)4p$	z^5G_5
1.74.....	18	383	2662.6507	37545.392	0.017	$3d^7(a^2D)4s$	a^3D_2	$3d^7(^4P)4p$	y^3P_1
1.79.....	70	240	2662.4827	37547.761	0.001	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)5s$	e^5F_4
1.72.....	61	235	2656.6436	37630.283	0.006	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)5s$	e^5F_3
2.29.....	197	195	2656.3619	37634.273	-0.002	$3d^7(^4P)4p$	y^5D_4	$3d^7(^4P)5s$	5P_3
2.43.....	238	224	2656.2257	37636.203	-0.003	$3d^7(^2G)4p$	z^3H_6	$3d^7(^2G)5s$	f^3G_5
1.28.....	12	308	2655.6897	37643.798	-0.009	$3d^7(^2P)4p$	z^1P_1	$3d^7(a^2D)5s$	3D_1

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.21.....	9	373	2654.6667	37658.304	-0.050	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)5s$	f^3G_4
2.29.....	92	404	2653.7133	37671.833	0.001	$3d^7(^4P)4s$	a^5P_1	$3d^7(^4P)4p$	z^5S_2
0.64.....	4	241	2653.1282	37680.140	0.031	$3d^7(^4F)4s$	b^3F_3	$3d^7(^4F)4p$	z^5G_2
2.34.....	160	218	2652.7823	37685.054	0.003	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2G)4p$	y^3G_4
1.98.....	74	363	2652.1986	37693.346	0.000	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)5s$	e^5F_5
2.12.....	70	375	2650.0839	37723.423	0.001	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)5s$	f^3G_5
2.17.....	73	220	2649.9115	37725.877	-0.114	$3d^7(a^2D)4p$	x^3F_2	$3d^7(a^2D)5s$	3D_1
3.11.....	981	215	2648.6419	37743.959	0.022	$3d^7(^2H)4s$	a^1H_5	$3d^7(^2H)4p$	z^3I_6
1.61.....	42	249	2648.4015	37747.386	-0.001	$3d^7(^4F)4p$	z^5D_1	$3d^7(^4F)5s$	e^5F_2
1.08.....	14	177	2647.3612	37762.218	0.012	$3d^7(^4P)4p$	y^5D_2	$3d^7(^4P)5s$	5P_3
1.11.....	11	245	2646.8262	37769.850	0.021	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)5s$	e^1G_4
1.36.....	11	410	2646.6429	37772.466	0.015	$3d^7(a^2D)4p$	w^3D_2	$3d^7(^4P)4d$	3D_2
1.82.....	73	184	2645.9904	37781.779	0.000	$3d^7(^4P)4p$	y^3D_3	$3d^7(^4P)5s$	5P_3
1.30.....	7	227	2644.4434	37803.880	0.012	$3d^7(^2P)4s$	c^3P_0	$3d^7(^4P)4p$	z^5P_1
0.59.....	7	123	2643.7212	37814.207	0.045	$3d^7(a^2D)4p$	w^3D_2	$3d^7(^2G)4d$	3D_3
1.62.....	33	190	2643.0909	37823.225	0.000	$3d^7(^2P)4s$	a^1P_1	$3d^7(^2P)4p$	z^3P_2
1.09.....	4	235	2640.4866	37860.528	0.010	$3d^7(a^2D)4s$	b^1D_2	$3d^7(a^2D)4p$	w^3D_3
1.57.....	19	416	2639.0822	37880.674	0.000	$3d^7(^4F)4p$	z^5D_0	$3d^7(^4F)5s$	e^5F_1
1.38.....	26	197	2638.7882	37884.894	0.004	$3d^7(^4P)4p$	y^5D_1	$3d^7(^4P)5s$	5P_2
1.55.....	41	184	2638.3410	37891.316	0.005	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)5s$	3P_2
1.24.....	16	232	2637.8340	37898.597	0.010	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)5s$	3D_2
2.14.....	82	269	2637.3347	37905.772	-0.001	$3d^7(a^2D)4s$	a^3D_2	$3d^7(^2G)4p$	z^1F_3
2.91.....	218	679	2636.0677	37923.990	0.000	$3d^7(a^2D)4s$	a^3D_3	$3d^7(^2P)4p$	z^3P_2
1.89.....	56	271	2635.8658	37926.895	0.044	$3d^7(^2P)4s$	a^1P_1	$3d^7(^4P)4p$	y^3P_0
1.89.....	56	271	2635.8658	37926.895	-0.021	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2G)5s$	f^3G_5
2.83.....	329	330	2634.9221	37940.477	-0.001	$3d^7(a^2D)4s$	a^3D_1	$3d^7(^2P)4p$	z^1D_2
1.30.....	25	175	2634.8917	37940.915	0.024	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)5s$	f^3G_4
1.50.....	18	384	2632.8585	37970.213	-0.035	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)5s$	e^1G_4
1.82.....	77	190	2632.5374	37974.844	0.005	$3d^7(^4P)4p$	y^5D_2	$3d^7(^4P)5s$	5P_2
2.57.....	140	562	2632.2464	37979.042	-0.003	$3d^7(^4P)4s$	a^5P_2	$3d^7(^4P)4p$	z^5S_2
2.08.....	109	182	2631.1816	37994.410	-0.002	$3d^7(^4P)4p$	y^5D_3	$3d^7(^4P)5s$	5P_2
1.45.....	14	310	2630.5300	38003.822	-0.024	$3d^7(^2P)4s$	c^3P_0	$3d^7(^2P)4p$	y^3D_1
1.69.....	39	356	2628.8934	38027.480	-0.007	$3d^7(^4F)4p$	z^5D_1	$3d^7(^4F)5s$	e^5F_1
2.54.....	176	176	2628.8161	38028.597	0.000	$3d^7(^4P)4s$	b^3P_0	$3d^7(^4P)4p$	z^3S_1
1.01.....	7	318	2626.9556	38055.529	-0.015	$3d^7(^2P)4p$	z^1P_1	$3d^7(^2G)4d$	1D_2
1.98.....	117	250	2626.7296	38058.803	0.001	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)5s$	e^5F_2
1.28.....	6	304	2625.8134	38072.082	-0.027	$3d^7(^2P)4s$	a^1P_1	$3d^7(^4P)4p$	y^3P_1
1.12.....	13	234	2625.4939	38076.714	0.001	$3d^7(a^2D)4p$	w^3D_2	$3d^7(^2G)4d$	3D_2
1.37.....	26	207	2624.2742	38094.410	-0.023	$3d^7(^4P)4p$	y^5D_0	$3d^7(^4P)5s$	5P_1
1.55.....	26	307	2624.2371	38094.948	0.006	$3d^7(a^2D)4p$	w^3D_3	$3d^7(a^2D)5s$	3D_3
1.55.....	26	307	2624.2371	38094.948	0.003	$3d^7(^2H)4p$	x^3G_3	$3d^7(^2G)4d$	3D_3
1.42.....	5	460	2622.6706	38117.702	0.040	$3d^7(a^2D)4s$	b^1D_2	$3d^7(a^2D)4p$	w^3D_1
2.18.....	219	223	2621.9255	38128.533	-0.004	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)5s$	e^5F_3
0.64.....	7	137	2621.4219	38135.858	0.017	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)5s$	e^3F_4
2.28.....	131	332	2620.8358	38144.385	0.000	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2G)5s$	f^3G_4
1.14.....	13	248	2620.0154	38156.328	0.023	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)5s$	3P_1
1.69.....	32	270	2619.9810	38156.829	0.004	$3d^7(a^2D)4s$	b^1D_2	$3d^7(^2H)4p$	x^3G_3
2.88.....	641	211	2619.8008	38159.453	0.002	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2G)4p$	z^3H_5
2.52.....	329	184	2618.8920	38172.695	0.001	$3d^7(^4P)4s$	b^3P_1	$3d^7(^4P)4p$	z^3S_1
1.59.....	36	249	2616.8632	38202.288	-0.001	$3d^7(^4P)4p$	y^5D_1	$3d^7(^4P)5s$	5P_1
1.10.....	14	205	2615.5693	38221.186	0.013	$3d^7(^2P)4p$	z^1D_2	$3d^7(^2P)5s$	1P_1
2.16.....	97	347	2615.1272	38227.646	0.002	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)5s$	f^3G_3
0.74.....	8	165	2614.9416	38230.360	-0.009	$3d^7(a^2D)4p$	y^1D_2	$3d^7(^2P)4d$	1F_3
0.64.....	6	172	2614.6428	38234.728	0.069	$3d^7(a^2D)4p$	x^3P_0	$3d^7(^2P)4d$	1P_1
2.78.....	209	654	2614.3530	38238.966	0.001	$3d^7(^4P)4s$	a^5P_3	$3d^7(^4P)4p$	z^5S_2
2.79.....	489	223	2613.4910	38251.577	-0.001	$3d^8$	a^3P_2	$3d^7(^4F)4p$	z^3D_3
1.27.....	8	231	2612.7622	38262.247	-0.028	$3d^7(^2H)4s$	a^1H_5	$3d^7(^2H)4p$	z^3I_5
2.30.....	319	224	2612.5036	38266.034	0.001	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)5s$	e^5F_4
1.83.....	72	224	2612.3421	38268.399	0.001	$3d^7(^2H)4p$	x^3G_3	$3d^7(^2H)5s$	3H_4
1.82.....	75	209	2612.0566	38272.582	0.003	$3d^7(^2H)4p$	x^3G_4	$3d^7(^2H)5s$	3H_5
1.21.....	14	269	2612.0237	38273.064	0.032	$3d^7(a^2D)4p$	x^3F_3	$3d^7(a^2D)5s$	1D_2
1.57.....	21	321	2611.8058	38276.256	0.004	$3d^7(^2H)4s$	a^1H_5	$3d^7(^2H)4p$	x^3G_4
2.18.....	161	221	2610.8082	38290.881	0.001	$3d^7(^2H)4p$	z^3I_7	$3d^7(^2H)5s$	3H_6
1.44.....	22	300	2610.7163	38292.229	-0.009	$3d^7(^4P)4p$	y^5D_2	$3d^7(^4P)5s$	5P_1
1.64.....	17	247	2610.2903	38298.479	0.008	$3d^7(^2P)4s$	c^3P_1	$3d^7(^4P)4p$	y^3D_2
0.97.....	8	293	2607.5375	38338.908	0.005	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)5s$	e^5F_1
1.72.....	25	365	2606.9409	38347.681	0.008	$3d^7(^2P)4s$	c^3P_1	$3d^7(^4P)4p$	z^5P_1
0.64.....	5	234	2606.8238	38349.403	0.015	$3d^7(a^2D)4p$	y^1F_3	$3d^7(^2P)4d$	1F_3
2.73.....	233	421	2605.9036	38362.944	-0.001	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2G)4p$	y^3F_4
3.14.....	1511	174	2605.7194	38365.656	0.000	$3d^7(^4P)4s$	b^3P_2	$3d^7(^4P)4p$	z^3S_1
1.85.....	39	414	2604.4013	38385.072	0.002	$3d^8$	a^1D_2	$3d^7(^4F)4p$	z^3G_3
1.69.....	49	244	2603.9818	38391.256	0.004	$3d^7(a^2D)4p$	w^3D_3	$3d^7(^2G)4d$	3D_3

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
2.28	220	209	2603.1378	38403.703	0.000	$3d^7(^2H)4p$	z^1I_6	$3d^7(^2H)5s$	1H_5
1.28	5	359	2600.8423	38437.596	-0.012	$3d^7(a^2D)4s$	b^1D_2	$3d^7(a^2D)4p$	w^3D_2
1.35	5	467	2600.6982	38439.724	-0.028	$3d^7(^2G)4s$	b^1G_4	$3d^7(^4P)4p$	y^3D_3
0.99	9	273	2600.5049	38442.583	0.002	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)5s$	e^3F_4
0.85	7	257	2600.2245	38446.727	0.020	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)5s$	3P_0
1.06	14	205	2599.6611	38455.058	-0.001	$3d^7(a^2D)4p$	x^3F_3	$3d^7(^2G)4d$	1D_2
1.02	13	200	2595.9391	38510.192	0.010	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)5s$	f^3G_3
1.92	45	362	2593.4164	38547.650	-0.001	$3d^7(^2P)4s$	c^3P_1	$3d^7(^4P)4p$	y^3D_1
1.55	23	288	2592.8809	38555.609	0.000	$3d^7(a^2D)4s$	a^3D_1	$3d^7(^2P)4p$	x^3D_1
1.12	15	227	2592.7829	38557.067	0.004	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)5s$	e^5F_2
1.29	19	253	2591.3148	38578.910	0.020	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)5s$	e^1G_4
0.59	6	169	2590.3030	38593.979	-0.010	$3d^7(^2H)4p$	z^3I_6	$3d^7(^2H)5s$	3H_6
1.49	26	295	2589.9234	38599.635	0.006	$3d^7(^2H)4p$	z^1I_6	$3d^7(^2G)4d$	3I_5
2.17	271	205	2588.9045	38614.825	-0.004	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)5s$	e^5F_4
2.43	289	343	2587.5243	38635.421	-0.003	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)5s$	e^5F_5
3.48	3101	225	2587.2197	38639.970	-0.001	$3d^7(^4F)4s$	b^3F_3	$3d^7(^4F)4p$	z^3G_4
2.66	565	163	2587.0734	38642.155	0.002	$3d^7(a^2D)4s$	a^3D_1	$3d^7(^2P)4p$	1S_0
2.44	229	237	2586.8507	38645.482	0.000	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2G)4p$	z^3H_4
2.23	141	238	2585.1711	38670.588	-0.002	$3d^7(a^2D)4s$	a^3D_1	$3d^7(^2P)4p$	x^3D_2
0.83	8	204	2584.7458	38676.951	0.019	$3d^7(a^2D)4p$	x^3P_2	$3d^7(^2P)4d$	3D_2
0.89	9	215	2583.3498	38697.849	-0.006	$3d^7(^2P)4p$	x^3D_3	$3d^7(^4P)4d$	3F_4
3.27	708	549	2583.1672	38700.585	0.000	$3d^7(^2P)4s$	c^3P_2	$3d^7(^4P)4p$	y^3D_3
2.03	74	376	2583.0669	38702.087	-0.003	$3d^7(^2H)4p$	x^3G_5	$3d^7(^2H)5s$	3H_6
3.50	2050	358	2582.2396	38714.486	0.000	$3d^7(^4F)4s$	b^3F_2	$3d^7(^4F)4p$	z^3G_3
2.50	200	270	2582.2092	38714.942	0.000	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)5s$	e^5F_3
2.45	55	527	2581.2326	38729.588	0.000	$3d^7(^2P)4s$	c^3P_2	$3d^7(^4P)4p$	y^3D_2
1.85	47	396	2581.2054	38729.995	0.000	$3d^7(^2H)4p$	z^1I_6	$3d^7(^2G)4d$	1I_6
0.90	7	276	2580.6831	38737.834	-0.028	$3d^7(^4F)4p$	z^3D_2	$3d^7(^4F)4d$	f^5F_2
3.87	3790	479	2580.3264	38743.190	-0.001	$3d^7(^4F)4s$	b^3F_4	$3d^7(^4F)4p$	z^3G_5
1.06	15	192	2577.7304	38782.204	-0.004	$3d^7(a^2D)4p$	y^1D_2	111436 ^e	3F_2
1.15	16	239	2577.5506	38784.910	0.000	$3d^7(a^2D)4p$	x^3F_3	$3d^7(^2G)4d$	3F_2
2.02	77	359	2576.8682	38795.181	-0.006	$3d^7(^2H)4p$	z^3I_5	$3d^7(^2H)5s$	3H_4
1.16	20	192	2576.3476	38803.019	-0.001	$3d^7(^2H)4p$	x^3G_4	$3d^7(^2G)4d$	3H_5
2.05	94	312	2576.2233	38804.891	-0.003	$3d^7(^2H)4p$	z^3I_6	$3d^7(^2H)5s$	3H_5
0.48	4	280	2575.9281	38809.337	0.000	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)5s$	e^3F_3
1.70	67	284	2575.9002	38809.758	0.000	$3d^7(^4F)4p$	z^5F_1	$3d^7(^4F)5s$	e^5F_2
2.66	662	267	2575.4551	38816.465	-0.002	$3d^7(^4F)4p$	z^5F_5	$3d^7(^4F)5s$	e^5F_5
2.71	256	400	2574.8622	38825.403	0.000	$3d^8$	a^3P_1	$3d^7(^4F)4p$	z^3D_2
1.25	20	233	2573.4431	38846.810	0.000	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)5s$	e^5F_3
1.22	20	222	2570.7688	38887.219	-0.016	$3d^7(a^2D)4p$	y^1D_2	$3d^7(^2P)4d$	3F_3
0.81	7	239	2569.1458	38911.784	-0.060	$3d^7(^2H)4p$	x^3G_3	$3d^7(^2G)4d$	3G_3
0.89	8	270	2566.8363	38946.792	0.001	$3d^7(^2H)4p$	x^3G_4	$3d^7(^2G)4d$	3G_4
0.66	5	257	2566.4676	38952.388	0.070	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)4d$	e^5P_3
2.12	99	259	2565.3711	38969.036	0.001	$3d^8$	a^3P_2	$3d^7(^4F)4p$	z^3D_2
1.28	17	304	2564.4737	38982.671	-0.005	$3d^7(^2H)4p$	z^1I_6	$3d^7(^2G)4d$	1H_5
3.41	3409	196	2564.0345	38989.348	-0.002	$3d^7(^4F)4s$	b^3F_3	$3d^7(^4F)4p$	z^3F_4
1.30	16	341	2563.0538	39004.266	0.003	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2P)5s$	3P_2
1.03	17	172	2560.8349	39038.059	0.004	$3d^7(a^2D)4p$	x^3P_2	$3d^7(^2P)4d$	1F_3
3.61	4119	208	2560.0309	39050.319	0.000	$3d^7(^2H)4s$	a^1H_5	$3d^7(^2H)4p$	z^1I_6
3.14	772	468	2559.4053	39059.863	0.001	$3d^7(^4F)4s$	b^3F_2	$3d^7(^4F)4p$	z^3F_3
1.62	38	390	2557.4410	39089.862	0.003	$3d^7(^4F)4p$	z^5F_1	$3d^7(^4F)5s$	e^5F_1
2.43	114	468	2557.3451	39091.328	-0.015	$3d^8$	a^3P_0	$3d^7(^4F)4p$	z^3D_1
2.43	114	468	2557.3451	39091.328	-0.038	$3d^7(^4F)4p$	z^5D_1	$3d^7(^4F)5s$	e^3F_2
1.32	15	371	2557.1987	39093.566	0.019	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)5s$	1D_2
2.03	176	167	2556.7812	39099.949	0.000	$3d^7(^4P)4s$	b^3P_1	$3d^7(^4P)4p$	z^5P_2
1.65	72	234	2553.9389	39143.462	-0.005	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)5s$	e^5F_2
1.65	49	253	2552.8044	39160.856	0.002	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)5s$	e^3F_4
0.45	5	170	2552.4380	39166.478	0.012	$3d^7(^4P)4p$	y^3P_0	$3d^7(^2P)5s$	3P_1
2.29	248	170	2552.3917	39167.188	-0.001	$3d^7(^2P)4s$	c^3P_0	$3d^7(^2P)4p$	z^3P_1
1.33	23	260	2551.7032	39177.755	-0.015	$3d^7(^2H)4p$	x^3G_4	$3d^7(^2H)5s$	1H_5
1.22	23	196	2551.6372	39178.768	0.002	$3d^7(^4F)4p$	z^3D_2	$3d^7(^4F)4d$	e^3D_3
0.91	8	284	2551.3101	39183.792	0.009	$3d^7(a^2D)4p$	w^3D_1	$3d^7(a^2D)5s$	3D_1
1.75	109	202	2550.5408	39195.610	0.004	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)5s$	e^5F_3
1.87	149	198	2549.7272	39208.116	0.005	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)5s$	e^5F_4
1.12	5	286	2549.4201	39212.837	0.022	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2G)4p$	y^3F_3
1.54	45	212	2547.5903	39241.000	0.005	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)4d$	f^5F_3
0.87	10	204	2547.3724	39244.357	0.004	$3d^7(^4F)4p$	z^3D_1	$3d^7(^4F)4d$	e^5G_2
3.74	3567	333	2546.7386	39254.124	0.412	$3d^7(^4P)4s$	b^3P_0	$3d^7(^4P)4p$	z^5P_1
3.74	3567	333	2546.7386	39254.124	-0.001	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2G)4p$	z^1G_4
1.55	13	313	2546.4782	39258.138	0.015	$3d^7(a^2D)4s$	b^1D_2	$3d^7(a^2D)4p$	x^3F_3
1.85	45	381	2546.1599	39263.043	-0.003	$3d^8$	a^1D_2	$3d^7(^4F)4p$	z^3F_2
2.07	95	265	2545.7147	39269.911	0.000	$3d^7(^4P)4s$	b^3P_2	$3d^7(^4P)4p$	z^5P_3

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
2.30.....	84	467	2545.0406	39280.311	0.001	3d ⁸	<i>a</i> ³ P ₁	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₁
2.25.....	108	356	2544.5419	39288.010	0.001	3d ⁷ (² P)4s	<i>c</i> ³ P ₁	3d ⁷ (² P)4p	<i>z</i> ³ P ₀
1.18.....	11	400	2543.2722	39307.622	0.025	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₃	3d ⁷ (⁴ F)5s	<i>e</i> ³ F ₃
0.51.....	6	140	2542.8793	39313.695	-0.007	3d ⁷ (² P)4p	¹ S ₀	3d ⁷ (⁴ P)4d	³ D ₁
3.25.....	1345	330	2541.9533	39328.015	0.000	3d ⁷ (⁴ F)4s	<i>b</i> ³ F ₃	3d ⁷ (⁴ F)4p	<i>z</i> ³ G ₃
1.49.....	28	310	2541.5099	39334.876	-0.045	3d ⁷ (² D)4p	<i>y</i> ¹ P ₁	3d ⁷ (² D)4d	¹ P ₁
0.87.....	7	321	2541.1448	39340.526	-0.024	3d ⁷ (² H)4p	<i>x</i> ³ G ₅	3d ⁷ (² G)4d	³ G ₅
3.35.....	1701	288	2540.6231	39348.605	-0.001	3d ⁷ (⁴ P)4s	<i>b</i> ³ P ₁	3d ⁷ (⁴ P)4p	<i>y</i> ³ D ₂
0.79.....	8	219	2539.8673	39360.313	0.036	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₁	3d ⁷ (⁴ F)4d	<i>e</i> ³ D ₂
0.88.....	10	214	2538.0075	39389.154	0.000	3d ⁷ (⁴ F)4p	<i>z</i> ⁵ F ₅	3d ⁷ (⁴ F)5s	<i>e</i> ⁵ F ₄
2.24.....	194	209	2537.4500	39397.808	0.000	3d ⁷ (⁴ P)4s	<i>b</i> ³ P ₁	3d ⁷ (⁴ P)4p	<i>z</i> ⁵ P ₁
1.16.....	17	235	2535.7911	39423.580	0.012	3d ⁷ (⁴ F)4p	<i>z</i> ⁵ F ₂	3d ⁷ (⁴ F)5s	<i>e</i> ⁵ F ₁
0.98.....	12	225	2535.5867	39426.757	0.004	3d ⁷ (² H)4p	<i>y</i> ¹ H ₅	3d ⁷ (² H)4d	³ I ₆
3.09.....	751	376	2533.8557	39453.690	0.001	3d ⁷ (⁴ P)4s	<i>b</i> ³ P ₀	3d ⁷ (⁴ P)4p	<i>y</i> ³ D ₁
3.28.....	1441	288	2533.8009	39454.543	0.000	3d ⁷ (² G)4s	<i>b</i> ¹ G ₄	3d ⁷ (² G)4p	<i>y</i> ³ G ₅
0.56.....	6	171	2533.7507	39455.325	0.006	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₃	3d ⁷ (⁴ F)4d	<i>f</i> ⁵ F ₂
1.73.....	34	449	2532.9017	39468.549	0.004	3d ⁷ (² H)4p	<i>y</i> ¹ G ₄	3d ⁷ (⁴ F)5d	⁵ G ₃
2.18.....	170	257	2531.6670	39487.797	0.000	3d ⁷ (² H)4p	<i>y</i> ¹ H ₅	3d ⁷ (² H)4d	¹ H ₅
1.44.....	25	322	2531.0138	39497.987	-0.011	3d ⁷ (⁴ P)4p	<i>y</i> ³ P ₂	3d ⁷ (² P)5s	³ P ₂
1.54.....	40	248	2530.2659	39509.661	0.011	3d ⁷ (⁴ F)4p	<i>z</i> ⁵ F ₃	3d ⁷ (⁴ F)5s	<i>e</i> ³ F ₄
3.56.....	2390	331	2530.0799	39512.565	0.000	3d ⁷ (⁴ P)4s	<i>b</i> ³ P ₂	3d ⁷ (⁴ P)4p	<i>y</i> ³ D ₃
3.54.....	1833	500	2528.6157	39535.443	0.001	3d ⁷ (⁴ F)4s	<i>b</i> ³ F ₄	3d ⁷ (⁴ F)4p	<i>z</i> ³ G ₄
2.88.....	524	318	2528.2239	39541.570	0.001	3d ⁷ (⁴ P)4s	<i>b</i> ³ P ₂	3d ⁷ (⁴ P)4p	<i>y</i> ³ D ₂
1.70.....	60	243	2526.5035	39568.493	0.003	3d ⁷ (² H)4p	<i>y</i> ¹ H ₅	3d ⁷ (² H)4d	³ H ₆
1.96.....	83	319	2526.1864	39573.460	0.000	3d ⁷ (² G)4p	<i>z</i> ¹ F ₃	3d ⁶ 4s ²	¹ G ₄
1.98.....	61	351	2526.0591	39575.454	0.000	3d ⁷ (² D)4s	<i>b</i> ¹ D ₂	3d ⁷ (² D)4p	<i>x</i> ³ F ₂
2.73.....	711	177	2525.0818	39590.770	0.000	3d ⁷ (⁴ P)4s	<i>b</i> ³ P ₂	3d ⁷ (⁴ P)4p	<i>z</i> ⁵ P ₁
3.37.....	1379	434	2524.9739	39592.463	0.000	3d ⁷ (⁴ F)4s	<i>b</i> ³ F ₂	3d ⁷ (⁴ F)4p	<i>z</i> ⁵ F ₂
1.05.....	9	354	2524.7787	39595.523	0.002	3d ⁷ (² D)4p	<i>w</i> ³ D ₁	3d ⁷ (² G)4d	¹ D ₂
2.35.....	194	262	2524.6772	39597.114	0.003	3d ⁷ (² P)4s	<i>c</i> ³ P ₁	3d ⁷ (⁴ P)4p	<i>y</i> ³ P ₂
2.95.....	516	400	2524.6344	39597.785	-0.001	3d ⁷ (⁴ P)4s	<i>b</i> ³ P ₁	3d ⁷ (⁴ P)4p	<i>y</i> ³ D ₁
3.22.....	1822	208	2522.9567	39624.116	-0.001	3d ⁷ (² P)4s	<i>a</i> ¹ P ₁	3d ⁷ (² P)4p	<i>z</i> ¹ D ₂
3.22.....	1822	208	2522.9567	39624.116	-0.015	3d ⁷ (⁴ F)4p	<i>z</i> ⁵ F ₃	3d ⁷ (⁴ F)5s	<i>e</i> ⁵ F ₂
1.45.....	14	447	2520.8244	39657.631	-0.007	3d ⁷ (² D)4s	<i>b</i> ¹ D ₂	3d ⁷ (² P)4p	<i>z</i> ¹ P ₁
0.61.....	6	211	2520.2734	39666.300	-0.021	3d ⁷ (² P)4p	<i>z</i> ¹ P ₁	3d ⁷ (² P)4d	³ D ₂
3.21.....	1911	239	2519.8229	39673.391	0.000	3d ⁷ (⁴ F)4s	<i>b</i> ³ F ₃	3d ⁷ (⁴ F)4p	<i>z</i> ³ F ₃
0.70.....	7	216	2518.3673	39696.321	-0.018	3d ⁷ (² D)4p	<i>y</i> ¹ D ₂	3d ⁷ (² P)4d	¹ D ₂
1.49.....	34	272	2518.1799	39699.275	0.014	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₂	3d ⁷ (⁴ F)4d	<i>e</i> ⁵ G ₂
1.63.....	14	368	2518.1735	39699.375	-0.021	3d ⁷ (² P)4s	<i>c</i> ³ P ₁	3d ⁷ (² G)4p	<i>y</i> ³ F ₂
2.44.....	177	346	2517.4366	39710.995	0.002	3d ⁷ (² P)4s	<i>c</i> ³ P ₁	3d ⁷ (² P)4p	<i>z</i> ³ P ₁
0.83.....	6	351	2516.9574	39718.555	-0.009	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₁	3d ⁷ (⁴ F)4d	<i>e</i> ⁵ D ₁
1.46.....	8	438	2516.5540	39724.922	0.040	3d ⁷ (² D)4s	<i>a</i> ³ D ₃	3d ⁷ (² P)4p	<i>z</i> ¹ D ₂
0.64.....	6	230	2516.2487	39729.741	-0.006	3d ⁷ (² P)4p	<i>z</i> ¹ D ₂	3d ⁷ (⁴ P)4d	³ D ₃
1.06.....	16	216	2514.5393	39756.747	0.004	3d ⁷ (² H)4p	<i>x</i> ³ G ₄	3d ⁷ (² G)4d	¹ H ₅
0.49.....	4	247	2514.3371	39759.944	0.019	3d ⁷ (² D)4p	<i>w</i> ³ D ₃	3d ⁷ (⁴ F)6s	³ F ₄
0.59.....	6	209	2513.4238	39774.391	0.025	3d ⁷ (² P)4p	<i>x</i> ³ D ₂	3d ⁷ (² G)4d	³ D ₂
0.95.....	13	204	2512.5062	39788.918	0.030	3d ⁷ (⁴ F)4p	<i>z</i> ⁵ F ₄	3d ⁷ (⁴ F)5s	<i>e</i> ⁵ F ₃
2.15.....	39	427	2512.3905	39790.748	0.000	3d ⁷ (⁴ P)4s	<i>b</i> ³ P ₂	3d ⁷ (⁴ P)4p	<i>y</i> ³ D ₁
2.67.....	649	173	2512.0636	39795.927	0.002	3d ⁷ (² P)4s	<i>c</i> ³ P ₀	3d ⁷ (⁴ P)4p	<i>y</i> ³ P ₁
3.90.....	8759	211	2511.1599	39810.247	-0.001	3d ⁷ (² G)4s	<i>b</i> ¹ G ₄	3d ⁷ (² G)4p	<i>z</i> ¹ H ₅
1.60.....	87	241	2510.8483	39815.187	0.002	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₂	3d ⁷ (⁴ F)4d	<i>e</i> ³ D ₂
2.29.....	215	268	2510.5487	39819.938	0.000	3d ⁷ (² H)4p	<i>y</i> ¹ G ₄	3d ⁷ (² H)4d	¹ F ₃
2.25.....	132	303	2510.0725	39827.493	-0.002	3d ⁷ (² D)4s	<i>a</i> ³ D ₂	3d ⁷ (² P)4p	<i>x</i> ³ D ₂
2.45.....	289	221	2507.9630	39860.990	0.001	3d ⁸	<i>a</i> ¹ D ₂	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₃
3.42.....	1940	396	2506.4644	39884.820	-0.001	3d ⁷ (⁴ F)4s	<i>b</i> ³ F ₄	3d ⁷ (⁴ F)4p	<i>z</i> ³ F ₄
0.88.....	9	263	2506.3729	39886.277	0.069	3d ⁷ (² H)4p	<i>x</i> ³ G ₃	3d ⁷ (² G)4d	³ F ₂
1.06.....	12	284	2505.8865	39894.018	0.016	3d ⁷ (⁴ F)4p	<i>z</i> ⁵ F ₂	3d ⁷ (⁴ F)5s	<i>e</i> ³ F ₃
2.06.....	294	208	2505.7480	39896.223	0.000	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₃	3d ⁷ (⁴ F)4d	<i>e</i> ³ D ₃
1.52.....	23	437	2503.9183	39925.375	0.004	3d ⁷ (² D)4p	<i>w</i> ³ D ₁	3d ⁷ (² G)4d	³ F ₂
1.70.....	57	410	2502.0484	39955.210	0.000	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₁	3d ⁷ (⁴ F)4d	<i>e</i> ³ D ₁
0.90.....	5	184	2501.8358	39958.605	0.013	3d ⁷ (² D)4p	<i>x</i> ³ P ₀	3d ⁷ (⁴ F)5d	³ P ₁
1.35.....	25	262	2499.2512	39999.926	-0.001	3d ⁷ (² H)4p	<i>y</i> ¹ H ₅	3d ⁷ (² H)4d	³ I ₅
3.44.....	2194	291	2498.8214	40006.806	0.000	3d ⁷ (² G)4s	<i>b</i> ¹ G ₄	3d ⁷ (² G)4p	<i>y</i> ³ G ₄
0.53.....	5	209	2497.6267	40025.941	0.071	3d ⁷ (⁴ F)4p	<i>z</i> ⁵ D ₄	3d ⁷ (⁴ F)5s	<i>e</i> ³ F ₃
1.92.....	63	310	2497.5338	40027.429	0.003	3d ⁷ (² G)4s	<i>b</i> ¹ G ₄	3d ⁷ (² G)4p	<i>y</i> ³ G ₃
2.69.....	205	572	2497.4840	40028.228	0.000	3d ⁷ (² P)4s	<i>c</i> ³ P ₂	3d ⁷ (⁴ P)4p	<i>y</i> ³ P ₂
2.17.....	129	346	2496.4599	40044.647	0.005	3d ⁷ (² H)4p	<i>y</i> ¹ G ₄	113191 ^e	
0.91.....	6	168	2496.2335	40048.279	-0.018	3d ⁷ (² D)4s	<i>a</i> ³ D ₁	3d ⁷ (² D)4p	<i>w</i> ³ D ₁
0.85.....	13	162	2494.6976	40072.934	0.004	3d ⁷ (² P)4p	<i>z</i> ³ P ₀	3d ⁷ (² P)5s	³ P ₁
1.39.....	23	319	2493.7818	40087.648	0.008	3d ⁷ (⁴ F)4p	<i>z</i> ³ D ₂	3d ⁷ (⁴ F)4d	<i>e</i> ⁵ D ₂
1.39.....	20	247	2493.5829	40090.847	0.001	3d ⁷ (² P)4s	<i>c</i> ³ P ₁	3d ⁷ (² P)4p	<i>z</i> ³ P ₂
0.49.....	6	143	2492.8288	40102.973	0.041	3d ⁷ (⁴ F)4p	<i>z</i> ⁵ F ₄	3d ⁷ (⁴ F)5s	<i>e</i> ³ F ₄

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
0.40.....	4	215	2491.8338	40118.984	0.042	$3d^7(a^2D)4p$	x^3F_3	$3d^7(^2P)4d$	3D_3
1.31.....	14	381	2491.1177	40130.517	0.004	$3d^7(^2P)4s$	c^3P_2	$3d^7(^2G)4p$	y^3F_2
2.90.....	347	556	2490.3981	40142.113	0.003	$3d^7(^2P)4s$	c^3P_2	$3d^7(^2P)4p$	z^3P_1
2.42.....	305	262	2487.9066	40182.310	-0.003	$3d^7(^2H)4p$	y^1H_5	$3d^7(^2H)4d$	3H_5
0.59.....	6	210	2487.6910	40185.791	-0.017	$3d^7(^2H)4p$	x^3G_5	$3d^7(^2G)4d$	3H_4
1.85.....	27	608	2487.4060	40190.396	-0.010	$3d^7(^4F)4s$	b^3F_2	$3d^7(^4F)4p$	z^3D_3
2.79.....	397	369	2487.1539	40194.469	-0.003	$3d^7(^2P)4s$	c^3P_1	$3d^7(^4P)4p$	y^3P_0
0.39.....	3	254	2486.8008	40200.175	-0.041	$3d^7(^2P)4p$	z^1D_2	$3d^7(^4P)4d$	3D_2
2.85.....	701	273	2486.4410	40205.993	0.001	$3d^7(^4F)4s$	b^3F_3	$3d^7(^4F)4p$	z^3F_2
2.32.....	97	593	2485.3594	40223.489	0.003	$3d^7(^4F)4s$	b^3F_4	$3d^7(^4F)4p$	z^3G_3
1.74.....	45	276	2484.3857	40239.252	0.004	$3d^7(^2P)4s$	a^1P_1	$3d^7(^2P)4p$	x^3D_1
0.58.....	5	256	2483.2661	40257.394	-0.065	$3d^7(^2P)4p$	y^3S_1	$3d^7(^2P)4d$	3D_2
1.03.....	13	246	2482.8860	40263.555	-0.019	$3d^7(a^2D)4p$	y^1D_2	$3d^7(^4F)5d$	5G_2
0.94.....	13	204	2481.6259	40283.999	0.024	$3d^7(^4F)4p$	z^5F_5	$3d^7(^4F)5s$	e^3F_4
0.77.....	8	234	2481.4544	40286.783	-0.002	$3d^7(a^2D)4p$	x^3P_1	$3d^7(^4F)5d$	3P_1
0.90.....	8	320	2479.8517	40312.818	-0.034	$3d^7(a^2D)4p$	y^1D_2	$3d^7(^2H)4d$	1F_3
2.71.....	400	305	2479.0538	40325.791	-0.001	$3d^7(^2P)4s$	a^1P_1	$3d^7(^2P)4p$	1S_0
1.88.....	78	300	2478.7107	40331.374	-0.018	$3d^7(^2P)4p$	z^3P_2	$3d^7(^4P)4d$	5F_1
1.88.....	78	300	2478.7107	40331.374	-0.042	$3d^7(a^2D)4p$	y^1P_1	$3d^7(a^2D)4d$	3D_1
2.38.....	303	188	2478.2947	40338.142	-0.001	$3d^7(^4P)4s$	b^3P_1	$3d^7(^2P)4p$	z^3P_0
2.82.....	413	379	2478.1973	40339.728	-0.002	$3d^7(^2P)4s$	c^3P_1	$3d^7(^4P)4p$	y^3P_1
2.89.....	953	197	2477.3067	40354.229	0.000	$3d^7(^2P)4s$	a^1P_1	$3d^7(^2P)4p$	x^3D_2
1.98.....	32	377	2476.4485	40368.213	-0.030	$3d^7(a^2D)4s$	a^3D_1	$3d^7(a^2D)4p$	w^3D_2
1.22.....	10	204	2476.0551	40374.626	-0.040	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)5s$	e^3F_3
0.46.....	5	167	2475.5950	40382.130	-0.007	$3d^7(a^2D)4p$	w^3D_3	$3d^7(^4F)6s$	5F_4
2.61.....	563	222	2475.3026	40386.899	-0.001	$3d^7(^2H)4p$	y^1H_5	$3d^7(^2H)4d$	1I_6
1.12.....	15	260	2473.4811	40416.639	-0.079	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)4d$	e^5G_2
0.48.....	4	206	2472.5464	40431.916	0.045	$3d^7(a^2D)4p$	y^1F_3	$3d^7(^2H)4d$	1F_3
1.42.....	28	291	2472.2313	40437.069	0.003	$3d^7(^2G)4p$	y^3G_4	$3d^64s^2$	1G_4
1.61.....	41	304	2471.6795	40446.095	-0.003	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)4d$	e^5D_3
3.30.....	849	578	2467.0516	40521.962	-0.001	$3d^7(^2P)4s$	c^3P_2	$3d^7(^2P)4p$	z^3P_2
1.46.....	45	199	2466.4012	40532.647	0.005	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)4d$	e^3D_2
1.00.....	12	250	2466.2221	40535.591	0.013	$3d^7(a^2D)4p$	w^3D_2	$3d^7(^4F)6s$	3F_3
0.86.....	8	296	2466.1045	40537.525	-0.031	$3d^7(a^2D)4p$	y^1D_2	113191 ^e	
2.91.....	576	427	2464.1993	40568.863	0.001	$3d^7(^4F)4s$	b^3F_4	$3d^7(^4F)4p$	z^3F_3
1.29.....	24	252	2463.6726	40577.536	0.008	$3d^7(^2H)4p$	y^1G_4	$3d^7(^2H)4d$	3G_3
0.87.....	8	197	2463.6173	40578.447	0.001	$3d^8$	a^1D_2	$3d^7(^4F)4p$	z^3D_2
0.88.....	10	223	2463.5589	40579.409	-0.004	$3d^7(a^2D)4p$	x^3P_2	$3d^7(^4F)5d$	3D_3
0.70.....	7	210	2463.1674	40585.858	-0.005	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	f^5F_2
1.66.....	76	187	2462.7026	40593.518	-0.001	$3d^7(^2P)4p$	y^3S_1	$3d^7(^2P)4d$	3P_1
1.52.....	43	243	2462.4545	40597.607	-0.005	$3d^7(^2P)4p$	y^3S_1	$3d^7(^2P)4d$	3P_0
0.76.....	5	365	2461.9054	40606.661	-0.013	$3d^7(^2H)4p$	y^3H_4	$3d^7(^4F)5d$	5G_3
1.71.....	37	171	2461.2767	40617.032	0.001	$3d^7(^4P)4s$	b^3P_0	$3d^7(^2P)4p$	z^3P_1
0.75.....	9	200	2460.2722	40633.614	-0.011	$3d^7(^2G)4p$	z^1H_5	$3d^64s^2$	1G_4
1.08.....	18	209	2460.0924	40636.585	0.002	$3d^7(^2P)4p$	z^1P_1	$3d^7(^2P)4d$	3F_2
2.60.....	240	404	2459.4530	40647.149	0.122	$3d^7(a^2D)4s$	b^1D_2	$3d^7(a^2D)4p$	x^3P_2
2.60.....	240	404	2459.4530	40647.149	-0.097	$3d^7(^4P)4s$	b^3P_1	$3d^7(^4P)4p$	y^3P_2
0.84.....	7	286	2458.8827	40656.575	0.000	$3d^7(a^2D)4p$	y^1F_3	113191 ^e	
0.98.....	12	247	2458.2086	40667.723	0.019	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	e^3D_4
1.19.....	16	305	2457.6380	40677.164	-0.006	$3d^7(a^2D)4p$	x^3P_1	$3d^7(a^2D)4d$	3F_2
1.55.....	48	229	2455.4445	40713.499	0.000	$3d^7(a^2D)4p$	x^3P_1	$3d^7(a^2D)4d$	1P_1
1.73.....	77	216	2455.2003	40717.549	0.001	$3d^7(^2H)4p$	y^1G_4	$3d^7(^2H)4d$	1H_5
0.46.....	6	143	2455.1220	40718.847	0.012	$3d^7(a^2D)4p$	y^1F_3	$3d^7(a^2D)4d$	3F_4
1.63.....	44	223	2454.2074	40734.020	-0.001	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2H)4p$	x^3G_5
1.53.....	10	443	2453.2721	40749.550	0.019	$3d^7(^4P)4s$	b^3P_1	$3d^7(^2G)4p$	y^3F_2
1.02.....	11	287	2453.0624	40753.033	0.023	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)4d$	e^5G_3
1.88.....	85	214	2452.5754	40761.125	-0.003	$3d^7(^4P)4s$	b^3P_1	$3d^7(^2P)4p$	z^3P_1
1.60.....	10	518	2451.9881	40770.887	0.040	$3d^7(^2P)4s$	c^3P_2	$3d^7(^4P)4p$	y^3P_1
0.85.....	8	290	2451.6240	40776.941	-0.055	$3d^7(a^2D)4p$	y^1D_2	$3d^7(^4F)5d$	3P_1
1.47.....	49	189	2451.4758	40779.406	0.003	$3d^7(a^2D)4p$	x^3P_0	$3d^7(a^2D)4d$	3S_1
3.11.....	1154	270	2450.0020	40803.935	0.000	$3d^7(^4F)4s$	b^3F_3	$3d^7(^4F)4p$	z^3D_3
1.22.....	15	348	2449.9297	40805.140	0.043	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)4d$	e^5D_2
2.22.....	177	333	2449.1601	40817.961	-0.001	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^5F_4
0.66.....	5	310	2448.6967	40825.684	0.043	$3d^7(^4P)4p$	y^3D_3	$3d^7(^2P)5s$	3P_2
0.72.....	7	201	2448.0483	40836.497	0.029	$3d^7(^2H)4s$	a^1H_5	$3d^7(^2H)4p$	y^3H_6
3.21.....	1115	341	2447.8259	40840.207	-0.001	$3d^7(^4P)4s$	b^3P_2	$3d^7(^4P)4p$	y^3P_2
3.54.....	3466	240	2447.7112	40842.121	-0.001	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2H)4p$	z^1I_6
1.31.....	21	296	2447.2311	40850.133	-0.005	$3d^7(^2P)4p$	z^1P_1	$3d^7(^2P)4d$	1P_1
0.50.....	7	149	2446.6767	40859.388	-0.001	$3d^7(^4P)4p$	y^3P_1	$3d^7(^4P)4d$	5D_1
0.85.....	8	290	2446.3533	40864.789	-0.010	$3d^7(^2P)4p$	x^3D_3	$3d^7(^2G)4d$	3H_4
1.89.....	109	221	2446.0956	40869.094	0.006	$3d^7(a^2D)4p$	y^1D_2	$3d^7(a^2D)4d$	3D_3
3.67.....	2993	370	2446.0167	40870.412	0.000	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2G)4p$	z^1F_3

