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Part II

U.S. DEPARTMENT OF COMMERCE / National Bureau of Standards

**Tables of  
Spectral-Line Intensities**  
Arranged by Wavelengths







*W. F. Meggers prepares to measure one of the spectrograms on which these tables of spectral-line intensities are based.*

NATIONAL BUREAU OF STANDARDS

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# Tables of Spectral-Line Intensities

## Part II - Arranged by Wavelengths

Second Edition

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The intensity, character, wavelength, and  
spectrum of 39 000 lines between 2000 Å  
and 9000 Å observed in copper arcs containing  
0.1 atomic percent of each of 70 elements.

(Supersedes NBS Monograph 32, Parts I and II  
and its Supplement)



U.S. DEPARTMENT OF COMMERCE

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## Preface

A second edition of the NBS Tables of Spectral-Line Intensities (Part I, Arranged by Elements and Part II, Arranged by Wavelengths) has been prepared. New classifications have been provided for 8500 previously unclassified lines, improved wavelengths are given for about 9000 lines and some revision of the intensity scale has been made. (Supersedes NBS Monograph 32, Parts I and II and its Supplement.)

Key words: Classification of spectral lines; intensities of spectral lines; spectral-line intensities; tables of spectral-line intensities; wavelengths of spectral lines.

This new edition of the NBS Tables of Spectral-Line Intensities incorporates three improvements on the original edition of 1961. In the original edition only about 25 000 of the 39 000 lines in the tables had been classified. In the ensuing thirteen years, about 8500 more lines (chiefly rare-earths) have been classified and the new classifications are here incorporated.

Furthermore in the course of spectroscopic research during that period, many spectra have been remeasured. About 9000 improved wavelength values have been adopted here. Many of the new values are accurate to somewhat better than two decimal places but in most cases there remains some uncertainty in the third place. We have therefore printed only two decimal places in this edition.

The third improvement to be found in this edition is in the intensity scale. Three changes have been made. The calibration of the region below 2450 Å, which was published by Corliss [1967], has been incorporated in the new edition. Secondly, a slight error in the original reduction of the intensity data from the overlapping regions of the plates has been corrected. In the original reduction the duplicate observations in the overlapping regions were simply averaged. This was a theoretically correct procedure since the observations had already been normalized to the intensity scale of the copper matrix. However, it was observed that this normalization did not produce identical scales on each plate. A more practical procedure would have been to have adjusted each plate to a common scale determined by the mean intensity level of all the plates. This was pointed out by J. L. Tech [1971] who has now applied this correction to all of the complex spectra in the tables. The elements with less than 100 lines (simple spectra) remain uncorrected for this relatively minor error because there are not enough lines in the overlapping regions to determine correction factors.

Finally, the whole scale of relative intensity numbers has been multiplied by ten to eliminate numbers less than unity. The intensity numbers now range from 1 to 90 000.

For the convenience of the user, the tables are presented in two separate parts, in the same way as the original edition. Part I is arranged by element in alphabetic order of chemical name. In Part II all observed lines are consolidated in a single table arranged in order of increasing wavelength and in a supplementary table of selected strong lines.

The values of ionization potentials for many of the elements are taken from the compilations of C. E. Moore but those for the lanthanides, actinides and Hf are taken from the compilation of W. C. Martin, Lucy Hagan, Joseph Reader and Jack Sugar (J. Phys. Chem. Ref. Data, Vol. 3, No. 3, 1974). The values of atomic weights are taken from the 1969 Report of the International Commission on Atomic Weights.

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Charles H. Corliss

Washington, D.C., April 25, 1974

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# Tables of Spectral-Line Intensities—Part II

## Arranged by Wavelengths

The relative intensities, or radiant powers, of 39 000 spectral lines with wavelengths between 2000 and 9000 Ångstroms have been determined on a uniform energy scale for seventy chemical elements. This was done by mixing 0.1 atomic percent of each element in powdered copper, pressing the powder-mixture to form solid electrodes which were burned in a 10 ampere, 220 volt direct-current arc, and photographing the spectra with a stigmatic concave grating while a step sector was rotating in front of the slit. The sectored spectrograms facilitated the estimation of intensities of all element lines relative to copper lines which were then calibrated on an energy scale provided by standardized lamps, and all estimated line intensities were finally adjusted to fit this calibration. Comparisons with other intensity measurements in individual spectra indicate that the National Bureau of Standards spectral-line intensities may have average errors of 20 percent, but first of all they provide uniform quantitative values for the seventy chemical elements commonly determined by spectrochemists. These data are presented by element in part I, and all 39 000 observed lines are given in order of wavelength in part II.

Key words: Classification of spectral lines; intensities of spectral lines; spectral-line intensities; tables of spectral-line intensities; wavelengths of spectral lines.

### 1. Introduction

Spectrochemistry was born a century ago when Kirchhoff and Bunsen [1]<sup>1</sup> definitely demonstrated that chemical elements were uniquely identified by spectral radiations, or lines as seen in a spectroscope provided with a slit. This led immediately to the identification of many chemical elements in the sun and to the discovery of several new elements, but no quantitative chemical analyses were made until much later.

In 1874, Lockyer [2] stated that “while the qualitative spectrum analysis depends upon the *positions* of the lines, the quantitative analysis depends not upon their position but upon their *length, brightness, thickness, and number* as compared with the number visible in the spectrum of a pure vapor”. Thus, position (or wavelength) and brightness (or intensity) are recognized as being the two most important properties of spectral lines; wavelengths identify chemical elements and intensities indicate the concentrations of identified elements in mixtures or chemical compounds.

During the past century there has been spectacular improvement in the accuracy of spectral wavelength determinations; the early ones were limited to 3 or 4 figures, the later use of diffraction gratings and wavelength standards permitted the specification of 5 or 6 figures. Since 1900 the application of interferometers and better gratings has refined many wavelengths to 7 figures, and recently some 8-figure values of wavelength standards have been provided.

Unfortunately during this past century very little progress has been made in assigning uniform quantitative intensity values to spectral radiations. The great bulk of spectral observations have been made photographically because photographic emulsions provide detailed, permanent records of spectra not only in the visible but also in the invisible ultraviolet and infrared regions. But even if the light source is reproducible and standardized it is not easy to evaluate the spectral efficiencies of spectrographs and photographic emulsions so the usual procedure has been to make subjective visual estimates of relative intensities of spectral lines on an arbitrary scale based on the relative blackness and/or width of spectral-line images appearing on a developed photographic plate. Consequently, in thousands of individual papers and in numerous comprehensive compilations of spectral data we find only qualitative data on intensities which may have some meaning for adjacent lines in a given spectrum but none at all when comparing widely spaced lines, or lines of different spectra of the same element or of different chemical elements.

In the beginning, most intensity data were reported on an arbitrary scale of 10 steps, weak lines being assigned an intensity of 1, and the strongest line intensity 10. Even as late as 1945 extensive new spectral tables prepared by Gatterer and Junkes [3] displayed estimated intensities on this limited 1 to 10 scale. Since 1910 some spectroscopists have arbitrarily expanded this arbitrarily compressed

<sup>1</sup> Figures in brackets indicate the literature references on page xiv.

scale. For example, in the very extensive spectral tables published by Exner and Haschek [4] the estimated intensities range from 1 to 1000. In wavelength tables compiled by Twyman and Smith [5] the maximum intensity is 20, in the compilation of Kayser and Ritschl [6] estimated intensities rise to 4000, and in the well-known M.I.T. Wavelength Tables [7] they soar to 9000. The most recent compilation of Tables of Spectrum Lines by Zaïdel, Prokof'ev, and Raïskii [8] quotes data from the M.I.T. Tables and more modern sources but adds nothing new on spectral line intensities.

In or about the year 1925, microdensitometers were developed for the purpose of quantitative measurement of relative intensities among related lines in multiplets to test the sum rules derived from the quantum theory of spectral structure, but no general applications were made. Since then thousands of spectrochemists have applied microdensitometers to quantitative chemical analyses by calibrating intensity ratios of analysis- and internal-standard lines but such measurements have contributed nothing to the basic data on spectral line intensities. Likewise, with few exceptions, the modern substitution of electronic photodetectors for photographic emulsions has added nothing to our knowledge of true line intensities over long ranges of different spectra of many chemical elements.

How may one hope to obtain, with a reasonable amount of labor, quantitative intensity data on the same scale for thousands of spectral lines representing practically all of the metallic elements? A hint was given in 1874 by Lockyer [2] who observed that "the lines of any constituent of a mechanical mixture disappeared from the spectrum as its percentage was reduced." Acting on this suggestion, Hartley [9], in 1884, began to study the spark spectra of metals in solutions with concentrations of 1 percent, 0.1 percent, 0.01 percent, and 0.001 percent, and proposed a method of quantitative spectrochemical analysis based on the lines that could be detected at each dilution. Similar studies were later made by Pollok and Leonard [10], by de Gramont [11], and by Löwe [12], all showing that with progressive dilution of an element its spectral lines weakened and vanished until only the most sensitive line remained to reveal its presence. In all these works the principle of quantitative spectrochemistry appeared to rest on the *number of lines* detectable rather than on their individual *intensities*. Casual observation must have shown lines of equal strength in spectra of solutions differing 1000 fold in concentration but no one mentioned it. It is difficult to understand why these early studies of residual spectra in quantitatively prepared mixtures or solutions did not suggest a method for obtaining physical intensities, but it is a fact that before our work had begun no one had attempted to express spectral line intensities as directly proportional to the number of radiating atoms or concentration of the element. The present monograph reports such an attempt [13].

Our method of deriving line intensities from arc spectra of elements diluted in copper was recently adopted by Allen [14, 15] to obtain oscillator strengths of some radiations from 3200 to 5400 Å representing nine elements.

At various times since 1932 we have photographed the arc spectra of 70 chemical elements diluted in silver or in copper, and determined the line intensities of the diluted elements relative to selected lines of the matrix. An energy calibration of the latter finally led to physical intensities of 39,000 spectral lines representing 70 elements, all on the same energy scale. These experiments and results are based on the following propositions, regarded as fundamental for the quantitative description of residual spectra of diluted elements excited in ordinary d-c arcs.

1. *The limiting detectability of any line is defined as the atomic concentration that ensures positive detection of the line.* This limit is determined mainly by unavoidable background on a fully exposed spectrogram. The spectrum of an arc burning in air consists of discrete lines due to atoms, and of more or less extensive band systems from transient compounds (usually monoxides), all superposed on a continuous background arising from thermal radiation of incandescent oxides, from transitions in the continuum, and possibly from scattered light. This background sets a limit to the exposure for faint lines that may be given by any actual spectrograph. If this were not true, the exposure could be increased indefinitely to compensate for unlimited reduction in concentration, and detectability would always be infinite. Faint lines are not recorded by underexposure, and they cannot be recognized on a very dense background produced by overexposure. In order to guarantee positive recognition and unambiguous chemical identification a spectral line should be sufficiently well defined to permit accurate wavelength measurement. Experience shows that the minimum photographic density that meets this requirement is of the order of 0.05 above that of the background.

2. *The limiting detectability of any element in an arc depends on the matrix in which the element finds itself.* There is no doubt that in the conventional arc relative volatilities of the chemical elements as well as relative ionization potentials affect the relative strengths of their mixed spectra. In general, the elements with high-vapor pressure and/or low-ionization potential will be favored in spectral excitation, but elements with either high or low volatility may be underestimated if not uniformly present during the exposure, and easily ionized elements may appear less sensitive because of more complete ionization. In this connection it must be noted that large differences in apparent detectability are possible if concentrations are expressed in relative weights instead of numbers of atoms. Thus,

0.01 atomic percent of boron in uranium is equal to  $< 0.0005$  weight percent since the uranium atom is 22 times heavier than the boron atom.

3. *The primary substance (matrix) has no important effect on the relative intensities of lines due to a secondary substance.* It is conceded that the relative intensities of analogous spectra of different elements, and of successive spectra of the same element, may vary with the composition of the samples and/or with the type, or portion, of light source from which radiation is taken, but there is no evidence that the relative intensities of lines in any particular spectrum of a given element are thereby greatly changed. It may be expected, therefore, that the relative intensities of lines observed in one metal arc will remain valid in any other metal arc, provided the arcs are at approximately the same temperature. The absolute intensities and the relative strengths of successive spectra may be altered by excitation conditions. For example, silicon may be more sensitive in carbon than in calcium, and it is well known that when easily ionized alkalis are present in sufficient quantity to influence discharge conditions they reduce the intensity of other spectra, especially those characteristic of ionized atoms.

4. *The order of lines arranged according to decreasing detectability in progressive dilution is the same as the order of decreasing intensity in the spectrum of the pure element.* In other words, emission line intensities in residual arc spectra (barring self-absorption) are proportional to the number of radiating atoms; and relative intensities may therefore be derived from concentrations at which different lines show the same intensity or limiting detectability.

Arc spectra usually exhibit a variety of lines, sharp or narrow ones, diffuse or wide ones (including band heads), strong ones accompanied by photographic spreading of developed images, others wide on account of hyperfine structure, and some partially reversed. All of these types, except the last, appear in residual arc spectra at low concentrations, and it may be questioned if it is possible to place them on a uniform intensity scale. It may be assumed that if total blackening integrated over the width of the line when recorded at a moderate level of density be con-

sidered in estimating relative intensities these will be on a uniform scale within the limits of precision in making such estimates on lines of different types.

5. *The order of spectral lines arranged according to decreasing intensity is the same when the intensities are decreased by rotating stepped sectors as when the intensity reduction is produced by successive dilution of the element in a matrix.* This was recognized by Löwe [12] who published an atlas of spark spectra of 44 elements diluted from 1 percent to 0.001 percent and later obtained practically the same results by observing spectra with stepped exposure times [16]. In our experiments the labor of preparing samples of 70 elements in four or more dilutions was greatly reduced by adopting only one dilution (0.1 atomic percent) and then producing further reductions of spectral-line intensities by means of rotating step sectors.

6. *Limiting detectability (as defined in 1.) may be adopted as a physical scale of intensities.* Such intensities may be fixed as follows: In a fully exposed spectrogram of copper containing 0.1 atomic percent of another element any faint but unmistakable line at a given wavelength is assigned unit intensity. Any similar line appearing with unit intensity in a spectrogram when the energy, or concentration, is reduced to  $1/5$  is said to be 5 times as strong. Thus, all lines can be assigned relative intensities proportional to their limiting detectabilities by determining either the energy reduction or the concentration reduction at which the stronger lines finally show unit intensity. The atomic percent concentration at which any line will show unit intensity then results from dividing 0.1 by its required energy or concentration reduction. For example, a line of intensity 10 should show plainly at 0.01 atomic percent, while one of intensity 1000 should be easily seen at 0.0001 atomic percent (one in a million). Assuming the ratio concentration/intensity to be constant, the maximum intensity at 100 percent is easily obtained. Thus, a line of intensity 1000 at 0.1 atomic percent will have an intensity value of  $1000 \times 100/0.1 = 1,000,000$  at 100 percent. This indicates a much larger range of spectral intensities than mentioned heretofore, but it is not unrealistic.

## 2. Experiments

Whereas all earlier experiments on residual spectra of diluted elements involved spark excitation of solutions or fused salts, we decided to employ d-c arc excitation for the following reasons. It has been shown [17] that the first ionization potentials of some seventy metallic elements range from 4 to 11 V and the strongest spectral lines of most of these elements have wavelengths between 2000 and

9000 Å, which is the spectral region covered by the present investigations. Furthermore, it is known [18] that the second ionization potential of these elements ranges from 10 to 75 V and that the strongest lines of singly ionized atoms generally have shorter wavelengths than those of neutral atoms, nearly half of them being shorter than 2000 Å so that they can be detected only in vacuum spectrographs.