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)	
3.03.....	386	646	2443.7767	40907.872	0.009	$3d^7(^4F)4s$	b^3F_2	$3d^7(^4F)4p$	z^3D_2	D
3.03.....	386	646	2443.7767	40907.872	-0.104	$3d^7(^2P)4p$	z^3P_2	$3d^7(^4P)4d$	3F_3	D
3.52.....	996	811	2442.6174	40927.286	-0.001	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2H)4p$	z^3I_5	
1.70.....	21	572	2441.7836	40941.260	-0.004	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2H)4p$	x^3G_4	
2.48.....	71	531	2441.7102	40942.492	-0.002	$3d^7(^4P)4s$	b^3P_2	$3d^7(^2G)4p$	y^3F_2	
0.93.....	7	146	2441.3782	40948.058	0.000	$3d^7(a^2D)4s$	a^3D_2	$3d^7(a^2D)4p$	w^3D_3	
1.48.....	35	269	2440.7811	40958.075	0.008	$3d^7(^2H)4p$	y^3H_4	$3d^7(^2H)4d$	1F_3	
1.39.....	43	243	2440.0019	40971.154	0.001	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	e^5G_4	
0.95.....	9	320	2438.6526	40993.822	0.035	$3d^7(^4F)4p$	z^3D_1	$3d^7(^4F)4d$	e^3P_2	
0.94.....	12	194	2438.4537	40997.165	0.029	$3d^7(a^2D)4s$	a^3D_1	$3d^7(^2P)4p$	y^3S_1	
1.84.....	174	209	2438.2981	40999.780	0.002	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	e^5G_5	
0.59.....	6	206	2437.8284	41007.680	-0.028	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)4d$	e^5G_3	
0.84.....	12	186	2437.6063	41011.416	-0.012	$3d^7(^4P)4p$	z^3P_1	$3d^7(^4P)4d$	5P_2	
0.44.....	5	164	2437.5040	41013.137	0.057	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)4d$	e^5D_4	
2.37.....	429	186	2436.9791	41021.971	0.000	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^5F_3	
1.87.....	57	299	2436.3030	41033.352	-0.002	$3d^8$	a^1D_2	$3d^7(^4F)4p$	z^3D_1	
1.31.....	26	242	2434.9842	41055.576	-0.004	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	f^5F_3	
2.00.....	157	198	2434.3331	41066.556	0.000	$3d^7(^2P)4p$	y^3S_1	$3d^7(^2P)4d$	3P_2	
1.19.....	19	248	2434.0535	41071.272	0.012	$3d^7(a^2D)4p$	x^3P_2	$3d^7(^4F)5d$	5G_2	
0.86.....	7	346	2433.0495	41088.220	0.012	$3d^7(^2P)4p$	x^3D_1	$3d^7(^2G)4d$	1D_2	
0.56.....	6	178	2432.7192	41093.798	0.046	$3d^7(^2P)4p$	z^3P_2	$3d^7(^4P)4d$	3F_2	
2.47.....	131	525	2432.6037	41095.748	0.001	$3d^7(^2G)4s$	a^3G_3	$3d^7(^2G)4p$	y^3F_4	
3.60.....	1113	869	2432.5139	41097.266	0.001	$3d^7(^2H)4s$	a^3H_6	$3d^7(^2H)4p$	x^3G_5	
0.92.....	12	208	2431.9044	41107.566	-0.030	$3d^7(a^2D)4p$	x^3P_1	$3d^7(a^2D)4d$	3S_1	
1.73.....	82	207	2431.3787	41116.452	-0.002	$3d^7(a^2D)4p$	x^3P_1	$3d^7(a^2D)4d$	3D_2	
1.62.....	27	380	2430.5038	41131.253	0.008	$3d^7(^2P)4s$	c^3P_2	$3d^7(^2G)4p$	z^1F_3	
2.64.....	387	275	2429.9289	41140.982	0.001	$3d^7(^4P)4s$	b^3P_1	$3d^7(^2P)4p$	z^3P_2	
0.74.....	9	192	2428.3696	41167.397	0.016	$3d^7(a^2D)4p$	y^1D_2	$3d^7(a^2D)4d$	3F_2	
2.25.....	117	528	2428.2914	41168.723	0.003	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^5F_5	
2.26.....	176	321	2427.0520	41189.745	-0.003	$3d^7(^2G)4p$	z^1G_4	$3d^64s^2$	1G_4	
1.35.....	22	321	2426.2304	41203.693	-0.017	$3d^7(a^2D)4p$	y^1D_2	$3d^7(a^2D)4d$	1P_1	
2.45.....	108	613	2426.1336	41205.336	0.134	$3d^7(a^2D)4s$	a^3D_2	$3d^7(a^2D)4p$	w^3D_1	D
2.45.....	108	613	2426.1336	41205.336	-0.030	$3d^7(^2H)4s$	a^3H_6	$3d^7(^2H)4p$	z^3I_6	D
0.99.....	14	212	2425.2787	41219.860	0.005	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)4d$	5P_1	
1.06.....	12	297	2424.8152	41227.738	0.017	$3d^7(^2P)4p$	y^3S_1	$3d^7(^2P)4d$	3F_2	
1.55.....	48	227	2424.7012	41229.677	-0.001	$3d^7(^2H)4p$	y^1G_4	$3d^7(^2H)4d$	3I_5	
0.76.....	6	310	2424.6201	41231.055	-0.002	$3d^7(^2G)4p$	y^3F_3	$3d^64s^2$	1G_4	
1.26.....	12	481	2424.1924	41238.330	0.005	$3d^7(^2H)4p$	y^1G_4	$3d^7(a^2D)4d$	1F_3	
0.75.....	7	250	2424.1516	41239.024	-0.034	$3d^7(^2H)4p$	x^3G_5	$3d^7(^4F)6s$	5F_4	
2.57.....	451	207	2423.8243	41244.592	-0.015	$3d^7(^4P)4s$	b^3P_1	$3d^7(^4P)4p$	y^3P_0	D
2.57.....	451	207	2423.8243	41244.592	0.227	$3d^7(a^2D)4s$	a^3D_2	$3d^7(^2H)4p$	x^3G_3	D
2.95.....	1292	178	2423.7551	41245.768	0.000	$3d^7(^4P)4s$	b^3P_0	$3d^7(^4P)4p$	y^3P_1	
2.37.....	185	438	2423.6241	41247.999	0.000	$3d^7(^4F)4s$	a^5F_1	$3d^7(^4F)4p$	z^5F_2	
1.48.....	45	209	2423.0522	41257.733	-0.003	$3d^7(^4P)4p$	y^3P_1	$3d^7(^4P)4d$	3P_0	
0.95.....	11	251	2422.8622	41260.969	-0.003	$3d^7(^4P)4p$	y^3P_1	$3d^7(^4P)4d$	3P_2	
0.64.....	5	200	2422.7648	41262.625	0.000	$3d^7(a^2D)4p$	y^1P_1	$3d^7(a^2D)4d$	3P_0	
0.96.....	12	232	2421.4155	41285.618	0.007	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	e^5G_3	
0.56.....	5	89	2421.1023	41290.958	0.040	$3d^7(^2H)4p$	y^3H_5	$3d^7(^2H)4d$	3G_5	
3.71.....	5397	232	2420.7282	41297.339	0.000	$3d^7(^2G)4s$	a^3G_4	$3d^7(^2G)4p$	z^3H_5	
1.02.....	9	375	2419.6045	41316.516	-0.013	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)4d$	e^5G_4	
1.04.....	14	245	2418.6807	41332.296	0.009	$3d^7(^4P)4p$	z^5P_3	$3d^7(^4P)4d$	5P_2	
3.03.....	445	303	2418.5843	41333.943	0.000	$3d^7(^4P)4s$	b^3P_2	$3d^7(^2P)4p$	z^3P_2	
2.88.....	834	264	2418.4819	41335.693	0.000	$3d^7(a^2D)4s$	b^1D_2	$3d^7(a^2D)4p$	y^1F_3	
0.80.....	5	376	2418.0904	41342.385	0.060	$3d^7(^2H)4p$	x^3G_3	$3d^7(^4F)6s$	3F_2	
2.30.....	90	728	2417.6943	41349.157	0.000	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	e^5G_5	BP
3.28.....	938	728	2417.6589	41349.763	0.000	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^5F_4	BP
2.61.....	265	270	2417.0336	41360.460	0.000	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2H)4p$	z^3I_5	UP
3.47.....	1247	520	2416.8986	41362.771	0.000	$3d^7(^4F)4s$	b^3F_2	$3d^7(^4F)4p$	z^3D_1	
3.42.....	2905	219	2416.2170	41374.437	0.000	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2H)4p$	x^3G_4	
3.74.....	1825	761	2415.9924	41378.284	0.000	$3d^7(^2G)4s$	a^3G_3	$3d^7(^2G)4p$	z^3H_4	
0.83.....	8	292	2415.8053	41381.488	0.000	$3d^7(a^2D)4p$	w^3D_1	$3d^7(^4F)6s$	3F_2	BP
1.55.....	38	292	2415.7900	41381.751	-0.050	$3d^7(a^2D)4p$	x^3P_0	$3d^7(a^2D)4d$	3D_1	BD
1.55.....	38	292	2415.7900	41381.751	-0.156	$3d^7(^2H)4p$	y^1G_4	$3d^7(^2H)4d$	3H_4	BD
3.44.....	777	448	2415.3160	41389.865	0.000	$3d^7(^4P)4s$	b^3P_1	$3d^7(^4P)4p$	y^3P_1	IP
0.92.....	9	301	2415.2035	41391.799	-0.027	$3d^7(^2G)4p$	z^1F_3	$3d^7(^4P)4d$	3D_2	
1.20.....	12	417	2414.7675	41399.272	0.008	$3d^7(^2H)4p$	y^3H_6	$3d^7(^4F)5d$	3H_5	
3.07.....	1072	398	2414.0693	41411.243	-0.001	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^5F_3	
1.67.....	64	224	2414.0211	41412.071	0.007	$3d^7(^2H)4p$	y^1G_4	$3d^7(^2H)4d$	3H_5	
0.65.....	6	226	2413.7677	41416.417	-0.035	$3d^7(^2H)4p$	y^3H_5	$3d^7(^2H)4d$	3K_7	
1.29.....	16	377	2413.2484	41425.329	-0.035	$3d^7(a^2D)4p$	y^1P_1	$3d^7(a^2D)4d$	3P_1	
1.91.....	39	262	2412.3197	41441.276	0.001	$3d^7(^2P)4p$	y^3S_1	$3d^7(^2P)4d$	1P_1	
1.73.....	26	262	2412.2933	41441.731	-0.006	$3d^7(^2H)4s$	a^1H_5	$3d^7(^2H)4p$	y^3H_4	

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.81.....	141	247	2411.8879	41448.695	0.001	$3d^7(^4F)4p$	z^3D_2	$3d^7(^4F)4d$	e^3P_2
3.61.....	320	700	2411.5748	41454.076	0.000	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2H)4p$	x^3G_3
3.14.....	132	500	2411.5378	41454.712	0.000	$3d^7(a^2D)4s$	b^1D_2	$3d^7(a^2D)4p$	y^1D_2
1.00.....	15	208	2410.7384	41468.458	0.020	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)4d$	5P_3
0.71.....	4	414	2409.7622	41485.255	0.053	$3d^7(^2G)4p$	y^3F_2	$3d^7(^4P)4d$	3F_2
2.12.....	129	311	2409.3930	41491.611	0.173	$3d^7(^4P)4p$	z^5P_3	$3d^7(^4P)4d$	5P_3
2.12.....	129	311	2409.3930	41491.611	-0.060	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)4d$	e^5H_3
1.66.....	66	216	2409.2884	41493.412	-0.001	$3d^7(^2P)4p$	z^1P_1	$3d^7(^2P)4d$	1D_2
2.64.....	413	253	2408.8577	41500.832	-0.001	$3d^7(^2G)4s$	a^3G_4	$3d^7(^2G)4p$	y^3F_4
2.94.....	1309	237	2408.7530	41502.634	-0.001	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^5F_2
3.07.....	516	535	2408.5525	41506.089	0.000	$3d^7(a^2D)4s$	a^3D_1	$3d^7(a^2D)4p$	x^3F_2
3.71.....	1517	815	2408.4139	41508.478	0.003	$3d^7(^2H)4s$	a^3H_6	$3d^7(^2H)4p$	z^3I_7
1.53.....	49	216	2408.3339	41509.856	0.000	$3d^7(^2P)4p$	z^3P_2	$3d^7(^4P)4d$	3P_2
0.85.....	6	344	2407.9424	41516.606	0.059	$3d^7(a^2D)4p$	w^3D_3	$3d^7(^2P)4d$	3D_3
3.52.....	2782	275	2407.6648	41521.391	-0.001	$3d^7(^4F)4s$	b^3F_3	$3d^7(^4F)4p$	z^3D_2
3.14.....	1183	270	2407.4470	41525.148	0.000	$3d^7(a^2D)4s$	a^3D_2	$3d^7(a^2D)4p$	w^3D_2
1.72.....	72	225	2407.1284	41530.643	0.004	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2P)4d$	3D_3
2.05.....	291	203	2406.7906	41536.472	-0.001	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	e^3G_4
1.21.....	19	269	2406.4490	41542.368	0.011	$3d^7(a^2D)4p$	w^3D_1	$3d^7(^2P)4d$	3P_1
1.34.....	28	244	2406.1647	41547.275	0.013	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	e^5G_2
1.05.....	18	193	2405.0010	41567.378	-0.006	$3d^7(^4P)4p$	y^3P_1	$3d^7(^4P)4d$	3D_1
1.20.....	23	217	2404.9188	41568.798	-0.003	$3d^7(^2P)4p$	z^1P_1	$3d^7(^4F)5d$	3D_3
1.50.....	24	413	2404.7315	41572.035	-0.003	$3d^7(^2H)4p$	y^3H_5	$3d^7(^2H)4d$	3G_4
3.17.....	502	741	2404.5280	41575.553	-0.004	$3d^7(a^2D)4s$	a^3D_3	$3d^7(a^2D)4p$	w^3D_3
2.91.....	681	423	2404.1721	41581.707	-0.001	$3d^7(^4F)4s$	a^5F_1	$3d^7(^4F)4p$	z^5F_1
2.99.....	1202	202	2404.1073	41582.827	0.000	$3d^7(^4P)4s$	b^3P_2	$3d^7(^4P)4p$	y^3P_1
1.55.....	50	218	2403.9998	41584.687	0.005	$3d^7(a^2D)4p$	x^3P_2	$3d^7(^4F)5d$	3P_1
2.81.....	503	302	2403.7927	41588.270	-0.003	$3d^7(a^2D)4s$	a^3D_1	$3d^7(^2P)4p$	z^1P_1
2.36.....	253	280	2403.6792	41590.233	-0.001	$3d^7(^2H)4p$	y^3H_6	$3d^7(^2H)4d$	3G_5
1.14.....	13	321	2403.2429	41597.784	-0.023	$3d^7(a^2D)4p$	y^1D_2	$3d^7(a^2D)4d$	3S_1
1.91.....	189	232	2402.7883	41605.653	0.002	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)4d$	e^3G_3
1.18.....	16	283	2402.7308	41606.649	-0.016	$3d^7(a^2D)4p$	y^1D_2	$3d^7(a^2D)4d$	3D_2
1.06.....	12	297	2401.9127	41620.819	0.013	$3d^7(^2P)4p$	z^1D_2	$3d^7(^2G)4d$	3F_3
2.03.....	278	198	2401.4264	41629.246	0.000	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	e^3G_5
0.93.....	14	185	2400.6261	41643.124	0.016	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)4d$	f^5F_4
2.35.....	242	283	2399.9873	41654.207	0.001	$3d^7(^2G)4p$	z^1F_3	$3d^7(^2G)4d$	1F_3
1.60.....	84	227	2399.4700	41663.187	0.001	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	e^3D_2
0.50.....	7	150	2399.3404	41665.436	-0.036	$3d^7(a^2D)4p$	w^3D_3	$3d^7(^2P)4d$	3F_4
0.77.....	6	284	2398.9843	41671.621	0.021	$3d^7(^4P)4p$	y^3P_2	$3d^7(^4P)4d$	5D_3
1.09.....	17	225	2398.6860	41676.802	0.028	$3d^7(a^2D)4p$	x^3P_2	$3d^7(a^2D)4d$	3D_3
3.17.....	474	735	2398.3778	41682.157	0.002	$3d^7(^2G)4s$	a^3G_5	$3d^7(^2G)4p$	z^3H_5
3.60.....	3178	303	2397.3857	41699.406	0.000	$3d^7(^4F)4s$	b^3F_4	$3d^7(^4F)4p$	z^3D_3
1.01.....	10	318	2397.1601	41703.329	-0.010	$3d^7(^2P)4p$	z^1D_2	$3d^7(^2G)4d$	1D_2
1.91.....	107	282	2396.7826	41709.898	-0.096	$3d^7(a^2D)4p$	x^3P_1	$3d^7(a^2D)4d$	3D_1
1.61.....	81	242	2396.7290	41710.831	0.095	$3d^7(^2G)4p$	z^3H_6	$3d^7(^4P)4d$	5F_5
1.61.....	81	242	2396.7290	41710.831	0.023	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	e^3D_3
1.70.....	77	199	2396.6249	41712.642	0.000	$3d^7(^4P)4p$	y^3P_0	$3d^7(^4P)4d$	3D_1
2.01.....	130	243	2396.4516	41715.658	0.001	$3d^7(^2H)4p$	y^3H_4	$3d^7(^2H)4d$	3G_3
0.63.....	5	271	2396.2906	41718.460	0.033	$3d^7(^2P)4p$	x^3D_3	$3d^7(^2G)4d$	3F_2
1.65.....	61	350	2396.1507	41720.897	0.000	$3d^7(^4F)4p$	z^3D_1	$3d^7(^4F)4d$	e^3P_1
1.73.....	91	280	2395.8853	41725.518	0.000	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)4d$	e^3D_1
1.79.....	87	221	2395.5571	41731.233	-0.006	$3d^7(a^2D)4p$	y^1D_2	$3d^7(a^2D)4d$	1F_3
2.84.....	595	280	2395.5170	41731.933	0.022	$3d^7(^2H)4p$	y^3H_5	$3d^7(^2H)4d$	3K_6
2.84.....	595	280	2395.5170	41731.933	-0.003	$3d^7(^2P)4s$	a^1P_1	$3d^7(a^2D)4p$	w^3D_1
1.13.....	20	213	2395.1159	41738.920	0.007	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	e^5H_4
0.60.....	6	198	2394.6686	41746.716	-0.005	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)4d$	e^5G_6
2.08.....	179	208	2394.3525	41752.227	0.003	$3d^7(^4P)4p$	y^3P_1	$3d^7(^4P)4d$	3D_2
2.21.....	152	370	2393.9046	41760.039	-0.001	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^5D_4
0.64.....	5	262	2393.1875	41772.550	-0.021	$3d^7(^2G)4p$	z^1F_3	$3d^7(^2G)4d$	3G_4
3.04.....	825	318	2392.5678	41783.369	-0.001	$3d^7(^2G)4s$	a^3G_4	$3d^7(^2G)4p$	z^3H_4
0.61.....	6	223	2391.7088	41798.375	-0.015	$3d^7(^2G)4p$	z^3H_4	$3d^64s^2$	1G_4
1.09.....	15	248	2391.6549	41799.317	0.005	$3d^7(a^2D)4p$	w^3D_2	111436 ^e	
1.09.....	10	396	2390.0564	41827.271	-0.005	$3d^7(^2H)4p$	y^1G_4	$3d^7(a^2D)4d$	1G_4
3.01.....	1248	298	2389.5401	41836.307	-0.037	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^5F_1
3.84.....	3004	893	2388.9172	41847.214	0.000	$3d^7(^4F)4s$	a^5F_5	$3d^7(^4F)4p$	z^5F_5
1.91.....	83	302	2388.7435	41850.257	-0.001	$3d^7(a^2D)4p$	y^1F_3	$3d^7(a^2D)4d$	1F_3
1.22.....	23	222	2388.4346	41855.670	-0.007	$3d^7(^2H)4p$	y^3H_4	$3d^7(^2H)4d$	1H_5
1.43.....	26	318	2388.2020	41859.744	0.000	$3d^7(a^2D)4p$	y^1P_1	$3d^7(^2H)4d$	3F_2
1.29.....	16	368	2387.1399	41878.368	0.008	$3d^7(^4P)4p$	y^3P_1	$3d^7(a^2D)5s$	3D_2
1.86.....	79	283	2386.9417	41881.846	-0.003	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)4d$	e^3G_4
3.61.....	1193	842	2386.7250	41885.649	0.000	$3d^7(^2G)4s$	a^3G_5	$3d^7(^2G)4p$	y^3F_4

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O - C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)	
3.37.....	1939	377	2386.3695	41891.888	0.150	$3d^7(^2P)4s$	c^3P_1	$3d^7(^2P)4p$	z^1D_2	D
3.37.....	1939	377	2386.3695	41891.888	-0.020	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^5F_2	D
1.21.....	22	223	2385.6603	41904.339	0.000	$3d^7(a^2D)4p$	w^3D_2	$3d^7(^2P)4d$	3F_3	
0.87.....	5	463	2384.6519	41922.059	0.041	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)4d$	e^5D_3	D
0.87.....	5	463	2384.6519	41922.059	-0.030	$3d^7(^2G)4p$	y^3F_2	$3d^7(^4P)4d$	3D_3	D
1.52.....	22	465	2383.8794	41935.643	0.002	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	e^5D_2	
3.49.....	1591	705	2383.4586	41943.045	0.000	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^5F_3	IP
1.85.....	31	498	2383.3128	41945.611	-0.006	$3d^7(^2G)4s$	a^3G_3	$3d^7(^2G)4p$	y^3F_3	
1.51.....	47	210	2383.1339	41948.759	-0.002	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	e^5H_5	
0.79.....	6	330	2382.7060	41956.293	0.002	$3d^7(^2G)4p$	y^3F_3	$3d^7(^4P)4d$	3F_3	
3.07.....	846	327	2382.3216	41963.062	-0.002	$3d^7(^2P)4s$	c^3P_0	$3d^7(^2P)4p$	x^3D_1	
1.19.....	29	241	2381.9466	41969.667	0.015	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	e^5G_3	
3.99.....	2933	790	2381.7652	41972.864	-0.001	$3d^7(^2G)4s$	a^3G_5	$3d^7(^2G)4p$	z^3H_6	
0.75.....	7	258	2381.6422	41975.032	-0.035	$3d^7(a^2D)4p$	x^3P_2	$3d^7(a^2D)4d$	3F_2	
2.00.....	220	250	2381.4381	41978.629	0.004	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	e^3G_5	
2.45.....	101	634	2380.9676	41986.923	-0.003	$3d^7(^2G)4s$	a^3G_3	$3d^7(^2G)4p$	z^1G_4	
1.89.....	65	260	2380.0225	42003.596	0.005	$3d^7(^4P)4p$	y^3P_2	$3d^7(^4P)4d$	3P_2	B
2.29.....	163	260	2379.9977	42004.033	-0.011	$3d^7(a^2D)4p$	x^3P_1	$3d^7(a^2D)4d$	3P_2	B
1.29.....	16	260	2379.9678	42004.560	-0.013	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	e^5G_4	B
1.13.....	11	385	2379.7410	42008.563	0.001	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)4d$	e^3D_2	
0.73.....	8	221	2379.5820	42011.370	-0.026	$3d^7(a^2D)4p$	x^3P_2	$3d^7(a^2D)4d$	1P_1	
1.28.....	25	233	2379.3576	42015.332	-0.062	$3d^7(a^2D)4p$	w^3D_1	$3d^7(^2P)4d$	3P_2	DI
1.93.....	116	226	2378.8460	42024.368	-0.006	$3d^7(^4P)4p$	y^3P_2	$3d^7(^4P)4d$	3D_3	
3.64.....	1826	880	2378.6258	42028.258	0.001	$3d^7(^4F)4s$	a^5F_5	$3d^7(^4F)4p$	z^5F_4	
1.00.....	8	376	2378.3478	42033.170	-0.020	$3d^7(^2P)4p$	z^1D_2	$3d^7(^2G)4d$	3F_2	
1.84.....	50	423	2378.1718	42036.280	0.000	$3d^7(^4F)4p$	z^3D_1	$3d^7(^4F)4d$	e^3P_0	
2.02.....	89	359	2377.8018	42042.821	0.002	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2G)4d$	3D_3	
0.91.....	5	204	2377.2899	42051.873	-0.009	$3d^7(^2P)4s$	a^1P_1	$3d^7(a^2D)4p$	w^3D_2	
1.76.....	46	392	2377.0293	42056.482	-0.004	$3d^7(^4P)4p$	y^3P_1	$3d^7(^2G)4d$	3D_2	
1.75.....	123	256	2376.8835	42059.063	0.001	$3d^7(^4F)4p$	z^3D_1	$3d^7(^4F)4d$	f^3F_2	
0.82.....	5	174	2376.8244	42060.108	-0.079	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	e^3D_3	
1.64.....	37	366	2375.6477	42080.939	0.012	$3d^7(^2G)4p$	y^3F_4	$3d^64s^2$	1G_4	
1.23.....	16	330	2375.4447	42084.535	-0.016	$3d^7(^2P)4p$	y^3S_1	$3d^7(^2P)4d$	1D_2	
2.24.....	300	198	2375.1905	42089.040	-0.001	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^5D_3	
2.25.....	246	223	2374.5390	42100.585	0.000	$3d^7(^2H)4p$	y^3H_5	$3d^7(^2H)4d$	3I_6	
1.97.....	246	188	2372.3823	42138.856	-0.001	$3d^7(^4F)4p$	z^3D_2	$3d^7(^4F)4d$	f^3F_3	
1.22.....	18	283	2372.2397	42141.389	-0.020	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)4d$	e^5G_5	
3.17.....	1160	339	2371.8419	42148.456	-0.049	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2H)4p$	z^1I_6	DIn
2.42.....	86	715	2371.6058	42152.651	0.004	$3d^7(a^2D)4s$	a^3D_3	$3d^7(a^2D)4p$	w^3D_2	
2.38.....	292	253	2371.1009	42161.627	-0.002	$3d^7(^2H)4p$	y^3H_5	$3d^7(^2H)4d$	1H_5	
2.12.....	303	235	2370.8465	42166.151	0.000	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)4d$	e^3P_2	
2.70.....	174	669	2370.7320	42168.187	0.001	$3d^7(^2G)4s$	a^3G_5	$3d^7(^2G)4p$	z^3H_4	
1.87.....	144	267	2370.3037	42175.805	0.000	$3d^7(^4F)4p$	z^3D_2	$3d^7(^4F)4d$	e^3P_1	
1.01.....	16	191	2370.2616	42176.555	-0.004	$3d^7(a^2D)4p$	w^3D_1	$3d^7(^2P)4d$	3F_2	
0.76.....	6	300	2369.3886	42192.094	-0.016	$3d^7(a^2D)4p$	x^3F_2	$3d^7(^2H)4d$	1F_3	
1.07.....	14	264	2368.9346	42200.180	-0.026	$3d^7(a^2D)4p$	y^1D_2	$3d^7(a^2D)4d$	3D_1	
2.14.....	371	189	2367.4569	42226.517	0.000	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)4d$	f^3F_4	U
1.59.....	40	313	2367.2024	42231.057	0.000	$3d^7(^2F)4s$	c^3F_3	$3d^7(^2F)4p$	w^3G_3	
1.29.....	15	394	2367.0794	42233.251	0.020	$3d^7(^2P)4p$	x^3D_2	$3d^7(^4F)6s$	3F_3	
0.87.....	5	200	2366.7927	42238.366	-0.013	$3d^7(^4P)4p$	z^3S_1	$3d^7(^2P)5s$	3P_1	
2.54.....	452	231	2366.5711	42242.321	-0.001	$3d^7(^2H)4p$	y^3H_5	$3d^7(^2H)4d$	3H_6	
1.33.....	21	310	2366.1180	42250.410	-0.026	$3d^7(^2G)4p$	z^1F_3	$3d^7(^2G)4d$	3G_3	
1.23.....	13	406	2365.5425	42260.688	0.005	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	e^5D_3	
0.80.....	7	262	2365.3820	42263.555	0.066	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2G)4d$	1F_3	
1.90.....	100	242	2364.8633	42272.823	0.285	$3d^7(a^2D)4p$	w^3D_3	$3d^7(^2P)4d$	3P_2	D
1.90.....	100	242	2364.8633	42272.823	-0.026	$3d^7(a^2D)4p$	y^1D_2	$3d^7(a^2D)4d$	3G_3	D
0.86.....	5	483	2364.4069	42280.984	-0.033	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)4d$	e^5D_2	
3.57.....	1942	715	2363.7997	42291.843	0.002	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^5D_4	
0.79.....	9	217	2363.4465	42298.164	0.024	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	e^5H_5	
2.59.....	521	228	2363.1211	42303.988	-0.001	$3d^7(^2H)4p$	y^3H_6	$3d^7(^2H)4d$	3I_7	
0.95.....	13	213	2363.0428	42305.388	0.018	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2G)4d$	3D_2	
1.11.....	15	259	2362.2821	42319.011	0.042	$3d^7(^2P)4p$	z^1D_2	$3d^7(^4F)6s$	5F_3	D
1.11.....	15	259	2362.2821	42319.011	-0.020	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	e^5G_3	D
2.14.....	179	275	2361.5201	42332.665	0.000	$3d^7(^4F)4s$	a^5F_1	$3d^7(^4F)4p$	z^5D_2	
2.02.....	45	757	2361.1363	42339.546	0.000	$3d^7(^2F)4s$	c^3F_2	$3d^7(^2F)4p$	w^3G_3	
3.42.....	2803	220	2360.7955	42345.658	-0.005	$3d^7(a^2D)4s$	a^3D_2	$3d^7(a^2D)4p$	x^3F_3	
3.77.....	6210	231	2360.5136	42350.714	0.011	$3d^7(^2G)4s$	a^3G_4	$3d^7(^2G)4p$	y^3F_3	U
0.99.....	9	330	2359.9435	42360.944	-0.004	$3d^7(^2G)4p$	y^3G_3	$3d^7(a^2D)5s$	3D_2	
2.49.....	404	231	2359.5612	42367.806	-0.001	$3d^7(^2H)4p$	y^3H_4	$3d^7(^2H)4d$	3I_5	
1.46.....	53	231	2359.4585	42369.650	0.002	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)4d$	e^5H_3	
1.11.....	18	221	2359.3731	42371.184	0.012	$3d^7(^2G)4p$	z^1F_3	$3d^7(^2G)4d$	3H_4	
1.82.....	23	595	2359.0628	42376.758	-0.027	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2P)4p$	x^3D_3	
0.69.....	4	150	2358.8287	42380.962	0.001	$3d^7(^2P)4p$	z^3P_1	$3d^7(^4P)4d$	3D_2	