Because low-voltage arcs have less ionizing action than high-voltage sparks more atoms will remain in the neutral state and, in general, therefore, arc spectra will exhibit stronger lines and higher sensitivity than spark spectra.

The use of arc spectra in these experiments threatened to introduce errors on account of self-absorption of radiated energy in the arc aura or envelope which consists largely of unexcited neutral vapor atoms. In all spectra of arcs between metal electrodes this is the cause of conspicuous self-reversal of all lines involving the atom's ground state. However, this is a function of vapor density surrounding the arc and if this is reduced to 0.001, self-reversal is usually negligible (see fig. 2). This is our reason for making these experiments with individual elements diluted in copper in the ratio 1 to 1000. When ground-state lines of extraordinary intensity were suspected of some self-absorption, intensity ratios were checked or corrected by examining our earlier spectrograms made with this element diluted to 0.0002 atomic percent in silver.

### 2.1. Dilution in Silver

Our preliminary experiments, begun in 1932, can be described briefly as follows: solutions of known strength of the elements under investigation were prepared and proper amounts added to pure silver oxide, which was then reduced to metal by heating to make samples containing 8 definite atomic ratios extending from 0.05 to 0.0002 atomic percent of the element added to silver, with a factor of about 2 between 7 successive dilutions. In order to save time and labor, each series of silver samples incorporated 3 to 6 chemical elements, in addition to zinc which supplied internal standards. These samples were burned on pure copper electrodes of a 220 volt d-c arc with 10 amperes. An image of the arc was projected onto the slit of a stigmatic concave grating spectrograph by means of a fused-quartz lens. Each series of excited samples was exposed on successive segments of the slit, and was photographed in four spectral regions ranging from 2000 to 9000 Å (see fig. 1). A comparator was employed to measure wavelengths (relative to silver and copper lines) for the identification of the added elements, and relative inten-

sities of all lines belonging to residual spectra of diluted substances were estimated and related to concentration. These results were not satisfactory for the following reasons: The use of silver as a matrix and of copper for arc electrodes precluded the possibility of getting any data for these two elements or for any lines masked by silver and copper lines. Also the inclusion of 3 or more elements in each series of samples resulted in the blending of many lines, especially in complex spectra, so that it was not possible to assign proper intensities in these cases. Furthermore, the method of sample preparation and observing appeared to be unsuited to very volatile elements, or compounds, because no residual spectra could be recorded for them even at concentrations of 0.1 atomic percent.

### 2.2. Dilution in Copper

In 1941 these preliminary experiments were abandoned in favor of a modified procedure which led to satisfactory results. The chief changes in procedure came with the availability and use of pure metal powders, and a hydraulic press to form solid electrodes of mixed powders. Instead of reducing spectral line intensities to the limit of detectability by successive dilutions of the element in different samples only one dilution (0.1 atomic percent) was prepared and line intensities were reduced by observing through rotating step sectors. The successful procedure may be outlined as follows: An element under investigation was mixed with pure copper powder in the atomic ratio of 1 to 1000. These mixtures were pressed into solid electrodes, and burned in a 220-V, 10-A d-c arc which was imaged entirely on the collimator of a stigmatic grating spectrograph by a lens at the slit. A rotating step sector in front of the slit reduced the spectral intensities to one-fifth in each of four steps (see fig. 2). Spectral intensities of the element added to copper were estimated relative to those of selected copper lines, and this was done separately for each of 70 elements throughout the range of spectrum from 2000 to 9000 Å. The true intensities of the selected copper lines above 3300 Å that served as internal standards were then measured, by photographic photometry, relative to the known energy distribution in the spectrum of an incandescent tungsten-strip filament at a certain

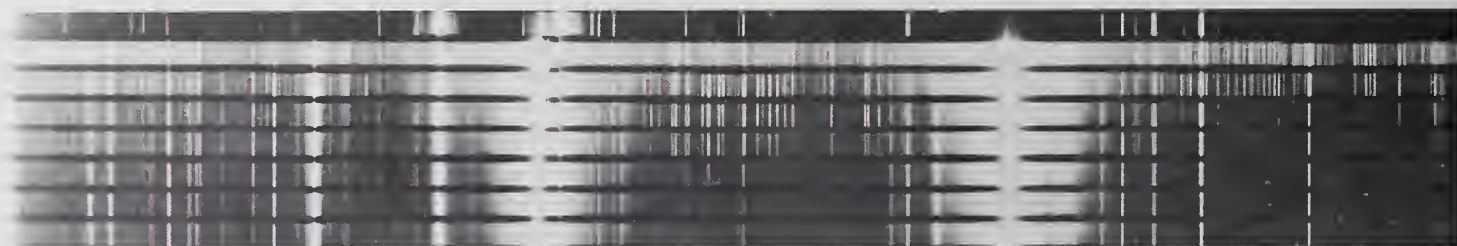


FIGURE 1. Arc spectra of elements (*V, Nb, Ta*) diluted progressively in silver, and burned on copper electrodes.  
Spectral range 3880 to 4320 Å.

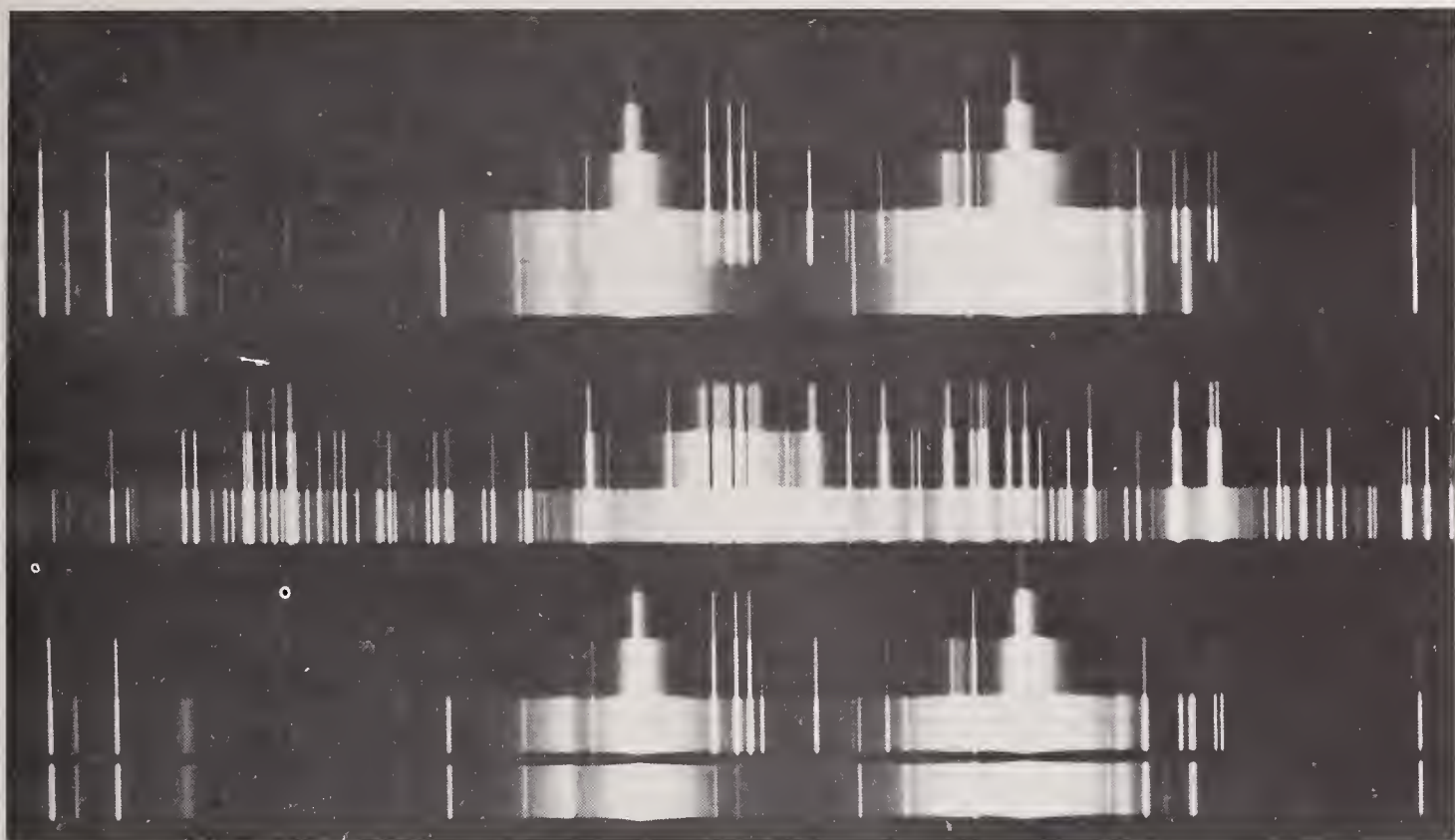


FIGURE 2. Arc spectra of pure manganese (center), and of copper containing 0.1 percent Mn (above and below), all through a rotating step sector.  
Spectral range 3960 to 4105 Å.

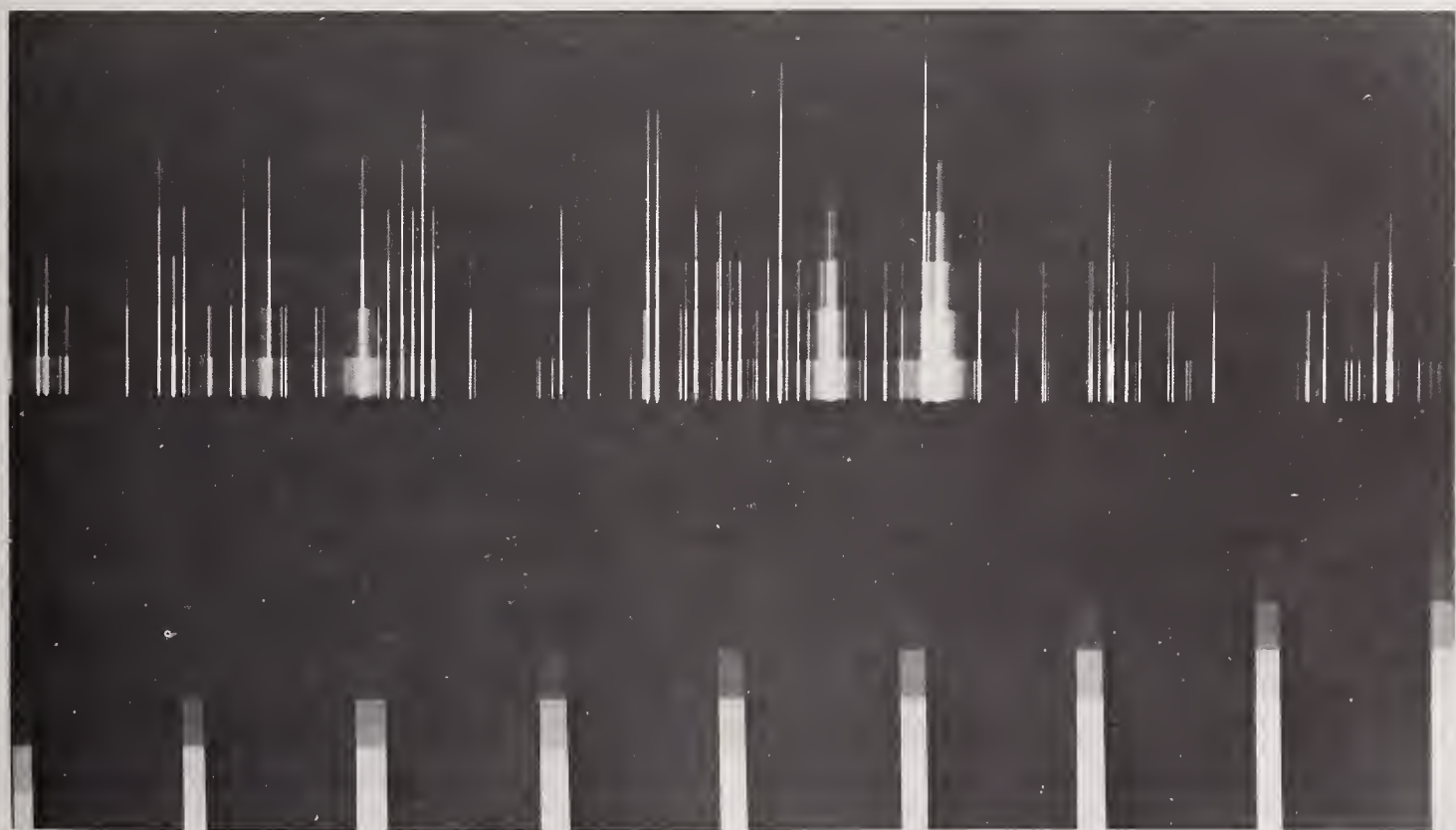


FIGURE 3. Energy calibration of copper lines.  
Above, arc spectrum of copper through rotating step sector. Spectral range 3400 to 3850 Å. Below, standard-lamp spectrum at 50 Å intervals through same step sector.

temperature (see fig. 3). Between 2000 and 3300 Å a calibrated hydrogen lamp was used to determine the relative intensities of copper lines. Finally the apparent intensities of 39 000 spectral lines of 70 elements, relative to copper, were adjusted to fit the copper calibrations. These experiments thus provide empirically determined lists of the principal lines of all elements actually detectable under average conditions in arc spectra when their concentrations are 0.1 atomic percent, and the individual lines bear intensity numbers approximately proportional to their detectability or their relative energy. That these intensity numbers really represent physical intensities was proved by comparing them with earlier, accurately measured relative intensities of lines in multiplets and with published relative  $f$ -values or oscillator strengths of lines in different multiplets extending over a wide range of spectrum.

In order to provide intensity data for spectral lines that are partially or wholly obscured by copper lines a sectored spectrogram of the pure element excited with self-electrodes, or of a metallic compound or salt excited in a carbon arc, was photographed on every plate so that any lines blended with copper could be interpolated with proper estimates of their relative intensities. Comparison of relative intensities in copper and in carbon matrices also supplied new information on successive spectra, I and II, especially of rare-earth spectra. Similar data for copper itself were obtained by using pressed electrodes of pure silver powder to which 0.1 atomic percent of copper was added, plus the same quantities of gold and zinc to serve as internal standards.

Further details of experimental materials, apparatus, and procedure are given in the following paragraphs.

### 2.3. Arc Electrodes

For this investigation materials of high purity were acquired, preferably in the form of metal powders, although some elements, not available in pure powdered metal form, were obtained as oxides. In every case the proper amount was added to powdered copper to produce a mixture in which there was one atom of the added element to each 1000 atoms of copper. These mixtures were homogenized by mechanical shaking and then compressed into solid cylindrical pellets in an hydraulic press at 5000 psi. The pellets were  $\frac{1}{4}$  in in diameter,  $\frac{1}{4}$  in in length, and weighed about 1.5 g. Two of a kind were mounted in massive water-cooled clamps in an arc stand and a direct current of 10 A passed between them from a 220-V line with ballast resistance. A 3-mm gap was maintained between the electrodes during the exposures which varied in duration from 1 s to 5 min depending on spectrographic efficiency and sensitivity of photographic plates in different spectral regions.

The arc was imaged on the collimator of a concave grating spectrograph by means of a quartz lens immediately in front of the slit to obtain uniform illumination along its length and collect light from all parts of the arc. Rotating step sectors were operated immediately in front of the collecting lens, one with 5 to 1 ratio was used for all line-intensity spectrograms, but a 2 to 1 step was used for the energy calibration of copper lines.

### 2.4. Spectrograph

The dispersing apparatus was a 6-in grating with 15 000 lines per inch, and 22 ft radius of curvature in a Wadsworth-type mounting to give stigmatic images on photographic plates. All observations were made in the first-order spectrum in which the reciprocal dispersion was 5Å/mm, and the practical resolving power about 50,000 with a slit width of 30  $\mu$ .

### 2.5. Photographic Plates

In order to determine, relative to copper, the intensities of all lines of 70 chemical elements diluted 1000 fold it was necessary to make many hundreds of spectrograms, and to employ 4 varieties of photographic plates to cover the wavelength range 2000 to 9000 Å. The spectral range 2000 to 3000 Å was recorded on Eastman<sup>2</sup> 103-0 Ultra-violet Sensitive plates, 2600 to 4900 Å on Eastman 33 plates, 4600 to 6900 Å on Eastman II-F plates, and 6600 to 9000 Å on Eastman I-N plates. Each plate was developed for 4 min in a rocking tray containing D-19 developer at 70 °F.

The exposure times in each spectral range were chosen by trial to obtain a suitable continuous background in the first step of the rotating step sector. Because of variations in spectral sensitivity of photographic materials and in spectrographic efficiency two exposures of the contaminated-copper arcs were usually made on each plate, with exposure durations in the ratio 2 to 1, and the sectored comparison spectrum of the contaminant was placed between them. Measurements were usually confined to the exposures which showed the optimum background in the first step of the rotating sector.

### 2.6. Energy Calibration of Copper Lines

In order to determine the factors necessary to convert the estimates of apparent intensities of the lines of 70 elements relative to copper into true relative intensities, it was necessary to determine the true relative intensities of selected reference lines in the spectrum of copper. The energy calibration of copper lines was performed as follows:

<sup>2</sup> Certain commercial products and instruments are identified in this paper in order to specify adequately the experimental procedure. In no case does such identification imply recommendation or endorsement by the National Bureau of Standards, nor does it imply that the products or equipment identified are necessarily the best available for the purpose.

A G.E. tungsten ribbon filament lamp (type F339-85, 30 A, 6V) equipped with a fused quartz window served as the reference standard of spectral energy distribution in the wavelength range 3300 to 9000 Å. The brightness temperature of the filament at 6500 Å was measured at two values of filament current by Henry Shenker in the National Bureau of Standards Pyrometry Laboratory. The true temperature  $T$  of the filament was determined from the brightness temperature by means of the following equation obtained from Wien's law

$$\frac{1}{T} = \frac{1}{T_B} + \frac{\lambda}{C_2} \ln A$$

where  $C_2 = 1.438$  cm-deg and  $A$  is the product of the emissivity of tungsten (0.427) and the transmittance of the quartz window (0.916) at 6500 Å.

TABLE 1. *Temperature of tungsten lamp*

Current	Brightness temperature	True temperature
<i>A</i>	<i>K</i>	<i>K</i>
38.00	2492	2787
40.00	2567	2881

The energy distribution from blackbodies operated at these temperatures was taken from tables prepared by Stair and Smith [19] in the 2300 to 3500 Å range, by Skogland [20] in the 3200 to 7600 Å range and by Lowan and Blanch [21] in the 7200 to 10 000 Å range. The data from these tables were adjusted to a common basis and multiplied by the emissivity of tungsten and the transmittance of fused quartz at intervals increasing from 50 Å in the ultraviolet to 200 Å in the infrared. The emissivity of tungsten was taken from a weighted mean curve of published values to which reference is made by Stair and Smith [19]. The transmittance of fused quartz was calculated from data on its index of refraction published by Sosman [22]. The final product, representing the relative energy distribution of the radiation emerging from the quartz window of the lamp, was plotted on a convenient scale to permit interpolation to any wavelength in the range 2300 to 10 000 Å.

Spectrograms of the pure copper arc and of the tungsten lamp were made under conditions identical with those described above except that for these a 2 to 1 step sector with 8 steps was used for closer calibration (fig. 3). Microphotometer measurements of transmittance were made in each step of the standard-lamp spectrum at intervals of 50 Å and a family of calibration curves of transmittance versus log exposure (hereafter referred to as log  $J$ ) was drawn up for each plate. The exposure of the standard-lamp  $J_s$  was read from the calibration curve

for each wavelength at a transmittance of 40 percent (where the curve is linear) and then divided by the calculated intensity  $I_s$  at that wavelength.  $I_s$  is the calculated intensity emitted by the standard-lamp. A standardization curve of  $\log J_s/I_s$  versus  $\lambda$  was plotted for each plate. Calibration curves of transmittance versus  $\log J$  were then drawn from measurements on each of the selected copper lines and the log exposure ( $\log J_{Cu}$ ) of each copper line at a transmittance of 40 percent was read from each curve.  $\log J_s/I_s$  was then subtracted from the average of numerous values of  $\log J_{Cu}$  to give  $\log I_{Cu}$  which is the log of the true relative intensity of the copper line. The values of  $\log I_{Cu}$  from plates in adjacent wavelength regions were adjusted to a common basis by means of lines common to both plates. The plot of  $\log J_s/I_s$  versus  $\lambda$  is the relative response function of the plate-spectrograph combination and as such was itself useful in the infrared where the copper spectrum lacks lines suitable for use as an intensity reference.

From 2 to 24 determinations were made on each of 202 lines of Cu I between 2800 and 8100 Å with an average of about 9 determinations per line. The values of  $I_{Cu}$  obtained by this procedure below 3300 Å were systematically low because of the rapid decline in intensity from the standard lamp in the direction of short wavelengths. The intensity from the lamp at 5500 Å is about 40 times the intensity at 3300 Å and about 300 times the intensity at 2800 Å. This fact introduces possible errors from scattered light of the intense visible radiation which tends to raise  $J_s$  and consequently depress  $I_{Cu}$ .

The spectrum of copper is composed of sharp lines and diffuse lines. Since the microphotometer measurements were made at the peaks of the lines rather than integrated over their widths, the measured intensities of the two groups of lines are on different relative scales, the scale of the diffuse lines being smaller than that of the sharp lines. The reference lines selected for calibration of the estimates of apparent intensity are all sharp lines.

The random error of the photometric procedure, including microphotometer error and irregularities of response of the "N" plates was determined from 92 measurements of apparent relative intensities in spectra of the standard lamp on two plates. The standard deviation of individual measurements from the mean was found to be about 1.5 percent. It is probable, therefore, that the uncertainties in these intensity measurements of the copper lines lie entirely in the systematic errors discussed above and in the random fluctuations of the arc under study.

Since the ribbon filament lamp was too faint in the region from 2000 to 3300 Å to serve as a standard, recourse was taken to a Hanovia hydrogen arc lamp. Output from this lamp was compared by R. Stair in the Radiometry Section of the Bureau with a standard tungsten-in-quartz lamp and a

standard mercury arc in the region from 2500 to 3800 Å; this provided an independent overlapping calibration which carried us down to 2500 Å.

The intensity numbers below 2500 Å become less accurate as the short wavelength limit is approached. Lacking any reliable energy calibration

for shorter waves, the intensity estimates from 2500 to 2000 Å were necessarily adjusted by judicious extrapolation, guided by the declining densities of background in the spectrograms, caused by the increasing absorption in the apparatus and in the air at shorter wavelengths.

### 3. Results

Because these relative intensities of 39,000 lines of 70 elements are based on empirical detectability they will be generally applicable to spectrochemical analysis provided that proper corrections are made on account of different excitation in different matrices. Chemical elements differ in volatility, electron emission, spectral excitation, and spectral background, and consequently their spectral detectability in different mixtures or matrices depends on certain controlling factors. One of the important factors is the atomic ionization potential which ranges from 3.9  $V$  for Cs to 11.3  $V$  for C, and for the investigated 70 elements has an average value of 7.3  $V$ . By mixing these 70 elements with copper, which has an ionization potential of 7.7  $V$ , we obtained excitation conditions very near the average for all. To convert our intensity numbers from copper to any other matrix would require the empirical determination of the proper conversion factor for each element.

It should be pointed out that sensitivity of detection in spectrochemical analysis is commonly given in percent by weight. In order to find the weight percent from the atomic percent given in the tables the following simple relation applies,

$$C_w = \frac{C_a A_x}{A_{Cu}}$$

where  $C_w$  is the concentration in percent by weight,  $C_a$  is the atomic percent (0.1 in this case),  $A_{Cu}$  is the atomic weight of copper, and  $A_x$  is the atomic weight of the element  $X$ .

Although our original intention was to determine the relative strengths of many spectral lines from different chemical elements for purposes of quantitative spectrochemical analysis we believe that the results may also interest theoretical spectroscopists and astrophysicists. For instance, if our intensity numbers, based on concentration detectability and relative energy calibration, actually express relative energies then all may be converted to oscillator strengths, or to relative  $gf$ -values, or even to absolute  $f$ -values, if the proper conversion factors can be found.

Because of the low concentration of each element in the copper arc from which the spectra were observed, the lines were extraordinarily free from

self absorption. This fact suggests that these emission intensities could be converted into relative  $gf$ -values, provided that a valid excitation temperature can be assigned to the copper arc.

The temperature of the copper arc can be determined by comparing the observed relative intensities of the lines of an element with the relative  $gf$ -values of those lines [23], provided that the arc can be shown to be in local thermodynamic equilibrium for the energy states under consideration. A preliminary investigation of this sort has been carried out by using relative  $gf$ -values determined by R. B. King and his coworkers for Ti I [24], Ti II [25], V I [26], Cr I [27], Fe I [28], [29] and Ni I [30] in the region above 3000 Å. Figure 4 is a typical example of the correlation of intensities and  $gf$ -values indicating the temperature of the copper arc. The comparison shows that our copper arc is sufficiently in equilibrium to yield a temperature which may be useful in calculating approximate  $gf$ -values of some utility from our intensity numbers. A preliminary value of 5000 K  $\pm$  300 K has been obtained as the average temperature of the 10 A, 220 V, copper arc.

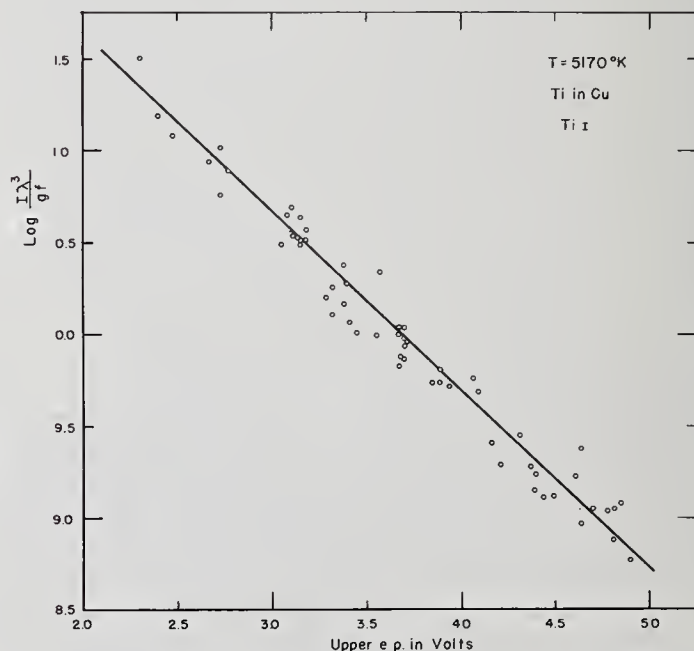


FIGURE 4. Plot of log intensity  $\lambda^3$  over  $gf$  versus upper excitation potential of Ti I lines.

The temperature of the arc is derived from the slope of the line which best fits the points.



Because our intensity data represent single (some times two) personal subjective estimates of photographic densities in sectored spectrograms there is no possibility of deriving statistically any probable errors or standard deviations for individual values. However, an estimate of the accuracy or reliability of our data may be obtained by comparing them with quantitative results published by other investigators. For example, figure 4 shows the ratios of our intensities to the relative  $f$ -values (or intensities) reported by King and King [24] who measured the total absorptions of Ti I lines in furnace absorption spectra; they stated [28] that "The average deviations of the individual intensity measures from the mean values vary from 4 to 15 percent for different lines" measured between 4 and 16 times on different plates. Each little circle plotted in figure 4 represents a Ti I multiplet of 1 to 12 lines. The average of 59 deviations from the mean of all is 25 percent.

A second indication of the reliability of our intensities is obtained by comparing our values with the relative intensities of lines in multiplets of five elements (Cr, Fe, Mn, Ti, V) measured with photographic densitometry by Frerichs [31] to test the sum rules. Such a comparison in 21 different multiplets indicates deviations ranging from 5 to 22 percent, with an overall average of 14 percent.

A third estimate of the errors in our data results from their comparison with photoelectric intensity measurements in the iron arc by Crosswhite [32], who claims an accuracy of the order of 1 percent. The average difference between intensities of 330 iron lines (3175 to 5658 Å) common to these two sets of observations is  $\pm 27$  percent, but some of this difference may be due to temperature if this is not the same in both arcs.

Other comparisons could be made but the above three are different and typical; they suggest that the average error of our spectral-line intensities within a spectrum of each element is probably between 15 and 25 percent. The uniformity of the intensity scale between the spectra of the various elements is more difficult to assess. Considerable care was taken to obtain spectrograms under comparable conditions for all of the elements; however, differences in volatilities of the elements or their oxides, and differences in ease of excitation may possibly result in shifts of intensity scales between elements. An inspection of the intensities of the strongest lines of the elements indicates that the values are generally in the same order as sensitivity of detection of the elements where these are known. Although no high precision was expected in our mass-production of intensities it is emphasized that reasonably uniform, quantitative values are now available for 39 000 lines emitted by 70 chemical elements.

The tables of spectral-line intensities resulting from this investigation are presented in two parts.

In part I the data are arranged by element in alphabetical order of chemical name. The heading of each table by element states the atomic symbol, atomic number, atomic weight, ratio of atomic weight to that of copper, the electron configuration and term symbol of the normal state of each spectrum and the corresponding ionization potential expressed in  $\text{cm}^{-1}$ . Following the heading is a selected list of references. Under *Wavelengths* are listed all of the sources from which the wavelengths used in the table were compiled. Under *Classification* or *Spectrum Assignments* are listed the sources from which the assignment of spectrum and energy levels were obtained. A few spectra showed bands of metallic oxides. References to data about these bands are given under *Molecular Spectra*.

Following the references there is abstracted from the main table a list of the strong lines arranged in order of decreasing intensity. These lists of the strong lines generally contain 2 percent or more of the lines in the main table.

Electron configurations and spectral term designations of quantum numbers are of unusual interest in the production of the strongest spectral lines, or *raies ultimes*. According to well-known rules governing the relative intensities of lines in multiplets, the strongest line arises from transitions between levels having the largest  $J$  and  $L$  values when  $\Delta J = \Delta L = 1$ . A rule relating to *raies ultimes* was expressed [33] a quarter of a century ago as follows: "A *raie ultime* in any spectrum originates with a simple interchange of a single electron between  $s$  and  $p$  states, usually preferring configurations in which only one electron occurs in such states." The above simple rules for the strongest lines appear to be valid for all spectra.

Then comes the main table, listing in order of wavelength, for every line of an element which appears on our plates, the intensity, character, wavelength, spectrum, and energy levels. The calibrated intensity numbers in the first column represent the relative radiant power emitted by our arc at each wavelength. Lines which differ in profile from a normal sharp symmetrical shape are described in the second column, with the notation suggested in the Transactions of the Joint Commission for Spectroscopy [34] as follows:

- b – band head,
- c – complex,
- d – unresolved double line,
- h – hazy,
- l – shaded longward,
- s – shaded shortward,
- w – wide.

The wavelengths in column 3 are taken from the places noted in the list of references and are given

to the nearest 0.01 Å. They are all normal air wavelengths, even those below 2000 Å. Column 4 gives the spectrum, I, II, or III (respectively from neutral, singly ionized and doubly ionized atoms) in which the line occurs or the molecule from which a band head originates and column 5 the numerical values, rounded off to the nearest wavenumber, of the levels between which the transition occurs. These data are taken from the *Classification* reference.