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.36	24	284	2358.3196	42390.111	-0.002	$3d^7(a^2D)4p$	w 3D_1	$3d^7(^2P)4d$	1P_1
3.68	2588	228	2358.2138	42392.011	-0.001	$3d^7(^2G)4s$	a 3G_4	$3d^7(^2G)4p$	z^1G_4
2.45	150	232	2358.1846	42392.536	-0.022	$3d^7(^2G)4p$	y 3F_2	$3d^7(^4P)4d$	3D_2
2.48	371	245	2357.7751	42399.900	-0.001	$3d^7(^2H)4p$	y 3H_6	$3d^7(^2H)4d$	3I_6
1.84	83	250	2357.4641	42405.491	-0.002	$3d^7(a^2D)4p$	x 3P_2	$3d^7(a^2D)4d$	3S_1
1.74	75	223	2356.9714	42414.355	0.004	$3d^7(a^2D)4p$	x 3P_2	$3d^7(a^2D)4d$	3D_2
0.77	7	238	2356.8354	42416.803	-0.011	$3d^7(a^2D)4p$	x 3F_2	113191 ^e	
1.86	168	232	2356.6863	42419.486	0.001	$3d^7(^4F)4p$	z 3G_5	$3d^7(^4F)4d$	e^3H_6
1.43	33	243	2355.8692	42434.197	-0.072	$3d^7(^2G)4p$	y 3F_2	$3d^7(^2G)4d$	3D_3
2.63	496	261	2355.5908	42439.212	0.002	$3d^7(a^2D)4p$	y 1F_3	$3d^7(a^2D)4d$	1G_4
0.86	10	216	2354.5764	42457.494	0.024	$3d^7(^2G)4p$	z 1F_3	$3d^7(^2G)4d$	3F_4
1.01	13	244	2354.4242	42460.239	0.076	$3d^7(a^2D)4p$	x 3F_3	$3d^7(^4F)5d$	5G_2
1.77	80	222	2353.5644	42475.749	0.000	$3d^7(a^2D)4p$	x 3P_0	$3d^7(a^2D)4d$	3P_1
3.39	1865	490	2353.4224	42478.312	-0.001	$3d^7(^4F)4s$	a 5F_3	$3d^7(^4F)4p$	z^5D_3
1.98	176	266	2353.1279	42483.628	0.000	$3d^7(^4F)4p$	z 3G_3	$3d^7(^4F)4d$	e^3G_3
1.39	32	234	2352.6417	42492.406	0.000	$3d^7(^2G)4p$	y 3G_4	$3d^7(^2G)4d$	3H_5
2.33	268	189	2352.2103	42500.199	0.002	$3d^7(^2G)4s$	a 3G_3	$3d^7(^4P)4p$	y^3P_2
0.94	10	258	2352.0076	42503.862	-0.002	$3d^7(^2P)4p$	x 3D_2	$3d^7(^2P)4d$	3D_1
2.81	425	347	2351.8412	42506.868	-0.001	$3d^7(^2P)4s$	c 3P_1	$3d^7(^2P)4p$	x^3D_1
1.99	212	236	2351.7957	42507.690	0.000	$3d^7(^4F)4p$	z 3F_3	$3d^7(^4F)4d$	e^3H_4
1.39	9	590	2351.5714	42511.744	-0.004	$3d^7(^2H)4s$	a 3H_6	$3d^7(^2H)4p$	z^1I_6
0.57	7	169	2351.3435	42515.866	0.010	$3d^7(^2G)4p$	z 1H_5	$3d^7(^2G)4d$	3I_6
0.78	8	235	2351.2345	42517.836	0.024	$3d^7(^2G)4p$	y 3G_4	$3d^7(^2G)4d$	1F_3
2.07	162	263	2351.1649	42519.094	0.000	$3d^7(^2F)4s$	c 3F_3	$3d^7(^2F)4p$	w^3G_4
2.62	433	287	2351.1129	42520.036	0.000	$3d^7(^2H)4p$	y 3H_4	$3d^7(^2H)4d$	3H_4
0.64	6	224	2350.4359	42532.282	-0.019	$3d^7(^2P)4p$	1S_0	$3d^7(^2P)4d$	3D_1
1.47	24	362	2350.2014	42536.525	-0.029	$3d^7(^4P)4p$	y 3P_2	$3d^7(^2G)4d$	3D_3
0.76	5	377	2350.1420	42537.600	-0.046	$3d^7(^2G)4p$	z 1G_4	$3d^7(^4P)4d$	3D_3
1.73	61	262	2350.0667	42538.962	0.036	$3d^7(a^2D)4p$	x 3P_2	$3d^7(a^2D)4d$	1F_3
1.73	61	262	2350.0667	42538.962	-0.112	$3d^7(^2G)4p$	y 3G_3	$3d^7(^2G)4d$	3D_2
2.48	333	269	2349.9188	42541.639	0.001	$3d^7(^2H)4p$	y 3H_6	$3d^7(^2H)4d$	3H_6
1.60	50	240	2349.4466	42550.189	-0.004	$3d^7(^2H)4p$	y 3H_4	$3d^7(^2H)4d$	3H_5
1.64	36	274	2349.1597	42555.386	0.012	$3d^7(^2H)4s$	a 3H_4	$3d^7(a^2D)4p$	x^3F_3
0.92	5	475	2349.0049	42558.189	0.018	$3d^7(^2G)4p$	y 3F_3	$3d^7(^4P)4d$	3P_2
2.21	355	242	2348.3596	42569.883	-0.010	$3d^7(^4F)4p$	z 3G_4	$3d^7(^4F)4d$	e^3G_4
1.41	23	275	2347.9306	42577.660	-0.001	$3d^7(a^2D)4s$	a 3D_1	$3d^7(a^2D)4p$	x^3P_2
2.70	459	342	2347.8089	42579.867	0.002	$3d^7(^2H)4s$	a 1H_5	$3d^7(^2H)4p$	y^1G_4
1.28	47	162	2347.5803	42584.013	0.010	$3d^7(^2P)4p$	x 3D_2	$3d^7(^2P)4d$	3D_2
1.41	24	317	2347.4646	42586.112	0.033	$3d^7(^2G)4p$	z 1H_5	$3d^7(^2G)4d$	3G_5
3.17	2080	266	2347.3991	42587.300	0.000	$3d^7(^4F)4s$	a 5F_2	$3d^7(^4F)4p$	z^5D_2
3.12	1541	209	2347.1161	42592.435	0.004	$3d^7(^2G)4s$	a 3G_4	$3d^7(^2G)4p$	y^3G_5
1.69	16	373	2347.0611	42593.432	0.019	$3d^7(^2P)4s$	c 3P_1	$3d^7(^2P)4p$	1S_0
3.50	1307	575	2346.5625	42602.482	-0.001	$3d^7(^2G)4s$	a 3G_3	$3d^7(^2G)4p$	y^3F_2
1.19	19	248	2345.8423	42615.560	0.003	$3d^7(^2G)4p$	y 3G_3	$3d^7(^2G)4d$	3G_4
1.26	22	380	2345.6614	42618.845	0.000	$3d^7(^2P)4p$	x 3D_1	$3d^7(^2P)4d$	3D_1
1.26	22	380	2345.6471	42619.106	0.000	$3d^7(^2P)4p$	z 3P_0	$3d^7(^4P)4d$	3D_1
3.32	1943	248	2345.4960	42621.852	0.002	$3d^7(^2P)4s$	c 3P_1	$3d^7(^2P)4p$	x^3D_2
2.32	294	212	2344.7788	42634.887	-0.001	$3d^7(^4P)4p$	y 3D_3	$3d^7(^4P)4d$	3F_4
2.49	295	312	2344.7062	42636.208	0.031	$3d^7(^2G)4p$	y 3G_4	$3d^7(^2G)4d$	3G_4
2.49	295	312	2344.7062	42636.208	0.064	$3d^7(^2G)4p$	z 3H_4	$3d^7(^4P)4d$	5D_4
2.30	75	300	2344.6655	42636.947	0.000	$3d^7(^4P)4p$	y 3D_1	$3d^7(^4P)4d$	3F_2
3.47	1131	627	2344.6287	42637.617	-0.001	$3d^7(^2P)4s$	c 3P_2	$3d^7(^2P)4p$	x^3D_3
1.54	38	270	2344.4314	42641.204	0.001	$3d^7(a^2D)4p$	x 3P_1	$3d^7(a^2D)4d$	3P_0
2.88	1240	223	2344.2732	42644.082	0.002	$3d^7(^4F)4s$	a 5F_1	$3d^7(^4F)4p$	z^5D_1
1.02	9	327	2344.0253	42648.592	0.012	$3d^7(^2P)4p$	x 3D_3	$3d^7(^4F)6s$	3F_3
0.73	5	305	2343.8471	42651.834	0.048	$3d^7(^2P)4p$	y 3S_1	$3d^7(^4F)5d$	5G_2
0.79	6	286	2343.6796	42654.882	-0.056	$3d^7(^2G)4p$	y 3F_2	$3d^7(^2G)4d$	1F_3
1.02	14	219	2343.5579	42657.098	0.005	$3d^7(^4F)4p$	z 5G_4	$3d^7(^4F)4d$	e^5P_3
2.31	525	203	2343.3164	42661.492	-0.002	$3d^7(^4F)4p$	z 3F_4	$3d^7(^4F)4d$	e^3H_5
1.63	34	281	2343.2342	42662.989	-0.005	$3d^7(a^2D)4s$	a 3D_2	$3d^7(a^2D)4p$	x^3F_2
1.51	24	317	2342.2578	42680.773	-0.002	$3d^7(^2P)4s$	a 1P_1	$3d^7(^2P)4p$	y^3S_1
0.90	9	270	2342.0137	42685.220	-0.003	$3d^7(^2P)4p$	z 3P_1	$3d^7(^2G)4d$	3D_2
0.88	6	393	2341.3765	42696.836	0.016	$3d^7(^2G)4p$	y 3F_2	$3d^7(^2G)4d$	3D_2
1.01	6	507	2341.3168	42697.925	-0.009	$3d^7(^2H)4p$	x 3G_4	$3d^7(^2P)4d$	3F_3
1.75	78	213	2341.1838	42700.350	-0.001	$3d^7(^4P)4p$	y 3D_2	$3d^7(^4P)4d$	3F_3
3.43	837	744	2341.1165	42701.578	-0.001	$3d^7(a^2D)4s$	a 3D_3	$3d^7(a^2D)4p$	x^3F_4
0.71	7	231	2340.5600	42711.729	0.034	$3d^7(^2G)4p$	y 3F_4	$3d^7(^4P)4d$	3F_4
1.36	34	202	2339.5948	42729.349	-0.005	$3d^7(^4P)4p$	y 3D_3	$3d^7(^4P)4d$	3F_3
3.69	804	724	2339.0331	42739.608	0.000	$3d^7(^2G)4s$	a 3G_3	$3d^7(^2G)4p$	y^3G_4
2.49	252	279	2338.7282	42745.181	0.003	$3d^7(a^2D)4s$	a 3D_2	$3d^7(^2P)4p$	z^1P_1
0.80	6	313	2338.5517	42748.406	0.060	$3d^7(a^2D)4p$	x 3F_2	$3d^7(a^2D)4d$	3D_3
1.40	30	251	2338.2724	42753.512	-0.003	$3d^7(^2G)4p$	z 1G_4	$3d^7(a^2D)5s$	3D_3

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O - C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
3.93	3071	638	2337.9052	42760.227	-0.001	$3d^7(^2G)4s$	a^3G_3	$3d^7(^2G)4p$	y^3G_3
2.30	422	251	2337.3231	42770.875	-0.002	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)4d$	e^3G_5
1.39	27	273	2337.2432	42772.336	0.003	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	e^3H_4
3.35	629	815	2336.9978	42776.828	0.000	$3d^7(^2G)4s$	a^3G_5	$3d^7(^2G)4p$	z^1G_4
1.83	54	376	2336.7146	42782.012	-0.001	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)4d$	5D_2
1.15	16	257	2336.3346	42788.970	-0.031	$3d^7(^4P)4p$	z^5P_1	$3d^7(^4P)4d$	5D_0
2.67	831	197	2336.2296	42790.893	0.000	$3d^7(^4F)4s$	a^5F_1	$3d^7(^4F)4p$	z^5D_0
0.81	7	269	2335.9264	42796.446	0.041	$3d^7(a^2D)4p$	x^3F_3	$3d^7(a^2D)4d$	3F_4
1.74	52	316	2335.5172	42803.944	0.002	$3d^7(a^2D)4p$	x^3P_1	$3d^7(a^2D)4d$	3P_1
0.96	11	249	2335.3007	42807.912	-0.011	$3d^7(a^2D)4p$	x^3F_4	$3d^7(^2H)4d$	3G_5
1.96	98	278	2335.0550	42812.416	0.000	$3d^7(^2G)4p$	z^1F_3	$3d^7(^2G)4d$	3F_3
1.56	14	758	2334.8864	42815.506	0.000	$3d^7(^2F)4s$	c^3F_4	$3d^7(^2F)4p$	w^3F_3
0.54	5	206	2334.5160	42822.300	0.007	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	e^3G_3
2.37	112	759	2334.0676	42830.526	0.000	$3d^7(^2F)4s$	c^3F_4	$3d^7(^2F)4p$	w^3G_5
1.25	16	339	2333.7184	42836.934	0.009	$3d^7(^4P)4p$	z^3P_1	$3d^7(^4P)4d$	3F_2
1.16	18	242	2333.4483	42841.893	0.018	$3d^7(^4P)4p$	y^3D_3	$3d^7(^4P)4d$	5D_4
1.55	43	238	2332.9283	42851.440	-0.006	$3d^7(^4P)4p$	z^3P_1	$3d^7(^4P)4d$	5D_1
2.55	700	254	2332.8403	42853.057	0.088	$3d^7(^4F)4p$	z^5G_6	$3d^7(^4F)4d$	f^5F_5
2.55	700	254	2332.8403	42853.057	-0.009	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)4d$	e^3H_4
2.55	700	254	2332.8403	42853.057	-0.258	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)4d$	f^5F_4
2.25	196	265	2332.6721	42856.146	0.001	$3d^7(^2H)4p$	y^3H_5	$3d^7(^2H)4d$	3H_5
1.11	17	224	2331.8332	42871.564	0.004	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)4d$	3I_6
1.50	21	443	2331.6914	42874.170	-0.006	$3d^7(^2P)4p$	x^3D_1	$3d^7(^4F)6s$	3F_2
0.86	11	187	2331.5080	42877.542	0.000	$3d^7(^4P)4p$	z^5P_3	$3d^7(^4P)4d$	3F_4
0.73	9	170	2331.0413	42886.125	-0.002	$3d^7(^4P)4p$	y^3D_2	$3d^7(^4P)4d$	3F_2
1.64	54	234	2330.6337	42893.625	-0.014	$3d^7(a^2D)4p$	y^1P_1	$3d^7(a^2D)4d$	1D_2
2.37	267	257	2330.5618	42894.949	0.000	$3d^7(^2G)4p$	z^1F_3	$3d^7(^2G)4d$	1D_2
2.81	781	297	2330.3572	42898.714	-0.002	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^5D_1
0.59	6	196	2329.4615	42915.208	0.019	$3d^7(^2G)4p$	z^3H_5	$3d^7(^4P)4d$	3F_4
2.71	241	513	2329.1058	42921.762	0.086	$3d^7(^4P)4s$	a^5P_1	$3d^7(^4P)4p$	y^5D_2
1.22	13	372	2328.8095	42927.220	-0.001	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)4d$	e^5P_3
2.44	315	256	2328.0202	42941.775	-0.008	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)4d$	3G_5
2.44	315	256	2328.0202	42941.775	-0.098	$3d^7(^4P)4s$	b^3P_1	$3d^7(^2P)4p$	z^1D_2
1.34	31	208	2327.8387	42945.123	-0.003	$3d^7(^2P)4p$	x^3D_2	$3d^7(^2P)4d$	1F_3
1.00	10	303	2327.8009	42945.820	0.050	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)4d$	f^5F_3
3.39	2162	258	2327.6754	42948.136	0.001	$3d^7(^2G)4s$	a^3G_4	$3d^7(^2G)4p$	z^1H_5
1.72	55	277	2327.6279	42949.012	0.004	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)4d$	3F_3
1.04	13	243	2327.5879	42949.749	-0.011	$3d^7(a^2D)4p$	y^1F_3	$3d^7(^2H)4d$	3F_4
0.85	9	229	2327.1992	42956.923	-0.005	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)4d$	e^5G_6
1.35	21	312	2326.8508	42963.355	0.012	$3d^7(^2P)4p$	z^1D_2	$3d^7(^4F)6s$	3F_3
1.47	31	283	2326.7907	42964.465	0.010	$3d^7(^2P)4p$	z^1P_1	$3d^7(a^2D)4d$	3F_2
3.16	548	877	2326.4730	42970.331	-0.004	$3d^7(^4F)4s$	a^5F_5	$3d^7(^4F)4p$	z^5D_4
3.16	548	877	2326.4730	42970.331	-0.216	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)4d$	f^5F_1
4.25	2592	805	2326.0996	42977.227	-0.020	$3d^7(^2G)4s$	a^3G_5	$3d^7(^2G)4p$	y^3G_5
4.25	2592	805	2326.0996	42977.227	0.654	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^5D_2
1.44	28	284	2325.8405	42982.016	0.025	$3d^7(^4P)4p$	z^5P_1	$3d^7(^4P)4d$	5D_2
1.87	56	449	2325.7730	42983.263	0.025	$3d^7(^2F)4s$	c^3F_3	$3d^7(^2F)4p$	w^3F_3
2.48	155	229	2325.5152	42988.028	-0.011	$3d^7(a^2D)4p$	x^3P_1	$3d^7(^2H)4d$	3F_3
2.21	146	322	2325.1894	42994.050	0.117	$3d^7(^2G)4s$	a^3G_3	$3d^7(^2P)4p$	z^3P_2
2.21	146	322	2325.1894	42994.050	-0.176	$3d^7(^2H)4p$	x^3G_3	$3d^7(^2P)4d$	1D_2
1.29	23	248	2324.9034	42999.338	-0.014	$3d^7(^2P)4p$	x^3D_3	$3d^7(^2P)4d$	3D_2
1.66	48	281	2324.8252	43000.786	0.002	$3d^7(^2P)4p$	z^1P_1	$3d^7(a^2D)4d$	1P_1
1.25	25	209	2324.4405	43007.901	0.010	$3d^7(a^2D)4p$	x^3P_2	$3d^7(a^2D)4d$	3D_1
3.03	487	736	2324.3208	43010.114	0.000	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^5D_3
2.40	604	224	2324.2798	43010.873	0.000	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	e^3H_5
2.88	341	515	2324.2382	43011.644	0.019	$3d^7(^4P)4s$	a^5P_1	$3d^7(^4P)4p$	y^5D_1
2.88	341	515	2324.2382	43011.644	-0.406	$3d^7(^4P)4p$	z^5S_2	$3d^7(^4P)5s$	5P_3
1.98	128	219	2323.0636	43033.390	0.001	$3d^7(a^2D)4p$	w^3D_1	$3d^7(^2P)4d$	1D_2
0.72	5	290	2322.9720	43035.086	0.041	$3d^7(^2P)4p$	x^3D_1	$3d^7(^2P)4d$	3P_1
1.92	95	253	2322.4550	43044.666	-0.003	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)4d$	3H_5
1.18	15	300	2322.3489	43046.632	-0.007	$3d^7(a^2D)4p$	x^3F_2	$3d^7(a^2D)4d$	3F_2
1.71	43	344	2322.1768	43049.822	0.007	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)4d$	3P_0
1.71	43	344	2322.1768	43049.822	-0.003	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	3D_3
2.82	132	594	2322.0070	43052.969	0.002	$3d^7(^2P)4s$	c^3P_2	$3d^7(^2P)4d$	x^3D_2
2.82	132	594	2322.0070	43052.969	-0.082	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)4d$	3P_2
0.51	5	207	2321.7525	43057.688	-0.004	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	e^5H_3
1.76	71	234	2321.5883	43060.733	0.001	$3d^7(^2H)4p$	y^3H_5	$3d^7(^2H)4d$	1I_6
2.28	238	232	2321.4617	43063.082	0.000	$3d^7(^2G)4p$	y^3G_4	$3d^7(^2G)4d$	3I_5
0.89	10	220	2321.4272	43063.721	0.006	$3d^7(^2G)4p$	z^1H_5	$3d^7(^2H)5s$	1H_5
1.84	67	297	2321.3223	43065.668	-0.009	$3d^7(a^2D)4p$	x^3F_3	$3d^7(a^2D)4d$	3D_3
2.74	1326	214	2321.2290	43067.399	-0.001	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)4d$	e^3H_6
1.85	89	229	2321.1971	43067.991	0.003	$3d^7(a^2D)4p$	x^3F_4	$3d^7(a^2D)4d$	3F_4

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)	
1.62.....	32	419	2320.9139	43073.246	-0.074	$3d^7(^4P)4p$	y^3P_1	$3d^7(a^2D)5s$	1D_2	DI
1.49.....	33	274	2320.5202	43080.553	0.018	$3d^7(a^2D)4p$	x^3P_2	$3d^7(a^2D)4d$	3G_3	
2.14.....	348	230	2320.3060	43084.528	0.000	$3d^7(^4P)4p$	z^5P_3	$3d^7(^4P)4d$	5D_4	
1.95.....	113	229	2320.0631	43089.040	-0.003	$3d^7(a^2D)4p$	x^3F_4	$3d^7(^2H)4d$	3G_4	D
1.17.....	17	246	2319.9898	43090.401	0.009	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)4d$	e^5H_5	
1.60.....	18	659	2319.9185	43091.725	-0.002	$3d^7(^2F)4s$	c^3F_2	$3d^7(^2F)4p$	w^3F_3	
2.41.....	279	612	2319.8298	43093.372	0.056	$3d^7(^2F)4s$	c^3F_4	$3d^7(^2F)4p$	w^3F_4	D
2.41.....	279	612	2319.8298	43093.372	-0.050	$3d^7(^2G)4p$	y^3G_3	$3d^7(^2G)4d$	3G_3	
2.91.....	1020	233	2319.3902	43101.540	0.000	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)4d$	3H_6	
1.86.....	88	237	2319.0007	43108.778	0.001	$3d^7(a^2D)4p$	w^3D_1	$3d^7(^4F)5d$	3D_3	D
1.42.....	31	246	2318.7173	43114.047	0.005	$3d^7(^2G)4p$	y^3G_4	$3d^7(^2G)4d$	3G_3	
2.59.....	186	482	2318.4252	43119.478	-0.003	$3d^7(^4P)4s$	a^5P_1	$3d^7(^4P)4p$	y^5D_0	
1.69.....	55	261	2317.6017	43134.798	0.014	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)4d$	3F_2	D
1.69.....	55	261	2317.6017	43134.798	-0.037	$3d^7(^4P)4s$	b^3P_2	$3d^7(^2P)4p$	z^1D_2	
1.32.....	26	228	2317.2043	43142.195	-0.007	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	3G_5	
3.85.....	6358	253	2317.0702	43144.692	-0.002	$3d^7(^2G)4s$	a^3G_4	$3d^7(^2G)4p$	y^3G_4	D
1.16.....	23	182	2316.8216	43149.321	0.016	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)4d$	5D_1	
1.85.....	80	254	2316.3316	43158.448	-0.002	$3d^7(^2H)4p$	y^1H_5	$3d^7(^2H)4d$	1G_4	
1.49.....	54	278	2316.2454	43160.055	0.000	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)4d$	f^5F_4	D
2.13.....	139	223	2315.9633	43165.311	-0.003	$3d^7(^2G)4s$	a^3G_4	$3d^7(^2G)4p$	y^3G_3	
2.12.....	56	745	2315.7438	43169.401	0.000	$3d^7(^2F)4s$	c^3F_4	$3d^7(^2F)4p$	v^3D_3	
1.13.....	16	246	2315.6228	43171.658	-0.014	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	e^3G_3	D
2.10.....	99	364	2315.4136	43175.558	-0.001	$3d^7(^2G)4p$	y^3F_3	$3d^7(a^2D)5s$	3D_2	
3.32.....	1099	637	2314.9748	43183.740	-0.001	$3d^7(^4F)4s$	a^5F_1	$3d^7(^4F)4p$	z^5G_2	
1.39.....	28	249	2314.7220	43188.457	0.017	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)4d$	3G_4	B
2.82.....	426	344	2314.6538	43189.728	0.000	$3d^7(^2P)4s$	a^1P_1	$3d^7(a^2D)4p$	x^3F_2	
1.31.....	19	306	2314.5485	43191.693	-0.038	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	e^3H_4	
3.45.....	3280	320	2314.0565	43200.876	0.001	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^5G_3	B
2.66.....	709	185	2314.0292	43201.386	0.002	$3d^7(^2P)4p$	x^3D_3	$3d^7(^2P)4d$	3F_4	
3.04.....	389	636	2313.6046	43209.314	-0.002	$3d^7(^4P)4s$	a^5P_2	$3d^7(^4P)4p$	y^5D_3	
2.36.....	249	263	2313.3452	43214.158	0.000	$3d^7(^2G)4p$	y^3G_3	$3d^7(^2G)4d$	3H_4	D
1.20.....	19	235	2313.2518	43215.902	0.004	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)4d$	f^5F_3	
1.96.....	120	218	2313.0915	43218.897	0.000	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)4d$	5D_3	
2.68.....	604	238	2312.8030	43224.289	0.010	$3d^7(^4F)4p$	z^5G_6	$3d^7(^4F)4d$	e^5G_6	B
2.53.....	422	391	2312.7761	43224.790	-0.010	$3d^7(^2G)4p$	z^1F_3	$3d^7(^2G)4d$	3F_2	
3.01.....	359	640	2312.5568	43228.890	0.001	$3d^7(^4P)4s$	a^5P_2	$3d^7(^4P)4p$	y^5D_2	
1.61.....	36	321	2312.2417	43234.780	0.002	$3d^7(^2G)4p$	y^3G_4	$3d^7(^2G)4d$	3H_4	D
1.66.....	93	218	2311.8598	43241.921	0.024	$3d^7(^4P)4p$	z^5P_3	$3d^7(^4P)4d$	5D_3	
1.66.....	93	218	2311.8598	43241.921	-0.014	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)4d$	e^5D_4	
2.17.....	183	231	2311.6910	43245.079	-0.009	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	3H_5	D
3.55.....	4533	295	2311.6044	43246.699	-0.002	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^5G_4	
1.56.....	37	278	2311.4388	43249.797	0.004	$3d^7(^4P)4p$	z^5P_1	$3d^7(^4P)4d$	3P_0	
2.58.....	462	305	2311.3616	43251.241	0.073	$3d^7(^2G)4p$	y^3F_2	$3d^7(^2G)4d$	3G_3	I
1.34.....	22	290	2311.2667	43253.017	-0.012	$3d^7(^4P)4p$	z^5P_1	$3d^7(^4P)4d$	3P_2	
0.91.....	7	350	2311.0248	43257.544	-0.007	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)4d$	e^3D_3	
1.07.....	9	384	2310.9094	43259.704	0.063	$3d^7(^2G)4p$	z^1H_5	$3d^7(^2G)4d$	3I_5	D
1.84.....	60	328	2310.8376	43261.048	0.000	$3d^7(^2F)4s$	c^3F_3	$3d^7(^2F)4p$	w^3F_4	
2.12.....	140	268	2310.3329	43270.497	0.003	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	1F_3	
1.75.....	41	303	2310.2574	43271.912	0.000	$3d^7(^2P)4s$	a^1P_1	$3d^7(^2P)4p$	z^1P_1	D
1.28.....	26	210	2309.8335	43279.851	0.001	$3d^7(^4P)4p$	z^5P_2	$3d^7(^4P)4d$	5D_2	
2.43.....	293	260	2309.0555	43294.434	0.001	$3d^7(^2G)4p$	z^1F_3	$3d^7(^2G)4d$	1G_4	
2.87.....	865	243	2308.7344	43300.454	-0.002	$3d^7(^2G)4p$	y^3G_3	$3d^7(^2G)4d$	3F_4	BP
2.02.....	115	262	2308.6551	43301.941	0.001	$3d^7(a^2D)4p$	x^3P_2	$3d^7(a^2D)4d$	3P_2	
0.99.....	6	436	2308.3459	43307.741	0.036	$3d^7(^2G)4p$	z^3H_6	$3d^7(^2H)5s$	3H_6	
1.67.....	47	278	2308.1297	43311.798	-0.005	$3d^7(^2G)4p$	y^3F_3	$3d^7(^2G)4d$	1F_3	D
0.97.....	9	296	2308.0094	43314.055	-0.061	$3d^7(^2P)4p$	z^1D_2	$3d^7(^2P)4d$	3D_2	
3.68.....	2970	559	2307.8603	43316.853	-0.001	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^5G_5	
2.67.....	157	645	2307.7545	43318.839	0.001	$3d^7(^4P)4s$	a^5P_2	$3d^7(^4P)4p$	y^5D_1	BP
1.98.....	97	280	2307.6351	43321.079	0.003	$3d^7(^2G)4p$	y^3G_4	$3d^7(^2G)4d$	3F_4	
2.33.....	150	482	2307.5061	43323.501	0.000	$3d^7(a^2D)4s$	b^1D_2	$3d^7(a^2D)4p$	y^1P_1	
0.93.....	10	240	2307.0960	43331.202	-0.032	$3d^7(^4P)4p$	y^3D_3	$3d^7(^4P)4d$	3P_2	D
2.70.....	145	743	2307.0028	43332.952	0.001	$3d^7(^2G)4s$	a^3G_5	$3d^7(^2G)4p$	z^1H_5	
1.57.....	23	442	2306.7802	43337.133	0.000	$3d^7(^2F)4s$	c^3F_3	$3d^7(^2F)4p$	v^3D_3	
2.37.....	450	254	2306.0094	43351.616	0.000	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)4d$	e^5G_5	BP
1.24.....	33	250	2305.9981	43352.017	0.000	$3d^7(^4P)4p$	y^3D_3	$3d^7(^4P)4d$	3D_3	
2.28.....	140	380	2305.9005	43353.665	0.212	$3d^7(^4P)4p$	y^3P_2	$3d^7(^2G)4d$	3G_3	
2.28.....	140	380	2305.9005	43353.665	-0.020	$3d^7(^2G)4p$	y^3F_3	$3d^7(^2G)4d$	3D_2	D
1.56.....	41	253	2305.7194	43357.069	0.008	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	f^3F_4	
1.31.....	16	365	2305.5916	43359.473	0.010	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)4d$	3D_1	
0.56.....	5	201	2305.5400	43360.443	-0.032	$3d^7(^2P)4p$	x^3D_3	$3d^7(^2P)4d$	1F_3	D
1.54.....	38	256	2305.4496	43362.142	-0.003	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)4d$	e^3G_4	
1.03.....	12	248	2305.2477	43365.940	0.019	$3d^7(a^2D)4p$	w^3D_3	$3d^7(^4F)5d$	3D_3	

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
2.54.....	422	233	2304.9540	43371.466	0.000	$3d^7(a^2D)4p$	x^3F_3	$3d^7(a^2D)4d$	3G_4
2.02.....	32	383	2304.2164	43385.348	0.001	$3d^7(a^2D)4s$	a^3D_1	$3d^7(a^2D)4p$	y^1D_2
1.89.....	69	321	2304.0288	43388.879	0.020	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	3G_4
3.15.....	1471	275	2303.9695	43389.997	-0.010	$3d^7(^2G)4p$	z^1H_5	$3d^7(^2G)4d$	1I_6
1.29.....	23	244	2303.8038	43393.118	0.017	$3d^7(^2P)4p$	x^3D_2	$3d^7(^2P)4d$	3P_2
1.17.....	16	255	2303.7102	43394.880	-0.001	$3d^7(^2P)4p$	z^1P_1	$3d^7(a^2D)4d$	3S_1
1.87.....	87	240	2303.2401	43403.737	-0.002	$3d^7(^2P)4p$	z^1P_1	$3d^7(a^2D)4d$	3D_2
1.74.....	39	305	2302.7536	43412.906	-0.001	$3d^7(^4P)4s$	b^3P_0	$3d^7(^2P)4p$	x^3D_1
1.33.....	22	275	2302.1429	43424.422	0.000	$3d^7(^2G)4p$	z^1F_3	$3d^7(^4F)6s$	5F_4
1.58.....	23	466	2301.9080	43428.852	0.027	$3d^7(^2G)4p$	y^3F_4	$3d^7(^4P)4d$	3D_3
2.19.....	178	247	2301.8383	43430.168	-0.001	$3d^7(^2G)4p$	y^3F_3	$3d^7(^2G)4d$	3G_4
2.19.....	178	247	2301.8383	43430.168	-0.054	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)4d$	f^5F_2
1.81.....	51	360	2301.7758	43431.345	0.008	$3d^7(^2G)4p$	z^1H_5	$3d^7(^2G)4d$	3H_4
2.46.....	203	458	2301.4032	43438.377	0.000	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^5G_2
2.79.....	733	236	2300.9931	43446.118	-0.011	$3d^7(^2G)4p$	y^3G_4	$3d^7(^2G)4d$	1H_5
3.21.....	771	443	2300.8087	43449.599	0.001	$3d^7(^4P)4s$	b^3P_2	$3d^7(^2P)4p$	x^3D_3
1.51.....	27	335	2300.5617	43454.265	0.008	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)4d$	f^3F_3
1.92.....	66	271	2300.4830	43455.750	-0.002	$3d^7(^2P)4s$	c^3P_0	$3d^7(a^2D)4p$	w^3D_1
2.96.....	267	748	2299.7693	43469.237	0.001	$3d^7(^4P)4s$	a^5P_3	$3d^7(^4P)4p$	y^5D_3
1.79.....	43	407	2298.8871	43485.916	-0.007	$3d^7(a^2D)4p$	x^3F_2	$3d^7(a^2D)4d$	3D_2
2.29.....	57	735	2298.7340	43488.812	0.003	$3d^7(^4P)4s$	a^5P_3	$3d^7(^4P)4p$	y^5D_2
2.18.....	192	218	2298.3031	43496.965	0.000	$3d^7(^2P)4p$	x^3D_2	111436 ^e	3P_2
1.48.....	30	279	2297.7157	43508.082	0.000	$3d^7(^2P)4p$	x^3D_1	$3d^7(^2P)4d$	3P_2
1.20.....	10	445	2297.6018	43510.239	0.031	$3d^7(^4F)4p$	z^5D_1	$3d^7(^4F)4d$	f^5F_1
1.95.....	48	487	2297.3503	43515.003	0.000	$3d^7(^2F)4s$	c^3F_3	$3d^7(^2F)4p$	v^3D_2
1.80.....	107	254	2297.2767	43516.396	0.001	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)4d$	e^5G_3
1.44.....	35	222	2297.1167	43519.428	-0.009	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)4d$	e^3G_5
1.78.....	17	655	2296.5842	43529.517	0.007	$3d^7(^2G)4s$	a^3G_5	$3d^7(^2G)4p$	y^3G_4
1.50.....	35	378	2296.0026	43540.542	-0.002	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)4d$	e^5G_2
2.04.....	108	271	2295.9178	43542.152	0.069	$3d^7(^4P)4p$	z^5S_2	$3d^7(^4P)5s$	5P_1
1.09.....	8	413	2295.8015	43544.356	0.053	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)4d$	3D_2
2.06.....	172	308	2295.7474	43545.382	-0.002	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)4d$	e^5G_4
1.68.....	27	373	2295.1353	43556.994	-0.011	$3d^7(^4P)4s$	b^3P_1	$3d^7(^2P)4p$	x^3D_1
0.77.....	9	173	2295.0061	43559.446	0.005	$3d^7(^4P)4p$	z^5P_1	$3d^7(^4P)4d$	3D_1
1.89.....	40	544	2294.8998	43561.463	0.002	$3d^7(^2H)4p$	x^3G_3	$3d^7(^4F)5d$	5G_2
0.86.....	8	261	2294.4549	43569.909	-0.015	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)4d$	e^5D_3
0.69.....	7	186	2294.1344	43575.995	0.006	$3d^7(^4F)4p$	z^5D_1	$3d^7(^4F)4d$	e^5P_2
2.93.....	1965	206	2293.4290	43589.398	0.001	$3d^7(^4F)4p$	z^5G_6	$3d^7(^4F)4d$	e^5H_7
2.49.....	360	275	2293.3895	43590.149	0.001	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^5G_3
0.86.....	8	250	2293.0143	43597.280	0.011	$3d^7(a^2D)4p$	y^1F_3	$3d^7(^2H)4d$	3F_3
0.71.....	5	312	2292.8384	43600.624	0.000	$3d^7(a^2D)4p$	w^3D_1	$3d^7(^4F)5d$	5G_2
1.41.....	23	312	2292.8187	43600.998	0.000	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)4d$	e^3D_3
2.54.....	476	203	2292.7665	43601.992	0.000	$3d^7(^2P)4p$	x^3D_2	$3d^7(^2P)4d$	3F_3
1.89.....	31	519	2292.7018	43603.222	0.008	$3d^7(^2G)4s$	a^3G_3	$3d^7(^2G)4p$	z^1F_3
2.20.....	277	247	2292.3149	43610.581	0.084	$3d^7(a^2D)4p$	x^3F_2	$3d^7(a^2D)4d$	1F_3
2.20.....	277	247	2292.3149	43610.581	-0.050	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)4d$	f^5F_5
3.64.....	1184	762	2291.9913	43616.739	-0.001	$3d^7(^4P)4s$	a^5P_3	$3d^7(^4P)4p$	y^5D_4
1.52.....	25	370	2291.8282	43619.842	0.004	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2H)5s$	1H_5
1.16.....	5	324	2291.6343	43623.533	0.041	$3d^7(^2F)4s$	c^3F_2	$3d^7(^2F)4p$	v^3D_2
2.78.....	1391	209	2291.3108	43629.690	-0.002	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)4d$	e^5H_6
2.69.....	488	280	2290.6283	43642.688	0.000	$3d^7(^2G)4p$	z^1H_5	$3d^7(^2G)4d$	1H_5
1.83.....	39	193	2290.5834	43643.543	-0.005	$3d^7(^4P)4s$	b^3P_1	$3d^7(^2P)4p$	1S_0
2.17.....	100	220	2290.5231	43644.693	-0.001	$3d^7(^2G)4p$	y^3F_4	$3d^7(a^2D)5s$	3D_3
1.82.....	36	456	2290.3249	43648.469	0.000	$3d^7(^2F)4s$	c^3F_2	$3d^7(^2F)4p$	v^3D_1
2.46.....	244	324	2289.9612	43655.401	-0.001	$3d^7(^2G)4p$	y^3G_3	$3d^7(^2G)4d$	3F_3
1.69.....	30	442	2289.9054	43656.464	-0.004	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)4d$	e^3D_2
1.15.....	9	450	2289.8016	43658.444	-0.023	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)4d$	3D_3
2.37.....	287	224	2289.2351	43669.247	0.000	$3d^7(^2P)4p$	x^3D_1	$3d^7(^2P)4d$	3F_2
1.77.....	36	345	2289.0914	43671.988	0.003	$3d^7(^4P)4s$	b^3P_1	$3d^7(^2P)4p$	x^3D_2
2.54.....	411	231	2288.9209	43675.240	0.002	$3d^7(^2P)4p$	z^1D_2	$3d^7(^2P)4d$	1F_3
2.54.....	300	319	2288.8799	43676.023	0.001	$3d^7(^2G)4p$	y^3G_4	$3d^7(^2G)4d$	3F_3
1.48.....	28	230	2288.5554	43682.215	0.000	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2H)4p$	z^3I_5
1.44.....	49	216	2287.4362	43703.585	0.002	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)4d$	e^5D_4
1.48.....	37	222	2286.8832	43714.153	-0.005	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)4d$	f^5F_3
1.40.....	33	211	2286.6500	43718.610	0.003	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)4d$	3F_3
3.80.....	2616	917	2286.1591	43727.997	0.000	$3d^7(^4F)4s$	a^5F_5	$3d^7(^4F)4p$	z^5G_6
1.97.....	67	309	2285.8153	43734.574	0.008	$3d^7(a^2D)4s$	a^3D_2	$3d^7(a^2D)4p$	x^3P_2
1.92.....	80	284	2285.6396	43737.937	0.002	$3d^7(^2G)4p$	y^3G_3	$3d^7(^2G)4d$	1D_2
0.99.....	13	207	2285.3079	43744.283	0.002	$3d^7(^4P)4p$	z^5P_1	$3d^7(^4P)4d$	3D_2
0.77.....	5	301	2285.2333	43745.711	0.000	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)4d$	1I_6
0.61.....	4	272	2284.9650	43750.849	0.005	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)4d$	3G_5
1.54.....	42	221	2284.1079	43767.264	0.007	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)4d$	e^3G_4