The wavelength of a doubly classified line appears before the first pair of energy levels and the second pair follows immediately. In these tables all energy levels are given in vacuum wavenumber units,  $\text{cm}^{-1}$ , for which the name kayser ( $K$ ) has been proposed [35]. For all spectral lines explained as transitions between energy levels this serves as a mutual check since the wavelengths in normal air, when converted to vacuum wavenumbers by a conversion table [36], will coincide within one unit with the difference between the two energy levels. Furthermore these numbers serve as an index to the term designation in "Atomic Energy Levels" [37] where electron configurations, quantum numbers, and magnetic splitting factors are given.

A comparison of the excitation energies of any two classified lines may be made by directly comparing their energy levels in  $\text{cm}^{-1}$ . This direct and simple procedure avoids the labor of converting all energy levels from  $\text{cm}^{-1}$  to electron volts by means of the relation  $1 \text{ eV} = 8065 \text{ cm}^{-1}$ .

In part II the intensity data are arranged in two tables in order of increasing wavelengths. In table 1 the strong lines of each element which were ab-

stracted from the main tables in part I are here arranged in order of wavelength. Following this is table 2 in which the individual main tables of part I have been consolidated into a single table arranged by wavelength. This table contains about 39 000 lines of 70 elements. The intensities in the table are on a scale of relative radiant power and the scale is the same from element to element. Following the intensity numbers are given the wavelength, the element symbol, and the spectrum. The intensity of a double line appears before the first wavelength and the second wavelength follows immediately.

This investigation has extended over a period of 28 years, and represents a very considerable amount of intermittent labor contributed mainly by a relatively small number of individuals. The program was initiated by Meggers and Scribner; the latter prepared diluted-element mixtures, electrodes and spectrograms, while the former identified wavelengths, supplied many line classifications, and estimated relative intensities of some fifty thousand lines. In the production of the mixtures and the copper electrodes and spectrograms valuable assistance was given by Harriet E. Brown. Corliss contributed the copper calibration, the conversion of apparent intensities to relative radiant powers, and prepared the final tables. Mrs. Ruth Peterson carefully prepared and checked all the data on IBM cards so that it could be printed automatically. Valuable advice and assistance on the IBM machine operations was given by William Bozman. To all our able and reliable assistants the authors extend their sincere appreciation and thanks for cheerful and conscientious cooperation.

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**Tables of Spectral-Line Intensities—Part II**  
**Arranged by Wavelengths**



**Table 1.**

**The Strong Lines**

**in Order of Wavelength**





TABLE I. *The strong lines in order of wavelength*

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
55000	1936.96	As I	16000	2043.77	Ge I	2700	2100.84	Mo II
48000	1953.89	Bi I	3800	2043.79	Cu II	1500	2104.29	Mo II
30000	1954.47	Ge I	26000	2045.36	Os I	1400	2108.02	Mo II
9000	1959.48	Bi I	17000	2045.98	Mo II	2700	2109.22	Re I
90000	1960.26	Se I	7800	2048.28	Os I	2000	2109.42	Nb II
20000	1961.36	Ge I	27000	2049.08	Re I	1700	2109.58	Mn I
32000	1970.23	Ge I	5500	2049.37	Pt I	4600	2110.26	Bi I
26000	1970.80	Sn I	7800	2049.42	Os I	2500	2116.67	Yb II
65000	1971.97	As I	13000	2049.57	Sb I	4800	2117.96	Os I
15000	h 1983.55	Sn I	5300	2049.63	W II	2100	2118.87	W II
14000	1987.62	Ge I	6200	2052.22	Ir I	6600	2119.79	Os
36000	1989.70	As I	19000	2055.52	Cr II	2400	2121.59	W II
11000	1990.48	As I	8600	2058.69	Os I	2200	2124.12	Si I
14000	1994.18	Te I		2058.78	Os I	1700	2125.21	Nb II
5000	1994.78	As I	5000	2060.64	Ir I	3000	2126.74	Yb II
9700	1995.41	Mn I	14000	2061.49	Cr II	4500	2126.81	Ir II
42000	1998.24	Ge I	13000	2061.69	Os I	4500	2127.94	Ir I
14000	1998.86	Mn I	44000	2061.70	Bi I	1500	2131.18	Nb II
5500	1999.69	Cu II	10000	2062.00	Zn II	3400	2136.18	P I
9600	2001.45	Os I	7500	2065.21	Ge I	5300	2137.11	Os I
5800	2001.71	W II	8900	2065.42	Cr II	10000	2138.56	Zn I
26000	2002.02	Te I	2300	2065.57	W II	3400	2139.04	Re II
44000	2003.34	As I	7800	2067.21	Os II	3200	2139.69	Sb I
25000	2003.53	Re I	1500	2067.50	Pt I	1100	2140.13	Ta II
13000	2003.73	Os I	42000	2068.33	Sb I	18000	2142.81	Te I
18000	2003.85	Mn I	26000	2068.66	Ge I	1900	2144.23	Pt I
9000	2004.78	Os	4200	2070.67	Os II	19000	2144.38	Cd II
13000	2008.07	W II	3400	2071.21	W II	3200	2144.86	Sb I
5500	2009.19	As I	4200	2074.70	Re I	1500	2146.87	Ta II
5100	2009.98	W II	2200	2075.59	W II	3700	2148.22	Ir I
17000	2010.15	Os I	2400	2076.43	Ru I	2600	2149.14	P I
4100	2010.23	W II	7200	2076.95	Os I	3500	2152.68	Ir II
9900	2010.65	Ir I	7200	2078.09	Os	3700	2156.67	Re I
11000	2012.00	Au I	9700	2079.11	W II	7900	2158.05	Ir I
6200	2012.78	Hf II	14000	2079.97	Os I	3600	2166.77	Fe I
4200	2013.32	As I	4800	2081.68	Mo II	4900	2167.94	Re I
4100	2014.23	W II	3700	2083.22	Ir I	5800	2169.42	Ir II
19000	2015.11	Mo II	2600	2083.77	Ru I	1500	2174.67	Pt I
16000	2017.87	Re I	3700	2083.92	Re I	4500	2175.24	Ir I
29000	2018.14	Os I	3000	2084.12	Fe I	8500	2175.81	Sb I
17000	2019.07	Ge I	3000	2084.59	Pt I	3400	2176.21	Re I
29000	2020.26	Os	10000	2085.59	Re I	1200	2182.71	Ta II
40000	2020.30	Mo II	3600	2088.19	W II	850	2185.71	Yb II
10000	2021.21	Bi I	17000	2088.82	Ir I	1100	2193.88	Ta II
2600	2021.38	Au I	4200	2088.93	B I	1500	2196.03	Ta II
8700	2022.35	Ir I	2200	2089.14	W II	1500	2199.67	Ta II
14000	2022.76	Os I	2400	2089.52	Mo II	1400	d 2210.03	Ta II
2400	2024.34	Cu I	6500	2089.59	B I		2210.19	Ta II
3000	2025.48	Zn II	1700	2090.48	W I	4200	c 2214.26	Re II
7300	2026.08	W II	2400	2090.89	Ru I	2200	2214.58	Re I
8500	2028.18	Hf II	1500	2092.16	Mn I	640	2224.46	Yb II
14000	2028.23	Os I	4700	2092.41	Re II	1400	2239.48	Ta II
3300	2029.32	Nb II	2100	2092.44	V I	1200	2250.76	Ta II
15000	2029.98	W II	2200	2092.50	Mo II	9000	2265.02	Cd II
3200	2030.63	Pt I	14000	2092.63	Ir I	5200	c 2275.25	Re II
4400	2032.41	Pt I	4000	2093.11	Mo II	4100	2286.16	Co II
3000	2032.99	Nb II	20000	2094.26	Ge I	2900	2287.51	Re I
15000	2033.57	Ir I	6100	2094.75	W II	15000	2288.02	Cd I
18000	2034.44	Os I	1200	2096.18	Hf II	2600	2288.12	As I
2700	2035.03	W II	9800	2097.12	Re I	2700	2294.49	Re I
21000	2038.44	Mo II	6000	2097.60	Os I	1100	2297.78	La III
5000	2039.77	Sb I	5000	2098.41	Sb I	2600	2320.03	Ni I
40000	2039.85	Se I	2400	2098.60	W II	9500	2348.61	Be I
8000	2040.66	Sn I	5300	2100.63	Os I	2600	2349.84	As I
24000	2041.71	Ge I	2200	2100.67	W II	3500	2372.77	Ir I

TABLE I. *The strong lines in order of wavelength—Continued*

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
1400	2387.06	Ta II	1600	2705.89	Pt I	3200	2906.68	Eu II
2400	2400.63	Ta II	7000	2706.51	Sn I	780	2906.80	U II
1700	d 2405.58	W I	8500	2709.63	Ge I	780	2908.28	U II
	2405.69	W I	1200	2710.13	Ta I	2400	2908.82	V II
5300	2407.25	Co I	2600	2714.67	Ta I	9600	2909.06	Os I
5300	2411.62	Co I	2100	2718.91	W I	1500	2910.36	Er II
4800	2414.46	Co I	2600	2719.02	Fe I	9000	2911.39	Lu II
4800	2415.30	Co I	1300	2722.61	Zr II	2000	2916.48	Hf I
4100	2424.93	Co I	2600	2724.35	W I	2400	2924.02	V II
2600	2427.95	Au I	4200	2727.78	Eu II	4400	2924.79	Ir I
2500	2428.58	Re I	1800	2733.96	Pt I	1700	2929.79	Pt I
1800	2435.96	W I	1400	2734.86	Zr II	1700	2933.55	Ta I
3300	2475.12	Ir I	520	2747.16	Th II	1500	2939.30	Mn II
2800	2483.27	Fe I	1200	2748.78	Ta I	1200	2940.22	Ta I
2600	2488.15	Fe I	1300	2750.48	Yb II	2000	2940.77	Hf I
4500	2488.55	Os I	3600	2754.17	Lu II	1300	2941.92	U II
1800	2489.75	Fe I	6500	2754.59	Ge I	9500	2943.64	Ca I
1800	2490.64	Fe I	1000	d 2758.31	Ta I	830	2943.90	U II
2400	2496.78	B I	4400	2767.87	Tl I	2400	2944.40	W I
4800	2497.73	B I	1700	2775.40	Mo II	2400	2946.99	W I
4100	2502.98	Ir I	1400	2780.22	As I	1900	2949.20	Mn II
3600	2516.11	Si I	830	2793.94	U II	1200	2950.68	Hf I
4300	2521.36	Co I	6200	2794.82	Mn I	1100	2954.20	Hf I
2800	2522.85	Fe I	10000	2795.53	Mg II	1500	2963.32	Ta I
2400	2524.11	Si I	5100	2798.27	Mn I	4200	2963.32	Lu II
1200	d 2526.35	Ta I	3700	2801.06	Mn I	1500	2964.52	Er II
	2526.45	Ta I	10000	2801.99	Pb I	1400	2964.88	Hf I
2000	2528.51	Si I	870	2802.56	U II	1700	2966.90	Fe I
3200	2528.52	Sb I	6000	2802.70	Mg II	2000	2970.56	Yb II
15000	2536.52	Hg I	1900	2802.84	Eu II	1100	2980.81	Hf I
7900	2543.97	Ir I	3400	2813.94	Eu II	1500	2986.00	Cr I
2700	2551.35	W I	1700	2816.15	Mo II	2100	2986.47	Cr I
1200	2559.43	Ta I	1200	2820.22	Hf II	1800	2997.97	Pt I
500	2565.59	Th II	2000	2820.78	Eu II	5500	2999.60	Re I
1600	2568.87	Zr II	870	2821.12	U II	4000	3002.49	Ni I
2100	2571.39	Zr II	920	2832.06	U II	7000	3009.14	Sn I
12000	2576.10	Mn II	800	2832.31	Th II	3700	3012.00	Ni I
6200	2593.73	Mn II	9500	2833.06	Pb I	1800	3012.54	Ta II
6000	2598.05	Sb I	2500	2835.63	Cr II	1100	3012.90	Hf II
	2598.09	Sb I	1200	2837.30	Th II	1400	3014.92	Cr I
2000	2599.40	Fe II	5100	2838.63	Os I	1100	3016.94	Hf II
4300	2605.69	Mn II	14000	2839.99	Sn I	2800	3017.57	Cr I
1400	2608.63	Ta I	1700	2843.25	Cr II	4400	3018.04	Os I
18000	2615.42	Lu II	3000	2847.51	Lu II	1200	3020.53	Hf I
1200	2635.58	Ta II	1700	2848.23	Mo II	3000	3020.54	Lu II
3800	2637.13	Os I	3800	2849.72	Ir I	2800	3020.64	Fe I
1100	2638.71	Hf II	1200	2849.84	Cr II	2800	3021.56	Cr I
1000	2638.77	Eu II	1500	2850.49	Ta I	920	3031.11	Yb II
3500	2639.71	Ir I	1900	2850.98	Ta I	8500	3034.12	Sn I
1100	2641.41	Hf II	60000	2852.13	Mg I	7500	3039.06	Ge I
2400	2647.47	Ta I	10000	2863.33	Sn I	8000	3039.36	In I
12000	2651.18	Ge I	970	2865.68	U II	3500	3050.82	Ni I
2600	2653.27	Ta I	2100	2866.37	Hf I	1100	3057.02	Hf I
990	2653.75	Yb II	550	2870.41	Th II	8600	3058.66	Os I
1900	2656.61	Ta I	1700	2871.51	Mo II	3200	3064.71	Pt I
2800	2659.45	Pt I	5000	2874.24	Ga I	2400	3066.38	V I
1500	2661.34	Ta I	2600	2881.58	Si I	36000	c 3067.72	Bi I
3400	2675.95	Au I	2900	2887.68	Re I	2100	3072.88	Hf I
1800	2677.16	Cr II	1200	2889.63	U II	7500	3077.60	Lu II
1800	2678.63	Zr II	3600	2891.38	Yb II	670	3078.83	Th II
2100	2681.42	W I	6300	2894.84	Lu II	5100	h 3081.47	Lu I
1500	2685.17	Ta II	4000	2897.98	Bi I	3200	3082.15	Al I
1000	2698.30	Ta I	1800	2898.26	Hf I	6500	d 3092.71	Al I
4200	2701.71	Lu II	4500	2900.30	Lu II		3092.84	Al I
2000	2702.40	Pt I	1200	2904.41	Hf I	3800	3093.11	V II

TABLE 1. *The strong lines in order of wavelength—Continued*

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
1800	3094.18	Nb II	730	3291.34	U II	11000	3405.12	Co I
3500	3100.50	Gd II	910	3291.74	Th II	5300	3407.80	Dy II
2600	3101.55	Ni I	620	3292.52	Th II	4500	3409.18	Co I
3000	3102.30	V II	1500	3293.07	Tb II	6700	3412.34	Co I
510	3108.30	Th II	7600	3301.56	Os I	8200	3414.76	Ni I
2600	3110.71	V II	2000	3302.46	Tm II	1400	c 3414.90	Ho II
970	3111.62	U II	1100	3305.90	U II	5400	3416.46	Ho II
1400	3112.12	Mo I	1700	3306.39	Sm II	3100	3417.35	Ru I
2000	3118.38	V II	1100	3311.16	Ta I	13000	3421.24	Pd I
3000	3118.43	Lu I	6200	3312.11	Lu I	6900	3422.47	Gd II
510	3119.53	Th II	2300	3312.42	Er II	8000	3424.62	Re I
510	3122.96	Th II	510	3321.45	Th II	6400	3425.08	Tm II
4800	3130.42	Be II	4200	3323.09	Rh I	2000	c 3425.34	Ho II
1500	3130.79	Nb II	3800	3324.40	Tb II	2000	c 3428.13	Ho II
3200	3131.07	Be II	840	3325.12	Th II	4900	3428.31	Ru I
7400	3131.26	Tm II	4700	3327.89	Y II	4500	3433.04	Co I
14000	3132.59	Mo I	620	3334.60	Th II	2600	3433.56	Ni I
3400	3133.32	Ir I	1500	3337.49	La II	980	3434.00	Th II
2300	3133.89	Tm II	620	3337.87	Th II	8200	3434.89	Rh I
2900	3134.11	Ni I	5700	3341.88	Ti I	770	3435.98	Th II
6000	3158.16	Mo I	1300	3341.97	Nb I	6400	3436.74	Ru I
1200	3163.40	Nb II	1300	3343.71	Nb I	4700	3438.23	Zr II
8700	3170.35	Mo I	1400	3345.02	Zn I	530	3439.71	Th II
2300	3172.83	Tm II	4300	3349.04	Ti II	2700	3439.99	Gd II
1100	3180.20	Th II	1700	3349.06	Nb I	4000	3440.61	Fe I
3200	3183.41	V I	12000	3349.41	Ti II	6400	3441.40	Pd I
5300	3183.98	V I	5400	3350.47	Gd II	4900	3441.50	Tm II
3800	3185.40	V I	980	3351.23	Th II	8800	3443.64	Co I
770	3188.23	Th II	9900	3353.73	Sc II	3800	3445.57	Dy II
7600	3193.97	Mo I	4100	3354.64	Ti I	4800	3446.26	Ni I
3800	3199.92	Ti I	1600	3358.12	Mo I	3200	3447.12	Mo I
990	3201.71	Ce II	1700	3358.42	Nb I	4100	3449.17	Co I
3000	3208.83	Mo I	620	3358.60	Th II	16000	c 3451.88	Re I
1000	3212.81	Eu I	4300	3358.62	Gd II	3200	3453.14	Ho II
3900	3216.69	Y II	7600	3359.56	Lu I	21000	3453.50	Co I
1100	3218.93	Tb II	7200	3361.21	Ti II	4900	3453.66	Tm II
1200	3219.98	Tb II	5400	3361.26	Ti I	2700	3454.32	Dy II
5100	3220.78	Ir I	5400	3362.23	Gd II	16000	c 3456.00	Ho II
880	3221.17	Ce II	4000	3362.61	Tm II	5000	3458.47	Ni I
560	3221.29	Th II	2900	3369.57	Ni I	55000	c 3460.46	Re I
	3229.01	Th II	4300	3371.45	Ti I	7700	3460.77	Pd I
2300	3230.58	Er II	6600	3372.15	Sc II	4400	3460.97	Dy II
6600	3234.52	Ti II	7700	3372.71	Er II	5000	3461.65	Ni I
5200	3236.57	Ti II	5700	3372.80	Ti II	1600	3461.97	Ho II
590	3238.12	Th II	6200	3376.50	Lu I	5900	3462.04	Rh I
4100	3239.04	Ti II	3300	3380.57	Ni I	8500	3462.20	Tm II
2300	3241.54	Tm II	1500	3380.91	La II	5100	3462.80	Co I
6200	3242.28	Y II	28000	3382.89	Ag I	2700	3463.98	Gd II
11000	3242.70	Pd I	5700	3383.76	Ti II	2400	3464.37	Yb I
50000	3247.54	Cu I	1900	3384.62	Mo I	40000	c 3464.73	Re I
4800	3254.31	Lu II	5300	3385.02	Dy II	5100	3465.80	Co I
13000	3256.09	In I	1700	3385.08	Er II	1300	3469.92	Th II
910	3256.27	Th II	730	3390.39	U I	4700	3470.66	Rh I
910	3262.67	Th II	5700	3391.98	Zr II	4800	3472.48	Lu II
2700	3264.78	Er II	2300	3392.00	Er II	8000	3474.02	Co I
990	3272.25	Ce II	1300	3392.04	Th II	5400	c 3474.26	Ho II
5500	3273.63	Sc I	3300	3392.99	Ni I	4700	3474.78	Rh I
25000	3273.96	Cu I	3800	3393.57	Dy II	1200	3479.39	Zr II
3800	3278.97	Lu I	5600	3396.82	Rh I	1300	3481.15	Zr II
1300	3279.26	Zr II	4100	3397.07	Lu II	10000	3481.15	Pd I
55000	3280.68	Ag I	8100	c 3398.98	Ho II	2200	3481.28	Gd II
7600	3281.74	Lu I	4000	3399.30	Re I	6300	3484.84	Ho II
1000	3285.04	Tb II	2300	3399.80	Hf II	1600	3489.37	U I
620	3287.79	Th II	980	3402.70	Th II	4800	3489.40	Co I
18000	3289.37	Yb II	24000	3404.58	Pd I	5500	3492.96	Ni I
2300	3291.00	Tm II						

TABLE 1. *The strong lines in order of wavelength—Continued*

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
4400	3494.49	Dy II	8800	3569.38	Co I	6600	3642.68	Ti I
2500	3494.76	Ho II	2200	3569.49	Mn I	13000	3642.79	Sc II
4100	3496.21	Zr II	4000	3570.10	Fe I	6600	3645.31	Sc II
8300	3498.94	Ru I	2100	3572.47	Zr II	11000	3645.40	Dy II
6700	3499.10	Er II	13000	3572.53	Sc II	6100	3646.19	Gd II
9600	3502.28	Co I	530	3575.32	Th II	2800	3650.15	Hg I
5900	3502.52	Rh I	1500	3575.85	Nb I	2300	3650.40	Tb II
1200	3505.23	Hf II	4400	3576.24	Dy II	7200	3653.50	Ti I
7000	3506.32	Co I	9900	3576.35	Sc II	3900	3654.62	Gd II
780	3507.34	U I	1300	3576.85	Zr II	1800	3655.85	Ce II
8300	3507.39	Lu II	1000	3577.45	Ce II	3100	3656.15	Gd II
5700	3509.17	Tb II	1400	3577.88	Mn I	8200	3657.99	Rh I
2600	3510.34	Ni I	19000	3578.69	Cr I	2000	3658.88	Tb II
670	3511.56	Th II	1100	3579.20	Tb II	960	3659.16	U I
	3511.67	Th II	5000	3580.27	Nb I	560	3659.51	Th II
4800	3512.64	Co I	7700	3580.94	Sc II	880	3660.64	Ce II
3200	3513.64	Ir I	6000	3581.20	Fe I	6200	3661.35	Ru I
1600	3514.61	U I	1400	3581.89	Mo I	2200	3661.36	Sm II
6600	3515.05	Ni I	4700	3583.10	Rh I	1600	3662.29	Ho I
4100	3515.59	Ho II	3300	3584.52	Y II	2700	3664.60	Gd II
12000	3516.94	Pd I	3200	3584.88	U I	3000	3664.61	Y II
4800	3518.35	Co I	5400	3584.96	Gd II	1400	3667.97	Ho I
20000	3519.24	Tl I	3300	3585.06	Dy II	880	3667.98	Ce II
2000	3519.60	Zr I	6700	3587.19	Co I	2800	3670.07	U II
1300	3523.66	Tb II	6400	3589.22	Ru I	2200	3670.84	Sm II
4400	3523.98	Dy II	4200	3592.60	Sm II	700	3675.57	Th II
8200	3524.54	Ni I	2800	3592.92	Y I	3800	3676.35	Tb II
6400	3526.85	Co I	6900	3593.02	Ru I	2200	3682.24	Hf I
8800	3528.02	Rh I	17000	3593.49	Cr I	14000	3683.48	Pb I
5000	3529.43	Tl I	6400	3596.18	Ru I	1200	3685.80	Nd II
7300	3529.81	Co I	4700	3596.19	Rh I	3100	3687.74	Gd II
22000	3531.70	Dy II	5900	3597.15	Rh I	6400	3688.42	Eu II
4400	3534.96	Dy II	1600	3600.44	Tb II	9400	3692.36	Rh I
2000	3535.30	Nb I	10000	3600.73	Y II	7900	3692.65	Er II
5500	3536.02	Dy II	3500	3601.19	Zr I	32000	3694.19	Yb II
1300	3537.48	Nb I	6200	3601.92	Y II	4700	3694.81	Dy II
4400	3538.52	Dy II	1700	3604.28	Sm II	1400	3694.94	Mo I
670	3539.59	Th II	13000	3605.33	Cr I	1500	3697.85	Nb I
1100	3540.24	Tb II	2100	3608.77	Tm II	4800	3700.26	Tm II
4300	3545.80	Gd II	2000	3608.86	Fe I	7600	3700.91	Rh I
1600	3546.05	Ho II	980	3609.44	Th II	3800	3701.36	Tm II
1800	3547.68	Zr I	3400	3609.49	Sm II	1100	3701.52	U II
3900	3549.01	Y II	20000	3609.55	Pd I	4700	3702.86	Tb II
3900	3549.36	Gd II	3600	3610.51	Cd I	3800	3703.58	V I
4400	3550.22	Dy II	7800	3611.05	Y II	2400	3703.92	Tb II
1200	3550.82	U II	28000	3613.84	Sc II	1000	3709.29	Ce II
1800	3551.95	Zr II	3100	3616.56	Er II	1000	3709.93	Ce II
12000	3553.08	Pd I	670	3617.02	Th II	13000	3710.30	Y II
4800	3554.43	Lu II		3617.12	Th II	1000	3711.76	Tb II
2100	3556.60	Zr II	1900	3617.52	W I	2700	3712.70	Gd II
1500	3558.02	Er I	2000	3618.77	Fe I	3300	3713.01	Nb I
6600	3558.55	Sc II	6600	3619.39	Ni I	1400	3716.37	Ce II
530	3559.45	Th II	4300	3620.94	Y I	1000	3717.80	Hf I
1200	3560.80	Ce II	1700	3621.23	Sm II	7700	3717.91	Tm I
1300	3561.66	Hf II	1400	3624.46	Mo I	590	3719.44	Th I
3200	3561.74	Tb II	4000	3630.24	Dy II	6000	3719.94	Fe I
1200	3561.80	U I	20000	3630.75	Sc II	770	3721.82	Th II
5000	3566.37	Ni I	2000	3631.46	Fe I	20000	3724.94	Eu II
2300	3566.60	U I	7800	3633.12	Y II	4000	3725.76	Re I
6100	3567.70	Sc II	3400	3634.29	Sm II	2700	3726.24	Nb I
4800	3567.84	Lu I	20000	3634.70	Pd I	8700	3726.93	Ru I
4200	3568.27	Sm II	3100	3634.93	Ru I	11000	3728.03	Ru I
4200	3568.52	Tb II	4800	3635.46	Ti I	1600	3728.47	Sm II
1600	3568.98	Tb II	840	3638.20	U I	7100	3730.43	Ru I
1100	3569.04	Hf II	1600	3638.68	Er I	2100	3731.26	Sm II

TABLE 1. *The strong lines in order of wavelength—Continued*

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
2400	3734.12	Tm II	7600	3799.35	Ru I		3863.40	Nd II
7000	3734.87	Fe I	2500	3801.52	Ce II	2900	3863.87	Zr I
1600	3735.98	Sm II	2700	3802.92	Nb I	29000	3864.11	Mo I
3400	3737.13	Fe I	590	3803.08	Th I	1900	3865.92	U II
2900	3739.12	Sm II	1200	3803.47	Nd II	1800	3867.99	W I
	3739.20	Sm II						
2700	3739.80	Nb I	2500	3805.36	Nd II	1500	3871.04	U I
1300	3741.18	Th II	3200	3806.72	Mn I	3400	3871.64	La II
3500	3742.28	Ru I	1000	3808.11	Ce II	7000	3872.11	Dy II
1700	3742.39	Nb I	1600	3810.33	Er I	5500	3873.12	Co I
			8900	c 3810.73	Ho II	3500	w 3874.17	Tb II
4500	3743.47	Gd II	1900		U I	1700	c 3877.19	Pr II
5000	3744.06	Tm I	3700		Gd II	1100		Ce II
2400	3745.56	Fe I	1300	h 3816.03	Pr II	1500		Er II
2800	3745.59	Ru I	39000	cw 3819.67	Eu II	1200		Nd II
870	3747.17	Tb II	5000		Fe I	1000		U II
870	3747.34	Tb II	1300		Hf I	1500		Ce II
3200	cw 3748.17	Ho II	3800		Rh I	6800		Tm I
950		U II	2100		Mn I	3700		Sm II
4000	3749.49	Fe I	3200		Fe I	1500		Zr I
3700	3752.52	Os I	1600		Sm II	1800		Fe I
650	3752.57	Th II	1200		Nd II	1700		La II
5200	3752.86	Ti I	750		U II	5400		Tm I
1100	3755.24	Tb II	1500		Tb I	3000	c 3888.96	Ho II
4700	3757.37	Dy II	3600		Er II	1300		Nd II
3000	3758.24	Fe I	960		Pr II	1000		Ce II
2400	3759.08	La II	2000		U II	2900		Zr I
1900	3760.69	Sm II	4000		Y II	2200		U II
6000	3761.33	Tm II	1700		Mo I	1300		Nd II
4800	3761.91	Tm II	2200		Zr I	1300		Nd II
510	3762.88	Th II	2300		Dy II	13000	c 3891.02	Ho II
	3762.94	Th I						
1700	3763.79	Fe I	1300		Zr II	2000		Zr I
1700	3765.14	Tb I	1100		Ce II	4200		Er I
8700	3768.39	Gd II	1700		Nd II	7900		Co I
10000	3774.33	Y II	1200		U I	5200		Er II
			840		Th II	1600		Sm II
1400	3775.50	Nd II	2600		V I	5800		Dy II
12000	cw 3775.72	Tl I	1600		Sm II	2400		Tb II
2100		Tb II	6900		Co I	2000		Nd II
1400	3777.64	Hf I	8900		Tm II	1600		Tb I
1900	3782.84	U II	1700	d 3848.24	Nd II	1300		Nd II
					Nd II			
2900	3783.05	Gd I						
2400	3784.25	Nd II	1500		Nd II	2400		V I
1400	3785.46	Hf I	860		Ce II	19000		Mo I
3900	3786.06	Ru I	3700		Tb II	1700		Nd II
3300	3786.18	Dy II	1600		La II	11000		Er II
						28000	cw 3907.10	Eu II
860	3786.63	Ce II	3300		Gd II	20000		Sc I
1800	3786.84	Er II	1200		Pr II	3100		Pr II
1700	3787.06	Nb I	5100		Gd II	2000		Nd II
1500	3788.12	Sm II	2400	d 3851.66	Nd II	23000		Sc I
7400	3788.70	Y II			Nd II	980		Ce II
1300	3790.15	Nb I	4300		Gd II	1300		La II
6000	3790.51	Ru I	960		Pr II	3500		Tm I
3700	3790.83	La II	860		Ce II	2200		Gd II
3500	3791.21	Nb I	1800	c 3854.07	Ho II	1300		Pr II
3800	3793.22	Rh I	1200		Ce II	1900	c 3918.85	Cr I
1600	3793.97	Sm II	2700		Sm II	1100		La II
3900	3794.78	La II	1200		Ce II	2500		Sm II
7100	3795.75	Tm II	2400		U II	960		Pr II
5100	3796.37	Gd II	3000		V I	3300		Ru I
8900	c 3796.75	Ho II	5900		Rh I	1900		Sm II
1600	3797.73	Sm II	4900		U II	2200		La II
2700	3798.12	Nb I	4200		Fe I	1200		Zr I
29000	3798.25	Mo I	2700	c 3861.68	Ho II	590		Th II
7600	3798.90	Ru I	7500		Er I	32000	cw 3930.48	Eu II
4900	3799.31	Rh I	3700	d 3863.33	Nd II	2000		U II