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
2.01.....	66	430	2283.8525	43772.158	0.000	$3d^7(^2H)4p$	x^3G_4	$3d^7(^4F)5d$	5G_3
2.39.....	140	563	2283.5216	43778.499	-0.003	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^5G_4
2.76.....	591	268	2283.0761	43787.041	0.000	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)4d$	3H_4
0.67.....	6	217	2282.7391	43793.505	0.022	$3d^7(^4P)4p$	y^3D_2	$3d^7(^4P)4d$	3D_2
1.35.....	23	265	2282.7081	43794.100	0.000	$3d^7(a^2D)4p$	w^3D_2	$3d^7(^4F)5d$	3P_1
1.92.....	110	208	2282.5953	43796.265	0.008	$3d^7(^2P)4p$	1S_0	$3d^7(^2P)4d$	1P_1
2.10.....	44	649	2282.3588	43800.802	0.006	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2H)4p$	y^3H_5
1.67.....	25	503	2282.0139	43807.421	-0.005	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)4d$	e^5D_3
2.91.....	954	310	2281.8996	43809.616	0.000	$3d^7(^2H)4s$	a^1H_5	$3d^7(^2H)4p$	y^1H_5
2.01.....	102	270	2281.7155	43813.150	0.002	$3d^7(^2G)4p$	y^3F_2	$3d^7(^2G)4d$	3F_3
2.14.....	152	248	2281.5794	43815.764	0.000	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	3I_5
1.32.....	26	257	2280.9611	43827.639	-0.011	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^5G_2
2.08.....	177	339	2280.8711	43829.369	-0.001	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)4d$	f^3F_2
1.08.....	9	350	2280.5680	43835.193	-0.001	$3d^7(^4P)4p$	y^3D_2	$3d^7(^2G)4d$	3D_3
2.68.....	1043	219	2280.3727	43838.947	-0.004	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)4d$	e^5H_5
0.67.....	6	220	2279.8721	43848.572	0.007	$3d^7(^4P)4p$	y^3D_1	$3d^7(^2G)4d$	3D_2
1.82.....	60	292	2279.6037	43853.734	0.004	$3d^7(^2G)4s$	z^3H_4	$3d^7(^2G)4d$	3H_5
1.26.....	23	209	2279.3942	43857.763	-0.005	$3d^7(a^2D)4p$	w^3D_3	$3d^7(^4F)5d$	5G_2
1.12.....	16	225	2279.2861	43859.844	0.002	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)4d$	e^5G_3
1.60.....	32	336	2279.0604	43864.188	-0.009	$3d^7(^4P)4p$	y^3D_3	$3d^7(^2G)4d$	3D_3
2.08.....	67	378	2279.0212	43864.942	-0.005	$3d^7(^4P)4s$	b^3P_2	$3d^7(^2P)4p$	x^3D_2
0.92.....	10	219	2278.9289	43866.717	-0.007	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	3G_3
1.47.....	37	220	2278.6996	43871.131	0.005	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)4d$	e^3D_3
1.68.....	51	254	2278.5862	43873.315	-0.024	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)4d$	3F_4
2.21.....	115	253	2278.4697	43875.558	0.000	$3d^7(a^2D)4s$	a^3D_1	$3d^7(a^2D)4p$	x^3P_1
1.60.....	30	250	2278.4499	43875.940	-0.002	$3d^7(^2G)4p$	z^3H_6	$3d^7(^2G)4d$	3I_6
1.71.....	30	470	2278.0960	43882.755	-0.046	$3d^7(^2P)4p$	x^3D_1	$3d^7(^2P)4d$	1P_1
1.95.....	109	220	2277.9174	43886.195	0.003	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)4d$	3D_3
1.23.....	38	161	2277.8549	43887.400	-0.005	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)4d$	e^5P_2
2.35.....	166	366	2277.4253	43895.678	-0.003	$3d^7(^2G)4p$	y^3F_2	$3d^7(^2G)4d$	1D_2
1.19.....	16	258	2277.3571	43896.992	-0.051	$3d^7(^4F)4p$	z^5G_6	$3d^7(^4F)4d$	e^5H_6
1.95.....	80	240	2276.7835	43908.049	0.016	$3d^7(^2G)4p$	y^3F_3	$3d^7(^2G)4d$	3G_3
1.21.....	11	406	2276.4010	43915.427	-0.006	$3d^7(^4P)4p$	y^3P_2	$3d^7(^2G)4d$	3F_3
2.48.....	344	235	2276.1701	43919.882	0.000	$3d^7(^4P)4p$	y^5D_4	$3d^7(^4P)4d$	5F_5
0.90.....	8	257	2275.7568	43927.856	0.028	$3d^7(a^2D)4p$	x^3F_3	$3d^7(a^2D)4d$	1F_3
2.14.....	154	207	2275.4047	43934.653	0.000	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2H)4p$	y^3H_6
2.30.....	138	391	2275.3160	43936.367	-0.120	$3d^7(^4F)4p$	z^5D_0	$3d^7(^4F)4d$	e^5P_1
2.06.....	118	264	2275.0758	43941.005	0.001	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	3D_3
1.83.....	73	250	2274.8086	43946.165	0.000	$3d^7(^2G)4p$	z^3H_6	$3d^7(^2G)4d$	3G_5
2.57.....	753	221	2273.5910	43969.698	0.001	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)4d$	e^5H_4
1.07.....	15	209	2273.0031	43981.069	-0.015	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)4d$	e^3G_5
2.27.....	236	233	2272.7048	43986.842	-0.016	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	f^3F_3
2.57.....	472	240	2272.6737	43987.444	-0.016	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	3H_4
1.78.....	42	350	2272.2896	43994.877	0.000	$3d^7(^2P)4p$	y^3S_1	$3d^7(a^2D)4d$	3D_2
1.50.....	23	350	2272.2653	43995.348	0.000	$3d^7(^4F)4s$	a^5F_5	$3d^7(^4F)4p$	z^5G_5
1.30.....	12	350	2272.1656	43997.279	0.000	$3d^7(^2P)4p$	z^1P_1	$3d^7(a^2D)4d$	3D_1
1.00.....	5	400	2272.1541	43997.501	0.000	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)4d$	3G_4
1.30.....	15	400	2272.1301	43997.966	0.000	$3d^7(^4P)4p$	y^3P_2	$3d^7(^2G)4d$	1D_2
1.00.....	23	350	2272.1081	43998.392	0.000	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)4d$	1H_5
1.59.....	47	222	2271.6707	44006.863	-0.002	$3d^7(^4P)4p$	y^5D_4	$3d^7(^4P)4d$	5F_4
1.02.....	14	200	2271.4922	44010.322	-0.001	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)4d$	e^5D_4
1.06.....	14	215	2271.2954	44014.134	0.019	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)4d$	5D_0
2.28.....	313	265	2271.1190	44017.553	-0.001	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)4d$	e^5H_3
2.37.....	262	240	2270.5403	44028.771	0.001	$3d^7(^2G)4p$	y^3F_3	$3d^7(^2G)4d$	3H_4
2.08.....	137	234	2270.3026	44033.381	0.000	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	3G_5
2.28.....	353	233	2269.9045	44041.101	-0.001	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	f^3F_4
1.14.....	10	381	2269.1455	44055.832	-0.031	$3d^7(^4P)4p$	y^3D_2	$3d^7(^2G)4d$	1F_3
1.31.....	18	304	2268.8263	44062.029	-0.010	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)4d$	3F_2
2.04.....	104	281	2268.5301	44067.783	-0.003	$3d^7(^2G)4p$	y^3G_3	$3d^7(^2G)4d$	3F_2
1.91.....	81	268	2268.2224	44073.759	0.001	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	3F_4
1.57.....	44	223	2268.0781	44076.564	0.004	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)4d$	5D_1
1.44.....	33	222	2267.7312	44083.304	0.004	$3d^7(^4F)4p$	z^5D_1	$3d^7(^4F)4d$	e^5P_1
2.35.....	213	282	2267.3798	44090.137	-0.001	$3d^7(^2H)4p$	z^1I_6	$3d^7(^2H)4d$	3I_7
1.13.....	12	295	2266.9873	44097.770	0.025	$3d^7(^4P)4p$	y^3D_2	$3d^7(^2G)4d$	3D_2
2.60.....	175	480	2266.7988	44101.435	0.000	$3d^7(^4P)4s$	a^5P_1	$3d^7(^4P)4p$	z^3S_1
2.70.....	426	264	2266.5679	44105.928	0.006	$3d^7(^2G)4p$	z^3H_6	$3d^7(^2G)4d$	3H_6
3.40.....	393	687	2266.5259	44106.746	-0.002	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2H)4p$	y^3H_4
0.63.....	7	151	2266.0448	44116.109	-0.018	$3d^7(^4P)4p$	y^5D_4	$3d^7(^4P)4d$	5F_3
1.38.....	13	477	2265.7444	44121.958	0.009	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^5G_3
1.37.....	19	318	2265.6789	44123.232	0.019	$3d^7(^2P)4p$	z^1D_2	$3d^7(^2P)4d$	3P_2
1.47.....	29	268	2265.3326	44129.977	0.007	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)4d$	e^5G_3
1.98.....	169	259	2265.2527	44131.533	-0.001	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)4d$	e^3G_3

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.69.....	52	247	2265.0097	44136.268	0.001	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	3H_5
1.60.....	45	233	2264.6254	44143.757	0.003	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)4d$	e^5P_3
0.83.....	7	238	2264.2815	44150.460	0.010	$3d^7(^2H)4p$	x^3G_4	$3d^7(^2H)4d$	3G_5
2.42.....	287	243	2264.1971	44152.107	0.000	$3d^7(a^2D)4p$	x^3F_2	$3d^7(a^2D)4d$	3G_3
2.18.....	176	226	2264.0810	44154.370	0.001	$3d^7(^4P)4p$	y^3D_3	$3d^7(^4P)4d$	5F_4
2.50.....	297	277	2263.8931	44158.036	-0.003	$3d^7(^2G)4p$	y^3G_4	$3d^7(^2G)4d$	1G_4
1.78.....	67	238	2263.7067	44161.671	-0.002	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	1F_3
2.59.....	412	247	2263.4514	44166.652	0.000	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2G)4d$	3I_6
2.07.....	110	277	2262.5379	44184.481	-0.004	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)4d$	3F_2
2.06.....	117	255	2262.0502	44194.007	-0.003	$3d^7(a^2D)4p$	w^3D_3	$3d^7(a^2D)4d$	3F_4
1.53.....	52	257	2261.9417	44196.127	-0.002	$3d^7(^4F)4p$	z^3D_1	$3d^7(^4F)4d$	e^3D_2
1.99.....	112	228	2261.8043	44198.812	0.001	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	1H_5
0.48.....	5	200	2261.5781	44203.231	0.000	$3d^7(^4P)4p$	y^3D_3	$3d^7(^4P)4d$	3G_4
1.78.....	84	203	2261.5530	44203.722	-0.029	$3d^7(a^2D)4s$	a^3D_1	$3d^7(a^2D)4p$	x^3P_0
0.91.....	10	211	2261.4420	44205.892	0.018	$3d^7(^2H)4p$	z^3I_7	$3d^7(^2H)4d$	3K_7
0.93.....	10	213	2261.3802	44207.100	-0.005	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)4d$	5D_2
1.44.....	23	238	2261.2833	44208.993	-0.011	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2G)4p$	x^3G_3
2.13.....	154	229	2260.9727	44215.067	0.002	$3d^7(a^2D)4p$	w^3D_3	$3d^7(^2H)4d$	3G_4
2.03.....	70	399	2260.8184	44218.084	0.005	$3d^7(^2G)4p$	y^3G_5	$3d^7(^4F)6s$	3F_4
0.97.....	10	245	2260.6791	44220.809	-0.005	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)4d$	1P_1
2.18.....	108	366	2260.4375	44225.535	0.003	$3d^7(^2G)4p$	y^3F_2	$3d^7(^2G)4d$	3F_2
1.72.....	64	216	2260.3584	44227.083	0.006	$3d^7(^2P)4p$	z^1D_2	111436 ^e	
1.72.....	64	216	2260.3584	44227.083	-0.041	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	f^3F_4
2.21.....	160	261	2260.2870	44228.479	-0.001	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2H)5s$	1H_5
3.32.....	1929	240	2260.0064	44233.969	0.000	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2H)4p$	y^3H_5
1.90.....	72	291	2259.8579	44236.877	0.001	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2G)4d$	3G_5
1.91.....	89	238	2259.4911	44244.057	-0.001	$3d^7(^4P)4p$	y^3D_2	$3d^7(^4P)4d$	5F_3
0.88.....	8	241	2258.9286	44255.073	0.017	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)4d$	e^5H_3
0.86.....	8	179	2258.6104	44261.307	0.006	$3d^7(^2P)4s$	a^1P_1	$3d^7(a^2D)4p$	x^3P_2
1.75.....	68	217	2258.4917	44263.633	0.002	$3d^7(^4P)4p$	y^5D_3	$3d^7(^4P)4d$	5F_3
1.81.....	72	232	2257.9179	44274.881	-0.001	$3d^7(^4P)4p$	y^5D_1	$3d^7(^4P)4d$	5F_2
1.86.....	159	195	2257.7788	44277.608	0.001	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)4d$	e^5H_6
2.42.....	256	266	2257.6549	44280.037	-0.001	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	3G_4
2.06.....	50	441	2257.5736	44281.632	-0.001	$3d^7(^4P)4p$	y^5D_0	$3d^7(^4P)4d$	5F_1
0.86.....	9	217	2257.4336	44284.378	0.000	$3d^7(^2P)4p$	z^1D_2	$3d^7(^2P)4d$	3F_2
1.50.....	22	377	2257.2473	44288.032	0.004	$3d^7(^2G)4p$	y^3G_4	$3d^7(^4F)6s$	5F_4
0.80.....	8	194	2257.0785	44291.344	0.016	$3d^7(^2P)4p$	z^1P_1	$3d^7(a^2D)4d$	3P_2
2.28.....	197	246	2256.8567	44295.697	0.000	$3d^7(a^2D)4p$	w^3D_3	$3d^7(a^2D)4d$	3F_3
3.37.....	601	867	2256.7448	44297.894	-0.003	$3d^7(^2H)4s$	a^3H_6	$3d^7(^2H)4p$	y^3H_6
1.23.....	19	230	2256.6063	44300.612	0.012	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)4d$	e^5H_5
1.23.....	19	230	2256.6063	44300.612	0.049	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)4d$	f^5F_3
1.59.....	31	231	2255.9677	44313.151	0.007	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)4d$	e^5H_4
2.20.....	357	198	2255.9359	44313.777	0.005	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)4d$	e^5G_4
1.94.....	72	240	2255.6445	44319.501	-0.002	$3d^7(^2P)4s$	c^3P_1	$3d^7(a^2D)4p$	w^3D_2
1.22.....	15	287	2255.0000	44332.166	-0.068	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)4d$	f^3F_3
2.00.....	88	221	2254.9598	44332.956	-0.001	$3d^8$	a^1G_4	$3d^7(^2G)4p$	z^3H_5
2.21.....	151	275	2254.6137	44339.761	0.000	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2G)4d$	3H_5
1.78.....	51	300	2254.1826	44348.239	-0.016	$3d^7(^2H)4p$	x^3G_4	113191 ^e	
1.10.....	8	418	2253.9145	44353.514	-0.051	$3d^7(^2G)4p$	y^3G_3	$3d^7(^4F)6s$	3F_3
1.97.....	86	278	2253.8592	44354.602	0.004	$3d^7(^2G)4p$	z^1H_5	$3d^7(^2G)4d$	1G_4
2.64.....	124	740	2253.4803	44362.060	0.089	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	f^3F_2
2.64.....	124	740	2253.4803	44362.060	-0.005	$3d^7(a^2D)4s$	a^3D_3	$3d^7(a^2D)4p$	x^3P_2
1.83.....	70	248	2253.3394	44364.832	0.001	$3d^7(^4P)4p$	y^5D_2	$3d^7(^4P)4d$	5F_2
2.22.....	133	318	2253.1619	44368.328	-0.001	$3d^7(^2H)4p$	x^3G_3	$3d^7(^2H)4d$	3G_3
0.91.....	15	225	2253.1259	44369.036	0.000	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)4d$	e^3G_3
1.69.....	89	224	2253.1108	44369.333	-0.053	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)4d$	e^3D_3
1.69.....	89	224	2253.1108	44369.333	-0.069	$3d^7(^4P)4p$	z^5P_3	$3d^7(^2G)4d$	3D_2
2.48.....	289	230	2252.7403	44376.629	0.000	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)4d$	e^5G_5
1.02.....	11	244	2252.3448	44384.421	0.017	$3d^7(^4P)4p$	y^5D_3	$3d^7(^4P)4d$	5F_2
1.98.....	198	201	2252.2817	44385.666	0.001	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)4d$	e^5P_2
1.74.....	98	208	2252.1529	44388.203	0.002	$3d^7(^2H)4p$	y^1G_4	$3d^7(^2H)4d$	1G_4
1.74.....	41	342	2252.0876	44389.490	0.001	$3d^7(^4P)4p$	y^5D_1	$3d^7(^4P)4d$	5F_1
1.52.....	26	322	2252.0364	44390.499	0.018	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	f^3F_4
1.59.....	55	263	2251.9794	44391.623	0.002	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)4d$	e^5G_2
2.07.....	105	285	2251.8225	44394.716	0.000	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)4d$	e^5P_1
1.49.....	35	175	2251.3218	44404.588	-0.002	$3d^7(^2P)4s$	c^3P_0	$3d^7(^2P)4p$	y^3S_1
1.75.....	74	307	2251.1688	44407.606	0.003	$3d^7(^4F)4p$	z^5D_0	$3d^7(^4F)4d$	e^5D_1
2.41.....	84	626	2251.1159	44408.649	0.001	$3d^7(^4P)4s$	a^5P_2	$3d^7(^4P)4p$	z^3S_1
0.63.....	4	269	2251.0227	44410.489	-0.026	$3d^7(^2H)4p$	x^3G_4	$3d^7(a^2D)4d$	3F_4
1.51.....	37	224	2250.9918	44411.097	0.001	$3d^7(^2P)4p$	x^3D_2	$3d^7(^2P)4d$	1D_2
2.01.....	67	389	2250.6166	44418.501	0.003	$3d^7(^2G)4p$	z^1G_4	$3d^7(^4F)6s$	3F_4
2.33.....	232	237	2250.4913	44420.974	-0.027	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)4d$	e^5D_3

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.43.....	26	255	2250.3762	44423.244	0.011	$3d^7(a^2D)4s$	a^3D_2	$3d^7(a^2D)4p$	y^1F_3
2.79.....	577	272	2250.3173	44424.407	0.001	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)4d$	3I_5
1.35.....	5	468	2249.9988	44430.696	0.022	$3d^7(^2P)4s$	c^3P_2	$3d^7(a^2D)4p$	w^3D_1
1.77.....	36	412	2249.9544	44431.573	0.003	$3d^7(^2H)4p$	x^3G_4	$3d^7(^2H)4d$	3G_4
2.12.....	279	206	2249.9109	44432.431	0.000	$3d^7(^4F)4p$	z^3D_4	$3d^7(^4F)4d$	f^5F_3
1.55.....	43	213	2249.6935	44436.726	0.000	$3d^7(^4F)4p$	z^5D_1	$3d^7(^4F)4d$	e^5D_0
1.05.....	6	494	2248.6708	44456.932	-0.064	$3d^7(^4F)4s$	a^5F_5	$3d^7(^4F)4p$	z^5G_4
0.89.....	9	217	2248.5244	44459.828	0.021	$3d^7(^2G)4p$	y^3F_3	$3d^7(^4F)6s$	3F_4
1.26.....	17	273	2248.3509	44463.257	-0.025	$3d^7(a^2D)4p$	w^3D_3	$3d^7(a^2D)4d$	3D_3
1.59.....	21	469	2248.2491	44465.270	0.002	$3d^7(^2H)4p$	x^3G_3	$3d^7(a^2D)4d$	3F_2
1.86.....	159	202	2248.0816	44468.584	0.000	$3d^7(^4F)4p$	z^3D_1	$3d^7(^4F)4d$	e^5D_2
2.57.....	316	296	2248.0101	44469.997	0.160	$3d^7(^2P)4s$	c^3P_2	$3d^7(^2H)4p$	x^3G_3
2.57.....	316	296	2248.0101	44469.997	-0.016	$3d^7(^2G)4p$	y^3F_3	$3d^7(^4F)4d$	3F_3
1.70.....	31	240	2247.7620	44474.906	-0.001	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)4d$	3P_0
2.02.....	62	240	2247.7388	44475.365	-0.001	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)4d$	3G_3
1.51.....	32	258	2247.5983	44478.144	0.001	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)4d$	3P_2
1.10.....	12	270	2247.5330	44479.436	-0.002	$3d^7(^4P)4p$	y^3D_2	$3d^7(^4P)4d$	5F_1
2.12.....	110	302	2247.3259	44483.536	0.004	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2G)4d$	3G_4
1.10.....	9	356	2247.2716	44484.611	0.024	$3d^7(^2G)4p$	z^3H_5	$3d^7(^4F)6s$	5F_4
1.18.....	16	241	2247.1768	44486.486	0.002	$3d^7(^2P)4p$	x^3D_2	$3d^7(^4F)5d$	3D_3
1.55.....	63	197	2246.8706	44492.549	-0.001	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)4d$	e^5P_3
1.32.....	20	271	2246.2703	44504.437	0.006	$3d^7(a^2D)4p$	w^3D_1	$3d^7(a^2D)4d$	3F_2
2.74.....	563	246	2246.0409	44508.983	-0.001	$3d^7(^2H)4p$	z^3I_6	$3d^7(^2H)4d$	3K_7
1.71.....	26	503	2245.9374	44511.034	0.017	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2H)5s$	1H_5
1.16.....	7	504	2245.8772	44512.227	0.025	$3d^7(^2H)4p$	x^3G_4	$3d^7(a^2D)4d$	3F_3
1.66.....	67	272	2245.7430	44514.887	0.000	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)4d$	f^5F_2
2.18.....	165	234	2245.6475	44516.779	0.000	$3d^7(a^2D)4p$	x^3F_3	$3d^7(a^2D)4d$	1G_4
3.21.....	815	487	2245.1289	44527.062	0.001	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^3G_5
0.55.....	4	234	2244.6641	44536.281	0.061	$3d^7(a^2D)4p$	x^3P_2	$3d^7(^2H)4d$	3F_2
0.95.....	4	237	2244.6554	44536.452	0.002	$3d^8$	a^1G_4	$3d^7(^2G)4p$	y^3F_4
1.58.....	36	220	2244.4807	44539.920	-0.001	$3d^7(^2H)4s$	a^3H_5	$3d^7(^2H)4p$	y^3H_4
1.10.....	11	247	2244.3624	44542.268	0.015	$3d^7(a^2D)4s$	a^3D_2	$3d^7(a^2D)4p$	y^1D_2
0.58.....	5	179	2244.2252	44544.989	0.031	$3d^7(^4F)4p$	z^5G_6	$3d^7(^4F)4d$	e^5H_6
1.48.....	37	210	2243.8872	44551.698	0.014	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)4d$	e^5H_5
1.85.....	136	205	2243.8371	44552.694	0.148	$3d^7(^2G)4p$	y^3F_3	$3d^7(^2G)4d$	1D_2
1.85.....	136	205	2243.8371	44552.694	-0.015	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)4d$	f^5F_5
1.62.....	50	317	2243.7505	44554.412	-0.004	$3d^7(^4F)4p$	z^5D_1	$3d^7(^4F)4d$	e^5D_1
1.72.....	43	387	2242.8360	44572.577	0.225	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)4d$	e^5G_4
1.72.....	43	387	2242.8360	44572.577	-0.003	$3d^7(^4F)4p$	z^5F_1	$3d^7(^4F)4d$	f^5F_1
2.83.....	376	452	2241.6529	44596.100	-0.002	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)4d$	3H_4
1.35.....	8	575	2241.5929	44597.293	0.080	$3d^7(^2H)4s$	a^3H_6	$3d^7(^2H)4p$	y^3H_5
1.35.....	16	352	2241.4629	44599.881	-0.015	$3d^7(^2H)4p$	x^3G_5	$3d^7(^5F)5d$	3H_5
2.59.....	391	250	2241.1845	44605.420	0.001	$3d^7(^2H)4p$	z^3I_5	$3d^7(^2H)4d$	3K_6
1.26.....	16	282	2240.2629	44623.767	-0.002	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)4d$	3D_2
1.64.....	78	219	2240.0389	44628.230	0.000	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)4d$	e^5G_3
1.35.....	17	324	2239.8017	44632.955	0.011	$3d^7(^2H)4s$	a^3H_4	$3d^7(a^2D)4p$	y^1F_3
0.92.....	7	312	2239.2361	44644.228	-0.021	$3d^7(^4F)4p$	z^5D_0	$3d^7(^4F)4d$	e^5D_1
0.93.....	5	414	2237.4525	44679.814	0.027	$3d^7(^2H)4p$	x^3G_4	$3d^7(a^2D)4d$	3D_3
2.34.....	143	380	2237.3228	44682.402	0.002	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)4d$	3F_4
0.71.....	5	232	2236.9020	44690.807	-0.036	$3d^7(a^2D)4p$	x^3F_3	$3d^7(a^2D)4d$	3P_2
1.76.....	35	404	2236.0729	44707.376	0.029	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)4d$	f^5F_2
1.12.....	16	210	2235.9258	44710.318	0.016	$3d^7(^2G)4p$	y^3G_5	$3d^7(^2G)4d$	1G_4
1.63.....	34	309	2235.7158	44714.517	0.006	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2H)5s$	1H_5
2.34.....	442	212	2235.0120	44728.595	-0.001	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)4d$	e^5D_4
2.58.....	656	233	2234.7543	44733.753	0.001	$3d^7(^4F)4p$	z^5F_5	$3d^7(^4F)4d$	f^5F_5
0.81.....	8	192	2234.5170	44738.502	0.028	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)4d$	e^5H_4
1.57.....	42	218	2234.0256	44748.343	-0.001	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)4d$	1F_3
0.96.....	9	242	2233.9348	44750.161	0.068	$3d^7(^2G)4p$	z^3H_6	$3d^7(^2G)4d$	1I_6
0.88.....	9	220	2233.5466	44757.939	0.035	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	3G_3
0.83.....	6	268	2233.4854	44759.165	-0.059	$3d^7(^2H)4p$	z^3I_6	$3d^7(^2H)4d$	3I_5
1.34.....	22	247	2233.3650	44761.577	0.002	$3d^7(a^2D)4p$	w^3D_3	$3d^7(a^2D)4d$	3F_2
1.69.....	45	265	2233.3215	44762.450	0.022	$3d^7(a^2D)4p$	y^1D_2	$3d^7(a^2D)4d$	1D_2
0.92.....	10	203	2232.9906	44769.083	0.012	$3d^7(a^2D)4p$	w^3D_3	$3d^7(a^2D)4d$	3G_4
2.05.....	110	240	2232.4459	44780.002	0.001	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)4d$	e^5D_2
2.13.....	256	212	2232.3854	44781.217	-0.010	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)4d$	f^5F_3
1.07.....	14	212	2232.2188	44784.560	0.005	$3d^7(^4P)4p$	z^3S_1	$3d^7(^4P)4d$	3D_1
0.65.....	6	178	2232.1479	44785.983	-0.001	$3d^7(^4P)4p$	y^3P_1	$3d^7(^2P)4d$	3D_1
2.41.....	259	226	2232.0717	44787.511	-0.001	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^3G_4
2.45.....	268	255	2231.9044	44790.868	0.002	$3d^7(^2H)4p$	x^3G_5	$3d^7(^2H)4d$	3G_5
0.99.....	4	230	2231.7068	44794.832	0.008	$3d^7(^2G)4s$	a^3G_3	$3d^7(^2P)4p$	z^1D_2
2.31.....	112	442	2231.3579	44801.837	0.005	$3d^7(^4P)4p$	y^3D_3	$3d^7(^2G)4d$	3H_4
1.53.....	30	275	2231.0784	44807.449	-0.004	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)4d$	1H_5

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
2.42.....	482	226	2230.4333	44820.406	0.000	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)4d$	f^5F_4
0.99.....	11	225	2229.7754	44833.630	0.005	$3d^7(^4P)4p$	y^5D_4	$3d^7(^4P)4d$	3F_4
0.99.....	9	251	2229.4456	44840.261	-0.030	$3d^7(^2G)4p$	y^3G_5	$3d^7(^4F)6s$	5F_4
0.90.....	10	191	2228.1604	44866.123	0.000	$3d^7(^4P)4p$	y^3P_1	$3d^7(^2P)4d$	3D_2
2.44.....	223	200	2227.5389	44878.639	0.000	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	3H_4
1.74.....	44	200	2227.5164	44879.092	0.000	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)4d$	e^3G_4
1.31.....	13	385	2227.4029	44881.379	-0.068	$3d^7(a^2D)4p$	y^1F_3	$3d^7(a^2D)4d$	1D_2
1.96.....	83	266	2227.3518	44882.409	0.012	$3d^7(^2G)4p$	y^3F_3	$3d^7(^2G)4d$	3F_2
1.96.....	83	266	2227.3518	44882.409	-0.058	$3d^7(^2P)4p$	y^3S_1	$3d^7(a^2D)4d$	3P_2
1.32.....	13	401	2227.0681	44888.126	-0.004	$3d^7(^4P)4p$	y^3D_3	$3d^7(^2G)4d$	3F_4
1.26.....	8	573	2226.2518	44904.583	0.031	$3d^7(^2H)4p$	x^3G_3	$3d^7(a^2D)4d$	3D_2
1.82.....	91	305	2226.1672	44906.289	0.000	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)4d$	f^5F_1
2.62.....	355	286	2225.9481	44910.709	0.272	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2G)4d$	3I_5
2.62.....	355	286	2225.9481	44910.709	-0.012	$3d^7(^2G)4p$	z^1G_4	$3d^7(^2G)4d$	1G_4
1.89.....	132	241	2225.5243	44919.260	-0.001	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)4d$	e^3D_3
1.38.....	17	336	2225.0674	44928.485	-0.003	$3d^7(^2P)4p$	z^1P_1	$3d^7(a^2D)4d$	3P_0
1.15.....	14	245	2224.9309	44931.239	-0.003	$3d^7(^4P)4p$	y^3P_0	$3d^7(^2P)4d$	3D_1
1.88.....	63	287	2224.4176	44941.606	-0.004	$3d^7(^2H)4p$	z^1I_6	$3d^7(^2H)4d$	3H_5
1.32.....	21	242	2224.3128	44943.724	0.009	$3d^7(a^2D)4p$	w^3D_1	$3d^7(a^2D)4d$	3D_2
2.14.....	64	411	2224.0816	44948.395	0.000	$3d^7(^2P)4s$	c^3P_1	$3d^7(^2P)4p$	y^3S_1
1.05.....	13	217	2223.9016	44952.033	0.003	$3d^7(^2G)4p$	y^3F_3	$3d^7(^2G)4d$	1G_4
1.46.....	32	216	2223.7155	44955.795	0.004	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)4d$	e^3D_3
2.08.....	112	260	2223.2634	44964.937	0.000	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	3F_4
1.58.....	40	231	2223.0435	44969.382	-0.013	$3d^7(^4P)4p$	z^3S_1	$3d^7(^2P)4d$	3D_2
1.85.....	105	262	2222.9107	44972.071	0.000	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)4d$	e^5P_2
1.52.....	26	301	2222.8109	44974.089	-0.005	$3d^7(^2H)4p$	z^3I_5	$3d^7(^2H)4d$	3I_6
0.94.....	6	329	2222.6026	44978.304	-0.027	$3d^7(^2P)4p$	x^3D_2	$3d^7(^4F)5d$	5G_2
0.64.....	6	186	2222.4618	44981.152	0.023	$3d^7(^4P)4p$	y^5D_3	$3d^7(^4P)4d$	3F_4
1.66.....	17	519	2222.2461	44985.517	0.007	$3d^7(^4P)4s$	b^3P_2	$3d^7(a^2D)4p$	w^3D_3
2.40.....	232	258	2221.7509	44995.543	-0.008	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)4d$	f^5F_2
2.40.....	232	258	2221.7509	44995.543	-0.185	$3d^7(^2P)4s$	c^3P_0	$3d^7(^2P)4p$	z^1P_1
1.19.....	13	281	2221.5234	45000.151	0.017	$3d^7(a^2D)4p$	y^1F_3	$3d^7(^2H)4d$	1G_4
2.10.....	233	208	2221.4593	45001.449	-0.001	$3d^7(^4F)4p$	z^5F_5	$3d^7(^4F)4d$	f^5F_4
1.92.....	162	188	2221.2299	45006.096	-0.001	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)4d$	e^3G_5
1.03.....	10	268	2220.6148	45018.561	0.002	$3d^7(^2G)4p$	y^3G_4	$3d^7(^4F)6s$	3F_3
1.62.....	33	305	2220.5300	45020.281	0.003	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)4d$	f^3F_3
1.82.....	65	244	2220.4865	45021.163	0.002	$3d^7(^2H)4p$	x^3G_4	$3d^7(^2H)4d$	1H_5
0.71.....	6	205	2220.4579	45021.743	0.034	$3d^8$	a^3F_3	$3d^7(^4F)4p$	z^5F_3
1.56.....	28	314	2220.1800	45027.378	0.237	$3d^7(^2G)4p$	z^3H_4	$3d^7(^4F)6s$	3F_4
1.56.....	28	314	2220.1800	45027.378	0.048	$3d^7(a^2D)4p$	x^3F_3	$3d^7(^2H)4d$	3F_4
3.25.....	723	527	2220.1152	45028.692	0.002	$3d^7(^4P)4s$	a^5P_1	$3d^7(^4P)4p$	z^5P_2
2.15.....	471	180	2220.0937	45029.126	0.000	$3d^7(^2H)4p$	x^3G_3	$3d^7(a^2D)4d$	1F_3
2.00.....	39	260	2219.9498	45032.046	0.001	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)4d$	e^5G_4
2.43.....	139	318	2219.9294	45032.460	-0.004	$3d^7(a^2D)4s$	a^3D_2	$3d^7(a^2D)4p$	x^3P_1
1.41.....	12	499	2219.8002	45035.081	-0.057	$3d^7(^2H)4p$	z^3I_5	$3d^7(^2H)4d$	1H_5
1.88.....	49	371	2219.5241	45040.681	0.070	$3d^7(^4P)4p$	y^5D_4	$3d^7(^4P)4d$	5D_4
1.88.....	49	371	2219.5241	45040.681	-0.029	$3d^7(^2G)4p$	z^1G_4	$3d^7(^4F)6s$	5F_4
0.77.....	5	259	2219.3376	45044.467	-0.019	$3d^7(^4P)4p$	z^5P_3	$3d^7(^2G)4d$	3H_4
0.88.....	7	249	2219.1906	45047.449	0.023	$3d^7(^4P)4p$	y^3D_1	$3d^7(^2G)4d$	1D_2
1.78.....	34	320	2219.0797	45049.701	0.009	$3d^7(^4P)4s$	b^3P_1	$3d^7(a^2D)4p$	w^3D_1
1.75.....	37	365	2219.0198	45050.916	0.184	$3d^7(a^2D)4s$	a^3D_3	$3d^7(a^2D)4p$	y^1F_3
1.75.....	37	365	2219.0198	45050.916	-0.015	$3d^7(^2H)4p$	x^3G_5	$3d^7(a^2D)4d$	3F_4
1.88.....	49	371	2219.5241	45040.681	-0.122	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2G)4d$	1I_6
1.34.....	23	228	2218.6469	45058.488	-0.026	$3d^7(^4P)4p$	y^5D_0	$3d^7(^4P)4d$	5D_1
1.44.....	18	260	2218.1303	45068.981	-0.005	$3d^7(^2P)4s$	a^1P_1	$3d^7(a^2D)4p$	y^1D_2
1.41.....	16	374	2217.9824	45071.987	0.001	$3d^7(^2H)4p$	x^3G_5	$3d^7(^2H)4d$	3G_4
1.93.....	166	204	2217.7164	45077.392	0.000	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)4d$	e^5D_4
1.22.....	12	315	2217.4841	45082.114	-0.019	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2G)4d$	3H_4
2.45.....	459	234	2217.3012	45085.832	0.000	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)4d$	e^5P_3
1.22.....	28	385	2217.2790	45086.283	0.000	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^3G_3
0.55.....	6	139	2217.2114	45087.658	-0.001	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)4d$	e^3D_3
1.26.....	19	232	2217.0960	45090.005	0.015	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	1H_5
2.36.....	196	276	2216.9284	45093.414	0.003	$3d^7(^2H)4p$	z^3I_7	$3d^7(^2H)4d$	3I_7
1.20.....	14	270	2216.4109	45103.940	0.015	$3d^7(^4P)4p$	y^5D_1	$3d^7(a^2D)4d$	5D_0
2.61.....	759	214	2216.3558	45105.062	0.000	$3d^7(^4F)4p$	z^5F_5	$3d^7(^4F)4d$	e^5G_6
1.69.....	54	212	2215.8672	45115.005	-0.002	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2P)4d$	3D_2
1.28.....	14	325	2215.8264	45115.837	0.006	$3d^7(^2H)4p$	z^3I_5	$3d^7(^2H)4d$	3H_6
1.38.....	22	249	2215.4376	45123.754	-0.003	$3d^7(^2H)4p$	z^3I_6	$3d^7(^2H)4d$	3K_6
2.35.....	185	274	2214.7927	45136.893	0.001	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^3F_4
1.49.....	29	251	2214.5812	45141.201	-0.007	$3d^7(^2P)4p$	z^1D_2	$3d^7(^2P)4d$	1D_2
1.84.....	105	252	2214.5139	45142.574	-0.003	$3d^7(^4F)4p$	z^5F_1	$3d^7(^4F)4d$	e^5G_2
1.87.....	50	260	2214.3616	45145.678	0.006	$3d^7(^4F)4p$	z^5F_1	$3d^7(^4F)4d$	e^5P_1

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)	
2.57.....	260	260	2214.3356	45146.207	0.010	$3d^7(^2H)4p$	z^1I_6	$3d^7(^2H)4d$	1I_6	B
0.81.....	7	215	2214.0572	45151.884	0.035	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)4d$	3F_2	
0.56.....	4	208	2213.3451	45166.410	0.040	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)4d$	5D_1	
2.04.....	112	228	2213.2602	45168.142	-0.034	$3d^7(^2G)4p$	y^3F_3	$3d^7(^4F)6s$	5F_3	D
2.04.....	112	228	2213.2602	45168.142	0.028	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2P)4d$	3D_3	D
1.93.....	24	712	2213.1805	45169.768	0.017	$3d^7(a^2D)4s$	a^3D_3	$3d^7(a^2D)4p$	y^1D_2	
2.19.....	138	262	2213.0365	45172.708	0.000	$3d^7(^2H)4p$	x^3G_3	$3d^7(^2H)4d$	3H_4	
1.61.....	33	292	2212.5451	45182.739	0.006	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)4d$	f^3F_4	
0.93.....	8	238	2212.2827	45188.097	-0.018	$3d^7(^4P)4p$	y^3D_3	$3d^7(^4P)4d$	5D_4	
1.93.....	72	272	2212.2238	45189.300	0.091	$3d^8$	a^3F_2	$3d^7(^4F)4p$	z^5F_1	D
1.93.....	72	272	2212.2238	45189.300	-0.023	$3d^7(^2H)4p$	z^3I_7	$3d^7(^2H)4d$	3I_6	D
0.78.....	7	211	2211.7976	45198.008	0.028	$3d^7(^4P)4p$	y^3D_4	$3d^7(^4P)4d$	5D_3	
1.48.....	25	278	2211.6577	45200.866	0.007	$3d^7(a^2D)4p$	w^3D_3	$3d^7(a^2D)4d$	3D_2	
2.31.....	53	824	2211.4282	45205.557	0.002	$3d^7(^4F)4s$	a^5F_5	$3d^7(^4F)4p$	z^3G_5	
1.62.....	31	311	2211.0116	45214.073	0.000	$3d^7(^4P)4p$	y^3D_2	$3d^7(^2G)4d$	3F_3	BP
2.40.....	188	220	2210.9841	45214.635	0.000	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)4d$	e^5G_3	BP
1.39.....	22	254	2210.8887	45216.587	-0.009	$3d^7(^2P)4p$	z^1D_2	$3d^7(^4F)5d$	3D_3	
0.82.....	7	222	2210.8545	45217.285	-0.024	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)4d$	3D_1	
0.79.....	6	226	2209.6590	45241.748	-0.050	$3d^7(^4P)4p$	y^3D_2	$3d^7(^4P)4d$	3F_2	
1.24.....	11	366	2209.5926	45243.107	0.031	$3d^7(^4P)4p$	y^3D_3	$3d^7(^2G)4d$	3F_3	
1.59.....	16	546	2209.5058	45244.883	0.006	$3d^7(^2H)4s$	a^3H_4	$3d^7(^2H)4p$	y^1G_4	
0.93.....	5	359	2209.0535	45254.146	0.010	$3d^7(a^2D)4s$	a^3D_1	$3d^7(a^2D)4p$	y^1P_1	
1.22.....	11	333	2208.9481	45256.307	-0.012	$3d^7(^4P)4p$	y^3D_2	$3d^7(^4P)4d$	5D_1	
1.66.....	65	266	2208.8411	45258.498	-0.003	$3d^7(^4F)4p$	z^5F_1	$3d^7(^4F)4d$	e^3D_2	
2.85.....	289	450	2207.9215	45277.346	-0.001	$3d^7(^4P)4s$	a^5P_1	$3d^7(^4P)4p$	y^3D_2	
0.87.....	7	239	2207.3069	45289.953	-0.024	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)4d$	e^3P_2	D
0.87.....	7	239	2207.3069	45289.953	0.000	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)4d$	3G_3	D
1.16.....	12	267	2207.1347	45293.484	0.000	$3d^7(^2G)4p$	z^3H_5	$3d^7(^2G)4d$	1H_5	
1.21.....	16	225	2206.9677	45296.912	-0.003	$3d^7(^4P)4p$	y^3D_1	$3d^7(^4P)4d$	5D_2	
1.73.....	54	228	2206.8703	45298.912	-0.001	$3d^7(a^2D)4p$	x^3F_4	$3d^7(^2H)4d$	3F_4	
2.26.....	32	536	2206.3151	45310.310	0.008	$3d^7(^2G)4s$	b^1G_4	$3d^7(a^2D)4p$	x^3F_3	
3.44.....	803	633	2206.1888	45312.903	-0.001	$3d^7(^4P)4s$	a^5P_2	$3d^7(^4P)4p$	z^5P_3	
2.04.....	204	208	2205.9061	45318.708	0.001	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)4d$	e^5G_5	
1.88.....	34	475	2205.8763	45319.322	0.009	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^3G_4	
1.67.....	42	258	2205.8490	45319.881	-0.002	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	3F_3	
3.03.....	214	469	2205.5247	45326.546	-0.003	$3d^7(^4P)4s$	a^5P_1	$3d^7(^4P)4p$	z^5P_1	
1.59.....	28	308	2205.3048	45331.064	0.004	$3d^7(^2H)4p$	z^3I_7	$3d^7(^2H)4d$	3H_6	
2.41.....	76	628	2205.0696	45335.900	-0.003	$3d^7(^4P)4s$	a^5P_2	$3d^7(^4P)4p$	z^5P_2	
1.43.....	20	303	2204.6041	45345.471	-0.013	$3d^7(^4P)4p$	y^5D_3	$3d^7(^4P)4d$	5D_3	
0.71.....	7	168	2204.5526	45346.530	0.027	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)4d$	e^5G_3	
1.12.....	12	262	2204.0198	45357.492	-0.016	$3d^7(a^2D)4p$	x^3F_2	$3d^7(^2H)4d$	3F_3	
1.51.....	14	358	2203.4296	45369.639	0.001	$3d^7(^4P)4s$	b^3P_1	$3d^7(a^2D)4p$	w^3D_2	
0.63.....	6	166	2203.1920	45374.530	0.021	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)4d$	f^5F_3	
1.49.....	18	393	2203.0588	45377.274	-0.003	$3d^7(^4P)4p$	y^3D_1	$3d^7(^2G)4d$	3F_2	
1.01.....	6	159	2202.9877	45378.738	-0.013	$3d^8$	a^3F_4	$3d^7(^4F)4p$	z^5F_4	
2.49.....	85	671	2202.9502	45379.511	-0.001	$3d^7(^2P)4s$	c^3P_2	$3d^7(^2P)4p$	y^3S_1	
1.65.....	80	196	2202.8858	45380.838	-0.003	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)4d$	e^5G_4	
1.10.....	6	188	2202.6193	45386.329	0.008	$3d^8$	a^1G_4	$3d^7(^2G)4p$	y^3F_3	
0.80.....	6	244	2202.5917	45386.896	0.032	$3d^7(^4P)4p$	y^5D_2	$3d^7(^4P)4d$	5D_2	
0.64.....	4	281	2202.1253	45396.509	-0.011	$3d^7(^2H)4p$	z^3I_6	$3d^7(^2H)4d$	3I_7	
0.95.....	10	195	2201.6438	45406.436	-0.001	$3d^7(^4P)4p$	y^5D_3	$3d^7(^4P)4d$	5D_2	
1.62.....	63	283	2201.2420	45414.724	0.003	$3d^7(^2P)4p$	z^3P_1	$3d^7(^2P)4d$	3D_1	
1.10.....	13	223	2201.1664	45416.283	0.023	$3d^7(^2P)4p$	x^3D_2	$3d^7(a^2D)4d$	3F_3	
1.89.....	61	276	2200.4213	45431.660	0.001	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^3F_3	
1.58.....	64	247	2200.1891	45436.454	-0.001	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)4d$	e^3D_3	
1.14.....	13	237	2199.4818	45451.063	-0.005	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2P)4d$	3P_1	
1.45.....	26	236	2199.4014	45452.725	-0.009	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)4d$	e^5P_2	
1.02.....	5	191	2199.1791	45457.319	-0.030	$3d^7(^2P)4s$	c^3P_1	$3d^7(a^2D)4p$	x^3F_2	
1.06.....	5	469	2198.9195	45462.686	-0.044	$3d^7(^4P)4p$	z^5P_2	$3d^7(^2G)4d$	3F_3	
1.38.....	18	261	2198.2962	45475.573	0.017	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^3G_3	D
1.38.....	18	261	2198.2962	45475.573	0.049	$3d^7(^4P)4p$	z^5P_3	$3d^7(^4F)6s$	3F_4	D
1.52.....	27	269	2198.2616	45476.289	0.003	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)4d$	e^5G_2	
1.55.....	21	376	2198.1125	45479.374	-0.007	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)4d$	e^5P_1	
2.26.....	138	295	2197.4815	45492.433	0.001	$3d^7(^2H)4p$	z^3I_6	$3d^7(^2H)4d$	3I_6	
2.02.....	107	219	2197.3643	45494.858	-0.002	$3d^7(^2P)4p$	z^3P_1	$3d^7(^2P)4d$	3D_2	
1.65.....	23	427	2197.1596	45499.097	-0.001	$3d^7(^4F)4p$	z^5F_1	$3d^7(^4F)4d$	e^5D_0	
1.09.....	12	220	2197.1277	45499.757	0.007	$3d^7(^4F)4p$	z^5F_5	$3d^7(^4F)4d$	e^5G_5	
1.14.....	10	307	2196.8409	45505.696	0.030	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)4d$	e^5D_3	
1.62.....	29	326	2196.5683	45511.343	-0.015	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)4d$	3P_2	
1.71.....	31	364	2196.1807	45519.374	0.011	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2G)4d$	1G_4	
0.80.....	7	207	2195.9633	45523.881	-0.022	$3d^7(^2G)4p$	y^3G_3	$3d^7(^4F)6s$	3F_2	
1.37.....	14	378	2195.8786	45525.637	0.030	$3d^7(^2P)4p$	z^1P_1	$3d^7(^2H)4d$	3F_2	