TABLE 1. *The strong lines in order of wavelength—Continued*

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
42000	3933.66	Ca II	910	4014.90	Ce II	910	4083.23	Ce II
3200	3937.01	Er I	1500	4018.10	Mn I	700	4085.04	Th II
2100	3938.63	Er II	4200	4019.13	Th II	700	4086.52	Th II
2000	3941.51	Nd II	20000	4020.40	Sc I	5500	4086.72	La II
2000	3942.15	Ce II	3000	4020.51	Er I	3500	4087.63	Er I
2700	3942.75	Ce II	1200	4023.00	Nd II	2200	4090.14	U II
1200	3943.82	U I	20000	4023.69	Sc I	10000	4094.19	Tm I
4500	3944.01	Al I	27000	4030.76	Mn I	700	4094.75	Th II
3200	3944.42	Er I	2800	4031.69	La II	2600	4098.61	Gd II
10000	3944.68	Dy II	1200	4031.82	Nd II	2800	4099.80	V I
4500	3948.67	Ti I	870	4032.28	Tb I	2900	c 4100.71	Pr II
9000	3949.10	La II	10000	4032.98	Ga I	6700	4100.92	Nb I
4400	3950.36	Y II	2100	4033.03	Tb II	17000	4101.76	In I
2000	3951.16	Nd II	19000	4033.07	Mn I	9900	4102.38	Y I
3100	3952.54	Ce II	960	4033.84	Pr II	3900	4103.30	Dy II
980	3956.28	Ce II	11000	4034.49	Mn I	8900	4103.84	Ho I
4500	3956.34	Ti I	1500	4035.73	Mn I	2800	4105.17	V I
5200	3958.21	Ti I	2100	4040.76	Ce II	9500	4105.84	Tm I
3800	3958.86	Rh I	3000	4040.80	Nd II	840	4108.42	Th II
9000	3961.52	Al I	2700	4040.81	Ho I	2900	4108.62	Ho I
1500	3963.00	Sm II	5600	4041.36	Mn I	1400	4109.08	Nd II
1400	3963.12	Nd II	910	4042.58	Ce II	2500	4109.46	Nd II
1900	3963.69	Cr I	1000	4042.76	U I	2300	4109.79	V I
1600	c 3964.81	Pr II	3000	4042.91	La II	8900	4111.78	V I
1100	c 3965.25	Pr II	1300	4044.82	Pr II	1900	4112.74	Ru I
14000	3968.39	Dy II	5400	c 4045.44	Ho II	4300	4115.18	V I
22000	3968.47	Ca II	3000	4045.82	Fe I	810	4116.10	U II
1600	3969.75	Cr I	12000	4045.97	Dy I	1100	4116.71	Th II
1500	3971.40	Sm II	1800	4046.56	Hg I	1700	c 4118.45	Pr II
30000	cw 3971.96	Eu II	2200	4049.86	Gd II	1900	c 4118.55	Sm II
2700	3973.04	Er I	1600	4050.04	U II	1500	4120.20	Ho I
3200	3973.58	Er I	2600	4053.64	Gd I	4400	4121.32	Co I
1600	3976.66	Cr I	8100	4053.93	Ho I	4400	4123.23	La II
2200	d 3976.84	Tb II	5500	4054.55	Sc I	2000	4123.57	V I
2700	3978.57	Dy II	2200	4054.86	Pr II	5300	4123.81	Nb I
4800	3981.76	Ti I	1900	4055.54	Mn I	980	4123.87	Ce II
1800	3981.87	Tb II	2200	4056.53	Pr II	3100	4124.73	Lu I
2100	c 3982.05	Pr II	34000	4057.83	Pb I	4300	4127.16	Ho I
3600	3982.60	Y II	2600	4058.22	Gd I	980	4127.37	Ce II
1200	3985.80	U II	16000	c 4058.94	Nb I	3100	4128.07	V I
32000	3987.99	Yb I	4700	4061.09	Nd II	8900	4128.31	Y I
4400	3988.52	La II	1300	4061.58	Tb I	33000	cw 4129.70	Eu II
1300	c 3989.69	Pr II	1400	4062.08	Mo I	2200	4130.37	Gd II
5700	3989.76	Ti I	880	4062.55	U II	3100	4132.02	V I
1500	3990.00	Sm II	3400	4062.83	Pr II	2700	4133.80	Ce II
	3990.02	Sm I	1500	4064.16	Zr I	2300	4134.49	V I
1400	3990.10	Nd II	1700	4065.09	Ho II	1500	4136.22	Ho I
930	3990.88	Yb I	910	4069.20	Th II	2300	4137.10	Nb I
910	3993.82	Ce II	2300	4069.88	Mo I	2000	4137.65	Ce II
530	3994.55	Th II	1100	4071.81	Ce II	2700	4139.71	Nb I
1600	3994.79	Pr II	2000	4072.70	Zr I	1500	c 4141.21	Pr II
6000	3995.31	Co I	2500	4073.12	Dy II	7500	4142.85	Y I
3600	3995.75	La II	1800	4073.48	Ce II	2700	4143.12	Pr II
5500	3996.61	Sc I	5000	4074.36	W I	2900	4143.55	Mo I
7800	3998.64	Ti I	1500	4075.71	Ce II	2000	4144.16	Ru I
2800	3999.24	Ce II	1500	4075.85	Ce II	1100	4144.41	Tb II
8000	4000.45	Dy II	2800	4077.35	La II	1200	4149.20	Zr II
970	4002.59	Tb II	9400	4077.38	Y I	980	4149.94	Ce II
910	4003.77	Ce II	46000	4077.71	Sr II	6900	4151.11	Er I
1900	4005.47	Tb II	7400	4077.96	Dy II	1100	4151.97	La II
14000	4007.96	Er I	2800	4078.70	Gd I	1400	4151.97	Ce II
1900	4008.70	Pr II	12000	4079.73	Nb I	4400	4152.58	Nb I
8600	4008.75	W I	6000	4080.60	Ru I	880	4153.97	U I
3700	4012.25	Nd II	2000	4081.22	Zr I	3000	4156.08	Nd II
2700	4012.39	Ce II	6100	4082.40	Sc I	8100	4163.03	Ho I

TABLE 1. *The strong lines in order of wavelength*—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
4400	4163.66	Nb I	1400	4288.64	Mo I	1400	4451.57	Nd II
1700	4164.19	Pr II	10000	4289.72	Cr I	2400	4460.21	Ce II
4000	4164.66	Nb I	2000	4289.94	Ce II	2000	4460.29	V I
1300	4165.61	Ce II	4100	4294.61	W I	2200	4467.34	Sm II
5700	4167.97	Dy I	1500	4296.67	Ce II	960	4468.71	Pr II
3500	4168.13	Nb I	1600	4296.74	Sm I	1400	4471.24	Ce II
1400	4171.59	U II	3700	4297.71	Ru I	1100	4496.44	Pr II
20000	4172.06	Ga I	1100	4297.76	Pr II	18000	4511.31	In I
2500	4173.23	Ho I	4100	4301.09	Ti I	2600	4513.31	Re I
1100	4174.34	Hf I	2200	4302.11	W I	3300	4518.57	Lu I
2400	4175.54	Gd I	5400	4303.58	Nd II	3000	4522.57	Eu II
2400	4177.32	Nd II	1500	4305.76	Pr II	6000	4533.24	Ti I
8000	4177.54	Y II	6000	4305.92	Ti I	65000	4554.03	Ba II
620	4178.06	Th II	2800	4309.63	Y II	5400	4554.51	Ru I
5200	4179.38	Pr II	2200	4318.83	Tb I	2100	4562.36	Ce II
2400	4184.25	Gd II	1900	4318.94	Sm II	1100	4572.28	Ce II
3500	4186.60	Ce II	2600	4325.57	Gd II	640	4576.21	Yb I
12000	4186.82	Dy I		4325.69	Gd I	11000	4594.03	Eu I
8800	4187.62	Tm I	3000	4326.43	Tb I	1200	4606.77	Nb I
2500	4188.32	Mo I	1800	4329.02	Sm II	6500	4607.33	Sr I
2500	4189.48	Pr II	4600	4333.74	La II	9800	4627.22	Eu I
2200	4190.78	Gd I	1300	4333.97	Pr II	1700	4628.16	Ce II
1200	4190.88	Nb I	870	4336.43	Tb I	1600	4646.17	Cr I
6800	4194.84	Dy I	980	4337.77	Ce II	8300	4661.88	Eu I
1300	4195.66	Nb I	1700	4338.41	Tb I	2300	4687.80	Zr I
1500	4196.55	La II	680	4341.69	U II	1900	4710.08	Zr I
7600	4199.90	Ru I	1900	4344.51	Cr I	1400	4739.48	Zr I
910	4202.94	Ce II	2200	4346.46	Gd I	1400	4810.53	Zn I
6000	4203.73	Tm I	2300	4351.77	Cr I	2200	4889.14	Re I
60000	4205.05	Eu II	1100	4351.84	Pr II	20000	4934.09	Ba II
2500	4206.71	Pr II	870	4356.81	Tb I	710	4935.50	Yb I
620	4208.89	Th II	4000	4358.35	Hg I	5800	4981.73	Ti I
16000	4211.72	Dy I	2700	4359.93	Tm I	4600	4991.07	Ti I
5400	4212.06	Ru I	910	4364.66	Ce II	4000	4999.51	Ti I
3700	4215.16	Dy I	1200	4368.33	Pr II	5300	5204.52	Cr I
32000	4215.52	Sr II	2400	4372.21	Ru I	8400	5206.04	Cr I
4400	4218.09	Dy I	4200	4374.80	Rh I	11000	5208.44	Cr I
4400	4221.11	Dy I	12000	4374.94	Y II	18000	5350.46	Tl I
1500	4222.60	Ce II	12000	4379.24	V I	1400	5409.79	Cr I
3800	4222.98	Pr II	1900	4381.64	Mo I	3200	5460.74	Hg I
2700	4225.16	Dy I	1300	4381.86	Th II	7800	5506.49	Mo I
3800	4225.31	Pr II	910	4382.17	Ce II	5200	5533.05	Mo I
4800	4225.85	Gd I	1700	4383.55	Fe I	6500	5535.48	Ba I
11000	4226.73	Ca I	7000	4384.72	V I	2400	5556.47	Yb I
2000	4227.04	Ho I	4800	4389.97	V I	2500	5570.45	Mo I
3600	4227.46	Re I	1600	4390.86	Sm II	20000	5889.95	Na I
2000	4227.76	Zr I	1100	4391.11	Th II	10000	5895.92	Na I
1300	4232.38	Nd II	1700	4391.66	Ce II	20000	6141.72	Ba II
1500	4232.59	Mo I	3600	4395.23	V I	12000	6496.90	Ba II
1600	4238.38	La II	2300	4406.64	V I	1400	6645.11	Eu II
2000	4239.31	Zr I	2800	4407.64	V I	36000	6707.84	Li I
980	4239.92	Ce II	3600	4408.20	V I	690	6799.60	Yb I
960	4241.02	Pr II	4600	4408.51	V I	18000	7664.90	K I
1000	4241.67	U II	1700	4408.84	Pr II	9000	7698.96	K I
1200	4241.69	Zr I	2500	4411.57	Mo I	750	7699.48	Yb I
3000	4242.15	Tm II		4411.70	Mo I	30000	7800.23	Rb I
15000	4246.83	Sc II	980	4418.78	Ce II	15000	7947.60	Rb I
2000	4247.38	Nd II	4900	4420.47	Os I	15000	8521.24	Cs I
1100	4248.68	Ce II	1500	4420.53	Sm II	8000	8943.59	Cs I
20000	4254.35	Cr I	2900	4424.34	Sm II			
2100	4256.39	Sm II	1200	4429.20	Pr II			
4900	4260.85	Os I	2000	4429.90	La II			
16000	4274.80	Cr I	1600	4433.88	Sm II			
2200	4280.79	Sm II	1800	4434.32	Sm II			
700	4282.04	Th II	14000	4435.56	Eu II			





**Table 2.**

**All Observed Lines**

**in Order of Wavelength**



TABLE 2. All observed lines in order of wavelength

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
55000	1936.96	As I	5000	2039.77	Sb I	2400	2090.89	Ru I
48000	1953.89	Bi I	40000	2039.85	Se I	5500	2091.58	Sn I
30000	1954.47	Ge I	8000	2040.66	Sn I	1500	2092.16	Mn I
9000	1959.48	Bi I	24000	2041.71	Ge I	4700	2092.41	Re II
90000	1960.26	Se I	16000	2043.77	Ge I	2100	2092.44	V I
20000	1961.36	Ge I	3800	2043.79	Cu II	2200	2092.50	Mo II
32000	1970.23	Ge I	26000	2045.36	Os I	14000	2092.63	Ir I
26000	1970.80	Sn I	17000	2045.98	Mo II	4000	2093.11	Mo II
65000	1971.97	As I	7800	2048.28	Os I	20000	2094.26	Ge I
15000	h 1983.55	Sn I	27000	2049.08	Re I	6100	2094.75	W II
14000	1987.62	Ge I	5500	2049.37	Pt I	1200	2096.18	Hf II
36000	1989.70	As I	7800	2049.42	Os I	1400	h 2096.39	Sn I
11000	1990.48	As I	13000	2049.57	Sb I	9800	2097.12	Re I
14000	1994.18	Te I	5300	2049.63	W II	6000	2097.60	Os I
5000	1994.78	As I	6200	2052.22	Ir I	5000	2098.41	Sb I
9700	1995.41	Mn I	7000	2053.27	Pb I	2400	2098.60	W II
42000	1998.24	Ge I	4200	2054.46	Ge I	5300	2100.63	Os I
14000	1998.86	Mn I	19000	2055.52	Cr II	2200	2100.67	W II
5500	1999.69	Cu II	2200	2057.24	Ge I	2700	2100.84	Mo II
9600	2001.45	Os I	8600	2058.69	Os I	1500	2100.93	Sn I
5800	2001.71	W II		2058.78	Os I	1500	2101.54	W I
26000	2002.02	Te I	5000	2060.64	Ir I	1000	2103.33	Pt I
44000	2003.34	As I	14000	2061.49	Cr II	1500	2104.29	Mo II
25000	2003.53	Re I	13000	2061.69	Os I	2400	2105.82	Ge I
13000	2003.73	Os I	44000	2061.70	Bi I	1500	2106.18	W II
18000	2003.85	Mn I	10000	2062.00	Zn II	1400	2108.02	Mo II
9000	2004.78	Os I	11000	2062.79	Se I	2700	2109.22	Re I
13000	2008.07	W II	7500	2065.21	Ge I	2000	2109.42	Nb II
5500	2009.19	As I	8900	2065.42	Cr II	1700	2109.58	Mn I
5100	2009.98	W II	2300	2065.57	W II	4600	2110.26	Bi I
17000	2010.15	Os I	7800	2067.21	Os II	1300	2110.34	W II
4100	2010.23	W II	1500	2067.50	Pt I	650	2112.09	Cu II
9900	2010.65	Ir I	42000	2068.33	Sb I	2700	2112.68	Ir I
11000	2012.00	Au I	26000	2068.66	Ge I	5500	2113.93	Sn I
6200	2012.78	Hf II	4200	2070.67	Os II	2500	2116.67	Yb II
4200	2013.32	As I	3400	2071.21	W II	2100	2117.66	Os I
4100	2014.23	W II	4800	2073.08	Sn I	4800	2117.96	Os I
19000	2015.11	Mo II	4200	2074.70	Re I	1000	2118.48	Sb I
16000	2017.87	Re I	2000	2074.79	Se I	2100	2118.87	W II
29000	2018.14	Os I	2200	2075.59	W II	1800	2119.54	Ir I
17000	2019.07	Ge I	2400	2076.43	Ru I	6600	2119.79	Os
29000	2020.26	Os I	7200	2076.95	Os I	2400	2121.59	W II
40000	2020.30	Mo II	7200	2078.09	Os I	1900	2123.84	Os I
10000	2021.21	Bi I	9700	2079.11	W II	2200	2124.12	Si I
2600	2021.38	Au I	14000	2079.97	Os I	950	2124.74	Ge I
6000	2022.02	Pb I	6500	2081.16	Te I	1700	2125.21	Nb II
8700	2022.35	Ir I	4800	2081.68	Mo II	2000	2125.44	Ir I
14000	2022.76	Os I	2900	2082.54	Os I	1100	2126.54	Nb II
2400	2024.34	Cu I	3700	2083.22	Ir I	3000	2126.74	Yb II
3000	2025.48	Zn II	2600	2083.77	Ru I	4500	2126.81	Ir II
7300	2026.08	W II	3700	2083.92	Re I	1900	2127.39	Sb I
8500	2028.18	Hf II	3000	2084.12	Fe I	2000	2127.52	Ir I
14000	2028.23	Os I	3000	2084.59	Pt I	4500	2127.94	Ir I
3300	2029.32	Nb II	10000	2085.59	Re I	950	2128.61	Pt I
3000	2029.49	Sb I	3100	2085.74	Ir I	1500	2131.18	Nb II
15000	2029.98	W II	4200	2086.02	Ge I	2500	2133.63	Bi I
3200	2030.63	Pt I	3600	2088.19	W II	340	2135.47	P I
4400	2032.41	Pt I	17000	2088.82	Ir I	2000	2135.98	Cu II
3000	2032.99	Nb II	4200	2088.93	B I	3400	2136.18	P I
15000	2033.57	Ir I	2900	2089.03	Os I	5300	2137.11	Os I
18000	2034.44	Os I	2200	2089.14	W II	700	2138.53	Cu I
2700	2035.03	W II	2900	2089.21	Os I	10000	2138.56	Zn I
1600	2035.84	Cu II	2400	2089.52	Mo II	3400	2139.04	Re II
2200	2037.12	Cu II	6500	2089.59	B I	3200	2139.69	Sb I
21000	2038.44	Mo II	1700	2090.48	W I	1100	2140.13	Ta II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
1600	2141.83	Sb I	740	2191.64	Ir I	460	2248.75	W II
1600	2142.74	Re II	630	2191.84	Fe I	150	2249.30	Pt I
	2142.97	Re I	360	2192.26	Cu II	480	2249.79	Ta II
18000	2142.81	Te I	540	2193.20	Ta II	460	2249.80	W I
1900	2144.23	Pt I	1100	2193.88	Ta II	1200	2250.76	Ta II
19000	2144.38	Cd II	840	2194.39	Os II	190	2251.17	Sn I
3200	2144.86	Sb I	1600	2194.49	Sn I	1300	2252.15	Os I
1500	2146.87	Ta II	440	2194.52	W II	2100	2253.38	Ir I
3200	2147.25	Te I	1700	h 2195.54	Lu II		2253.49	Ir I
3700	2148.22	Ir I	1500	2196.03	Ta II	320	2254.01	Hf II
600	2148.73	Sn I	600	2196.04	Fe I	260	2254.86	Ta II
2600	2149.14	P I	3400	2198.71	Ge I	2100	2255.10	Ir I
2400	2149.97	Os	2200	2199.34	Sn I	160	2255.15	Hf II
2500	2150.54	Ir I	1700	d 2199.58	Cu I	690	2255.52	Ru I
740	2150.62	Ta II		2199.75	Cu I	440	2255.73	Re I
1400	2151.43	Sn I	1500	2199.67	Ta II	440	2255.77	Ta II
3500	2152.68	Ir II	400	2201.32	Sb I	1400	2255.81	Ir I
1400	2152.84	Sr II	400	2202.22	Pt I	2000	2255.85	Os II
280	2152.94	P I	760	2202.49	Os I	180	2256.00	Ge I
850	2153.56	W II	1400	2203.53	Pb II	860	2256.19	Re I
550	2154.08	P I	1300	2204.48	W II	360	2256.51	Ta II
2600	2154.59	Os I	500	2207.14	Ta II	770	2256.76	La II
2900	2155.81	Ir I	300	2207.98	Si I	350	2258.51	Ir I
3700	2156.67	Re I	910	2208.09	Ir II	500	2258.71	Ta II
850	2157.80	W II	1000	2208.45	Sb I	1400	2258.86	Ir I
1300	2157.84	Os I	290	2208.81	Mn I	500	2259.02	Te I
7900	2158.05	Ir I	3200	2209.65	Sn I	290	2259.53	Ru I
1200	2158.53	Os I	1400	d 2210.03	Ta II	840	2261.42	Ta II
360	2159.85	Te I		2210.19	Ta II	260	2261.62	Ta II
2400	2161.00	Os	540	2210.82	Hf II	990	2262.30	Ta II
370	2161.60	Yb II	300	2210.89	Si I	550	2262.51	Sb I
2100	2162.88	Ir I	300	2211.05	Sn I	2000	2264.39	Re I
600	2165.01	Ta II	540	2213.85	Mn I	1400	2264.60	Os I
1400	2165.09	Cu I	4200	c 2214.26	Re II	830	2264.61	Ir I
600	2165.17	Pt I	550	2214.58	Cu I	9000	2265.02	Cd II
480	2165.52	As I	2200	2214.58	Re I	1100	2266.33	Ir I
1400	2165.96	Sr II	420	2215.60	Ta II	250	2266.83	Hf II
1500	2166.32	W II	480	2216.67	Si I	480	2267.19	Sn I
3600	2166.77	Fe I	1300	2220.37	Ir I	150	2267.47	Cd I
3100	2166.90	Os I	650	2220.73	Sb I	290	2268.17	Co I
1100	2167.75	Os I	790	2221.07	Ir II	360	2268.28	Os I
4900	2167.94	Re I	770	2221.84	Mn I	190	2268.84	Pt I
5800	2169.42	Ir II	320	2222.61	Pt I	1000	2268.90	Ir I
5500	2169.99	Pb I	640	2224.46	Yb II	3200	2268.91	Sn I
2100	2171.65	Os I	320	2224.93	Sb I	500	d 2269.10	Al I
1100	2174.60	Co I	460	2225.70	Cu I		2269.22	Al I
1500	2174.67	Pt I	1700	2226.42	Re I	220	2269.56	Ta II
1100	h 2174.99	Be I	950	2227.78	Cu I	400	2269.69	Mo II
	2175.10	Be I	600	2227.98	Os I	960	2270.17	Os I
4500	2175.24	Ir I	360	2228.25	Bi I	180	2270.24	W II
8500	2175.81	Sb I	1200	2230.08	Cu I	95	2271.37	W I
3400	2176.21	Re I	1700	2230.61	Bi I	740	2271.85	Ta II
740	2178.03	Ta II	480	2231.72	Sn I	780	2272.09	Ru I
1500	2178.09	Fe I	1100	2234.61	Os I	990	2272.59	Ta II
2700	2178.17	Ir I	920	2235.44	Re I	140	2272.61	Ti I
1800	2178.94	Cu I	580	2236.17	Lu III	180	2273.28	Ti I
1500	2179.19	Sb I	1400	2239.48	Ta II	280	2274.38	Pt I
1200	2181.72	Cu I	2500	2242.68	Ir II	260	2274.49	Co I
1200	2182.71	Ta II	350	2243.06	Y II	2100	2274.62	Re I
480	2182.90	W I	720	2245.13	Co II	5200	c 2275.25	Re II
960	2184.68	Os I	620	2245.76	Ir II	150	2276.21	Rh II
850	2185.71	Yb II	4200	2246.05	Sn I	810	2276.53	Co I
1600	2187.43	Ir II	200	2246.88	Pb I	340	2276.58	Bi I
240	2187.87	La II	400	2247.00	Cu II	130	2276.70	Ti I
1100	2190.38	Ir II	240	2248.48	Ta II	95	2276.94	Lu II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
620	2277.16	Hf II	630	2300.78	Ni I	260	2319.16	Ta II
510	2277.58	W I	160	2301.47	Ta II	220	2319.19	Re I
240	2278.19	Ru I	280	2302.08	Nb II	200	2319.44	La II
780	2279.57	Ru I	440	2302.24	Ta II	2600	2320.03	Ni I
200	2279.85	Ta I	290	2302.54	Ru I	370	2320.16	Re I
190	2279.96	Ti I	140	2302.73	Ti I	550	2320.18	Os I
660	2280.00	Ir I	440	2302.93	Ta II	140	2320.81	Yb II
950	2281.02	Ir II	610	2302.99	Re I	230	2321.14	Hf II
1600	2281.62	Re I	300	2303.49	Ta II	1900	2321.38	Ni I
660	2281.91	Ir I	240	2303.83	W II	410	2321.45	Ir I
320	2282.19	Ta II	190	2303.97	Co I	410	2321.58	Ir I
1400	2282.26	Os II	290	2304.18	Co I	460	2321.63	W I
240	2283.52	Co II	2700	2304.22	Ir I	95	2321.73	Rh I
840	2283.67	Os I	1400	2304.24	Ba II	150	2322.01	Ru I
330	2284.60	Ir I	160	2304.25	Mo II	580	2322.47	Hf II
360	2284.79	Tm II	360	2305.18	Co I	800	2322.49	Re I
260	2284.85	Co I	410	2305.47	Ir I	350	2322.58	Rh I
160	2284.91	W I	190	2305.67	Ti I	240	2322.68	Ni I
130	2285.02	Ta II	180	2306.06	In II	2400	2323.14	Co I
320	2285.17	W I	200	2306.46	Sb I	300	2323.25	Hf II
790	2285.25	Ta II	680	2306.54	Re I	310	2323.98	Os I
170	2285.38	Ru I	240	2306.59	W I	660	2324.24	Os I
4100	2286.16	Co II	400	2306.61	Cd I	810	2324.32	Co II
600	2286.59	Ta II	160	2306.97	Mo II	120	2324.50	Hf II
650	2286.68	Sn I	210	2307.27	Ir I	300	2324.89	Hf II
240	2287.27	Ta II	2900	2307.86	Co II	170	2325.51	Os I
2900	2287.51	Re I	240	2308.04	Pt I	570	2325.55	Co I
720	2287.81	Co I	660	2308.31	Os I	1400	2325.79	Ni I
15000	2288.02	Cd I	100	2308.46	Ta II	130	2325.94	Mo I
2600	2288.12	As I	910	2308.93	Ir I	290	2326.09	W II
140	2288.57	Rh I	2600	2309.02	Co I	100	2326.10	Pt I
120	2288.98	Sb I	340	2309.02	W I	770	2326.14	Co II
990	2289.16	Ta II	110	2309.82	Rh I	140	2326.47	Rh I
150	2289.27	Pt I	2000	2310.96	Ni I	770	2326.48	Co II
570	2289.32	Os I	2200	2311.47	Sb I	390	2326.56	W I
1600	2289.98	Ni I	1800	2311.60	Co II		2326.70	W I
240	2291.46	Co I	1700	2312.34	Ni I	110	2326.93	Th II
290	2292.00	Co II	440	2312.60	Ta II	330	2326.99	Os I
150	2292.40	Pt I	190	2312.84	Cd II	240	2327.92	Ge I
180	2292.54	Ta II	230	2312.97	Re I	210	2327.98	Ir I
260	2293.39	Co II	440	2313.17	W I	75	2328.31	W II
380	2293.44	Sb I	220	2313.34	Re I	80	2328.64	Rh I
280	2293.84	Cu I	1400	2313.66	Ni I	300	2328.66	Re I
35	2294.20	Ga I	190	2313.75	Os II	75	2328.75	La II
2700	2294.49	Re I	1400	2313.98	Ni I	140	2329.10	Co II
530	d 2294.49	W I	1800	2314.05	Co II	300	h 2329.28	Cd I
	2294.54	W II	220	2314.17	W I	120	2329.77	Tm II
330	2295.08	Ir I	180	2314.20	Ge I	940	2329.96	Ni I
160	2295.18	Ta I	1400	2314.98	Co II	530	2330.35	Co II
260	2295.23	Co I	190	2315.02	W II	240	2330.46	Mo I
370	2295.68	Nb II	460	2315.38	Ir I	100	2331.29	Ta II
220	2296.05	Co I	420	2315.46	Ta II	180	2331.29	W I
450	2296.71	Co I	90	2315.50	Pt I	80	2331.37	Ag II
380	2297.31	Os I	140	2315.98	Tl I	230	2331.80	Tm III
190	2297.41	Lu II	430	2316.04	Ni II	75	2331.91	W I
1100	2297.78	La III	430	2316.16	Co I	690	2331.98	Ta II
220	2297.79	Fe I	530	2316.86	Co I	110	2332.12	Mo II
790	2298.05	Ir I	1400	2317.16	Ni I	550	2332.19	Ta II
	2298.16	Ir I	2200	2317.23	Sn I	70	2332.44	Pb I
390	2298.09	Re II	480	2317.80	Ru I	75	2332.76	W I
270	2298.33	W I	90	2317.82	La II	260	2332.80	Fe II
460	2299.53	Ir I	220	2318.29	Pt I	200	2332.97	Hf II
390	2299.77	Re I	55	2318.36	Rh I	540	2333.30	Ir I
150	2299.85	Ti I	110	2318.96	W I	130	2333.77	W II
910	2300.50	Ir I	95	2319.10	Rh I	740	2333.84	Ir I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	
110	2334.13	Ta II		2349.33	W I	260	2361.09	Ta I	
270	2334.33	Re I		190	2349.34	Ru I	120	2361.23	Tm III
580	2334.50	Ir I		230	2349.39	Re I	95	2361.53	Co II
310	2334.56	Os I		2600	2349.84	As I	300	2361.92	Rh I
190	2334.77	Rh II		230	2350.23	Os II	200	2362.06	Ni I
1400	2334.80	Sn I		190	2350.28	Co I	310	2362.41	Os I
180	2334.88	Ta II		120	2350.37	W II	900	2362.77	Os I
120	2334.96	Ru II	d	220	2350.46	Re I	160	2362.78	Ta II
2000	2335.27	Ba II			2350.46	W I	50	2362.89	Yb II
270	2335.73	Re I		540	2351.22	Hf II	2500	2363.04	Ir I
140	2335.75	Ta II		310	2351.33	Ru I	850	2363.07	W I
1400	2335.99	Co I		140	2351.39	Co I	130	2363.32	Ta II
220	2336.10	Re I		60	2351.55	Os I	190	2363.33	Os I
720	2336.80	Os II		60	2351.72	Os I	1900	2363.79	Co II
200	2337.33	Hf II		90	2351.99	Ta II	120	2363.91	Tm II
460	2337.49	Ni I		680	2352.07	Re I		2363.97	Tm III
160	2337.82	Ni I		55	2352.47	Rh I	60	2364.22	W II
670	2337.94	Co II		80	2352.61	Mo I	600	2364.24	Ta II
270	2337.95	Re I		100	2352.62	Ir I	70	2364.37	Mo I
140	2338.00	Fe II		180	2352.65	Au I	80	2364.71	Cr I
70	2338.28	Ga I		1600	2352.85	Co I	200	2364.83	Fe II
300	2338.28	Ta II		360	2352.99	Os I	960	2365.07	Co I
220	2338.36	Tm III		110	2353.02	Hf I	200	2365.32	Re I
430	2338.63	Os I		2000	2353.42	Co I	110	2365.45	W I
1600	2338.67	Co I		170	2353.86	Ta II	110	2365.85	W I
480	2339.05	Co I		210	2353.95	Re I	1200	2365.90	Re I
170	2340.18	Pt I	d		2354.08	Re I	45	2365.96	Tm II
190	2340.47	Mo I		85	2354.03	Th II	90	2365.98	Hf II
290	2340.69	Os I		50	2354.20	Y I	40	2366.04	Th II
240	2340.69	Ru I		320	2354.61	W I	50	2366.09	Mo II
70	2340.92	Tm II		5500	2354.84	Sn I	110	2366.18	W I
200	2340.94	Ta II		580	2355.00	Ir I	95	2366.96	W I
210	2341.37	W I		80	2355.22	Mo I	95	2366.99	Th II
190	2341.59	Mo II		120	2355.22	Ta II	460	2367.05	Al I
200	2341.61	Ta II		120	2355.28	Os II	160	2367.11	Tm II
80	2341.82	Er II		80	2355.42	Mo II	50	2367.24	Ta II
190	2342.85	Ru II	h	620	2355.48	Co I	200	2367.25	Y III
60	2343.12	W I		170	2356.05	Ta II	500	2367.35	Os II
1600	2343.18	Ir I		250	2356.50	Re I	570	2367.68	Re I
230	2343.32	Hf II		85	2356.76	Th II	150	2367.69	W I
360	2343.49	Fe II		140	2356.90	Ta II	370	2368.04	Ir II
740	2343.61	Ir I		260	2356.91	Dy II	40	2368.05	Th II
130	2343.64	Ta II		240	2356.92	Os I	180	2368.28	Pt I
430	2343.74	Os I		310	2357.05	Tm III	110	2368.34	Rh I
160	2344.03	As I		280	2357.10	Pt I	180	2368.53	Re II
620	2344.26	Co II		240	2357.25	Os I	100	2368.60	Fe II
860	2344.78	Re I		250	2357.30	Ta I	290	2369.24	Os I
140	2345.28	Re I		230	2357.53	Ir II	520	2369.27	Re I
55	2345.41	Rh I		60	2357.90	Sn I	150	2369.32	Ta II
1200	2345.54	Ni I		170	2357.91	Ru II	500	2369.67	As I
260	2345.75	Os I		60	2358.07	W I	360	2369.68	Co I
620	2346.16	Co I		410	2358.16	Ir I	50	2369.89	Cu II
100	2346.42	Ta II		530	2358.18	Co I	170	2370.17	Ru I
190	2346.63	Ni I		110	2358.51	Er II	240	2370.51	Co I
140	2347.06	Re I		60	2358.81	W II	500	2370.70	Os I
430	2347.38	Os I		110	2359.10	Fe II	220	2370.76	Re II
910	2347.39	Co II		170	2359.16	Ta II	300	2370.76	Ta II
320	2347.44	Hf II		55	2359.18	Rh I	400	2370.77	As I
400	2347.52	Ni I		110	2360.00	Fe II	95	2370.89	W I
190	2347.58	Ba II		90	2360.29	Fe II	480	2371.18	Os I
75	2347.97	W I		580	2360.44	W I	40	2371.32	Ga I
120	2348.10	Fe II		50	2360.50	Sb I	35	2371.39	W I
120	2348.30	Fe II		140	2360.56	Ru I	170	2371.44	Co I
9500	2348.61	Be I		160	2360.63	Ni I	210	2371.52	Re I
75	2349.26	W II		500	2360.73	Ir I	320	2371.58	Ta I