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.71.....	22	406	2195.8364	45526.510	-0.017	$3d^7(^4P)4s$	a^5P_1	$3d^7(^4P)4p$	y^3D_1
1.44.....	24	249	2195.3186	45537.247	-0.008	$3d^7(a^2D)4p$	w^3D_1	$3d^7(a^2D)4d$	3D_1
1.14.....	5	253	2195.2078	45539.547	0.014	$3d^7(^2P)4s$	c^3P_1	$3d^7(^2P)4p$	z^1P_1
1.56.....	20	415	2195.0930	45541.928	-0.010	$3d^7(^2H)4p$	x^3G_4	$3d^7(a^2D)4d$	1F_3
2.36.....	149	340	2194.8355	45547.271	0.003	$3d^7(^2H)4p$	z^3I_5	$3d^7(^2H)4d$	3I_5
1.90.....	59	298	2194.5365	45553.475	-0.001	$3d^7(^2H)4p$	z^3I_6	$3d^7(^2H)4d$	1H_5
1.49.....	6	491	2194.4347	45555.588	0.031	$3d^7(^4P)4s$	a^5P_2	$3d^7(^4P)4p$	y^3D_3
1.39.....	6	345	2194.0962	45562.617	0.017	$3d^7(^4P)4s$	b^3P_2	$3d^7(a^2D)4p$	w^3D_2
1.02.....	9	243	2193.7332	45570.153	0.039	$3d^7(a^2D)4p$	x^3P_2	$3d^7(a^2D)4d$	1D_2
3.46.....	678	747	2193.6048	45572.822	-0.001	$3d^7(^4P)4s$	a^5P_3	$3d^7(^4P)4p$	z^5P_3
1.10.....	16	178	2193.0739	45583.852	0.006	$3d^7(^2P)4p$	x^3D_2	$3d^7(a^2D)4d$	3D_3
3.08.....	281	753	2192.4980	45595.824	0.001	$3d^7(^4P)4s$	a^5P_3	$3d^7(^4P)4p$	z^5P_2
2.06.....	99	255	2192.2716	45600.533	0.000	$3d^7(^2H)4p$	x^3G_5	$3d^7(^2H)4d$	3I_6
1.39.....	19	285	2191.9240	45607.764	-0.027	$3d^7(a^2D)4p$	x^3F_2	$3d^7(^2H)4d$	3F_2
1.75.....	58	214	2191.8767	45608.748	0.006	$3d^7(^4P)4p$	y^3P_2	$3d^7(^2P)4d$	3D_2
1.06.....	5	462	2191.4901	45616.794	0.005	$3d^7(^4F)4p$	z^5F_1	$3d^7(^4F)4d$	e^5D_1
2.41.....	209	214	2190.9495	45628.047	-0.001	$3d^8$	a^1G_4	$3d^7(^4G)4p$	y^3G_5
3.39.....	365	593	2190.6751	45633.761	-0.001	$3d^7(^4P)4s$	a^5P_2	$3d^7(^4P)4p$	z^5P_1
2.59.....	145	260	2190.6556	45634.167	-0.002	$3d^7(^2H)4p$	z^3I_6	$3d^7(^2H)4d$	3H_6
1.22.....	13	280	2190.4944	45637.527	-0.007	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)4d$	e^5D_3
0.83.....	5	314	2189.9301	45649.285	-0.067	$3d^7(^2G)4p$	z^3H_4	$3d^7(^2H)6s$	5F_4
2.10.....	117	231	2189.3281	45661.836	0.259	$3d^7(^2H)4p$	x^3G_5	$3d^7(^2H)4d$	1H_5
2.10.....	117	231	2189.3281	45661.836	-0.013	$3d^7(^4P)4p$	y^3P_2	$3d^7(^2P)4d$	3D_3
1.47.....	13	426	2188.9993	45668.693	0.000	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^3F_4
0.82.....	7	199	2188.9045	45670.671	-0.003	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)4d$	e^5D_4
1.58.....	25	328	2188.7015	45674.907	0.068	$3d^7(a^2D)4p$	x^3F_3	$3d^7(^2H)4d$	3F_3
0.96.....	10	198	2188.3439	45682.370	0.005	$3d^7(^2P)4p$	y^3S_1	$3d^7(a^2D)4d$	3P_1
1.92.....	50	358	2187.5251	45699.466	-0.031	$3d^7(^2H)4p$	z^3I_5	$3d^7(^2H)4d$	3H_4
1.47.....	11	503	2187.0396	45709.611	-0.013	$3d^7(^4F)4s$	a^5F_1	$3d^7(^4F)4p$	z^3F_2
1.91.....	72	243	2186.7494	45715.677	0.000	$3d^7(^2H)4p$	x^3G_4	$3d^7(^2H)4d$	3H_5
0.79.....	6	228	2186.0666	45729.953	0.031	$3d^7(^2P)4p$	x^3D_3	$3d^7(a^2D)4d$	3F_4
1.96.....	84	234	2185.4781	45742.267	-0.003	$3d^7(^2H)4p$	x^3G_5	$3d^7(^2H)4d$	3H_6
0.77.....	5	240	2185.0623	45750.970	-0.007	$3d^7(^2P)4p$	x^3D_3	$3d^7(^2H)4d$	3G_4
1.75.....	43	277	2182.6322	45801.903	0.003	$3d^7(^2G)4p$	y^3F_4	$3d^7(^2G)4d$	1G_4
0.62.....	4	200	2182.1230	45812.590	0.040	$3d^7(^2G)4p$	y^3F_3	$3d^7(^4F)6s$	3F_3
2.51.....	75	699	2181.9853	45815.481	0.004	$3d^7(^4P)4s$	a^5P_3	$3d^7(^4P)4p$	y^3D_3
1.20.....	11	306	2181.7262	45820.921	-0.012	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^3F_3
1.25.....	15	241	2181.2501	45830.921	0.000	$3d^7(^2P)4p$	z^3P_1	$3d^7(^2P)4d$	3P_1
0.56.....	3	241	2181.2318	45831.304	0.000	$3d^7(a^2D)4p$	w^3D_1	$3d^7(a^2D)4d$	3P_2
1.46.....	29	212	2181.0544	45835.032	0.018	$3d^7(^2P)4p$	z^3P_1	$3d^7(^2P)4d$	3P_0
1.62.....	34	252	2180.9275	45837.699	-0.008	$3d^7(^2P)4p$	z^3P_0	$3d^7(^2P)4d$	3D_1
2.24.....	41	668	2180.6045	45844.489	0.009	$3d^7(^4P)4s$	a^5P_3	$3d^7(^4P)4p$	y^3D_2
1.45.....	41	187	2180.2611	45851.709	-0.008	$3d^7(^4F)4p$	z^5F_5	$3d^7(^4F)4d$	e^5D_4
1.87.....	62	199	2180.1316	45854.431	-0.002	$3d^7(^4P)4s$	b^3P_0	$3d^7(^2P)4p$	y^3S_1
0.89.....	5	300	2180.1012	45855.070	-0.012	$3d^7(^4P)4p$	y^3D_3	$3d^7(^4F)6s$	5F_4
1.65.....	30	310	2178.5653	45887.395	0.005	$3d^7(^2P)4s$	a^1P_1	$3d^7(a^2D)4p$	x^3P_0
1.25.....	16	227	2176.8234	45924.112	0.006	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2P)4d$	3P_2
1.04.....	11	207	2176.4546	45931.891	0.002	$3d^7(^2G)4p$	y^3F_4	$3d^7(^4F)6s$	5F_4
0.94.....	8	236	2175.8420	45944.823	0.020	$3d^7(^4P)4p$	y^3P_2	$3d^7(^2P)4d$	3P_1
1.65.....	36	254	2175.7783	45946.167	0.006	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)4d$	e^3G_4
1.69.....	47	217	2175.6830	45948.179	0.004	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)4d$	e^3G_5
0.97.....	5	362	2175.5723	45950.518	0.021	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)4d$	e^5D_1
0.95.....	6	296	2175.4395	45953.322	0.026	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)4d$	e^5H_3
0.89.....	3	212	2174.9250	45964.191	-0.069	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^3F_2
2.72.....	329	254	2173.9998	45983.752	0.000	$3d^8$	a^1G_4	$3d^7(^2G)4p$	z^1H_5
1.57.....	11	704	2173.3478	45997.545	0.426	$3d^7(^2P)4p$	x^3D_1	$3d^7(a^2D)4d$	3F_2
1.57.....	11	704	2173.3478	45997.545	-0.262	$3d^7(^4F)4s$	a^5F_5	$3d^7(^4F)4p$	z^3G_4
1.82.....	56	208	2173.3010	45998.535	0.005	$3d^7(^4P)4s$	b^3P_1	$3d^7(^2P)4p$	y^3S_1
0.78.....	6	220	2173.2698	45999.194	0.000	$3d^7(^2P)4p$	x^3D_3	$3d^7(a^2D)4d$	3D_3
1.82.....	56	208	2173.3010	45998.535	0.005	$3d^7(^4P)4s$	b^3P_1	$3d^7(^2P)4p$	y^3S_1
1.04.....	6	292	2172.8816	46007.413	0.056	$3d^7(^4F)4s$	a^5F_4	$3d^7(^4F)4p$	z^3G_3
0.53.....	5	127	2171.8270	46029.749	0.012	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)4d$	e^3D_3
0.64.....	4	243	2171.4249	46038.273	-0.072	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)4d$	e^3H_5
1.39.....	14	366	2169.0612	46088.437	-0.011	$3d^7(a^2D)4p$	w^3D_3	$3d^7(a^2D)4d$	3P_2
0.56.....	3	245	2166.9639	46133.040	0.044	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2P)4d$	3F_3
1.29.....	15	252	2165.9242	46155.182	0.016	$3d^7(^4F)4p$	z^5F_5	$3d^7(^4F)4d$	e^5G_4
1.32.....	18	235	2164.0472	46195.210	0.012	$3d^7(^4P)4p$	y^3P_0	$3d^7(^2P)4d$	1P_1
1.19.....	6	190	2163.7794	46200.926	-0.005	$3d^8$	a^1G_4	$3d^7(^2G)4p$	y^3G_3
1.39.....	23	200	2161.3005	46253.910	0.004	$3d^7(^2P)4p$	z^3P_0	$3d^7(^2P)4d$	3P_1
1.58.....	34	212	2158.9644	46303.955	-0.003	$3d^7(^2P)4p$	z^3P_1	$3d^7(^2P)4d$	3P_2
0.76.....	6	176	2158.9172	46304.968	-0.015	$3d^7(^2P)4p$	x^3D_3	$3d^7(a^2D)4d$	3G_4
1.20.....	8	368	2158.6228	46311.282	0.025	$3d^7(a^2D)4p$	w^3D_2	$3d^7(a^2D)4d$	3P_1

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
0.85.....	7	197	2157.2359	46341.052	0.051	$3d^7(^2P)4p$	1S_0	$3d^7(a^2D)4d$	3S_1
1.38.....	14	315	2157.0375	46345.314	-0.015	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)4d$	e^5D_2
1.33.....	8	487	2156.9524	46347.142	-0.044	$3d^7(^4F)4s$	a^5F_5	$3d^7(^4F)4p$	z^3F_4
0.62.....	5	148	2154.8214	46392.971	0.031	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)4d$	f^3F_4
0.87.....	5	256	2153.6675	46417.826	-0.014	$3d^7(^4P)4p$	y^3P_2	$3d^7(^2P)4d$	3P_2
2.04.....	83	246	2153.3377	46424.934	-0.001	$3d^7(a^2D)4p$	w^3D_3	$3d^7(^2H)4d$	3F_4
1.02.....	9	224	2153.2985	46425.780	0.039	$3d^7(^4F)4p$	z^5F_5	$3d^7(^4F)4d$	e^3H_6
1.12.....	11	222	2152.8047	46436.426	0.023	$3d^7(^2P)4p$	x^3D_1	$3d^7(a^2D)4d$	3D_2
0.78.....	4	300	2152.0580	46452.538	-0.041	$3d^7(^2H)4p$	z^3F_6	$3d^7(^2H)4d$	1I_6
0.75.....	7	150	2151.4760	46465.101	-0.022	$3d^7(^2P)4p$	z^3P_1	$3d^7(^2P)4d$	3F_2
1.92.....	53	282	2150.0760	46495.354	0.000	$3d^7(a^2D)4p$	w^3D_2	$3d^7(^2H)4d$	3F_3
1.47.....	19	231	2148.5248	46528.919	-0.002	$3d^7(^2P)4s$	c^3P_1	$3d^7(a^2D)4p$	x^3P_2
0.88.....	6	219	2147.1123	46559.524	0.022	$3d^7(^2P)4p$	z^1P_1	$3d^7(a^2D)4d$	1D_2
0.59.....	5	146	2147.0597	46560.666	-0.014	$3d^7(^2H)4p$	x^3G_5	$3d^7(^2H)4d$	1I_6
1.27.....	4	368	2146.9888	46562.203	0.000	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^3D_3
2.30.....	135	263	2146.2612	46577.986	-0.077	$3d^7(^4P)4p$	y^3D_1	$3d^7(^2P)4d$	3D_1
1.13.....	8	296	2146.1848	46579.643	0.031	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)4d$	e^3D_3
1.07.....	7	301	2143.3414	46641.431	-0.009	$3d^7(^2H)4p$	x^3G_4	$3d^7(^2H)4d$	3F_4
1.42.....	16	325	2138.9711	46736.716	-0.055	$3d^7(^2P)4p$	x^3D_3	$3d^7(a^2D)4d$	3D_2
1.14.....	7	329	2138.5626	46745.642	0.005	$3d^7(a^2D)4p$	w^3D_2	$3d^7(^2H)4d$	3F_2
1.82.....	30	279	2134.5238	46834.081	0.001	$3d^7(^2G)4s$	a^3G_4	$3d^7(^2H)4p$	x^3G_4
0.88.....	8	158	2133.4705	46857.202	0.036	$3d^8$	a^3F_3	$3d^7(^4F)4p$	z^5G_4
1.92.....	47	264	2133.2667	46861.677	0.001	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2H)4p$	y^3H_4
1.22.....	11	265	2129.8083	46937.763	-0.012	$3d^7(^2P)4s$	a^1P_1	$3d^7(a^2D)4p$	y^1P_1
1.78.....	15	569	2129.6237	46941.832	0.026	$3d^7(^2G)4s$	a^3G_3	$3d^7(^2H)4p$	x^3G_3
1.30.....	8	241	2129.6121	46942.085	-0.015	$3d^7(^2P)4p$	z^3P_2	$3d^7(^2P)4d$	1D_2
2.16.....	38	660	2128.7977	46960.042	0.004	$3d^7(^2P)4s$	c^3P_2	$3d^7(a^2D)4p$	x^3P_2
1.31.....	12	290	2126.1987	47017.437	-0.051	$3d^7(^2P)4p$	z^3P_2	$3d^7(^5F)5d$	3D_3
2.10.....	53	431	2125.7925	47026.421	0.000	$3d^7(^2H)4p$	x^3G_3	$3d^7(^2H)4d$	3F_2
2.63.....	299	250	2125.0019	47043.914	-0.003	$3d^8$	a^1G_4	$3d^7(^2G)4p$	z^1F_3
1.52.....	18	319	2124.0235	47065.584	0.000	$3d^7(a^2D)4p$	w^3D_1	$3d^7(^2H)4d$	3F_2
1.45.....	11	323	2123.8359	47069.739	0.017	$3d^7(^4P)4s$	a^5P_1	$3d^7(^2P)4p$	z^3P_2
1.27.....	13	266	2123.7139	47072.443	-0.001	$3d^7(a^2D)4p$	w^3D_3	$3d^7(^2H)4d$	3F_3
1.58.....	19	193	2123.5585	47075.887	-0.013	$3d^7(^4P)4p$	z^5P_2	$3d^7(^2P)4d$	3D_1
0.97.....	5	270	2123.0968	47086.125	0.012	$3d^7(^4P)4p$	y^5D_4	$3d^7(^4F)6s$	5F_5
0.80.....	6	209	2122.3967	47101.654	-0.008	$3d^7(^2P)4p$	z^3P_0	$3d^7(^2P)4d$	1P_1
1.13.....	12	200	2120.7411	47138.422	0.005	$3d^7(^4P)4p$	y^3D_3	$3d^7(^2P)4d$	3F_4
1.29.....	16	212	2119.0467	47176.108	0.000	$3d^7(^2P)4p$	z^1D_2	$3d^7(a^2D)4d$	1F_3
0.93.....	5	184	2118.2324	47194.241	0.000	$3d^7(^4P)4p$	z^5P_1	$3d^7(^2P)4d$	3P_1
0.72.....	5	168	2117.9453	47200.639	0.026	$3d^8$	a^3F_3	$3d^7(^4F)4p$	z^5G_3
0.93.....	4	141	2115.4007	47257.409	0.059	$3d^7(^2G)4p$	z^1F_3	$3d^7(^2H)4d$	3G_4
0.90.....	5	152	2114.9048	47268.490	-0.015	$3d^7(^4P)4p$	y^3D_2	$3d^7(^2P)4d$	1F_3
2.40.....	140	362	2114.3068	47281.856	0.000	$3d^7(^2H)4p$	x^3G_5	$3d^7(^2H)4d$	3F_4
1.02.....	3	183	2114.2572	47282.964	-0.049	$3d^7(^2P)4s$	c^3P_0	$3d^7(a^2D)4p$	x^3P_1
2.23.....	94	374	2113.9895	47288.953	0.004	$3d^7(^2H)4p$	x^3G_4	$3d^7(^2H)4d$	3F_3
1.75.....	13	389	2112.6646	47318.605	-0.001	$3d^7(^4P)4s$	a^5P_1	$3d^7(^4P)4p$	y^3P_1
0.96.....	7	213	2112.5154	47321.946	-0.007	$3d^7(^2P)4p$	z^3P_1	$3d^7(^2P)4d$	1D_2
0.84.....	4	200	2111.8602	47336.627	0.020	$3d^7(^2P)4s$	c^3P_1	$3d^7(a^2D)4p$	y^1D_2
1.59.....	35	234	2111.4489	47345.845	0.003	$3d^8$	a^3F_4	$3d^7(^4F)4p$	z^5G_5
1.98.....	44	425	2109.5755	47387.886	0.014	$3d^7(^2G)4s$	b^1G_4	$3d^7(a^2D)4p$	y^1F_3
0.68.....	4	165	2107.4412	47435.872	0.037	$3d^7(^4P)4p$	y^3P_2	$3d^7(^2P)4d$	1D_2
1.10.....	7	332	2106.3008	47461.551	0.007	$3d^7(^2G)4p$	y^3G_4	$3d^7(^4F)5d$	5G_3
1.22.....	12	249	2104.1824	47509.328	-0.007	$3d^7(^2P)4p$	z^3P_2	$3d^7(^4F)5d$	5G_2
1.40.....	16	272	2101.0987	47579.048	-0.008	$3d^7(^4P)4s$	b^3P_1	$3d^7(a^2D)4p$	x^3P_2
1.40.....	16	272	2101.0987	47579.048	-0.063	$3d^7(^4P)4p$	y^5D_3	$3d^7(^4F)6s$	3F_4
0.85.....	5	148	2098.9192	47628.447	-0.018	$3d^7(^4P)4p$	y^3D_1	$3d^7(^2P)4d$	3F_2
1.78.....	10	571	2098.5478	47636.876	0.021	$3d^7(^4P)4s$	a^5P_3	$3d^7(^2P)4p$	z^3P_2
0.79.....	4	183	2098.1873	47645.059	-0.015	$3d^7(^2P)4p$	z^1D_2	$3d^7(a^2D)4d$	3D_1
0.93.....	5	138	2097.1378	47668.900	-0.033	$3d^7(^4F)4s$	a^5F_3	$3d^7(^4F)4p$	z^3D_2
0.63.....	4	113	2094.9929	47717.698	-0.020	$3d^7(^2P)4p$	z^1D_2	$3d^7(a^2D)4d$	3G_3
0.93.....	5	137	2094.2500	47734.624	0.056	$3d^7(^4F)4s$	a^5F_2	$3d^7(^4F)4p$	z^3D_1
0.81.....	3	281	2093.8835	47742.977	-0.062	$3d^7(^2G)4p$	y^3G_3	$3d^7(^4F)5d$	5G_2
1.40.....	3	408	2092.7996	47767.701	-0.023	$3d^7(^2P)4s$	c^3P_2	$3d^7(a^2D)4p$	y^1D_2
0.84.....	9	148	2091.0563	47807.519	0.029	$3d^8$	a^3F_4	$3d^7(^4F)4p$	z^5G_4
1.67.....	29	282	2090.8880	47811.367	0.010	$3d^7(^2G)4p$	z^1F_3	$3d^7(a^2D)4d$	3G_4
0.68.....	6	85	2087.4933	47889.110	-0.078	$3d^7(^2P)4p$	z^3P_1	$3d^7(^4F)5d$	5G_2
0.97.....	5	207	2084.9605	47947.278	0.014	$3d^7(^2P)4p$	z^3P_2	$3d^7(a^2D)4d$	3F_3
1.23.....	10	288	2084.3718	47960.819	-0.028	$3d^7(^2P)4p$	x^3D_3	$3d^7(^2H)4d$	3F_4
2.21.....	111	287	2082.6785	47999.806	0.001	$3d^7(^2G)4s$	b^1G_4	$3d^7(^2H)4p$	y^1G_4
1.18.....	12	204	2081.6838	48022.739	-0.018	$3d^7(^2P)4p$	z^3P_2	$3d^7(^4F)5d$	3P_1
0.89.....	3	284	2080.0563	48060.310	-0.005	$3d^7(^2H)4p$	x^3G_3	$3d^7(a^2D)4d$	1D_2
0.85.....	6	194	2079.0616	48083.300	0.005	$3d^7(^4P)4p$	z^3S_1	$3d^7(^2P)4d$	3D_2

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O - C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)	
1.09.....	6	218	2078.7891	48089.603	0.026	3d ⁸	a ³ P ₂	3d ⁷ (⁴ P)4p	y ⁵ D ₁	Ar
0.84.....	4	172	2073.4137	48214.260	0.034	3d ⁷ (² G)4p	z ¹ G ₄	3d ⁷ (⁴ F)5d	⁵ G ₃	
1.12.....	5	378	2071.5373	48257.928	-0.007	3d ⁷ (² P)4s	c ³ P ₂	3d ⁷ (a ² D)4p	x ³ P ₁	
0.92.....	4	252	2066.8328	48367.756	0.038	3d ⁷ (² G)4p	z ¹ F ₃	3d ⁷ (a ² D)4d	¹ F ₃	
2.39.....	208	225	2065.5420	48397.979	0.002	3d ⁸	a ³ F ₃	3d ⁷ (⁴ F)4p	z ³ G ₄	
0.89.....	5	176	2064.6284	48419.392	0.037	3d ⁷ (⁴ P)4p	z ³ S ₁	3d ⁷ (² P)4d	³ P ₁	
0.86.....	4	207	2064.4568	48423.418	-0.030	3d ⁷ (⁴ P)4p	z ³ S ₁	3d ⁷ (² P)4d	³ P ₀	
2.27.....	142	256	2063.7863	48439.147	-0.001	3d ⁸	a ³ F ₂	3d ⁷ (⁴ F)4p	z ³ G ₃	
2.29.....	156	247	2058.8170	48556.047	-0.002	3d ⁸	a ³ F ₄	3d ⁷ (⁴ F)4p	z ³ G ₅	
1.47.....	20	254	2058.4114	48565.614	-0.005	3d ⁷ (² G)4p	z ¹ G ₄	3d ⁷ (² H)4d	¹ F ₃	
1.42.....	18	211	2057.9412	48576.709	-0.004	3d ⁷ (⁴ P)4p	z ⁵ S ₂	3d ⁷ (⁴ P)4d	⁵ P ₁	DI
1.62.....	28	224	2054.1587	48666.145	0.000	3d ⁷ (⁴ P)4p	z ⁵ S ₂	3d ⁷ (⁴ P)4d	⁵ P ₂	
1.40.....	14	316	2054.0821	48667.960	-0.022	3d ⁷ (⁴ P)4p	z ⁵ S ₂	3d ⁷ (² P)5s	³ P ₁	
0.70.....	5	108	2052.2854	48710.562	0.015	3d ⁷ (² G)4p	y ³ G ₄	3d ⁷ (² H)4d	¹ H ₅	
0.95.....	3	288	2051.3463	48732.859	0.003	3d ⁷ (⁴ P)4s	b ³ P ₀	3d ⁷ (a ² D)4p	x ³ P ₁	
1.32.....	17	253	2049.1733	48784.530	0.005	3d ⁸	a ³ F ₂	3d ⁷ (⁴ F)4p	z ³ F ₃	
1.22.....	12	221	2048.9300	48790.321	-0.002	3d ⁷ (² G)4p	z ¹ G ₄	113191 ^e	³ P ₃	
1.77.....	38	226	2047.4626	48825.284	-0.012	3d ⁷ (⁴ P)4p	z ⁵ S ₂	3d ⁷ (⁴ P)4d	⁵ P ₃	
1.06.....	7	224	2046.6959	48843.570	0.002	3d ⁷ (² P)4p	z ³ P ₂	3d ⁷ (a ² D)4d	³ S ₁	
1.83.....	52	209	2046.5613	48846.783	-0.004	3d ⁸	a ³ P ₀	3d ⁷ (⁴ P)4p	z ³ S ₁	
1.41.....	15	264	2041.9676	48956.657	-0.013	3d ⁷ (² G)4p	z ¹ F ₃	3d ⁷ (a ² D)4d	¹ G ₄	D
0.70.....	3	183	2041.1211	48976.958	-0.042	3d ⁷ (² P)4p	z ³ P ₂	3d ⁷ (a ² D)4d	¹ F ₃	
0.78.....	5	136	2040.6591	48988.044	-0.031	3d ⁷ (⁴ P)4p	y ⁵ D ₁	3d ⁷ (⁴ F)6s	⁵ F ₁	
2.13.....	164	207	2038.6733	49035.754	0.000	3d ⁸	a ³ P ₁	3d ⁷ (⁴ P)4p	z ³ S ₁	
1.96.....	56	326	2036.5853	49086.022	0.001	3d ⁸	a ³ F ₃	3d ⁷ (⁴ F)4p	z ³ G ₃	
2.36.....	139	370	2032.7185	49179.383	-0.004	3d ⁸	a ³ P ₂	3d ⁷ (⁴ P)4p	z ³ S ₁	
2.88.....	394	377	2027.0403	49317.126	0.001	3d ⁸	a ³ F ₂	3d ⁷ (⁴ F)4p	z ³ F ₂	
2.53.....	230	282	2025.7595	49348.302	0.001	3d ⁸	a ³ F ₄	3d ⁷ (⁴ F)4p	z ³ G ₄	
2.88.....	543	276	2022.3538	49431.395	-0.002	3d ⁸	a ³ F ₃	3d ⁷ (⁴ F)4p	z ³ F ₃	
1.06.....	5	223	2021.0522	49463.226	-0.003	3d ⁷ (² G)4p	z ¹ G ₄	3d ⁷ (² H)4d	¹ H ₅	
0.96.....	4	255	2014.4396	49625.570	-0.015	3d ⁷ (⁴ P)4p	y ⁵ D ₄	3d ⁷ (⁴ F)5d	⁵ F ₅	D
0.75.....	3	176	2012.1727	49681.469	-0.033	3d ⁷ (² G)4p	y ³ F ₄	113191 ^e	³ H ₅	
1.30.....	13	256	2011.6811	49693.608	-0.004	3d ⁷ (² G)4s	a ³ G ₄	3d ⁷ (² H)4p	y ³ H ₅	
2.96.....	688	269	2011.5163	49697.679	-0.001	3d ⁸	a ³ F ₄	3d ⁷ (⁴ F)4p	z ³ F ₄	
0.75.....	3	184	2009.8060	49739.964	-0.051	3d ⁷ (² P)4p	z ³ P ₂	3d ⁷ (a ² D)4d	³ P ₂	
1.03.....	4	288	2008.6491	49768.610	-0.032	3d ⁷ (⁴ P)4p	y ³ D ₃	3d ⁷ (a ² D)4d	³ F ₃	
1.41.....	8	461	2008.2282	49779.039	-0.073	3d ⁷ (² G)4s	a ³ G ₅	3d ⁷ (² H)4p	y ³ H ₆	
1.54.....	25	251	2000.7931	49963.995	-0.003	3d ⁸	a ³ F ₃	3d ⁷ (⁴ F)4p	z ³ F ₂	
0.94.....	2	292	1999.4781	50013.052	0.017	3d ⁷ (² G)4p	y ³ F ₄	3d ⁷ (a ² D)4d	³ D ₃	
1.72.....	39	212	1997.1280	50071.904	0.003	3d ⁸	a ³ P ₀	3d ⁷ (⁴ P)4p	z ⁵ P ₁	
1.72.....	39	212	1997.1280	50071.904	0.033	3d ⁷ (² G)4p	z ³ H ₄	3d ⁷ (² H)4d	¹ H ₅	
1.34.....	9	229	1996.6601	50083.638	-0.004	3d ⁸	a ³ P ₂	3d ⁷ (⁴ P)4p	z ⁵ P ₃	D
1.55.....	17	257	1995.7429	50106.654	0.012	3d ⁸	a ³ P ₂	3d ⁷ (⁴ P)4p	z ⁵ P ₂	
0.99.....	5	189	1993.7101	50157.743	-0.002	3d ⁷ (² G)4p	z ¹ G ₄	3d ⁷ (² H)4d	³ H ₅	
1.73.....	41	210	1991.5693	50211.661	-0.005	3d ⁸	a ³ P ₁	3d ⁷ (⁴ P)4p	y ³ D ₂	
1.96.....	109	225	1989.6195	50260.867	-0.001	3d ⁸	a ³ P ₁	3d ⁷ (⁴ P)4p	z ⁵ P ₁	
1.29.....	8	201	1989.1851	50271.843	-0.036	3d ⁸	a ³ P ₀	3d ⁷ (⁴ P)4p	y ³ D ₁	
1.83.....	78	209	1987.0328	50326.296	0.000	3d ⁸	a ³ P ₂	3d ⁷ (⁴ P)4p	y ³ D ₃	
1.07.....	9	151	1985.8887	50355.289	-0.010	3d ⁸	a ³ P ₂	3d ⁷ (⁴ P)4p	y ³ D ₂	
0.96.....	5	225	1984.8447	50381.775	0.054	3d ⁸	a ³ F ₄	3d ⁷ (⁴ F)4p	z ³ F ₃	
1.92.....	40	394	1983.9501	50404.495	-0.007	3d ⁸	a ³ P ₂	3d ⁷ (⁴ P)4p	z ⁵ P ₁	
1.59.....	12	368	1975.0151	50632.524	-0.001	3d ⁸	a ³ F ₂	3d ⁷ (⁴ F)4p	z ³ D ₂	
2.06.....	58	377	1968.9380	50788.802	0.003	3d ⁸	a ¹ D ₂	3d ⁷ (⁴ P)4p	z ³ S ₁	
2.87.....	404	373	1957.4286	51087.433	0.000	3d ⁸	a ³ F ₂	3d ⁷ (⁴ F)4p	z ³ D ₁	
1.58.....	34	210	1953.0792	51201.199	-0.004	3d ⁸	a ³ P ₁	3d ⁷ (² P)4p	z ³ P ₀	
0.66.....	3	152	1952.5496	51215.090	0.059	3d ⁷ (⁴ F)4p	z ⁵ G ₄	3d ⁷ (⁴ P)5s	⁵ P ₃	
2.97.....	590	331	1950.1009	51279.398	0.000	3d ⁸	a ³ F ₃	3d ⁷ (⁴ F)4p	z ³ D ₂	
1.65.....	46	216	1944.1933	51435.214	-0.007	3d ⁸	a ³ P ₀	3d ⁷ (² P)4p	z ³ P ₁	
1.64.....	31	271	1942.3581	51483.813	0.006	3d ⁸	a ¹ G ₄	3d ⁷ (a ² D)4p	x ³ F ₃	
1.30.....	15	180	1941.3603	51510.273	-0.033	3d ⁸	a ³ P ₁	3d ⁷ (⁴ P)4p	y ³ P ₂	D
3.06.....	713	310	1941.2852	51512.266	0.001	3d ⁸	a ³ F ₄	3d ⁷ (⁴ F)4p	z ³ D ₃	
1.90.....	79	207	1937.0765	51624.187	-0.001	3d ⁸	a ³ P ₁	3d ⁷ (² P)4p	z ³ P ₁	
1.27.....	11	225	1935.9608	51653.938	-0.001	3d ⁸	a ³ P ₂	3d ⁷ (⁴ P)4p	y ³ P ₂	
1.39.....	9	330	1933.6363	51716.034	-0.019	3d ⁸	a ¹ D ₂	3d ⁷ (⁴ P)4p	z ⁵ P ₂	
1.35.....	5	318	1926.2638	51913.970	0.000	3d ⁸	a ³ P ₂	3d ⁷ (² G)4p	y ³ G ₃	
1.22.....	7	161	1925.4567	51935.730	0.023	3d ⁸	a ¹ D ₂	3d ⁷ (⁴ P)4p	y ³ D ₃	
1.00.....	3	188	1924.0116	51974.739	0.052	3d ⁷ (² G)4p	y ³ F ₄	3d ⁷ (² H)4d	³ F ₄	
1.94.....	88	229	1922.9275	52004.041	0.000	3d ⁸	a ³ P ₁	3d ⁷ (² P)4p	z ³ P ₂	
1.91.....	20	447	1922.5628	52013.907	-0.005	3d ⁸	a ¹ D ₂	3d ⁷ (⁴ P)4p	z ⁵ P ₁	
1.93.....	114	172	1920.7144	52063.961	0.003	3d ⁸	a ³ P ₀	3d ⁷ (⁴ P)4p	y ³ P ₁	
1.62.....	50	182	1919.1033	52107.669	0.002	3d ⁸	a ³ P ₁	3d ⁷ (⁴ P)4p	y ³ P ₀	
2.31.....	207	242	1917.6310	52147.677	0.003	3d ⁸	a ³ P ₂	3d ⁷ (² P)4p	z ³ P ₂	

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level		(7)	Upper Level		Blend (8)
1.81.....	36	192	1913.7682	52252.932	0.007	3d ⁸	a ³ P ₁	—	3d ⁷ (⁴ P)4p	y ³ P ₁	
2.24.....	125	287	1908.5225	52396.554	-0.004	3d ⁸	a ³ P ₂	—	3d ⁷ (⁴ P)4p	y ³ P ₁	
1.70.....	11	443	1903.1913	52543.324	0.017	3d ⁷ (⁴ F)4s	b ³ F ₂	—	3d ⁷ (⁴ P)4p	y ³ D ₁	
1.35.....	5	295	1899.0113	52658.982	-0.017	3d ⁷ (⁴ F)4s	b ³ F ₃	—	3d ⁷ (⁴ P)4p	z ⁵ P ₂	
1.26.....	4	316	1897.2168	52708.789	0.019	3d ⁸	a ¹ D ₂	—	3d ⁷ (² G)4p	y ³ F ₃	
1.26.....	8	229	1896.4827	52729.193	-0.036	3d ⁸	a ¹ G ₄	—	3d ⁷ (² H)4p	y ³ H ₅	
2.40.....	118	400	1895.4845	52756.960	0.003	3d ⁸	a ³ P ₂	—	3d ⁷ (² G)4p	z ¹ F ₃	
1.19.....	8	193	1893.8724	52801.867	0.021	3d ⁷ (⁴ F)4s	b ³ F ₃	—	3d ⁷ (² G)4p	y ³ F ₄	
1.76.....	16	329	1890.0855	52907.660	0.004	3d ⁷ (⁴ F)4s	b ³ F ₃	—	3d ⁷ (⁴ P)4p	y ³ D ₂	
1.25.....	4	269	1885.5405	53035.192	0.011	3d ⁸	a ¹ G ₄	—	3d ⁷ (² H)4p	y ³ H ₄	
1.34.....	8	250	1885.4330	53038.214	0.027	3d ⁷ (⁴ F)4s	b ³ F ₂	—	3d ⁷ (² G)4p	y ³ F ₃	
1.15.....	4	173	1868.8060	53510.103	0.072	3d ⁷ (⁴ F)4p	z ³ D ₂	—	3d ⁷ (⁴ P)4d	⁵ F ₁	
1.77.....	12	348	1868.3427	53523.372	-0.009	3d ⁸	a ¹ D ₂	—	3d ⁷ (² G)4p	y ³ G ₃	
1.93.....	37	274	1867.0169	53561.378	0.001	3d ⁸	a ¹ G ₄	—	3d ⁷ (a ² D)4p	y ¹ F ₃	
2.20.....	60	327	1863.8730	53651.724	0.008	3d ⁷ (⁴ F)4s	b ³ F ₃	—	3d ⁷ (² G)4p	y ³ F ₃	
1.51.....	9	238	1862.4386	53693.046	0.021	3d ⁷ (⁴ F)4s	b ³ F ₃	—	3d ⁷ (² G)4p	z ¹ G ₄	
2.01.....	34	380	1862.3687	53695.060	0.008	3d ⁷ (⁴ F)4s	b ³ F ₂	—	3d ⁷ (² G)4p	y ³ F ₂	
2.15.....	34	520	1862.2906	53697.314	-0.003	3d ⁷ (⁴ F)4s	b ³ F ₄	—	3d ⁷ (² G)4p	y ³ F ₄	
1.90.....	28	249	1861.4352	53721.987	-0.015	3d ⁶ 4s ²	a ⁵ D ₃	—	3d ⁷ (⁴ F)5p	⁵ D ₄	
2.37.....	84	305	1860.2199	53757.084	-0.001	3d ⁸	a ¹ D ₂	—	3d ⁷ (² P)4p	z ³ P ₂	
1.78.....	19	207	1859.6298	53774.143	0.019	3d ⁷ (⁴ F)4s	b ³ F ₄	—	3d ⁷ (⁴ P)4p	y ³ D ₃	
1.88.....	27	244	1853.7332	53945.196	-0.014	3d ⁶ 4s ²	a ⁵ D ₂	—	3d ⁷ (⁴ F)5p	⁵ D ₃	DI
1.83.....	5	616	1852.5441	53979.823	-0.032	3d ⁷ (⁴ F)4s	b ³ F ₄	—	3d ⁷ (² G)4p	z ³ H ₄	
2.11.....	40	345	1851.6471	54005.970	0.001	3d ⁸	a ¹ D ₂	—	3d ⁷ (⁴ P)4p	y ³ P ₁	
2.45.....	103	303	1845.9273	54173.314	0.004	3d ⁸	a ¹ G ₄	—	3d ⁷ (² H)4p	y ¹ G ₄	
1.48.....	7	231	1843.9611	54231.080	-0.017	3d ⁸	a ³ P ₀	—	3d ⁷ (² P)4p	x ³ D ₁	
1.63.....	11	218	1842.8649	54263.338	0.009	3d ⁸	a ³ P ₂	—	3d ⁷ (² P)4p	x ³ D ₃	
1.35.....	6	188	1841.3299	54308.572	-0.009	3d ⁷ (⁴ F)4s	b ³ F ₃	—	3d ⁷ (² G)4p	y ³ F ₂	
2.27.....	97	209	1840.2273	54341.112	-0.070	3d ⁶ 4s ²	a ⁵ D ₄	—	3d ⁷ (⁴ F)5p	⁵ D ₄	
3.07.....	302	379	1839.3725	54366.366	-0.001	3d ⁸	a ¹ D ₂	—	3d ⁷ (² G)4p	z ¹ F ₃	
1.81.....	34	223	1839.2762	54369.214	0.003	3d ⁶ 4s ²	a ⁵ D ₃	—	3d ⁷ (⁴ F)5p	⁵ D ₃	
1.42.....	5	241	1837.5559	54420.112	0.048	3d ⁸	a ³ P ₁	—	3d ⁷ (² P)4p	x ³ D ₁	
1.78.....	10	320	1835.9975	54466.306	-0.021	3d ⁷ (⁴ F)4s	b ³ F ₃	—	3d ⁷ (² G)4p	y ³ G ₃	
1.52.....	13	221	1835.9501	54467.713	0.026	3d ⁶ 4s ²	a ⁵ D ₂	—	3d ⁷ (⁴ F)5p	⁵ D ₂	
2.05.....	27	548	1834.6404	54506.595	-0.013	3d ⁸	a ³ P ₁	—	3d ⁷ (² P)4p	¹ S ₀	
1.80.....	13	639	1833.6836	54535.035	-0.010	3d ⁸	a ³ P ₁	—	3d ⁷ (² P)4p	x ³ D ₂	
2.36.....	38	802	1831.8871	54588.516	0.020	3d ⁷ (⁴ F)4s	b ³ F ₄	—	3d ⁷ (² G)4p	z ¹ G ₄	
1.47.....	11	209	1829.4098	54662.438	0.011	3d ⁶ 4s ²	a ⁵ D ₃	—	3d ⁷ (⁴ F)5p	⁵ F ₄	
1.45.....	5	879	1828.8650	54678.720	0.042	3d ⁸	a ³ P ₂	—	3d ⁷ (² P)4p	x ³ D ₂	
1.43.....	5	712	1828.2939	54695.802	0.018	3d ⁷ (⁴ F)4s	b ³ F ₂	—	3d ⁷ (² G)4p	z ¹ F ₃	
0.98.....	6	143	1827.8340	54709.563	-0.043	3d ⁷ (⁴ F)4p	z ³ D ₃	—	3d ⁷ (⁴ P)4d	³ F ₄	
1.69.....	10	697	1827.7911	54710.846	0.022	3d ⁷ (⁴ F)4p	z ³ F ₂	—	3d ⁷ (⁴ P)4d	⁵ F ₂	
2.15.....	53	238	1826.1166	54761.016	0.000	3d ⁶ 4s ²	a ⁵ D ₄	—	3d ⁷ (⁴ F)5p	⁵ F ₅	
1.79.....	23	225	1821.7685	54891.715	0.085	3d ⁷ (⁴ P)4p	y ⁵ D ₃	—	3d ⁷ (² H)4d	³ F ₃	D
1.79.....	23	225	1821.7685	54891.715	0.027	3d ⁶ 4s ²	a ⁵ D ₃	—	3d ⁷ (⁴ F)5p	⁵ D ₂	D
1.70.....	13	319	1818.5662	54988.375	-0.044	3d ⁶ 4s ²	a ⁵ D ₄	—	3d ⁷ (⁴ F)5p	⁵ D ₃	
1.57.....	8	738	1813.7694	55133.801	-0.086	3d ⁷ (⁴ P)4s	a ⁵ P ₁	—	3d ⁷ (a ² D)4p	x ³ P ₀	
1.72.....	15	313	1813.1431	55152.846	0.034	3d ⁶ 4s ²	a ⁵ D ₂	—	3d ⁷ (⁴ F)5p	⁵ F ₂	
1.89.....	26	236	1812.1871	55181.940	-0.010	3d ⁶ 4s ²	a ⁵ D ₃	—	3d ⁷ (⁴ F)5p	⁵ F ₃	
1.92.....	26	217	1808.9218	55281.551	0.003	3d ⁶ 4s ²	a ⁵ D ₄	—	3d ⁷ (⁴ F)5p	⁵ F ₄	
2.10.....	44	444	1804.9543	55403.066	0.005	3d ⁸	a ¹ G ₄	—	3d ⁷ (² H)4p	y ¹ H ₅	
1.51.....	10	225	1799.3088	55576.898	0.085	3d ⁶ 4s ²	a ⁵ D ₃	—	3d ⁷ (⁴ F)5p	⁵ F ₂	
1.09.....	2	318	1765.1166	56653.483	-0.061	3d ⁶ 4s ²	a ⁵ D ₃	—	3d ⁷ (⁴ F)5p	³ F ₃	
1.23.....	4	605	1794.5654	55723.797	0.012	3d ⁸	a ³ P ₀	—	3d ⁷ (a ² D)4p	w ³ D ₁	
1.63.....	12	575	1792.1388	55799.250	0.009	3d ⁸	a ³ P ₂	—	3d ⁷ (a ² D)4p	w ³ D ₃	
1.27.....	6	532	1789.3112	55887.428	0.034	3d ⁷ (⁴ F)4s	b ³ F ₂	—	3d ⁷ (² P)4p	z ¹ D ₂	
1.53.....	9	618	1781.0835	56145.601	0.034	3d ⁷ (⁴ F)4s	a ⁵ F ₁	—	3d ⁷ (⁴ P)4p	y ⁵ D ₁	
1.42.....	6	663	1780.2119	56173.088	-0.020	3d ⁸	a ¹ D ₂	—	3d ⁷ (² P)4p	x ³ D ₁	
1.98.....	21	696	1778.3262	56232.653	-0.045	3d ⁸	a ³ P ₁	—	3d ⁷ (a ² D)4p	w ³ D ₂	
1.34.....	5	656	1773.7930	56376.363	0.032	3d ⁸	a ³ P ₂	—	3d ⁷ (a ² D)4p	w ³ D ₂	
1.03.....	2	303	1764.5189	56672.670	0.047	3d ⁸	a ³ P ₀	—	3d ⁷ (² P)4p	y ³ S ₁	
1.69.....	10	739	1764.2900	56680.023	0.070	3d ⁷ (⁴ F)4s	a ⁵ F ₃	—	3d ⁷ (⁴ P)4p	y ⁵ D ₃	
1.77.....	23	471	1758.6561	56861.600	0.010	3d ⁸	a ³ P ₁	—	3d ⁷ (² P)4p	y ³ S ₁	
1.96.....	32	529	1754.2237	57005.273	0.049	3d ⁸	a ³ P ₂	—	3d ⁷ (² P)4p	y ³ S ₁	
1.84.....	14	664	1746.3034	57263.819	0.058	3d ⁸	a ³ P ₀	—	3d ⁷ (² P)4p	z ¹ P ₁	
1.92.....	14	282	1744.9700	57307.574	-0.014	3d ⁷ (⁴ F)4p	z ³ D ₃	—	3d ⁷ (⁴ F)6s	³ F ₄	
1.35.....	4	160	1743.5639	57353.791	0.034	3d ⁷ (⁴ F)4p	z ³ F ₂	—	3d ⁷ (² G)4d	³ G ₃	
1.53.....	7	683	1741.9010	57408.543	0.049	3d ⁷ (⁴ F)4p	z ³ F ₃	—	3d ⁷ (² G)4d	³ G ₄	
2.08.....	27	564	1736.2211	57596.352	-0.009	3d ⁸	a ³ P ₂	—	3d ⁷ (² P)4p	z ¹ P ₁	
2.45.....	51	678	1734.1312	57665.764	-0.032	3d ⁸	a ¹ D ₂	—	3d ⁷ (a ² D)4p	w ³ D ₁	D
2.45.....	51	678	1734.1312	57665.764	-0.058	3d ⁷ (⁴ F)4p	z ³ G ₅	—	3d ⁷ (⁴ P)4d	³ F ₄	D
1.50.....	6	619	1732.9507	57705.047	0.088	3d ⁸	a ¹ D ₂	—	3d ⁷ (² H)4p	x ³ G ₃	

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
2.11.....	21	748	1732.7682	57711.122	-0.035	$3d^7(^4F)4s$	b^3F_4	$3d^7(^2P)4p$	x^3D_3
1.82.....	13	262	1726.2269	57929.813	0.013	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)6s$	5F_4
1.91.....	12	330	1725.8373	57942.890	0.016	$3d^7(^4F)4p$	z^3D_2	$3d^7(^4F)6s$	3F_3
1.34.....	4	236	1723.6634	58015.968	0.011	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)6s$	5F_3
2.47.....	25	230	1723.0158	58037.772	0.020	$3d^7(^4F)4s$	a^5F_5	$3d^7(^4P)4p$	y^5D_4
1.75.....	7	758	1712.6166	58390.184	0.036	$3d^7(^4F)4s$	b^3F_4	$3d^7(^2H)4p$	x^3G_5
1.48.....	6	250	1711.2124	58438.098	-0.034	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)6s$	3F_4
1.85.....	11	554	1706.0601	58614.582	-0.052	$3d^8$	a^1D_2	$3d^7(^2P)4p$	y^3S_1
1.73.....	7	374	1704.7300	58660.314	-0.017	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)6s$	3F_3
1.36.....	4	274	1703.8332	58691.190	0.055	$3d^7(^4F)4p$	z^3F_4	$3d^7(^2G)4d$	3H_4
1.43.....	5	247	1693.1833	59060.351	0.007	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)6s$	5F_4
1.53.....	2	655	1691.7989	59108.682	0.084	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)6s$	5F_2
2.18.....	24	297	1691.4124	59122.188	0.015	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)6s$	3F_4
1.83.....	11	295	1690.7165	59146.520	0.019	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)6s$	5F_3
2.17.....	24	501	1689.0248	59205.763	-0.009	$3d^8$	a^1D_2	$3d^7(^2P)4p$	z^1P_1
1.99.....	8	729	1687.8456	59247.124	0.055	$3d^7(^4F)4s$	b^3F_4	$3d^7(a^2D)4p$	w^3D_3
1.70.....	7	360	1687.5284	59258.262	-0.012	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)6s$	3F_3
2.28.....	31	453	1683.6866	59393.477	0.042	$3d^8$	a^3P_2	$3d^7(a^2D)4p$	y^1D_2
2.01.....	12	415	1681.4755	59471.578	0.026	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)6s$	3F_4
1.56.....	3	583	1680.9005	59491.920	0.043	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)6s$	5F_3
1.28.....	3	295	1679.2300	59551.103	0.057	$3d^8$	a^3P_0	$3d^7(a^2D)4p$	x^3P_1
1.29.....	3	292	1673.9188	59740.054	0.041	$3d^8$	a^3P_1	$3d^7(a^2D)4p$	x^3P_1
2.12.....	13	479	1672.6816	59784.241	0.003	$3d^7(^4F)4p$	z^3F_2	$3d^7(^4F)6s$	3F_2
2.04.....	13	407	1672.4943	59790.935	0.060	$3d^7(^4F)4p$	z^3F_3	$3d^7(^4F)6s$	3F_3
1.46.....	3	440	1669.9064	59883.596	-0.050	$3d^8$	a^3P_2	$3d^7(a^2D)4p$	x^3P_1
2.18.....	23	317	1664.0673	60093.724	-0.040	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)6s$	5F_4
1.90.....	12	326	1662.8902	60136.260	0.009	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)6s$	3F_3
2.40.....	30	515	1661.2642	60195.122	-0.038	$3d^8$	a^1D_2	$3d^7(a^2D)4p$	x^3P_2
1.61.....	6	330	1659.3732	60263.718	-0.087	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)6s$	3F_4
2.28.....	28	328	1653.5787	60474.896	-0.020	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)6s$	3F_3
2.06.....	19	285	1648.4725	60662.218	0.003	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)6s$	3F_2
2.18.....	22	338	1644.0776	60824.379	0.084	$3d^7(^4F)4p$	z^3G_4	$3d^7(^4F)6s$	3F_3
1.75.....	7	361	1642.4734	60883.787	-0.040	$3d^8$	a^1D_2	$3d^7(a^2D)4p$	y^1F_3
2.60.....	63	304	1642.4134	60886.012	-0.005	$3d^7(^4F)4p$	z^3G_5	$3d^7(^4F)6s$	5F_4
2.12.....	13	594	1639.2670	61002.877	0.031	$3d^8$	a^1D_2	$3d^7(a^2D)4p$	y^1D_2
1.32.....	3	337	1632.3293	61262.147	-0.077	$3d^8$	a^3P_2	$3d^7(a^2D)4p$	y^1P_1
1.31.....	3	347	1631.5564	61291.168	0.040	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)6s$	5F_4
2.86.....	121	288	1628.7741	61395.870	0.002	$3d^7(^4F)4p$	z^5G_6	$3d^7(^4F)6s$	5F_5
1.39.....	3	378	1628.5188	61405.492	0.061	$3d^7(^4F)4p$	z^3D_3	$3d^7(^4F)5d$	5G_2
2.54.....	52	317	1626.7038	61474.008	-0.003	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)6s$	3F_4
1.54.....	5	344	1622.4672	61634.529	0.048	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)6s$	5F_2
1.54.....	5	344	1622.4672	61634.529	-0.046	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)6s$	5F_4
1.71.....	5	456	1621.9972	61652.387	-0.006	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)5d$	3G_5
2.56.....	54	321	1620.2012	61720.730	-0.002	$3d^7(^4F)4p$	z^5G_4	$3d^7(^4F)6s$	5F_3
1.63.....	5	384	1618.6278	61780.726	-0.025	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)6s$	3F_4
2.41.....	37	340	1616.2402	61871.991	0.008	$3d^7(^4F)4p$	z^5G_3	$3d^7(^4F)6s$	5F_2
2.18.....	3	279	1614.2762	61947.268	0.018	$3d^7(^4F)4p$	z^5D_4	$3d^7(^2G)4d$	3G_3
2.19.....	18	409	1614.2071	61949.920	0.020	$3d^7(^4F)4p$	z^5G_2	$3d^7(^4F)6s$	5F_1
1.60.....	7	275	1613.1408	61990.869	0.009	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)6s$	5F_3
1.87.....	12	292	1610.4039	62096.224	0.001	$3d^7(^4F)4p$	z^5G_5	$3d^7(^4F)6s$	5F_4
2.08.....	19	309	1608.9190	62153.534	0.004	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)6s$	5F_5
1.76.....	15	512	1605.9626	62267.950	-0.019	$3d^8$	a^3F_2	$3d^7(^4P)4p$	y^3D_1
1.47.....	5	273	1603.1470	62377.313	-0.049	$3d^7(^4F)4p$	z^5F_2	$3d^7(^2G)4d$	3F_3
1.56.....	5	324	1602.4877	62402.973	0.010	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)6s$	5F_4
2.01.....	16	316	1600.3698	62485.556	-0.002	$3d^7(^4F)4p$	z^5D_2	$3d^7(^4F)6s$	5F_2
2.06.....	18	310	1600.0248	62499.032	0.008	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)6s$	3F_4
1.51.....	6	679	1598.4693	62559.849	-0.003	$3d^8$	a^3F_3	$3d^7(^2G)4p$	y^3F_4
1.91.....	7	579	1597.9756	62579.177	-0.059	$3d^7(^4F)4p$	z^3G_3	$3d^7(^4F)5d$	5G_3
1.83.....	10	811	1595.7721	62665.588	-0.074	$3d^8$	a^3F_3	$3d^7(^4P)4p$	y^3D_2
1.55.....	5	316	1593.2993	62762.848	-0.001	$3d^8$	a^3F_2	$3d^7(^2G)4p$	y^3F_3
1.92.....	12	342	1591.1449	62847.829	0.009	$3d^7(^4F)4p$	z^5F_3	$3d^7(^4F)6s$	3F_4
1.74.....	8	315	1590.5411	62871.687	0.052	$3d^8$	a^1D_2	$3d^7(a^2D)4p$	y^1P_1
2.00.....	16	299	1585.4017	63075.496	-0.029	$3d^7(^4F)4p$	z^5F_2	$3d^7(^4F)6s$	5F_3
2.58.....	50	364	1584.8963	63095.612	0.004	$3d^7(^4F)4p$	z^5F_4	$3d^7(^4F)6s$	5F_5
1.49.....	5	292	1584.6555	63105.199	0.007	$3d^7(^4F)4p$	z^5G_2	$3d^7(^2P)4d$	3F_2
1.49.....	5	292	1584.6555	63105.199	-0.024	$3d^7(^4F)4p$	z^3F_4	$3d^7(^4F)5d$	3H_5
2.18.....	20	353	1584.2531	63121.229	-0.007	$3d^7(^4F)4p$	z^5D_4	$3d^7(^4F)6s$	5F_4
1.88.....	8	467	1583.9469	63133.429	-0.065	$3d^7(^4F)4p$	z^5D_3	$3d^7(^4F)6s$	3F_3
1.76.....	9	324	1581.3649	63236.511	-0.003	$3d^7(^4F)4p$	z^5F_1	$3d^7(^4F)6s$	5F_2
2.79.....	91	329	1580.3620	63276.640	-0.011	$3d^7(^4F)4p$	z^5F_5	$3d^7(^4F)6s$	5F_5
2.56.....	40	434	1577.0442	63409.762	0.040	$3d^8$	a^3F_3	$3d^7(^2G)4p$	y^3F_3
2.35.....	25	425	1576.7965	63419.726	0.012	$3d^8$	a^3F_2	$3d^7(^2G)4p$	y^3F_2

TABLE 1—Continued

Intensity (1)	SNR (2)	Width (mK) (3)	λ (Å) (4)	σ (cm ⁻¹) (5)	$O - C$ (cm ⁻¹) (6)	Lower Level		(7)	Upper Level		Blend (8)
1.81.....	9	352	1576.2652	63441.103	0.001	$3d^7(^4F)4p$	z^5F_4	—	$3d^7(^4F)6s$	3F_4	
1.77.....	8	355	1575.9293	63454.625	0.023	$3d^7(^4F)4p$	z^3G_4	—	$3d^7(^4F)5d$	3H_5	
1.64.....	6	372	1575.5726	63468.990	0.052	$3d^7(^4F)4p$	z^3G_5	—	$3d^7(^4F)5d$	5G_5	
2.06.....	19	299	1575.5467	63470.034	0.002	$3d^7(^4F)4p$	z^5F_3	—	$3d^7(^4F)6s$	5F_4	
2.44.....	36	366	1574.5503	63510.196	0.020	$3d^8$	a^3F_4	—	$3d^7(^2G)4p$	y^3F_4	
1.69.....	4	547	1573.5172	63551.896	-0.037	$3d^7(^4F)4p$	z^5F_1	—	$3d^7(^4F)6s$	5F_1	
1.93.....	12	339	1573.4104	63556.209	0.020	$3d^7(^4F)4p$	z^5F_3	—	$3d^7(^4F)6s$	5F_3	D
1.93.....	12	339	1573.4104	63556.209	-0.049	$3d^7(^4F)4p$	z^3F_4	—	$3d^7(a^2D)4d$	3F_4	D
1.78.....	9	317	1573.0630	63570.247	0.024	$3d^7(^4F)4p$	z^5F_2	—	$3d^7(^4F)6s$	5F_2	
1.84.....	9	362	1572.8828	63577.529	0.069	$3d^8$	a^3F_2	—	$3d^7(^2G)4p$	y^3G_3	
2.14.....	17	405	1572.6492	63586.970	-0.013	$3d^8$	a^3F_4	—	$3d^7(^4F)4p$	y^3D_3	
1.99.....	15	313	1572.3378	63599.565	0.014	$3d^7(^4F)4p$	z^3G_5	—	$3d^7(^4F)5d$	5H_6	
1.97.....	6	696	1567.5767	63792.734	0.021	$3d^8$	a^3F_4	—	$3d^7(^2G)4p$	z^3H_4	
1.96.....	9	511	1562.3946	64004.318	0.087	$3d^7(^4F)4p$	z^5G_5	—	$3d^7(^4F)5d$	3G_5	
1.84.....	8	418	1560.9780	64062.400	-0.076	$3d^7(^4F)4p$	z^5G_6	—	$3d^7(^4F)5d$	5G_6	
1.62.....	7	286	1560.9558	64063.314	0.000	$3d^7(^4F)4p$	z^5F_4	—	$3d^7(^4F)6s$	5F_4	
2.15.....	20	336	1560.2369	64092.832	-0.009	$3d^7(^4F)4p$	z^5G_5	—	$3d^7(^4F)5d$	3H_6	
2.34.....	33	323	1557.4015	64209.518	-0.033	$3d^7(^4F)4p$	z^5G_6	—	$3d^7(^4F)5d$	5H_7	
2.08.....	13	432	1557.0405	64224.406	-0.036	$3d^7(^4F)4p$	z^3G_3	—	$3d^7(a^2D)4d$	3D_2	
1.45.....	5	290	1553.7590	64360.045	-0.001	$3d^8$	a^3F_4	—	$3d^7(^2G)4p$	y^3F_3	
2.28.....	19	475	1552.7625	64401.348	-0.007	$3d^8$	a^3F_4	—	$3d^7(^2G)4p$	z^1G_4	
1.92.....	13	296	1552.7204	64403.097	-0.013	$3d^7(^4F)4p$	z^5G_4	—	$3d^7(^4F)5d$	5H_5	
2.01.....	13	392	1547.9445	64601.799	0.024	$3d^8$	a^3F_4	—	$3d^7(^2G)4p$	y^3G_5	
1.55.....	6	280	1542.9755	64809.841	0.083	$3d^7(^4F)4p$	z^5G_5	—	$3d^7(^4F)5d$	5H_6	
1.45.....	5	298	1531.1939	65308.516	-0.019	$3d^7(^4F)4p$	z^3G_5	—	$3d^7(^2H)4d$	1H_5	
1.47.....	5	260	1521.9731	65704.183	0.025	$3d^7(^4F)4p$	z^5D_4	—	$3d^7(^4F)5d$	5G_5	
1.65.....	6	359	1520.5149	65767.195	0.078	$3d^7(^4F)4p$	z^5F_4	—	$3d^7(^4F)5d$	5F_4	
2.05.....	12	438	1519.3832	65816.183	0.060	$3d^7(^4F)4p$	z^5F_5	—	$3d^7(^4F)5d$	5F_5	
1.88.....	13	286	1516.4553	65943.255	-0.004	$3d^7(^4F)4p$	z^5F_5	—	$3d^7(^4F)5d$	5G_6	
1.55.....	6	306	1516.3431	65948.133	-0.027	$3d^7(^4F)4p$	z^5F_5	—	$3d^7(^4F)5d$	5F_4	
1.49.....	5	283	1512.0230	66136.561	-0.001	$3d^7(^4F)4p$	z^3G_4	—	$3d^7(^2H)4d$	3F_4	
1.70.....	8	300	1509.2300	66258.955	0.026	$3d^8$	a^3F_3	—	$3d^7(^2P)4p$	z^1D_2	
1.95.....	13	333	1480.9545	67524.019	0.003	$3d^8$	a^3F_4	—	$3d^7(^2P)4p$	x^3D_3	
1.66.....	4	591	1476.6721	67719.843	-0.032	$3d^8$	a^3F_2	—	$3d^7(a^2D)4p$	w^3D_1	
1.45.....	2	671	1475.9577	67752.620	0.089	$3d^7(^4F)4p$	z^5F_3	—	$3d^7(^2H)4d$	3G_3	
2.00.....	12	407	1475.8180	67759.034	-0.004	$3d^8$	a^3F_2	—	$3d^7(^2H)4p$	x^3G_3	
2.15.....	14	482	1472.9049	67893.044	-0.055	$3d^8$	a^3F_3	—	$3d^7(^2H)4p$	x^3G_4	
2.17.....	15	488	1466.2120	68202.959	-0.048	$3d^8$	a^3F_4	—	$3d^7(^2H)4p$	x^3G_5	
1.57.....	6	322	1448.0178	69059.924	-0.004	$3d^8$	a^3F_4	—	$3d^7(a^2D)4p$	w^3D_3	
1.37.....	3	439	1425.3062	70160.363	0.024	$3d^7(^4F)4p$	z^5F_3	—	$3d^7(^2H)4d$	3F_3	

NOTES.—Col. (1): Intensity in arbitrary units given as $\log_{10}$ (intensity). Col. (2): Observed signal-to-noise ratio of the transition. Col. (3): Guide to the line pattern width in mK (1 mK = 0.001 cm⁻¹). Col. (4): Wavelength in air for λ longer than 2000 Å and in vacuum below 2000 Å. Col. (5): Center-of-gravity vacuum wavenumber of the transition. Col. (6): Difference between the observed wavenumber and the wavenumber calculated from the energy levels in this work. Col. (7): Levels involved in the transition. Col. (8): Blends and doubly identified lines, where D designates a doubly identified line; DI is a line doubly identified with a Co I line; Ne and Ar are lines blended with neon and argon, respectively; B is a blend with another nearby Co II line; I is a line blended with a nearby Co I line; U is a line blended with an unknown feature; P is a transition for which the calculated wavenumber is given because it was not possible to determine the observed wavenumber because of blending; In refers to Co I transitions reported for the first time in this paper and listed in Table 3; and M marks a line that is masked by another much stronger transition.

TABLE 2
CO II INFRARED LINE LIST

Intensity (1)		SNR (2)	Width (mK) (3)	λ_{air} (Å) (4)	σ (cm ⁻¹) (5)	$O-C$ (cm ⁻¹) (6)	Lower Level		(7)	Upper Level		Blend (8)
5.23	<i>i</i>	4667	34	24364.974	4103.133	-0.034	$3d^7(^4F)4d$	e^5G_4	-	$3d^7(^4F)5p$	5F_5	M Ne
2.51	<i>i</i>	4	73	23358.562	4279.918	-0.012	$3d^7(^4F)4d$	f^3F_3	-	$3d^7(^4F)5p$	3D_2	
2.69	<i>i</i>	4	102	21868.412	4571.558	-0.008	$3d^7(^4F)4d$	e^5P_3	-	$3d^7(^4F)5p$	5D_4	D
2.69	<i>i</i>	4	102	21868.412	4571.558	0.002	$3d^7(^4P)4d$	3D_2	-	$3d^7(^4F)4f$	(1.5)[2.5] ₂	D
2.51	<i>i</i>	4	66	21008.905	4758.588	0.005	$3d^7(^4F)4d$	e^5G_5	-	$3d^7(^4F)5p$	5F_5	
2.54	<i>i</i>	5	63	20668.525	4836.954	-0.038	$3d^7(^4F)4d$	f^5F_4	-	$3d^7(^4F)5p$	5D_4	
2.91	<i>i</i>	11	64	20290.197	4927.144	-0.004	$3d^7(^4F)4d$	e^5D_4	-	$3d^7(^4F)5p$	5F_4	
2.50	<i>i</i>	3	86	19836.600	5039.811	0.006	$3d^7(^4P)4d$	5D_1	-	$3d^7(^4F)4f$	(2.5)[2.5] ₂	
2.67	<i>i</i>	4	88	19686.297	5078.289	0.010	$3d^7(^4F)4d$	e^3H_4	-	$3d^7(^4F)5p$	3F_3	
2.68	<i>i</i>	6	68	19650.298	5087.593	-0.016	$3d^7(^4F)4d$	e^3D_3	-	$3d^7(^4F)5p$	5F_3	
2.74	<i>i</i>	7	65	19584.516	5104.681	-0.008	$3d^7(^4F)4d$	f^5F_5	-	$3d^7(^4F)5p$	5D_4	
2.94	<i>i</i>	9	83	19437.771	5143.219	-0.004	$3d^7(^4F)4d$	e^5G_4	-	$3d^7(^4F)5p$	3F_3	
2.45	<i>i</i>	11	22	19432.390	5144.643	0.000	$3d^7(^4F)4d$	e^5G_4	-	$3d^7(^4F)5p$	3F_3	
3.55	<i>i</i>	68	48	19399.864	5153.268	-0.003	$3d^7(^4F)4d$	e^5G_6	-	$3d^7(^4F)5p$	5F_5	
3.58	<i>i</i>	64	55	19170.061	5215.044	0.000	$3d^7(^4F)4d$	e^5H_4	-	$3d^7(^4F)5p$	5G_3	
2.54	<i>i</i>	11	29	19142.929	5222.435	0.001	$3d^7(^4F)4d$	e^5H_3	-	$3d^7(^4F)5p$	5G_2	
3.52	<i>i</i>	70	43	19093.844	5235.861	-0.002	$3d^7(^4F)4d$	e^5H_5	-	$3d^7(^4F)5p$	5G_4	
3.10	<i>i</i>	30	38	19017.477	5256.886	0.002	$3d^7(^4F)4d$	f^5F_4	-	$3d^7(^4F)5p$	5F_5	
3.77	<i>i</i>	107	51	19002.425	5261.050	-0.004	$3d^7(^4F)4d$	e^5H_6	-	$3d^7(^4F)5p$	3G_5	
3.75	<i>i</i>	63	82	18937.505	5279.085	-0.030	$3d^7(^4F)4d$	e^5G_5	-	$3d^7(^4F)5p$	5F_4	M Ne
3.84	<i>i</i>	59	109	18796.546	5318.674	-0.001	$3d^7(^4F)4d$	e^3H_6	-	$3d^7(^4F)5p$	5G_5	
3.97	<i>i</i>	67	128	18753.640	5330.843	0.002	$3d^7(^4F)4d$	e^5H_7	-	$3d^7(^4F)5p$	5G_6	
3.60	<i>i</i>	52	71	18700.902	5345.876	0.001	$3d^7(^4F)4d$	e^3H_5	-	$3d^7(^4F)5p$	3G_4	
3.53	<i>i</i>	66	47	18550.716	5389.156	0.009	$3d^7(^4F)4d$	e^3H_4	-	$3d^7(^4F)5p$	3G_3	D
3.53	<i>i</i>	66	47	18550.716	5389.156	-0.010	$3d^7(^4F)4d$	5F_2	-	$3d^7(^4F)4f$	(3.5)[0.5] ₁	D
2.68	<i>i</i>	6	69	18457.448	5416.388	-0.008	$3d^7(^4F)4d$	e^5H_5	-	$3d^7(^4F)5p$	3F_4	
3.02	<i>i</i>	13	74	18171.766	5501.540	-0.005	$3d^7(^4P)4d$	5F_3	-	$3d^7(^4P)5p$	5D_3	
3.73	<i>i</i>	58	85	18095.961	5524.587	0.006	$3d^7(^4F)4d$	f^5F_5	-	$3d^7(^4F)5p$	5F_5	
5.23	<i>i</i>	2387	66	18083.154	5528.499	-0.014	$3d^7(^4F)4d$	f^5F_2	-	$3d^7(^4F)5p$	5F_3	M Ne
3.39	<i>i</i>	15	150	18080.054	5529.447	0.017	$3d^7(^4F)4d$	e^5G_4	-	$3d^7(^4F)5p$	5G_4	
2.89	<i>i</i>	11	66	18071.860	5531.954	-0.020	$3d^7(^4F)4d$	f^5F_1	-	$3d^7(^4F)5p$	5F_2	
3.46	<i>i</i>	28	96	18048.417	5539.140	0.010	$3d^7(^4F)4d$	e^5G_5	-	$3d^7(^4F)5p$	3G_5	
2.96	<i>i</i>	15	55	18013.222	5549.962	0.004	$3d^7(^4P)4d$	3F_3	-	$3d^7(^4P)5p$	3D_2	
2.97	<i>i</i>	17	51	17995.633	5555.387	0.009	$3d^7(^4F)4d$	e^3G_5	-	$3d^7(^4F)5p$	5G_4	
2.97	<i>i</i>	18	46	17921.935	5578.231	0.004	$3d^7(^4F)4d$	e^3G_4	-	$3d^7(^4F)5p$	3D_3	
2.69	<i>i</i>	5	83	17858.424	5598.070	-0.001	$3d^7(^4P)4d$	5F_4	-	$3d^7(^4P)5p$	5D_4	
3.32	<i>i</i>	17	110	17817.874	5610.810	0.003	$3d^7(^4P)4d$	5F_4	-	$3d^7(^4P)5p$	5D_3	
3.47	<i>i</i>	21	128	17803.953	5615.197	-0.001	$3d^7(^4F)4d$	e^3G_5	-	$3d^7(^4F)5p$	5G_5	
3.09	<i>i</i>	8	137	17680.706	5654.339	-0.010	$3d^7(^4F)4d$	e^3D_3	-	$3d^7(^4F)5p$	3F_4	
2.93	<i>i</i>	9	81	17637.014	5668.346	0.000	$3d^7(^4F)4d$	e^5G_3	-	$3d^7(^4F)5p$	5G_3	
3.52	<i>i</i>	22	136	17585.163	5685.059	0.005	$3d^7(^4P)4d$	5F_5	-	$3d^7(^4P)5p$	5D_4	
3.70	<i>i</i>	31	147	17551.502	5695.963	0.004	$3d^7(^4F)4d$	e^5G_6	-	$3d^7(^4F)5p$	5G_6	
3.58	<i>i</i>	37	94	17429.256	5735.913	0.002	$3d^7(^4F)4d$	e^3G_5	-	$3d^7(^4F)5p$	3F_4	
2.48	<i>i</i>	5	48	17408.316	5742.813	-0.024	$3d^7(^4F)4d$	f^5F_3	-	$3d^7(^4F)5p$	5F_3	
2.51	<i>i</i>	7	42	17360.668	5758.574	-0.011	$3d^7(^4F)4d$	e^3G_3	-	$3d^7(^4F)5p$	3G_3	
3.09	<i>i</i>	14	79	17333.345	5767.652	-0.008	$3d^7(^4F)4d$	e^3G_3	-	$3d^7(^4F)5p$	3F_2	
3.11	<i>i</i>	14	82	17304.048	5777.417	0.001	$3d^7(^4F)4d$	f^5F_4	-	$3d^7(^4F)5p$	5F_4	
3.18	<i>i</i>	14	100	17275.811	5786.860	0.005	$3d^7(^4F)4d$	e^3G_4	-	$3d^7(^4F)5p$	3G_4	
2.34	<i>i</i>	3	55	17252.227	5794.771	0.025	$3d^7(^4F)4d$	f^5F_1	-	$3d^7(^4F)5p$	5F_1	
2.17	<i>i</i>	3	35	16558.752	6037.453	0.022	$3d^7(^4F)4d$	f^5F_4	-	$3d^7(^4F)5p$	3G_5	
3.24	<i>i</i>	28	57	16525.738	6049.514	0.019	$3d^7(^4F)4d$	e^3G_4	-	$3d^7(^4F)5p$	3F_3	U
3.18	<i>i</i>	8	173	16477.383	6067.268	-0.001	$3d^7(^4F)4d$	f^5F_5	-	$3d^7(^4F)5p$	5G_6	
3.32	<i>i</i>	14	132	16421.450	6087.933	0.000	$3d^7(^4F)4d$	e^3D_3	-	$3d^7(^4F)5p$	3D_3	
2.74	<i>i</i>	5	88	16312.753	6128.499	-0.037	$3d^7(^4F)4d$	e^3G_3	-	$3d^7(^4F)5p$	3D_2	
2.36	<i>i</i>	4	52	15876.344	6296.959	0.019	$3d^7(^4F)4d$	f^5F_4	-	$3d^7(^4F)5p$	5F_3	
2.49	<i>i</i>	4	61	15718.097	6360.356	-0.008	$3d^7(^4F)4d$	e^3G_4	-	$3d^7(^4F)5p$	3G_3	
3.21	<i>i</i>	11	129	15705.684	6365.383	0.004	$3d^7(^4F)4d$	e^3G_5	-	$3d^7(^4F)5p$	3F_4	
3.07	<i>i</i>	10	108	15139.062	6603.624	0.022	$3d^7(^4F)4d$	e^3D_2	-	$3d^7(^4F)5p$	3D_2	
2.84	<i>i</i>	6	97	12868.889	7768.554	0.021	$3d^7(^4F)4d$	f^3F_4	-	$3d^7(^4F)5p$	3F_3	
3.06	<i>i</i>	13	77	11583.530	8630.584	0.000	$3d^7(^4F)5p$	3F_2	-	$3d^7(^4P)4d$	3P_2	
2.79	<i>i</i>	7	77	10022.952	9974.366	0.008	$3d^7(^4F)5s$	e^3F_4	-	$3d^7(^4F)5p$	5F_5	
3.01	<i>i</i>	8	113	9818.9917	10181.553	0.003	$3d^7(^4F)5p$	3D_2	-	$3d^7(^2G)4d$	3F_3	
3.05	<i>i</i>	8	118	9616.8478	10395.566	0.032	$3d^7(^4F)5s$	e^3F_2	-	$3d^7(^4F)5p$	5G_3	
3.19	<i>i</i>	14	97	9593.2568	10421.130	0.005	$3d^7(^4F)5p$	3F_3	-	$3d^7(^2G)4d$	3H_4	
2.78	<i>i</i>	5	109	9506.9654	10515.719	0.000	$3d^7(^4F)5s$	e^3F_3	-	$3d^7(^4F)5p$	5D_3	
3.60	<i>i</i>	24	153	9489.0022	10535.626	0.021	$3d^7(^4F)5s$	e^3F_3	-	$3d^7(^4F)5p$	5G_4	U
2.68	<i>i</i>	6	73	9482.8552	10542.455	0.029	$3d^7(^4F)5p$	3F_2	-	$3d^7(^2G)4d$	3F_3	
2.96	<i>i</i>	5	147	9422.7657	10609.685	0.032	$3d^7(^4F)5p$	5F_4	-	$3d^7(^4P)4d$	5D_3	D
2.96	<i>i</i>	5	147	9422.7657	10609.685	0.014	$3d^7(^4F)5s$	e^3F_2	-	$3d^7(^4F)5p$	5D_2	D
2.59	<i>i</i>	5	63	9377.2205	10661.216	-0.037	$3d^7(^4F)5p$	5G_4	-	$3d^7(^2G)4d$	3G_5	U
2.69	<i>i</i>	4	109	9365.4968	10674.561	0.028	$3d^7(^4P)5s$	3P_2	-	$3d^7(^4P)5p$	5D_3	

TABLE 2—Continued

Intensity (1)		SNR (2)	Width (mK) (3)	λ_{air} (Å) (4)	σ (cm ⁻¹) (5)	$O - C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)	
3.99	<i>i</i>	32	284	9329.1620	10716.136	-0.002	$3d^7(^4F)5s$	e^3F_3	-	$3d^7(^4F)5p$	3F_4
3.03	<i>iii</i>	8	112	9295.5280	10754.910	0.005	$3d^7(^4F)5s$	e^3F_4	-	$3d^7(^4F)5p$	3G_5
2.89	<i>i</i>	10	67	9249.0534	10808.951	0.017	$3d^7(^4F)5s$	e^5F_3	-	$3d^7(^4F)5p$	5F_4
3.49	<i>i</i>	20	139	9212.2134	10852.176	0.013	$3d^7(^4F)5p$	3F_3	-	$3d^7(^4F)6s$	3F_4
3.67	<i>i</i>	40	106	9188.8953	10879.715	0.002	$3d^7(^4F)5p$	3D_2	-	$3d^7(^4F)6s$	5F_3
3.38	<i>i</i>	22	100	9178.1792	10892.418	0.024	$3d^7(^4F)5p$	3D_3	-	$3d^7(^2G)4d$	3H_4
2.78	<i>i</i>	7	72	9176.0140	10894.988	-0.015	$3d^7(^4P)5s$	5P_2	-	$3d^7(^4F)4f$	(4.5)[3.5] ₃
3.07	<i>i</i>	15	72	9171.8421	10899.944	0.011	$3d^7(^4F)5s$	e^5F_2	-	$3d^7(^4F)5p$	5F_3
3.03	<i>i</i>	9	105	9076.2644	11014.725	0.025	$3d^7(^4F)5s$	e^5F_1	-	$3d^7(^4F)5p$	5F_2
4.16	<i>i</i>	48	278	9070.2966	11021.972	-0.002	$3d^7(^4F)5s$	e^5F_5	-	$3d^7(^4F)5p$	5D_4
3.12	<i>i</i>	7	164	9065.6840	11027.580	0.034	$3d^7(^4F)5s$	e^3F_2	-	$3d^7(^4F)5p$	3F_3
3.70	<i>i</i>	27	169	9056.9628	11038.199	0.003	$3d^7(^4F)5s$	e^5F_3	-	$3d^7(^4F)5p$	5D_2
3.72	<i>i</i>	27	180	9009.3829	11096.493	-0.003	$3d^7(^4F)5s$	e^5F_4	-	$3d^7(^4F)5p$	5D_3
2.96	<i>i</i>	4	174	8994.5644	11114.775	-0.029	$3d^7(^4F)5p$	3G_4	-	$3d^7(^4F)6s$	3F_4
2.97	<i>i</i>	6	146	8966.3654	11149.730	0.008	$3d^7(^4F)5s$	e^3F_3	-	$3d^7(^4F)5p$	3D_3
2.96	<i>iii</i>	3	246	8893.8991	11240.576	-0.013	$3d^7(^4F)5p$	3F_2	-	$3d^7(^4F)6s$	5F_3
2.78	<i>iii</i>	3	151	8870.7583	11269.899	-0.017	$3d^7(^4P)5s$	3P_1	-	$3d^7(^4P)5p$	3D_2
1.75	<i>ii</i>	4	242	8864.7816	11277.497	0.030	$3d^7(^4F)5s$	e^5F_1	-	$3d^7(^4F)5p$	5F_1
1.95	<i>ii</i>	11	140	8851.1865	11294.819	0.023	$3d^7(^4F)5s$	e^5F_2	-	$3d^7(^4F)5p$	5F_2
3.33	<i>iii</i>	13	144	8828.8122	11323.443	0.011	$3d^7(^4F)5p$	3D_3	-	$3d^7(^4F)6s$	3F_4
2.12	<i>ii</i>	21	111	8824.9125	11328.446	-0.012	$3d^7(^4F)5s$	e^5F_3	-	$3d^7(^4F)5p$	5F_3
2.31	<i>ii</i>	15	242	8817.1349	11338.439	0.025	$3d^7(^4F)5s$	e^3F_2	-	$3d^7(^4F)5p$	3G_3
1.56	<i>ii</i>	3	184	8810.0908	11347.505	0.016	$3d^7(^4F)5s$	e^3F_2	-	$3d^7(^4F)5p$	3F_2
3.51	<i>iii</i>	28	107	8801.6856	11358.341	-0.009	$3d^7(^4F)5s$	e^3F_3	-	$3d^7(^4F)5p$	3G_4
2.44	<i>ii</i>	51	101	8777.4450	11389.709	-0.002	$3d^7(^4F)5s$	e^5F_4	-	$3d^7(^4F)5p$	5F_4
1.59	<i>ii</i>	3	187	8769.0601	11400.600	-0.021	$3d^7(^4F)5s$	e^3F_4	-	$3d^7(^4F)5p$	5G_4
2.66	<i>ii</i>	34	247	8737.4405	11441.857	-0.009	$3d^7(^4F)5s$	e^5F_5	-	$3d^7(^4F)5p$	5F_5
3.57	<i>iii</i>	35	98	8723.2826	11460.427	-0.014	$3d^7(^4F)5s$	e^3F_4	-	$3d^7(^4F)5p$	5G_5
3.03	<i>iii</i>	4	208	8647.7390	11560.541	0.009	$3d^7(^4F)5p$	3F_3	-	$3d^7(^4F)6s$	5F_3
2.53	<i>ii</i>	63	101	8632.3477	11581.153	-0.001	$3d^7(^4F)5s$	e^3F_4	-	$3d^7(^4F)5p$	3F_4
2.35	<i>ii</i>	28	147	8602.7450	11621.004	0.013	$3d^7(^4F)5s$	e^3F_3	-	$3d^7(^4F)5p$	3F_3
2.66	<i>ii</i>	102	84	8581.5352	11649.726	0.000	$3d^7(^4F)5s$	e^5F_4	-	$3d^7(^4F)5p$	3G_5
3.17	<i>iii</i>	4	277	8538.5258	11708.407	0.042	$3d^7(^4F)5s$	e^3F_3	-	$3d^7(^4F)5p$	3D_2
2.52	<i>ii</i>	55	110	8533.9647	11714.665	0.000	$3d^7(^4F)5s$	e^5F_3	-	$3d^7(^4F)5p$	5G_4
1.58	<i>ii</i>	5	124	8527.6702	11723.312	-0.009	$3d^7(^4F)5s$	e^5F_3	-	$3d^7(^4F)5p$	5F_2
3.34	<i>iii</i>	13	149	8515.9011	11739.513	-0.001	$3d^7(^4F)5s$	e^5F_2	-	$3d^7(^4F)5p$	5G_3
1.71	<i>ii</i>	8	110	8506.7506	11752.141	-0.021	$3d^7(^4F)5s$	e^5F_1	-	$3d^7(^4F)5p$	5G_2
3.34	<i>iii</i>	12	159	8503.2123	11757.031	0.015	$3d^7(^4F)5p$	3F_4	-	$3d^7(^4F)6s$	3F_4
1.33	<i>ii</i>	5	79	8493.3005	11770.752	-0.012	$3d^7(^4P)5s$	5P_2	-	$3d^7(^4P)5p$	5D_3
3.33	<i>iii</i>	14	140	8411.6802	11884.965	0.002	$3d^7(^4F)5p$	3F_2	-	$3d^7(^4F)6s$	3F_3
1.30	<i>ii</i>	5	67	8397.2907	11905.331	0.014	$3d^7(^4P)5s$	5P_3	-	$3d^7(^4F)4f$	(3.5)[4.5] ₄
2.05	<i>ii</i>	19	109	8372.2476	11940.942	0.008	$3d^7(^4F)5s$	e^3F_3	-	$3d^7(^4F)5p$	3F_2
3.44	<i>iii</i>	23	110	8368.9580	11945.636	-0.008	$3d^7(^4F)5p$	3D_3	-	$3d^7(^4F)6s$	5F_4
1.81	<i>ii</i>	11	102	8351.4653	11970.657	-0.004	$3d^7(^4P)5s$	5P_3	-	$3d^7(^4P)5p$	5D_4
3.07	<i>iii</i>	7	145	8342.5881	11983.395	-0.002	$3d^7(^4P)5s$	5P_3	-	$3d^7(^4P)5p$	5D_3
2.90	<i>ii</i>	113	130	8341.7838	11984.550	-0.004	$3d^7(^4F)5s$	e^5F_5	-	$3d^7(^4F)5p$	5G_6
2.50	<i>ii</i>	65	90	8320.8248	12014.737	-0.001	$3d^7(^4F)5s$	e^3F_4	-	$3d^7(^4F)5p$	3D_3
3.40	<i>iii</i>	9	259	8296.4533	12050.031	-0.020	$3d^7(^4F)5p$	3D_2	-	$3d^7(^4F)6s$	3F_2
3.67	<i>iii</i>	28	154	8191.1727	12204.909	0.003	$3d^7(^4F)5p$	3F_3	-	$3d^7(^4F)6s$	3F_3
1.76	<i>ii</i>	4	239	8126.6150	12301.864	0.054	$3d^7(^4F)5s$	e^3F_3	-	$3d^7(^4F)5p$	3D_2
2.94	<i>iii</i>	7	105	8117.8155	12315.199	0.016	$3d^7(^4P)5s$	5P_2	-	$3d^7(^4F)4f$	(2.5)[3.5] ₃
2.18	<i>ii</i>	14	190	8091.5064	12355.241	-0.021	$3d^7(^4F)5s$	e^5F_4	-	$3d^7(^4F)5p$	5G_5
3.83	<i>iii</i>	49	127	8075.8257	12379.231	0.003	$3d^7(^4F)5p$	3F_4	-	$3d^7(^4F)6s$	5F_4
3.67	<i>iii</i>	24	176	8049.3133	12420.005	0.003	$3d^7(^4F)5p$	3G_3	-	$3d^7(^4F)6s$	3F_2
1.58	<i>ii</i>	9	76	8018.6309	12467.528	-0.019	$3d^7(^4F)5p$	3G_4	-	$3d^7(^4F)6s$	3F_3
4.17	<i>iii</i>	151	92	8013.4243	12475.629	-0.001	$3d^7(^4F)5p$	5G_6	-	$3d^7(^4F)6s$	5F_5
3.99	<i>iii</i>	86	106	7997.8385	12499.940	-0.001	$3d^7(^4F)5p$	5G_5	-	$3d^7(^4F)6s$	5F_4
3.97	<i>iii</i>	68	127	7944.8810	12583.260	-0.005	$3d^7(^4F)5p$	3G_5	-	$3d^7(^4F)6s$	3F_4
3.09	<i>iii</i>	8	135	7910.9518	12637.228	-0.034	$3d^7(^4F)5p$	5F_2	-	$3d^7(^4F)6s$	5F_3
3.94	<i>iii</i>	63	129	7905.5264	12645.900	-0.018	$3d^7(^4F)5p$	5G_4	-	$3d^7(^4F)6s$	5F_3
3.83	<i>iii</i>	47	132	7879.7658	12687.242	0.000	$3d^7(^4F)5p$	5G_3	-	$3d^7(^4F)6s$	5F_2
3.70	<i>iii</i>	20	234	7865.7111	12709.912	0.000	$3d^7(^4F)5p$	5G_2	-	$3d^7(^4F)6s$	5F_1
3.81	<i>iii</i>	53	113	7784.0328	12843.277	-0.003	$3d^7(^4F)5p$	5F_4	-	$3d^7(^4F)6s$	3F_4
3.18	<i>iii</i>	5	254	7768.3259	12869.245	-0.057	$3d^7(^4F)5p$	5F_1	-	$3d^7(^4F)6s$	5F_2
4.21	<i>iii</i>	103	148	7679.3689	13018.320	0.002	$3d^7(^4F)5p$	5F_5	-	$3d^7(^4F)6s$	5F_5
3.87	<i>iii</i>	54	128	7671.2347	13032.124	-0.001	$3d^7(^4F)5p$	5F_3	-	$3d^7(^4F)6s$	5F_3
3.90	<i>iii</i>	15	476	7662.3452	13047.243	0.036	$3d^7(^4F)5p$	5D_3	-	$3d^7(a^2D)5s$	1D_2
3.77	<i>iii</i>	29	190	7612.9311	13131.930	-0.030	$3d^7(^4F)5p$	5F_2	-	$3d^7(^4F)6s$	5F_2
3.69	<i>iii</i>	25	178	7610.2892	13136.489	-0.006	$3d^7(^4F)5p$	5D_3	-	$3d^7(^4F)6s$	3F_4
3.51	<i>iii</i>	14	214	7582.5144	13184.608	0.000	$3d^7(^4F)5p$	5F_1	-	$3d^7(^4F)6s$	5F_1
3.83	<i>iii</i>	24	258	7504.0878	13322.402	0.015	$3d^7(^4F)5p$	5D_2	-	$3d^7(^4F)6s$	5F_3
4.16	<i>iii</i>	58	236	7439.4107	13438.224	0.014	$3d^7(^4F)5p$	5D_4	-	$3d^7(^4F)6s$	5F_5

TABLE 2—Continued

Intensity (1)		SNR (2)	Width (mK) (3)	λ_{air} (Å) (4)	σ (cm ⁻¹) (5)	$O - C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
3.49	iii.....	13	208	7424.3565	13465.472	-0.020	$3d^7(^4F)5p$	5F_4	—	$3d^7(^4F)6s$ 5F_4
3.70	iii.....	15	313	7266.1126	13758.726	0.019	$3d^7(^4F)5p$	5D_3	—	$3d^7(^4F)6s$ 5F_4
3.47	iii.....	5	474	7157.8606	13966.805	0.044	$3d^7(^4F)5p$	5D_2	—	$3d^7(^4F)6s$ 3F_3
3.24	iii.....	13	125	6997.3162	14287.253	0.017	$3d^7(^4F)5p$	3F_4	—	$3d^7(^4F)5d$ 3G_5
3.27	iii.....	7	229	6833.3774	14630.015	-0.048	$3d^7(^4F)5p$	3F_2	—	$3d^7(^4F)5d$ 5G_2
3.30	iii.....	7	240	6696.3086	14929.479	0.051	$3d^7(^4F)5p$	3D_3	—	$3d^7(^4F)5d$ 3D_3
3.50	iii.....	22	132	6681.6931	14962.135	-0.015	$3d^7(^4F)5p$	3F_4	—	$3d^7(^4F)5d$ 5G_5
3.32	iii.....	16	122	6675.7835	14975.380	0.000	$3d^7(^4F)5p$	3G_3	—	$3d^7(a^2D)4d$ 3F_4
3.28	iii.....	10	179	6666.4062	14996.445	0.010	$3d^7(^4F)5p$	3G_3	—	$3d^7(^2H)4d$ 3G_4
3.30	iii.....	7	256	6658.1189	15015.111	0.009	$3d^7(^4F)5p$	5G_6	—	$3d^7(^4F)5d$ 5F_5
3.59	iii.....	18	199	6628.2166	15082.849	-0.014	$3d^7(^4F)5p$	5G_5	—	$3d^7(^4F)5d$ 5G_5
3.86	iii.....	57	117	6621.6294	15097.854	0.000	$3d^7(^4F)5p$	3G_4	—	$3d^7(^4F)5d$ 3H_5
3.69	iii.....	34	134	6614.7813	15113.484	-0.001	$3d^7(^4F)5p$	3G_5	—	$3d^7(^4F)5d$ 3G_5
3.67	iii.....	29	236	6602.2249	15142.227	-0.011	$3d^7(^4F)5p$	5G_6	—	$3d^7(^4F)5d$ 5G_6
4.06	iii.....	115	93	6576.2242	15202.095	0.000	$3d^7(^4F)5p$	3G_5	—	$3d^7(^4F)5d$ 3H_6
4.06	iii.....	70	150	6571.3053	15213.474	-0.002	$3d^7(^4F)5p$	5G_5	—	$3d^7(^4F)5d$ 5H_6
2.12	ii.....	16	153	6547.6035	15268.546	0.070	$3d^7(^4F)5p$	5G_5	—	$3d^7(^4F)5d$ 5H_5
3.19	iii.....	8	162	6542.7371	15279.902	-0.001	$3d^7(^4F)5p$	5G_3	—	$3d^7(^4F)5d$ 5G_3
2.61	ii.....	51	148	6538.7208	15289.287	0.018	$3d^7(^4F)5p$	5G_2	—	$3d^7(^4F)5d$ 5G_2
4.19	iii.....	99	146	6538.7097	15289.313	0.000	$3d^7(^4F)5p$	5G_6	—	$3d^7(^4F)5d$ 5H_7
3.93	iii.....	81	99	6522.1068	15328.234	-0.062	$3d^7(^4F)5p$	5G_4	—	$3d^7(^4F)5d$ 5H_5
3.66	iii.....	40	105	6502.9029	15373.500	0.000	$3d^7(^4F)5p$	5F_4	—	$3d^7(^4F)5d$ 3G_5
3.21	iii.....	10	142	6466.6106	15459.779	0.022	$3d^7(^4F)5p$	5F_4	—	111436 ^e
3.95	iii.....	71	115	6425.8719	15557.790	0.000	$3d^7(^4F)5p$	5F_5	—	$3d^7(^4F)5d$ 3F_5
3.95	iii.....	82	102	6373.7860	15684.926	0.000	$3d^7(^4F)5p$	5F_5	—	$3d^7(^4F)5d$ 5G_6
1.94	ii.....	20	79	6371.7917	15689.835	0.008	$3d^7(^4F)5p$	5F_5	—	$3d^7(^4F)5d$ 5F_4
3.42	iii.....	12	200	6357.7119	15724.582	-0.039	$3d^7(^4F)5p$	5F_2	—	$3d^7(^4F)5d$ 5G_3
2.21	ii.....	13	228	6257.0023	15977.675	-0.007	$3d^7(^4F)5p$	5D_4	—	$3d^7(^4F)5d$ 5F_5
3.68	iii.....	34	132	6229.4279	16048.399	-0.016	$3d^7(^4F)5p$	5F_4	—	$3d^7(^4F)5d$ 5G_5
3.89	iii.....	27	259	6205.7243	16109.697	-0.021	$3d^7(^4F)5p$	5D_4	—	$3d^7(^4F)5d$ 5F_4
2.61	ii.....	68	113	6158.1952	16234.031	0.004	$3d^7(^4F)5p$	5F_4	—	$3d^7(^4F)5d$ 5H_5

NOTES.—Col. (1): Intensity in arbitrary units given as $\log_{10}$ (intensity), where the intensity scales of the three spectra i, ii, and iii (see § 2) are different. Col. (2): Observed signal-to-noise ratio of the transition. Col. (3): Guide to the line pattern width in mK (1 mK = 0.001 cm⁻¹). Col. (4): Wavelength in air. Col. (5): Center-of-gravity vacuum wavenumber of the transition. Col. (6): Difference between the observed wavenumber and the wavenumber calculated from the energy levels given in this work. Col. (7): Levels involved in the transition. Col. (8): Blends and doubly identified lines, where D designates a doubly identified line; DI is a line doubly identified with a Co I line; Ne indicates a line blended with neon; U is a line blended with an unknown feature; B is a blend with another Co II line; and M marks a line that is masked by another much stronger transition.

TABLE 3
NEWLY IDENTIFIED CO I TRANSITIONS

Intensity (1)	SNR (2)	Width (mK) (3)	λ_{air} (Å) (4)	σ (cm ⁻¹) (5)	$O - C$ (cm ⁻¹) (6)	Lower Level	(7)	Upper Level	Blend (8)
1.22.....	5	220	2971.3611	33644.788	0.000	$3d^8(^3P)4s$	$b^4P_{5/2}$	—	$3d^7(^2P)4s4p(^3P)$ $^2D_{5/2}$ II P
2.24.....	75	317	2774.9641	36025.868	-0.100	$3d^8(^3F)4s$	$b^4F_{3/2}$	—	$3d^7(^4F)4s4p(^1P)$ $x^4D_{1/2}$ D II
1.52.....	7	400	2512.4413	39789.944	0.000	$3d^8(^3F)4s$	$b^4F_{5/2}$	—	$3d^7(^2P)4s4p(^3P)$ $^4P_{5/2}$ II P
1.98.....	32	377	2476.4485	40368.213	0.195	$3d^8(^3F)4s$	$a^2F_{5/2}$	—	$3d^7(^2P)4s4p(^3P)$ $^2D_{5/2}$ D II
3.01.....	1248	298	2389.5401	41836.307	0.256	$3d^74s^2$	$a^4F_{5/2}$	—	$3d^7(^4P)4s4p(^3P)$ $w^4D_{5/2}$ D II
3.17.....	1160	339	2371.8419	42148.456	0.157	$3d^74s^2$	$a^4F_{5/2}$	—	$3d^8(^1D)4p$ $x^2F_{7/2}$ D II
3.69.....	804	724	2339.0582	42739.150	0.000	$3d^74s^2$	$a^4F_{7/2}$	—	$3d^8(^1D)4p$ $x^2F_{7/2}$ II P
2.71.....	241	513	2329.1058	42921.762	-0.207	$3d^8(^3F)4s$	$b^4F_{5/2}$	—	$3d^7(^2P)4s4p(^3P)$ $u^4D_{3/2}$ D II
1.69.....	48	230	2252.7203	44377.023	0.000	$3d^74s^2$	$a^5F_{3/2}$	—	$3d^8(^3P)4p$ $^2D_{3/2}$ II P
1.39.....	23	280	2251.8405	44394.360	0.000	$3d^74s^2$	$a^4F_{9/2}$	—	$3d^7(^2G)4s4p(^3P)$ $w^4G_{7/2}$ II P
2.33.....	232	237	2250.4913	44420.974	0.225	$3d^8(^3F)4s$	$a^2F_{7/2}$	—	$3d^8(^3F)5p$ $^2D_{5/2}$ D II

NOTES.—Newly identified Co I lines that were not given in Pickering & Thorne 1996 as they were blended or doubly identified with Co II transitions. Col. (1): Intensity in arbitrary units given as $\log_{10}$ (intensity). Col. (2): Observed signal-to-noise ratio of the transition. Col. (3): Guide to the line pattern width in mK (1 mK = 0.001 cm⁻¹). Col. (4): Wavelength in air. Col. (5): Center-of-gravity vacuum wavenumber of the transition. Col. (6): Difference between the observed wavenumber and the wavenumber calculated from the energy levels given in Pickering & Thorne 1996. Col. (7): Levels involved in the transition. Col. (8): Blends and doubly identified lines where: D II designates a line doubly identified with Co II and II P is a line blended with Co II where the calculated wavenumber is given because it was not possible to determine the observed wavenumber because of blending.

TABLE 4
Co II EVEN ENERGY LEVELS

Assigned Configuration	Term	<i>J</i>	Energy (cm ⁻¹)	Error (cm ⁻¹)	Eigenvector Components (%)					
3d ⁸	<i>a</i> ³ <i>F</i>	4	0.000	0.001	100					
		3	950.324	0.002	100					
		2	1597.197	0.002	99					
3d ⁷ (⁴ <i>F</i>)4s	<i>a</i> ⁵ <i>F</i>	5	3350.494	0.001	100					
		4	4028.988	0.001	100					
		3	4560.789	0.001	100					
		2	4950.062	0.001	100					
		1	5204.698	0.001	100					
3d ⁷ (⁴ <i>F</i>)4s	<i>b</i> ³ <i>F</i>	4	9812.859	0.001	99					
		3	10708.330	0.001	100					
		2	11321.859	0.001	98					
3d ⁸	<i>a</i> ¹ <i>D</i>	2	11651.276	0.001	74	23	³ <i>P</i>	2	(⁴ <i>F</i>)4s ³ <i>F</i>	
3d ⁸	<i>a</i> ³ <i>P</i>	2	13260.687	0.002	75	24	¹ <i>D</i> 2			
		1	13404.320	0.001	99					
		0	13593.287	0.003	99					
3d ⁷ (⁴ <i>P</i>)4s	<i>a</i> ⁵ <i>P</i>	3	17771.506	0.001	100					
		2	18031.426	0.001	98	2	(² <i>P</i>) ³ <i>P</i>			
		1	18338.639	0.002	99					
3d ⁸	<i>a</i> ¹ <i>G</i>	4	* 18973.726	0.001	98	2	(² <i>G</i>) ¹ <i>G</i>			
3d ⁷ (² <i>G</i>)4s	<i>a</i> ³ <i>G</i>	5	21624.527	0.001	98					
		4	22009.343	0.001	97					
		3	22414.429	0.001	100					
3d ⁷ (⁴ <i>P</i>)4s	<i>b</i> ³ <i>P</i>	2	24074.418	0.001	81	16	(² <i>P</i>) ³ <i>P</i>			
		1	24267.380	0.001	77	16	(² <i>P</i>) ³ <i>P</i>	6	(² <i>P</i>) ¹ <i>P</i>	
		0	24411.477	0.001	69	31	(² <i>P</i>) ³ <i>P</i>			
3d ⁷ (² <i>P</i>)4s	<i>c</i> ³ <i>P</i>	2	24886.398	0.001	75	18	(⁴ <i>P</i>) ³ <i>P</i>	3	(² <i>D</i> 3) ³ <i>D</i>	2
		1	25317.515	0.001	76	18	(⁴ <i>P</i>) ³ <i>P</i>	3	(² <i>D</i> 3) ³ <i>D</i>	
		0	25861.320	0.002	68	32	(⁴ <i>P</i>) ³ <i>P</i>			
3d ⁷ (² <i>G</i>)4s	<i>b</i> ¹ <i>G</i>	4	25147.231	0.001	92	4	(² <i>H</i>) ³ <i>H</i>	2	(² <i>G</i>) ³ <i>G</i>	
3d ⁷ (² <i>H</i>)4s	<i>a</i> ³ <i>H</i>	6	27105.742	0.002	100					
		5	27468.986	0.001	98					
		4	27902.159	0.002	95	5	(² <i>G</i>) ¹ <i>G</i>			
3d ⁷ (<i>a</i> ² <i>D</i>)4s	<i>a</i> ³ <i>D</i>	3	27484.371	0.002	77	23	(² <i>D</i> 1) ³ <i>D</i>			
		2	28111.870	0.002	71	20	(² <i>D</i> 1) ³ <i>D</i>	5	(² <i>P</i>) ³ <i>P</i>	2
		1	29268.775	0.002	41	45	(² <i>P</i>) ¹ <i>P</i>	11	(² <i>D</i> 1) ³ <i>D</i>	3
3d ⁷ (² <i>P</i>)4s	<i>a</i> ¹ <i>P</i>	1	27585.136	0.001	48	34	(² <i>D</i> 3) ³ <i>D</i>	9	(² <i>D</i> 1) ³ <i>D</i>	5
3d ⁷ (² <i>H</i>)4s	<i>a</i> ¹ <i>H</i>	5	30567.171	0.001	98					
3d ⁷ (<i>a</i> ² <i>D</i>)4s	<i>b</i> ¹ <i>D</i>	2	31199.410	0.002	74	21	(² <i>D</i> 1) ¹ <i>D</i>	2	(² <i>D</i> 3) ³ <i>D</i>	2
3d ⁶ 4s ²	<i>a</i> ⁵ <i>D</i>	4	40695.025	0.008	100					
		3	41314.147	0.010	100					
		2	41738.148	0.030	100					
3d ⁷ (² <i>F</i>)4s	<i>c</i> ³ <i>F</i>	2	40771.110 + x	0.013	100					
		3	40879.599 + x	0.006	99					
		4	41047.331 + x	0.018	100					
3d ⁷ (⁴ <i>F</i>)5s	<i>e</i> ⁵ <i>F</i>	5	84014.175	0.002	100					
		4	84586.862	0.002	86	14	(⁴ <i>F</i>) ³ <i>F</i>			
		3	85167.639	0.002	93	7	(⁴ <i>F</i>) ³ <i>F</i>			
		2	85596.164	0.002	97	2	(⁴ <i>F</i>) ³ <i>F</i>			
		1	85876.265	0.004	100					
3d ⁷ (⁴ <i>F</i>)5s	<i>e</i> ³ <i>F</i>	4	85481.683	0.002	86	14	(⁴ <i>F</i>) ⁵ <i>F</i>			
		3	86346.699	0.002	93	7	(⁴ <i>F</i>) ⁵ <i>F</i>			
		2	86940.144	0.003	97	2	(⁴ <i>F</i>) ⁵ <i>F</i>			
3d ⁷ (⁴ <i>F</i>)4d	<i>f</i> ⁵ <i>F</i>	5	89931.460	0.002	86	13	(⁴ <i>F</i>) ⁵ <i>G</i>			
		4	90199.157	0.001	69	21	(⁴ <i>F</i>) ⁵ <i>D</i>	9	(⁴ <i>F</i>) ⁵ <i>G</i>	
		3	90753.260	0.002	45	36	(⁴ <i>F</i>) ⁵ <i>P</i>	9	(⁴ <i>F</i>) ³ <i>D</i>	7
		2	90967.584	0.003	57	22	(⁴ <i>F</i>) ⁵ <i>D</i>	11	(⁴ <i>F</i>) ³ <i>P</i>	4
		1	91358.986	0.004	85	10	(⁴ <i>F</i>) ⁵ <i>D</i>	3	(⁴ <i>F</i>) ³ <i>D</i>	
3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ⁵ <i>G</i>	6	90302.770	0.001	93	7	(⁴ <i>F</i>) ⁵ <i>H</i>			
		5	90697.458	0.001	49	34	(⁴ <i>F</i>) ³ <i>G</i>	8	(⁴ <i>F</i>) ⁵ <i>H</i>	7
		4	91352.874	0.001	27	26	(⁴ <i>F</i>) ⁵ <i>D</i>	25	(⁴ <i>F</i>) ⁵ <i>F</i>	15
		3	91667.332	0.002	50	20	(⁴ <i>F</i>) ³ <i>D</i>	12	(⁴ <i>F</i>) ³ <i>F</i>	6
		2	91928.983	0.003	72	13	(⁴ <i>F</i>) ³ <i>D</i>	7	(⁴ <i>F</i>) ⁵ <i>P</i>	6
3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ⁵ <i>P</i>	3	90464.583	0.003	50	24	(⁴ <i>F</i>) ⁵ <i>D</i>	23	(⁴ <i>F</i>) ⁵ <i>F</i>	2
		2	91424.767	0.002	62	23	(⁴ <i>F</i>) ⁵ <i>F</i>	9	(⁴ <i>F</i>) ⁵ <i>D</i>	4
		1	91932.078	0.004	59			31	(⁴ <i>F</i>) ⁵ <i>D</i>	9
3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ⁵ <i>H</i>	7	90667.888	0.002	100					
		6	90975.534	0.001	50	47	(⁴ <i>F</i>) ³ <i>H</i>	3	(⁴ <i>F</i>) ⁵ <i>G</i>	
		5	91646.441	0.002	74	16	(⁴ <i>F</i>) ³ <i>H</i>	5	(⁴ <i>F</i>) ³ <i>G</i>	5
		4	92120.634	0.002	83	7	(⁴ <i>F</i>) ³ <i>G</i>	4	(⁴ <i>F</i>) ³ <i>H</i>	4
		3	92405.993	0.002	70	17	(⁴ <i>F</i>) ³ <i>G</i>	12	(⁴ <i>F</i>) ⁵ <i>G</i>	

TABLE 4—Continued

Assigned Configuration	Term	J		Energy (cm ⁻¹)	Error (cm ⁻¹)	Eigenvector Components (%)						
$3d^7(^4F)4d$	e^5D	4	r	91049.425	0.001	52	36	(⁴ F) ⁵ G	6	(⁴ F) ³ G	3	(⁴ F) ⁵ H
		3		91958.363	0.002	57	12	(⁴ F) ⁵ F	11	(⁴ F) ³ D	10	(⁴ F) ⁵ P
		0	*	92285.504	0.004	99						
		2		92317.362	0.002	57	20	(⁴ F) ³ D	14	(⁴ F) ⁵ P	3	(⁴ F) ³ P
$3d^7(^4F)4d$	e^3G	1	*	92403.194	0.004	50	37	(⁴ F) ⁵ P	7	(⁴ F) ³ D	5	(⁴ F) ⁵ F
		5		91326.926	0.001	56	31	(⁴ F) ⁵ G	7	(⁴ F) ³ H	6	(⁴ F) ⁵ F
		4		91918.194	0.001	63	23	(⁴ F) ⁵ G	6	(⁴ F) ³ H	4	(⁴ F) ³ F
		3		92519.973	0.002	72	23	(⁴ F) ³ H	2	(⁴ F) ³ F		
$3d^7(^4F)4d$	e^3D	3		91408.488	0.001	56	21	(⁴ F) ⁵ G	14	(⁴ F) ⁵ D	7	(⁴ F) ⁵ F
		2		92044.907	0.002	52	18	(⁴ F) ⁵ G	15	(⁴ F) ⁵ F	5	(⁴ F) ⁵ D
		1		92639.840	0.003	87	9	(⁴ F) ⁵ D	2	(⁴ F) ³ P		
		6		91623.449	0.001	52	44	(⁴ F) ³ H	4	(⁴ F) ⁵ G		
$3d^7(^4F)4d$	e^3H	5	*	92359.174	0.002	74	18	(⁴ F) ⁵ H	5	(⁴ F) ³ G	3	(⁴ F) ⁵ G
		4	*	92889.411	0.002	88	7	(⁴ F) ³ H	3	(⁴ F) ³ G		
		2		93678.416	0.002	87	8	(⁴ F) ³ D	2	(⁴ F) ⁵ P		
		1		94405.527	0.003	93	3	(⁴ F) ³ D	2	(⁴ P) ³ P		
$3d^7(^4F)4d$	f^3F	0	*	94720.910	0.007	96	2	(⁴ P) ³ P				
		4		93738.782	0.001	89	6	(⁴ F) ³ G				
		3		94368.579	0.002	89	3	(⁴ F) ³ G	3	(⁴ F) ³ D		
		2		94743.692	0.003	92	3	(⁴ F) ³ D	2	(² G) ³ F		
$3d^7(^4P)5s$	5P	3	r	99022.521	0.002	100						
		2	r	99235.154	0.003	96	3	(² P) ³ P				
		1	r	99552.553	0.004	96	2	(² P) ³ P	2	(⁴ P) ³ P		
		2	*	100331.384	0.003	98						
$3d^7(^4P)5s$	3P	1	*	100596.379	0.004	93	4	(² P) ¹ P	3	(⁴ P) ⁵ P		
		0	*	100886.780	0.026	97	2	(² P) ³ P				
		5		101233.598	0.003	98						
		4		101451.067	0.002	76	22	(² G) ¹ G	2	(² H) ³ H		
$3d^7(^2G)5s$	e^1G	3		102020.357	0.003	100						
		4	*	102371.603	0.003	76	23	(² G) ³ G				
		2	*	104412.624	0.004	89	4	(² D3) ³ D	3	(⁴ P) ⁵ P	2	(² D3) ¹ D
		1	*	104678.453	0.013	65	23	(² P) ¹ P	6	(² D3) ³ D	3	(⁴ P) ³ P
$3d^7(^4P)4d$	5P	1	*	104587.184	0.008	99						
		2	*	104676.616	0.008	98						
		3	*	104835.767	0.020	96	2	(² P) ³ D	2	(⁴ P) ⁵ D		
		5	*	105308.128	0.003	99						
$3d^7(^4P)4d$	5F	4	*	105395.111	0.002	95						
		3	*	105504.373	0.003	92	3	(⁴ P) ⁵ D	2	(⁴ P) ³ F	2	(² P) ³ F
		2	*	105625.146	0.005	92	4	(⁴ P) ⁵ D	2	(² P) ³ D		
		1	*	105739.753	0.005	93	3	(⁴ P) ⁵ D	3	(² P) ³ D		
$3d^7(^2P)5s$	1P	1	*	105430.425	0.006	66	30	(² P) ³ P	2	(² D3) ³ D		
$3d^64s^2$	1G	4	*	105591.103	0.003	66	33	(¹ G) ¹ G				
$3d^7(^4P)4d$	3F	4	*	106221.871	0.002	73	20	(⁴ P) ⁵ D	5	(² G) ³ F		
		3	*	106316.337	0.003	71	17	(⁴ P) ⁵ D	3	(² G) ³ F	2	(² P) ¹ F
		2	*	106502.113	0.022	42	46	(⁴ P) ⁵ D	3	(⁴ P) ³ D		
		4	*	106428.857	0.002	76	17	(⁴ P) ³ F	2	(² P) ³ F	2	(⁴ P) ⁵ F
$3d^7(^4P)4d$	5D	0	*	106454.189	0.023	84	8	(⁴ P) ³ P	7	(² P) ³ P		
		1	*	106516.634	0.004	84	6	(⁴ P) ³ P	5	(² P) ³ P	3	(⁴ P) ⁵ F
		3	*	106586.226	0.004	74	12	(⁴ P) ³ F	5	(⁴ P) ³ D	4	(⁴ P) ³ F
		2	*	106647.179	0.005	47	37	(⁴ P) ³ F	5	(⁴ P) ⁵ F	4	(⁴ P) ³ D
$3d^7(^2H)5s$	3H	6	*	106905.097	0.003	100						
		5	*	107116.002	0.003	79	20	(² H) ¹ H				
		4	*	107624.633	0.003	97						
		0	*	106914.981	0.004	81	12	(⁴ P) ⁵ D	3	(² P) ³ P		
$3d^7(^4P)4d$	3P	2	*	106918.217	0.003	52	30	(⁴ P) ³ D	6	(⁴ P) ³ F	4	(² G) ³ D
		3	*	106939.000	0.004	47	42	(² G) ³ D	3	(⁴ P) ³ F	2	(⁴ P) ⁵ D
		1	*	107224.629	0.004	77	13	(⁴ P) ³ P	4	(² P) ¹ P		
		2	*	107409.469	0.004	31	29	(⁴ P) ³ P	23	(² G) ³ D	3	(² D3)5s ³ D
$3d^7(a^2D)5s$	3D	3	*	107154.870	0.010	51	22	(² G)4d ³ D	16	(² D1) ³ D	10	(⁴ P)4d ³ D
		2	*	107535.605	0.008	37	22	(² G)4d ³ D	20	(² D3) ¹ D	11	(² D1) ³ D
		3	*	107451.180	0.002	31	33	(² G) ³ D	25	(² D3)5s ³ D	8	(² D1)5s ³ D
		2	*	107713.731	0.005	40	30	(⁴ P) ³ D	6	(² D3)5s ³ D	6	(² D3)5s ¹ D
$3d^7(^2G)4d$	3I	6	*	107473.334	0.002	66	27	(² G) ¹ I	4	(² G) ³ H	2	(² H) ³ K
		5	*	108217.119	0.001	72	16	(² G) ³ H	8	(² G) ¹ H	3	(² H) ¹ H
		5	*	107543.557	0.002	91	7	(² G) ³ H				
		4	*	107790.214	0.002	84	6	(² G) ³ H	6	(² G) ¹ G		
$3d^7(^2G)4d$	3H	3	*	108268.079	0.004	89	11	(² G) ¹ F				
		5	*	107646.443	0.002	35	35	(² G) ¹ H	19	(² G) ³ I	4	(² H)5s ¹ H
		6	*	107703.314	0.004	85	13	(² G) ¹ I				
		4	*	108388.815	0.001	57	31	(² G) ³ F	3	(⁴ F)5d ³ F	2	(² G) ³ G
$3d^7(^2G)4d$	1F	3	*	107671.849	0.002	80	9	(² G) ³ G	4	(² G) ³ F	2	(⁴ P) ³ F
$3d^7(^2H)5s$	1H	5	*	108021.193	0.002	70	18	(² H) ³ H	8	(² G)4d ³ I	2	(² G)4d ³ H
$3d^7(^2G)4d$	1I	6	*	108347.485	0.015	58	32	(² G) ³ I	9	(² G) ³ H		

TABLE 4—Continued

Assigned Configuration	Term	J	Energy (cm ⁻¹)	Error (cm ⁻¹)	Eigenvector Components (%)							
$3d^7(^4H)6s$	5F	5	108474.359	0.003	100							
		4	109442.065	0.003	55	44	$(^4F)^3F$					
		3	109528.222	0.005	74	26	$(^4F)^3F$					
		2	110022.920	0.005	91	9	$(^4F)^3F$					
		1	110338.339	0.015	100							
$3d^7(^2G)4d$	3F	4	108475.113	0.002	46	35	$(^2G)^3H$	6	$(^2G)^3G$	4	$(^4F)5d^3F$	
		3	108830.059	0.001	78	5	$(^4F)5d^3F$	4	$(^2G)^1F$	2	$(^2P)^3F$	
		2	109242.443	0.003	51	29	$(^2G)^1D$	6	$(^2P)^1D$	4	$(^4F)5d^3F$	
$3d^7(a^2D)5s$	3D	1	108500.855	0.015	70	19	$(^2D1)^3D$	7	$(^2P)^1P$	2	$(^2P)^3P$	
$3d^7(^2G)4d$	1H	5	108600.166	0.002	55	40	$(^2G)^3H$	3	$(^2G)^3G$			
$3d^7(a^2D)5s$	1D	2	108730.565	0.004	45	25	$(^2D3)^3D$	13	$(^2D1)^1D$	6	$(^2D1)^3D$	
$3d^7(^4H)6s$	3F	4	108819.853	0.003	54	44	$(^4F)^5F$					
		3	110172.596	0.004	73	26	$(^4F)^5F$					
		2	110698.560	0.013	90	9	$(^4F)^5F$					
$3d^7(^2G)4d$	1D	2	108912.592	0.002	40	32	$(^2G)^3F$	8	$(^2P)^1D$	8	$(^2G)^3D$	
$3d^7(^2G)4d$	1G	4	109312.076	0.002	81	7	$(^2G)^3G$	7	$(^2H)^1G$			
$3d^7(^2P)4d$	3D	1	110443.229	0.005	78	8	$(^2D3)^3D$	4	$(^2P)^1P$	3	$(^2D1)^3D$	
		2	110523.368	0.002	79	3	$(^2D3)^3D$	3	$(^2P)^3F$	2	$(^2D3)^3F$	
		3	110576.475	0.030	82	7	$(^2P)^3F$	2	$(^2D3)^1F$	2	$(^2D3)^3F$	
$3d^7(^2P)4d$	3F	4	110725.400	0.020	67	20	$(^4F)5d^3F$	2	$(^2D3)^3F$	2	$(^2D3)^3G$	
		2	111493.631	0.002	44	17	$(^2F)^3P$	10	$(^4F)5d^3P$	6	$(^4F)5d^3F$	
		3	111541.357	0.010	39	22	$(^2P)^1F$	10	$(^4F)5d^3D$	9	$(^4F)5d^5F$	
$3d^7(^2P)4d$	3P	1	110859.429	0.004	60	17	$(^2P)^1P$	9	$(^2D3)^3P$	3	$(^2D1)^3P$	
		0	110863.522	0.007	72	13	$(^2D3)^3P$	5	$(^4P)^3P$	4	$(^2D1)^3P$	
		2	111332.466	0.003	37	32	$(^2P)^3F$	12	$(^4F)5d^3P$	3	$(^2D3)^3D$	
$3d^7(^2P)4d$	1F	3	110884.491	0.003	37	30	$(^2P)^3F$	8	$(^4F)5d^3F$	4	$(^2P)^3D$	
$3d^7(^4F)5d$	5F	5	111013.831	0.004	81	18	$(^4F)^5G$					
		4	111145.868	0.010	54	21	$(^4F)^5D$	11	$(^4F)^5G$	5	$(^4F)^3F$	
$3d^7(^4F)5d$	5G	6	111140.967	0.003	89	10	$(^4F)^5H$					
		5	112024.987	0.010	49	24	$(^4F)^3G$	14	$(^4F)^5F$	8	$(^4F)^3H$	
		3	112615.581	0.006	48	10	$(^4F)^3D$	10	$(^4F)^5H$	8	$(^4F)^3F$	
		2	112917.696	0.008	58	13	$(^4F)^5D$	13	$(^4F)^3P$	5	$(^4F)^3D$	
$3d^7(^4F)5d$	5H	7	111288.042	0.004	100							
		6	112155.600	0.015	67	24	$(^4F)^3H$	9	$(^4F)^5G$			
		5	112210.600	0.040	49	38	$(^4F)^3H$	9	$(^4F)^3G$	4	$(^4F)^5G$	
$3d^7(^4F)5d$	3G	5	111350.073	0.003	62	21	$(^4F)^5G$	6	$(^4F)^5H$	6	$(^4F)^3H$	
111436 ^e		3	111436.330	0.010		23	$(^2P)4d^1F$	21	$(^4F)5d^3D$	18	$(^4F)5d^3F$	
$3d^7(^4F)5d$	3H	6	111438.683	0.003	75	23	$(^4F)^5H$	2	$(^4F)^5G$			
		5	112802.903	0.010	47	38	$(^4F)^5H$	8	$(^4F)^5G$	4	$(^4F)^3G$	
$3d^7(^2P)4d$	1P	1	111707.185	0.007	66	15	$(^2P)^3P$	9	$(^2P)^3D$	4	$(^4F)5d^3P$	
$3d^7(^2P)4d$	1D	2	112350.461	0.003	19	36	$(^4F)5d^5F$	7	$(^4F)5d^3P$	6	$(^4F)5d^5P$	
$3d^7(^4F)5d$	3D	2	112425.849	0.004	25	18	$(^4F)^3P$	15	$(^2P)4d^1D$	13	$(^4F)^5P$	
$3d^7(^2H)4d$	3K	7	112820.091	0.002	60	40	$(^2H)^1K$					
		6	113434.865	0.003	95	2	$(^2H)^3I$					
$3d^7(^2H)4d$	1F	3	112966.974	0.006	62	14	$(^4F)5d^3G$	7	$(^4F)5d^5G$	4	$(^2H)^3G$	
$3d^7(^2H)4d$	3G	5	112993.873	0.002	96							
		4	113274.993	0.003	86	5	$(^4F)5d^3H$	2	$(^4F)5d^3G$			
		3	113724.564	0.003	91	3	$(^2H)^1F$					
113191 ^e		3	113191.678	0.006		48	$(^4F)5d^3G$	28	$(^4F)5d^5H$	11	$(^2H)4d^1F$	
$3d^7(a^2D)4d$	3F	4	113253.938	0.004	48	20	$(^2H)^3F$	15	$(^2D1)^3F$	5	$(^2D3)^3G$	
		3	113355.625	0.010	27	29	$(^2D3)^3D$	9	$(^2H)^3F$	9	$(^2D1)^3D$	
		2	113821.503	0.005	41	19	$(^2H)^3F$	12	$(^2D1)^3F$	12	$(^2D3)^3D$	
$3d^7(^4F)5d$	3P	1	113431.118	0.006	38	35	$(^4F)^3D$	9	$(^2D3)4d^3P$	5	$(^4F)^5P$	
$3d^7(a^2D)4d$	3D	3	113523.210	0.005	39	15	$(^2D3)^1F$	12	$(^2D1)^3D$	9	$(^2D3)^3F$	
		2	114260.787	0.003	40	12	$(^2D1)^3D$	9	$(^2D3)^3F$	7	$(^2P)^3P$	
		1	114854.327	0.012	35	34	$(^2D3)^1P$	9	$(^2D1)^1P$	8	$(^2D1)^3D$	
$3d^7(^2H)4d$	3I	7	113707.628	0.002	79	12	$(^2H)^1K$	9	$(^2H)^3K$			
		6	113803.540	0.001	48	45	$(^2H)^3H$	4	$(^2H)^1I$	2	$(^2H)^3K$	
		5	114376.714	0.002	89	7	$(^2H)^1H$	2	$(^2H)^3H$			
$3d^7(a^2D)4d$	3G	4	113828.999	0.007	38	36	$(^2D3)^1G$	11	$(^2D1)^3G$	11	$(^2D1)^1G$	
		3	114926.971	0.010	57	15	$(^2D1)^3G$	11	$(^2D3)^1F$	7	$(^2P)^1F$	
$3d^7(a^2D)4d$	1P	1	113857.832	0.004	34	21	$(^2D3)^3D$	19	$(^2D3)^3S$	10	$(^2D1)^1P$	
$3d^7(^2H)4d$	1H	5	113864.584	0.002	54	38	$(^2H)^3H$	8	$(^2H)^3I$			
$3d^7(^2H)4d$	3H	6	113945.277	0.001	53	33	$(^2H)^3I$	13	$(^2H)^1I$			
		4	114528.943	0.002	96	2	$(^2H)^3G$					
		5	114559.100	0.002	59	38	$(^2H)^1H$					
$3d^7(a^2D)4d$	3S	1	114251.929	0.004	44	13	$(^4F)5d^3P$	12	$(^2D1)^3S$	11	$(^2D3)^3D$	
$3d^7(a^2D)4d$	1F	3	114385.361	0.003	38	12	$(^2D3)^3F$	11	$(^2D1)^1F$	7	$(^2H)^3F$	
$3d^7(^2H)4d$	1I	6	114763.687	0.002	81	16	$(^2H)^3I$	2	$(^2H)^3H$			
$3d^7(a^2D)4d$	1G	4	114974.312	0.010	33	32	$(^2D3)^3G$	9	$(^2D1)^1G$	9	$(^2P)^3F$	
$3d^7(a^2D)4d$	3P	2	115148.376	0.005	55	17	$(^2D1)^3P$	9	$(^2D3)^3D$	5	$(^4F)5d^3P$	
		0	115785.536	0.010	41	18	$(^2D3)^1S$	14	$(^2D1)^3P$	11	$(^4F)5d^3P$	
		1	115948.275	0.010	44	14	$(^2D1)^3P$	13	$(^2P)^3P$	8	$(^2D3)^3S$	

TABLE 4—Continued

Assigned Configuration	Term	J		Energy (cm ⁻¹)	Error (cm ⁻¹)	Eigenvector Components (%)						
$3d^7(^2H)4d$	3F	4	*	115484.863	0.002	46	21	$(^2D3)^3F$	15	$(^4F)5d^3F$	6	$(^2D1)^3F$
		3	*	116132.372	0.005	43	20	$(^2D3)^3F$	16	$(^4F)5d^3F$	5	$(^2D1)^3F$
		2	*	116382.655	0.010	34	15	$(^4F)5d^3F$	14	$(^2D3)^3F$	13	$(^2D3)^1D$
$3d^7(a^2D)4d$	1D	2	*	117416.550	0.015	42	131	$(^2D1)^1D$	11	$(^2P)^1D$	9	$(^2G)^1D$
$3d^7(^2H)4d$	1G	4	*	117535.237	0.003	81	8	$(^2G)^1G$	4	$(^2D3)^1G$	2	$(^2D1)^1G$

NOTES.—Levels annotated with * are new. For levels marked with r , the term designations have been reassigned and are not as reported in Sugar & Corliss 1985. The first eigenvector component corresponds to the level designation. Components smaller than 2% are omitted. For the $(^2F)4s$ levels no transitions were observed involving levels of different parentage, and so these levels are given relative to the c^3F_2 level at 40771.110 cm⁻¹ (see § 5.3). The relative uncertainty x in the position of these $(^2F)4s$ levels with respect to the rest of the levels may be several hundred mK (1 mK = 0.001 cm⁻¹).

TABLE 5
Co II ODD ENERGY LEVELS

Assigned Configuration	Term	J	Energy (cm ⁻¹)	Error (cm ⁻¹)	Eigenvector Components (%)						
$3d^7(^4F)4p$	$z\ ^5F$	5	45197.708	0.001	96	3	$(^4F)^5G$				
		4	45378.751	0.001	59	36	$(^4F)^5D$	2	$(^4F)^5G$	2	$(^4P)^5D$
		3	45972.033	0.001	75	21	$(^4F)^5D$	2	$(^4F)^5G$		
		2	46452.697	0.002	86	11	$(^4F)^5D$				
		1	46786.406	0.002	95	4	$(^4F)^5D$				
$3d^7(^4F)4p$	$z\ ^5D$	4	46320.829	0.001	58	35	$(^4F)^5F$	3	$(^4P)^5D$	3	$(^4F)^5G$
		3	47039.102	0.001	73	20	$(^4F)^5F$	4	$(^4P)^5D$	2	$(^4F)^5G$
		2	47537.362	0.002	83	11	$(^4F)^5F$	5	$(^4P)^5D$		
		1	47848.778	0.001	90	5	$(^4P)^5D$	4	$(^4F)^5F$		
		0	47995.591	0.002	94	6	$(^4P)^5D$				
$3d^7(^4F)4p$	$z\ ^5G$	6	47078.491	0.002	100						
		5	47345.842	0.001	76	20	$(^4F)^3G$	4	$(^4F)^5F$		
		4	47807.490	0.002	85	10	$(^4F)^3G$	4	$(^4F)^5F$		
		3	48150.937	0.001	92	4	$(^4F)^3G$	3	$(^4F)^5F$		
		2	48388.439	0.001	97	2	$(^4F)^5F$				
$3d^7(^4F)4p$	$z\ ^3G$	5	48556.049	0.001	78	21	$(^4F)^5G$				
		4	49348.301	0.001	65	27	$(^4F)^3F$	6	$(^4F)^5G$		
		3	50036.345	0.001	82	14	$(^4F)^3F$	2	$(^4F)^5G$		
$3d^7(^4F)4p$	$z\ ^3F$	4	49697.680	0.001	68	24	$(^4F)^3G$	4	$(^4F)^5G$	2	$(^2G)^3F$
		3	50381.721	0.001	76	14	$(^4F)^3G$	5	$(^4F)^3D$	2	$(^2G)^3F$
		2	50914.322	0.001	93	3	$(^2G)^3F$	2	$(^4F)^3D$		
$3d^7(^4F)4p$	$z\ ^3D$	3	51512.265	0.001	91	5	$(^4F)^3F$				
		2	52229.722	0.001	93	2	$(^4F)^3F$				
		1	52684.630	0.001	95						
$3d^7(^4P)4p$	$z\ ^5S$	2	56010.471	0.002	99						
$3d^7(^4P)4p$	$y\ ^5D$	3	61240.742	0.002	88	4	$(^4F)^5D$	4	$(^4P)^3D$	2	$(^2P)^3D$
		2	61260.315	0.003	86	5	$(^4F)^5D$	3	$(^4P)^3D$	2	$(^2P)^3D$
		1	61350.264	0.003	86	5	$(^4F)^5D$	3	$(^2P)^3P$	2	$(^4P)^5P$
		4	61388.246	0.002	95	4	$(^4F)^5D$				
		0	61458.120	0.004	91	5	$(^4F)^5D$	2	$(^2P)^3P$		
$3d^7(^4P)4p$	$z\ ^3S$	1	62440.074	0.001	54	19	$(^4P)^5P$	15	$(^2P)^3S$	5	$(^2P)^3P$
$3d^7(^2G)4p$	$z\ ^3H$	5	63306.682	0.001	72	17	$(^2G)^1H$	7	$(^2G)^3G$	2	$(^2H)^3I$
		6	63597.392	0.002	97						
		4	63792.713	0.001	83	10	$(^2G)^3F$	2	$(^2G)^1G$	2	$(^2G)^3G$
$3d^7(^4P)4p$	$z\ ^5P$	3	63344.329	0.001	93	2	$(^2P)^3D$	2	$(^4P)^5D$		
		2	63367.329	0.002	74	15	$(^4P)^3D$	4	$(^2P)^3P$	3	$(^2P)^3D$
		1	63665.188	0.001	74	21	$(^4P)^3S$				
$3d^7(^2G)4p$	$y\ ^3F$	4	63510.176	0.001	58	13	$(^2G)^3G$	10	$(^2G)^1G$	9	$(^2G)^3H$
		3	64360.046	0.002	81	12	$(^2G)^3G$	3	$(^4F)^3F$	2	$(^2H)^3G$
		2	65016.911	0.002	77	10	$(^4P)^3P$	7	$(^2P)^3P$	3	$(^4F)^3F$
$3d^7(^4P)4p$	$y\ ^3D$	3	63586.983	0.001	88	4	$(^4P)^5D$	2	$(^2P)^3D$	2	$(^4P)^5P$
		2	63615.986	0.001	63	19	$(^4P)^5P$	5	$(^4P)^5D$	4	$(^2P)^1D$
		1	63865.166	0.002	80	9	$(^2P)^3D$	2	$(^4P)^5P$	2	$(^2P)^3P$
$3d^7(^2G)4p$	$z\ ^1G$	4	64401.355	0.001	51	25	$(^2G)^3F$	12	$(^2H)^1G$	9	$(^2G)^3G$
$3d^7(^2G)4p$	$y\ ^3G$	5	64601.774	0.001	79	17	$(^2G)^1H$				
		4	65154.037	0.001	73	13	$(^2G)^1G$	6	$(^2G)^3H$	4	$(^2H)^1G$
		3	65174.657	0.001	84	12	$(^2G)^3F$	2	$(^2G)^1F$		
$3d^7(^2P)4p$	$z\ ^3P$	0	64605.523	0.002	58	15	$(^4P)^3P$	15	$(^2D3)^3P$	6	$(^2P)^1S$
		1	65028.508	0.001	64	12	$(^2D3)^3P$	7	$(^4P)^3S$	5	$(^4P)^3P$
		2	65408.361	0.001	31	45	$(^4P)^3P$	14	$(^2D3)^3P$	4	$(^2D1)^3P$
$3d^7(^4P)4p$	$y\ ^3P$	2	64914.626	0.001	35	33	$(^2P)^3P$	18	$(^2G)^3F$	3	$(^2P)^3D$
		0	65511.987	0.003	62	22	$(^2P)^3P$	13	$(^2P)^1S$		
		1	65657.245	0.001	88	5	$(^2P)^3P$	2	$(^4P)^3S$	2	$(^2P)^3D$
$3d^7(^2G)4p$	$z\ ^1H$	5	64957.478	0.001	63	25	$(^2G)^3H$	11	$(^2G)^3G$		

TABLE 5—Continued

Assigned Configuration	Term	<i>J</i>	Energy (cm ⁻¹)	Error (cm ⁻¹)	Eigenvector Components (%)						
$3d^7(^2G)4p$	z^1F	3	66017.643	0.001	75	12	$(^2D3)^1F$	5	$(^2D1)^1F$	3	$(^2H)^3G$
$3d^7(^2P)4p$	z^1D	2	67209.253	0.003	47	13	$(^2P)^3D$	13	$(^4P)^3D$	8	$(^2D3)^1D$
$3d^7(^2P)4p$	x^3D	3	67524.016	0.002	84	5	$(^2D3)^3F$	2	$(^4P)^3D$	2	$(^4P)^5P$
		1	67824.384	0.002	74	9	$(^4P)^3D$	9	$(^2D3)^3D$	2	$(^2P)^3P$
		2	67939.365	0.001	65	18	$(^2P)^1D$	4	$(^2D3)^3D$	3	$(^2D3)^1D$
$3d^7(^2P)4p$	1S	0	67910.928	0.002	79	20	$(^4P)^3P$				
$3d^7(^2H)4p$	x^3G	5	68203.007	0.001	94	3	$(^2F)^3G$				
		4	68843.423	0.002	92	3	$(^2F)^3G$	2	$(^2G)^3G$		
		3	69356.235	0.002	88	3	$(^2F)^3G$	3	$(^2G)^3G$	2	$(^2D3)^1F$
$3d^7(^2H)4p$	z^3I	6	68311.108	0.001	66	32	$(^2H)^1I$				
		7	68614.217	0.002	100						
		5	68829.446	0.002	97	2	$(^2G)^1H$				
$3d^7(^2D)4p$	w^3D	3	69059.928	0.003	67	20	$(^2D1)^3D$	5	$(^2D3)^3F$	2	$(^4P)^3D$
		1	69317.072	0.003	34	39	$(^2P)^1P$	10	$(^2D1)^3D$	7	$(^2P)^3D$
		2	69637.018	0.002	58	17	$(^2D1)^3D$	5	$(^2D3)^3F$	4	$(^2P)^3D$
$3d^7(^2H)4p$	z^1I	6	69617.490	0.001	66	32	$(^2H)^3I$	2	$(^2G)^3H$		
$3d^7(^2D)4p$	x^3F	4	70185.950	0.002	77	21	$(^2D1)^3F$				
		3	70457.533	0.004	60	15	$(^2D1)^3F$	5	$(^2D3)^1F$	5	$(^2D3)^3D$
		2	70774.864	0.002	64	15	$(^2D1)^3F$	6	$(^2D3)^3D$	5	$(^2D3)^1D$
$3d^7(^2P)4p$	y^3S	1	70265.910	0.002	75	13	$(^4P)^3S$	3	$(^2P)^3P$	3	$(^2D3)^3D$
$3d^7(^2P)4p$	z^1P	1	70857.048	0.002	43	26	$(^2D3)^3D$	8	$(^2D3)^1P$	7	$(^2D1)^3D$
$3d^7(^2H)4p$	y^3H	6	71403.639	0.001	98						
		5	71702.955	0.001	96	2	$(^2H)^1H$				
		4	72008.907	0.001	95	2	$(^2H)^1G$				
$3d^7(^2D)4p$	x^3P	2	71846.436	0.003	49	14	$(^2D1)^3P$	12	$(^2D3)^1D$	10	$(^2P)^3P$
		1	73144.333	0.003	56	14	$(^2D1)^3P$	13	$(^2P)^3P$	8	$(^2P)^1P$
		0	73472.526	0.005	64	17	$(^2P)^3P$	15	$(^2D1)^3P$	2	$(^4P)^3P$
$3d^7(^2D)4p$	y^1F	3	72535.103	0.002	57	16	$(^2D1)^1F$	14	$(^2G)^1F$	7	$(^2D3)^3F$
$3d^7(^2D)4p$	y^1D	2	72654.122	0.007	44	16	$(^2P)^1D$	14	$(^2D1)^1D$	12	$(^2D3)^3P$
$3d^7(^2H)4p$	y^1G	4	73147.036	0.002	75	22	$(^2G3)^1G$	2	$(^2H)^3H$		
$3d^7(^2H)4p$	y^1H	5	74376.787	0.001	97	2	$(^2H)^3H$				
$3d^7(^2D)4p$	y^1P	1	74522.911	0.004	72	14	$(^2D1)^1P$	6	$(^2P)^1P$	2	$(^2P)^3S$
$3d^7(^2F)4p$	w^3G	3	83110.656 + <i>x</i>	0.007	87	7	$(^2F)^3F$	4	$(^2H)^3G$		
		4	83398.693 + <i>x</i>	0.007	84	10	$(^2F)^3F$	3	$(^2H)^3G$	2	$(^2F)^1G$
		5	83877.857 + <i>x</i>	0.019	96	3	$(^2H)^3G$				
$3d^7(^2F)4p$	w^3F	3	83862.837 + <i>x</i>	0.090	86	7	$(^2F)^3G$	4	$(^2F)^3D$	2	$(^2D1)^3F$
		4	84140.647 + <i>x</i>	0.008	78	11	$(^2F)^3G$	8	$(^2F)^1G$		
$3d^7(^2F)4p$	v^3D	3	84216.732 + <i>x</i>	0.015	89	4	$(^2F)^3F$	3	$(^2D1)^3D$		
		2	84394.602 + <i>x</i>	0.009	89	6	$(^2F)^1D$	3	$(^2D1)^3D$		
		1	84419.579 + <i>x</i>	0.015	95	3	$(^2D1)^3D$				
$3d^7(^4F)5p$	5D	4	95036.149	0.005	50	21	$^5D, ^4D, ^5D$	20	$^5D, ^6D, ^5D$	4	$(^4F)^5F$
		3	95683.358	0.008	44	23	$^5D, ^4D, ^5D$	22	$^5D, ^6D, ^5D$	4	$(^4F)^5F$
		2	96205.835	0.015	39	26	$^5D, ^4D, ^5D$	25	$^5D, ^6D, ^5D$	3	$(^4F)^5F$
$3d^7(^4F)5p$	5F	5	95456.041	0.002	91	6	$(^4F)^5G$	2	$^5D, ^4D, ^5F$		
		4	95976.573	0.003	75	8	$(^4F)^3F$	6	$(^4F)^5G$	3	$^5D, ^6D, ^5D$
		3	96496.097	0.005	78	6	$(^4F)^5G$	5	$(^4F)^3F$	3	$^5D, ^6D, ^5D$
		2	96890.960	0.015	86	4	$(^4F)^5G$	2	$^5D, ^6D, ^5D$	2	$^5D, ^4D, ^5D$
		1	97153.732	0.020	95	2	$^5D, ^4D, ^5F$				
$3d^7(^4F)5p$	5G	6	95998.729	0.002	97	2	$^3H, ^4H, ^5G$				
		4	96882.304	0.002	55	26	$(^4F)^3G$	7	$(^4F)^5F$	3	$(^4F)^3F$
		5	96942.124	0.002	50	45	$(^4F)^3G$	2	$(^4F)^5F$	2	$^3H, ^4H, ^5G$
		3	97335.678	0.003	78	8	$(^4F)^3G$	3	$(^4F)^5F$		
		2	97628.427	0.010	91	3	$^3H, ^4H, ^5G$	3	$(^4F)^5F$		
$3d^7(^4F)5p$	3G	5	96236.588	0.002	54	41	$(^4F)^5G$	4	$(^4F)^5F$		
		4	97705.049	0.003	68	20	$(^4F)^5G$	7	$(^4F)^3F$	2	$(^4F)^5F$
		3	98278.558	0.011	67	19	$(^4F)^3F$	6	$(^4F)^5G$	4	$(^4F)^3D$
$3d^7(^4F)5p$	3F	4	97062.837	0.002	76	14	$(^4F)^5G$	2	$(^4F)^3D$		
		3	97967.690	0.008	32	29	$(^4F)^3D$	20	$(^4F)^3G$	9	$(^4F)^5D$
		2	98287.633	0.009	55	17	$(^4F)^5D$	13	$(^4F)^3D$	3	$^5D, ^4D, ^5D$
$3d^7(^4F)5p$	3D	3	97496.421	0.003	62	16	$(^4F)^3F$	7	$(^4F)^5F$	3	$(^4F)^5D$
		2	98648.509	0.006	58	32	$(^4F)^3F$	5	$(^4F)^5D$		
$3d^7(^4P)5p$	5D	4	110993.182	0.004	35	18	$^3G, ^2G, ^3F$	9	$^3G, ^4G, ^3F$	6	4f
		3	111005.918	0.009	63	8	4f	6	4f	4	4f
		2	111049.917	0.006	84	5	4f	4	4f	2	4f
$3d^7(^4P)5p$	3D	2	111866.295	0.015	46	34	$(^4P)^5P$	10	$^3D, ^4D, ^5P$	2	$(^2P)^1D$

NOTES.—Levels annotated with * are new. For levels marked with *r* the term designations have been reassigned and are not as reported in Sugar & Corliss 1985. The first eigenvector component corresponds to the level designation. Components smaller than 3% are omitted. Although no doubly excited levels are listed, there is some mixing with *5p* levels of the normal system, and in these cases the notation used for the eigenvector components is as in this example: $3d^6(^5D)4s(^4D)4p^5F$ is represented as $^5D^4D, ^5F$. For the $(^2F)4p$ levels, no transitions were observed involving levels of different parentage, and so these levels are given relative to the c^3F_2 level at 40771.110 cm⁻¹ (see § 5.3). The relative uncertainty *x* in the position of these $(^2F)4p$ levels with respect to the rest of the levels may be several hundred mK (1 mK = 0.001 cm⁻¹).

TABLE 6
Co II $3d^7(^4F)4f$ ENERGY LEVELS

Configuration	Term (abbr)	J_c	K	J	Energy (cm ⁻¹)	Uncertainty (cm ⁻¹)	Eigenvector	Composition (%)
$3d^7(^4F)4f \dots\dots$	(4.5)[7.5] ₈	$J_c = 4.5$	7.5	8	110158.666	0.003	100	
	(4.5)[7.5] ₇		7.5	7	110148.054	0.002	100	
	(4.5)[6.5] ₇		6.5	7	110096.451	0.002	100	
	(4.5)[6.5] ₆		6.5	6	110008.475	0.007	100	
	(4.5)[5.5] ₆		5.5	6	110070.201	0.002	100	
	(4.5)[5.5] ₅		5.5	5	110094.049	0.002	67	32 [4.5]
	(4.5)[4.5] ₅		4.5	5	110077.553	0.002	67	32 [5.5]
	(4.5)[4.5] ₄		4.5	4	110099.378	0.002	72	28 [3.5]
	(4.5)[3.5] ₄		3.5	4	110129.919	0.003	72	28 [4.5]
	(4.5)[3.5] ₃		3.5	3	110130.157	0.004	80	20 [2.5]
	(4.5)[2.5] ₃		2.5	3	110162.774	0.002	80	20 [3.5]
	(4.5)[2.5] ₂		2.5	2	110163.087	0.030	63	37 [1.5]
	(4.5)[1.5] ₂		1.5	2	110194.237	0.008	63	37 [2.5]
	(4.5)[1.5] ₁		1.5	1	110199.783	0.011	100	
	(3.5)[6.5] ₇	$J_c = 3.5$	6.5	7	110986.076	0.002	100	
	(3.5)[6.5] ₆		6.5	6	110980.860	0.002	100	
	(3.5)[5.5] ₆		5.5	6	110932.336	0.002	100	
	(3.5)[5.5] ₅		5.5	5	110940.768	0.002	96	4 [4.5]
	(3.5)[4.5] ₅		4.5	5	110926.330	0.002	96	4 [5.5]
	(3.5)[4.5] ₄		4.5	4	110927.838	0.003	61	38 [3.5]
	(3.5)[3.5] ₄		3.5	4	110942.708	0.003	61	38 [4.5]
	(3.5)[3.5] ₃		3.5	3	110934.604	0.002	82	18 [2.5]
	(3.5)[2.5] ₃		2.5	3	110976.715	0.004	82	18 [3.5]
	(3.5)[2.5] ₂		2.5	2	110970.547	0.005	87	12 [1.5]
	(3.5)[1.5] ₂		1.5	2	110996.268	0.003	88	12 [2.5]
	(3.5)[1.5] ₁		1.5	1	111000.218	0.006	81	19 [0.5]
	(3.5)[0.5] ₁		0.5	1	111014.312	0.004	81	19 [1.5]
	(3.5)[0.5] ₀		0.5	0	—		100	
	(2.5)[5.5] ₆	$J_c = 2.5$	5.5	6	111586.390	0.002	100	
$3d^7(^4F)4f \dots\dots$	(2.5)[5.5] ₅		5.5	5	111586.823	0.003	100	
	(2.5)[4.5] ₅		4.5	5	111538.772	0.002	100	
	(2.5)[4.5] ₄		4.5	4	111543.194	0.003	59	40 [3.5]
	(2.5)[3.5] ₄		3.5	4	111555.694	0.003	59	40 [4.5]
	(2.5)[3.5] ₃		3.5	3	111550.337	0.004	93	7 [2.5]
	(2.5)[2.5] ₃		2.5	3	111572.688	0.003	92	7 [3.5]
	(2.5)[2.5] ₂		2.5	2	111556.439	0.009	98	
	(2.5)[1.5] ₂		1.5	2	111602.194	0.003	99	
	(2.5)[1.5] ₁		1.5	1	111562.730	0.020	99	
	(2.5)[0.5] ₁		0.5	1	111622.990	0.010	100	
	(2.5)[0.5] ₀		0.5	0	—		100	
	(1.5)[4.5] ₅	$J_c = 1.5$	4.5	5	112000.511	0.006	100	
	(1.5)[4.5] ₄		4.5	4	112007.825	0.003	97	
	(1.5)[3.5] ₄		3.5	4	111940.516	0.003	99	
	(1.5)[3.5] ₃		3.5	3	111949.693	0.003	90	10 [2.5]
	(1.5)[2.5] ₃		2.5	3	111984.567	0.003	90	10 [3.5]
	(1.5)[2.5] ₂		2.5	2	111981.025	0.005	94	4 [1.5]
	(1.5)[1.5] ₂		1.5	2	112036.171	0.028	95	4 [2.5]
	(1.5)[1.5] ₁		1.5	1	112041.587	0.019	99	

NOTES.—The eigenvector compositions are the squares of JK eigenvector components. For levels with mixing, K is given for the second component since the J_c is the same as the main component. All the $4f$ levels listed are new.

TABLE 7

REVISIONS TO THE CONFIGURATION DESCRIPTIONS, *LS* LABELS, OR *J*-VALUES OF ENERGY LEVELS LISTED IN SUGAR & CORLISS (1985) (S + C)

Assigned Configuration	Term	<i>J</i>	Energy (cm ⁻¹)	(S + C) Assigned Configuration	Term (S + C)	<i>J</i> (S + C)	Energy (S + C) (cm ⁻¹)	
3d ⁸	<i>a</i> ¹ <i>G</i>	4	18973.726	3d ⁸	<i>a</i> ¹ <i>G</i>	4	19190.11	Dis
3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ⁵ <i>G</i>	4	91352.874	3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ⁵ <i>D</i>	4	91352.96	
3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ⁵ <i>D</i>	4	91049.425	3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ⁵ <i>G</i>	4	91049.62	
3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ³ <i>H</i>	5	92359.174	3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ³ <i>H</i>	5	92452.30	Dis
3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ³ <i>H</i>	4	92889.411	3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ³ <i>H</i>	4	93019.60	Dis
3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ³ <i>P</i>	0	94720.910	3d ⁷ (⁴ <i>F</i>)4d	<i>e</i> ³ <i>P</i>	0	94785.4	Dis
3d ⁷ (⁴ <i>P</i>)5s	⁵ <i>P</i>	3	99022.521	3d ⁷ (⁴ <i>P</i>)5s	<i>e</i> ⁵ <i>P</i>	3	99022.66	
3d ⁷ (⁴ <i>P</i>)5s	⁵ <i>P</i>	2	99235.154	3d ⁷ (⁴ <i>P</i>)5s	<i>e</i> ⁵ <i>P</i>	2	99235.28	
3d ⁷ (⁴ <i>P</i>)5s	⁵ <i>P</i>	1	99552.553	3d ⁷ (⁴ <i>P</i>)5s	<i>e</i> ⁵ <i>P</i>	1	99552.67	
3d ⁷ (² <i>G</i>)5s	<i>e</i> ¹ <i>G</i>	4	102371.603	3d ⁷ (² <i>G</i>)5s	<i>e</i> ¹ <i>G</i>	4	103787.43	Dis
3d ⁷ (⁴ <i>F</i>)6s	⁵ <i>F</i>	4	109442.065	3d ⁷ (⁴ <i>F</i>)6s	³ <i>F</i>	4	109442.2	
3d ⁷ (⁴ <i>F</i>)6s	³ <i>F</i>	4	108819.853	3d ⁷ (⁴ <i>F</i>)6s	⁵ <i>F</i>	4	108819.90	
3d ⁷ (⁴ <i>F</i>)5d	⁵ <i>G</i>	5	112024.987	3d ⁷ (⁴ <i>F</i>)5d	⁵ <i>G</i>	5	111350.14	
3d ⁷ (⁴ <i>F</i>)5d	³ <i>G</i>	5	111350.073	3d ⁷ (⁴ <i>F</i>)5d	⁵ <i>G</i>	5	111350.14	
3d ⁷ (⁴ <i>F</i>)5d	⁵ <i>H</i>	6	112155.600	3d ⁷ (⁴ <i>F</i>)5d	³ <i>H</i>	6	112155.67	
3d ⁷ (⁴ <i>F</i>)5d	³ <i>H</i>	6	111438.683	3d ⁷ (⁴ <i>F</i>)5d	⁵ <i>H</i>	6	111438.81	
3d ⁷ (² <i>P</i>)4p	<i>z</i> ³ <i>P</i>	2	65408.361	3d ⁷ (⁴ <i>P</i>)4p	<i>y</i> ³ <i>P</i>	2	65408.59	
3d ⁷ (⁴ <i>P</i>)4p	<i>y</i> ³ <i>P</i>	2	64914.626	3d ⁷ (² <i>P</i>)4p	<i>z</i> ³ <i>P</i>	2	64914.81	
3d ⁷ (² <i>P</i>)4p	<i>z</i> ¹ <i>D</i>	2	67209.253	3d ⁷ (² <i>P</i>)4p	...	2	67209.42	
3d ⁷ (² <i>P</i>)4p	<i>z</i> ¹ <i>P</i>	1	70857.048	3d ⁷ (² <i>P</i>)4p	...	1	70857.1	
3d ⁷ (² <i>D</i>)4p	<i>x</i> ³ <i>P</i>	0	73472.526	3d ⁷ (² <i>D</i>)4p	<i>x</i> ³ <i>P</i>	0	73440.00	Dis
3d ⁷ (² <i>D</i>)4p	<i>y</i> ¹ <i>D</i>	2	72654.122	3d ⁷ (² <i>D</i>)4p	...	2	72654.32?	
3d ⁷ (⁴ <i>F</i>)5p	⁵ <i>G</i>	5	96942.124	3d ⁷ (⁴ <i>F</i>)5p	³ <i>G</i>	5	96942.21	
3d ⁷ (⁴ <i>F</i>)5p	³ <i>G</i>	5	96236.588	3d ⁷ (⁴ <i>F</i>)5p	⁵ <i>G</i>	5	96236.66	
3d ⁷ (⁴ <i>F</i>)5p	³ <i>F</i>	2	98287.633	3d ⁷ (⁴ <i>F</i>)5p	³ <i>D</i>	2	98287.75?	
3d ⁷ (⁴ <i>F</i>)5p	³ <i>D</i>	2	98648.509	3d ⁷ (⁴ <i>F</i>)5p	³ <i>F</i>	2	98648.67	

NOTES.—Revisions of labeling made in this paper to the energy levels listed in Sugar & Corliss 1985. The assigned configuration, term, and *J*-value for the energy levels of this work are given in the first four columns and compared to those of S + C, which are given in the next four columns. Levels annotated with * are new. In the final column, Dis indicates that the S + C level has been discarded.

TABLE 8

LEVELS LISTED IN S + C BUT NOT OBSERVED IN THIS WORK

Assigned Configuration	Term	<i>J</i>	Energy (S + C) (cm ⁻¹)	Assigned Configuration	Term	<i>J</i>	Energy (S + C) (cm ⁻¹)
3d ⁶ 4s ²	<i>a</i> ⁵ <i>D</i>	1	42008.9	3d ⁶ (⁵ <i>D</i>)4s4p	<i>v</i> ³ <i>F</i>	3	87112.5
						2	87896.2
3d ⁷ (² <i>F</i>)4s	<i>a</i> ¹ <i>F</i>	3	44090.94?			1	88417.5
3d ⁶ (⁵ <i>D</i>)4s4p	<i>x</i> ⁵ <i>D</i>	4	80299.5	3d ⁷ (² <i>F</i>)4s	<i>x</i> ¹ <i>F</i>	3	87633.0?
		3	80543.3				
		2	80788.7	3d ⁷ (⁴ <i>F</i>)7s	⁵ <i>F</i>	5	119311.7
		1	80971.5			4	119497.4?
		0	81066.6			3	120228.5?
3d ⁶ (⁵ <i>D</i>)4s4p	<i>y</i> ⁵ <i>F</i>	5	81970.7	3d ⁷ (⁴ <i>F</i>)7s	³ <i>F</i>	4	120201.3
		4	82343.5			3	120867.0?
		3	82627.5				
		2	82830.0	3d ⁷ (⁴ <i>F</i>)6d	⁵ <i>G</i>	6	120681.76
		1	82959.9				
3d ⁶ (⁵ <i>D</i>)4s4p	<i>y</i> ⁵ <i>P</i>	3	85044.3	3d ⁷ (⁴ <i>F</i>)6d	⁵ <i>H</i>	7	120760.36
		2	85712.6			6	120843.76
		1	86133.8?			5	121651.66
3d ⁶ (⁵ <i>D</i>)4s4p	<i>u</i> ³ <i>D</i>	3	86981.3			4	122169.2?
		2	87490.0	3d ⁷ (⁴ <i>F</i>)6d	³ <i>H</i>	6	121612.00
		1	87847.3	3d ⁷ (⁴ <i>F</i>)7d	⁵ <i>H</i>	7	125920.7?

NOTES.—These energy levels are those listed in the compilation of Sugar & Corliss 1985 (S + C), but no transitions involving them were observed in this work. Possibly these levels are not excited in the hollow cathode.

TABLE 9
HYPERFINE STRUCTURE SPLITTING
A FACTORS FOR A FEW Co II
LEVELS

Level	A (mK)
$3d^7(^4P)4s$	
a^5P_3	49
a^5P_2	62
a^5P_1	80

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Note added in proof.—Since submitting this paper, further analysis of the infrared spectra at IC has led to finding 51 levels of the $3d^7(4F)5g$ subconfiguration. One hundred forty-four $3d^7(4F)4f$ – $3d^7(4F)5g$ transitions in the 10000–10250 cm^{-1} region have been identified. The new $5g$ levels and $4f$ – $5g$ transitions will be presented in a future publication (J. C. Pickering, *Phys. Scr.*, in press).