TABLE 2. All observed lines in order of wavelength — Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
340	2371.86	Co I	75	2380.89	Re I	320	2388.63	Fe II
140	2372.27	Mo I	100	2381.00	Hf II	35	2388.80	Pb I
3500	2372.77	Ir I	440	2381.13	Ta II	3300	2388.92	Co II
70	2372.80	Ta II	180	2381.14	Re I	60	2388.92	V I
95	2372.83	Co I	400	2381.18	As I	110	2388.95	Tm II
850	2373.12	Al I	240	2381.52	Ta II	240	2389.08	W I
170	2373.35	Al I	540	2381.62	Ir I	170	2389.11	Re I
140	2373.38	Co I	170	2381.75	Co II	160	2389.11	Ta II
150	2373.48	Re II	65	2381.95	Dy	110	2389.20	Mo II
100	2373.67	Sb I	1300	2382.04	Fe II	50	2389.21	Zr I
260	2373.73	Fe II	180	2382.46	Os I	120	2389.53	Pt I
30	2373.83	Y	270	2382.89	Rh I	670	2389.54	Co II
130	2373.84	Th II	210	2382.99	W I	40	2389.54	In I
100	2373.94	Ta II	210	2383.17	Ir I	120	2390.37	W II
50	2374.13	W I	80	2383.24	Fe II	170	2390.43	Re I
85	2374.33	Os I	1200	2383.26	Te I	2500	2390.62	Ir I
60	2374.42	Zr I	80	2383.28	Er II	170	2390.74	Yb II
510	2374.47	W I	130	2383.33	Cr I	75	2390.87	V I
95	2374.51	Os I	230	2383.40	Rh I	2700	2391.18	Ir I
85	2374.76	W I	1800	2383.46	Co II	75	2391.26	V I
95	2375.06	Os II	180	2383.46	Re I	85	2391.28	Re I
320	2375.07	Re I	150	2383.52	Mo I	170	2391.37	Co I
85	2375.08	Th II	130	2383.64	Pt I	150	2392.15	Dy
290	2375.09	Ir II	80	2383.64	Sb I	1300	2392.19	Lu II
170	2375.18	Co II	150	2383.68	Tm II	160	2392.42	Ru I
70	2375.19	Fe II	170	2383.72	Ta II	240	2392.60	Co II
240	2375.27	Ru I	85	2383.79	Ir I	85	2392.90	V I
80	2375.63	Ru II	40	2384.00	V II	120	2392.93	W II
150	2375.82	Re I	60	2384.17	Zr I	55	2393.11	Th II
70	2375.91	Ta I	240	2384.28	Ta II	170	2393.18	Hf II
95	2376.06	W I	40	2384.28	V I	450	2393.36	Hf II
170	2376.40	Nb II	55	2384.36	Th II	230	2393.65	Re I
50	2376.57	W I	60	2384.39	Fe II	1700	2393.79	Pb I
2600	2377.03	Os I	35	2384.52	Ti I	670	2393.83	Hf II
50	2377.05	W I	240	2384.62	Os I	240	2393.90	Co II
220	2377.22	Co I	40	2384.65	Rh I	330	2394.29	Os I
250	2377.28	Ir I	670	2384.82	W I	320	2394.37	Re I
100	2377.33	Re I	1400	2384.86	Co I	320	2394.52	Ni II
260	2377.61	Os I	50	2385.24	Y	290	2395.39	Os I
80	2377.83	Er II	130	2385.73	Ta I	120	2395.48	W I
190	2377.84	Th II	1500	2385.78	Te I	1100	2395.62	Fe II
250	2377.98	Ir I	270	2386.14	Rh II	1100	2395.88	Os I
95	2378.14	Os I	85	2386.16	W I	35	2396.17	Pt I
150	2378.31	Ta II	1000	2386.36	Co II	70	2396.30	Ta I
40	2378.40	Al I	100	2386.58	Er II	110	2396.38	Er III
75	2378.53	Re II	120	2386.58	Ir II	95	2396.71	Ru II
2000	2378.62	Co II	240	2386.58	Ni I	220	2396.78	Os I
95	2378.74	Os I	40	2386.81	Pt I	320	2396.79	Re I
200	2379.14	Ge I	1300	2386.89	Ir I	120	2397.03	Co I
150	2379.28	Fe II	180	2386.90	Re II	730	2397.09	W II
500	2379.38	Ir I	60	2386.96	V I	90	2397.30	Er II
1000	2379.38	La III	1400	2387.06	Ta II	200	2397.31	Re I
900	2379.39	Os I	110	2387.09	Nb II	620	2397.39	Co II
180	2379.64	Os I	120	2387.17	Er II	60	2397.61	Os I
900	h 2379.69	Tl I	1700	2387.29	Os I	560	2397.73	W I
370	2379.77	Re I	130	2387.36	Dy II	70	2397.78	V I
180	2379.84	Os	140	2387.46	Co I	560	2397.98	W I
180	2380.22	Re I	85	2387.46	Re I	18	2398.02	Yb II
250	2380.30	Hf II	140	2387.52	Nb II	110	2398.18	Os I
100	2380.41	Mo I	120	2387.75	Au I	70	2398.27	V I
1400	2380.48	Co I	50	2388.01	Zr I	160	2398.48	Nb II
200	2380.72	Sn I	55	2388.14	Th II	70	2398.56	Ca I
150	2380.76	Fe II	45	2388.27	Nb II	75	2398.71	Re I
65	2380.81	Ti I	80	2388.37	Ta II	75	2398.89	Re I
95	2380.82	Os I	340	2388.57	Re I	60	2399.04	W I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
120	2399.14	Lu II	260	2407.67	Co II	120	2415.33	V I
110	2399.15	Ta I	80	2407.88	Rh I	610	2415.68	W I
360	2399.24	Fe II	110	2407.90	V I	80	2415.84	Rh II
30	2399.60	Pb I	150	2407.92	Ru II	370	2415.86	Ir I
50	2399.92	Ta II	260	2408.15	Sn I	55	2415.96	Hf II
70	2399.96	V I	27	2408.19	Rh I	220	2416.14	Ni II
40	2400.30	Er II	55	2408.23	Tm II	50	2416.24	W I
2400	2400.63	Ta II	130	2408.26	Ta II	120	2416.30	Re I
210	d 2400.72	Re I	40	2408.39	Mo I	120	2416.44	Re I
	2400.89	Re I	140	2408.62	Cr I	120	2416.75	V I
130	2400.78	Hf II	360	2408.67	Os I	320	2416.89	Ta II
60	2400.84	Co I	310	2408.75	Co II	140	2416.90	Co II
190	2400.88	Bi I	450	2409.02	Tm II	160	2416.99	Nb II
960	2401.13	Os I	95	2409.03	W I	140	2417.05	Co I
30	2401.30	W I	290	2409.37	Ir I	80	2417.33	Ta II
210	2401.68	Re I	240	2410.01	Dy II	90	2417.35	V I
85	2401.77	Ir I	370	2410.14	Hf II	1300	2417.37	Ge I
70	2401.87	Pt I	290	2410.17	Ir I	1000	2417.65	Co II
600	2401.95	Pb I	27	2410.25	Rh I	120	2417.66	Re I
1100	d 2402.06	Co I	270	2410.37	Re I	320	2417.69	Hf II
	2402.17	Co I	240	2410.51	Co I	220	2417.86	Ta II
140	2402.13	Ta II	300	2410.52	Fe II	80	2417.96	Mo II
260	2402.23	Os I	40	2410.53	Er II	530	2417.99	Os I
180	2402.29	Dy II	60	2410.62	W I	100	2418.06	Pt I
95	2402.45	W I	290	2410.73	Ir I	620	2418.11	Ir I
150	2402.60	Re I	55	2410.89	Ru I	60	2418.20	Re II
780	2402.72	Ru II	240	2410.98	Os I	85	2418.35	Os I
75	2403.04	Re II	120	2410.99	Re I	55	2418.36	Ti I
200	2403.09	Pt I	220	2411.07	Fe II	530	2418.53	Os I
200	2403.54	Os I	45	2411.30	Th II	55	2418.64	Rh
140	2403.61	Mo II	75	2411.54	W II	140	2418.69	Nb II
100	2403.68	Ta II	5300	2411.62	Co I	110	2418.70	Ga I
330	2403.85	Os I	130	2411.73	Pb I	150	2418.77	Ta II
410	2404.17	Co II	95	2411.90	Os	65	2419.01	Mo II
90	2404.17	Th II	110	2412.44	Tm II	670	2419.12	Co I
75	2404.24	W II	140	2412.46	Nb II	80	2419.21	Lu II
150	2404.34	Re I	40	d 2412.53	Ta II	240	2419.31	Ni I
35	2404.41	Er II		2412.67	Ta I	50	2419.34	W II
70	2404.43	Fe II	90	2412.69	V I	65	2419.37	Tm II
90	2404.50	Th II	1600	2412.76	Co I	170	2419.40	Re I
70	2404.56	Hf II	40	2412.84	Mo II	60	2419.41	Zr II
80	2404.66	Mo II	120	2413.01	Mo II	100	2419.57	U II
1000	2404.88	Fe II	70	2413.03	V I	50	2419.63	Os
1500	2405.06	Re I	150	2413.18	Ag II	45	2419.75	Rh I
95	2405.08	Os II	95	2413.19	Co I	1200	2419.81	Re I
50	2405.26	W I	180	2413.22	Re I	95	2420.02	Os II
55	2405.34	Nb II	220	2413.31	Fe II	100	2420.12	V I
540	2405.42	Hf II	540	2413.31	Ir I	80	2420.18	Mo II
290	2405.45	Os I	90	2413.33	Hf II	45	2420.18	Rh II
45	2405.52	Zr I	100	2413.41	Th II	30	2420.20	Tm II
1700	d 2405.58	W I	95	2413.58	Co I	60	2420.20	W I
	2405.69	W I	25	2413.93	Y II	70	2420.28	Er II
740	2405.60	Re I	320	2414.04	W I	120	2420.73	Co II
55	2405.85	Nb II	480	2414.06	Co II	130	2420.82	Ru I
140	2405.86	Mo I	95	2414.10	Os I	65	2420.98	Rh II
200	2405.96	Os I	120	2414.32	Ta I	50	2421.01	W II
120	2406.27	Co I	4800	2414.46	Co I	140	2421.03	Ta I
130	2406.44	Hf II	290	2414.52	Os I	100	2421.06	V I
130	2406.55	Ta I	120	2414.59	Re I	50	2421.15	Os I
300	2406.66	Fe II	240	2414.68	Y III	85	2421.23	Ni I
320	2406.70	Re I	55	2414.82	Ru II	75	2421.30	Ti I
120	2406.75	V I	240	2415.21	Ta II	28	2421.35	Yb II
5300	2407.25	Co I	4800	2415.30	Co I	170	2421.38	Re I
40	2407.57	Ta I	180	2415.32	Os I	120	2421.65	Tm II
230	2407.59	Ir I	70	2415.33	Mo I	3600	2421.70	Sn I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
300	2421.73	Re I	2600	2427.95	Au I	320	2435.15	Si I
150	2421.85	Ta II	60	2428.00	Ta II	140	2435.51	Os I
85	2421.86	Os I	80	2428.04	Pt I	110	2435.52	V I
300	2421.88	Re I	16	2428.10	Sr I	140	2435.65	Os I
85	2421.94	Os I	50	2428.20	Pt I	720	2435.83	Co I
100	2421.98	V I	40	2428.23	Ti I	40	2435.95	Nb II
60	2422.13	Sb I	110	2428.28	V I	65	2435.96	Mo II
560	2422.20	Y II	120	2428.29	Co II	1800	2435.96	W I
130	2422.29	W I	55	2428.43	Tm II	100	2436.05	Re I
190	2422.56	Co I	2500	2428.58	Re I	45	2436.19	Tm II
40	2422.66	W I	410	2428.60	Co I	29	2436.26	W I
150	2422.75	Dy II	20	2428.63	Pb I	35	2436.33	Nb I
55	2422.92	Ru I	45	2428.75	Hf I	85	2436.42	Ir I
45	2423.01	Th II	120	2428.99	Hf II	30	2436.51	Os I
200	2423.07	Os II	25	2429.10	Pt I	130	2436.51	Ta II
23	2423.28	Tm II	65	2429.16	Sc I	250	2436.62	W I
70	2423.33	Ni I	120	2429.23	Co I	2900	2436.66	Co I
40	2423.38	V I	170	2429.39	W II	180	2436.69	Pt I
170	2423.48	Ta II	5500	2429.49	Sn I	70	2436.98	Co II
60	2423.50	Re I	230	2429.52	Rh I	110	2437.07	Ta I
120	2423.62	Co II	45	2429.60	Ru I	18	2437.08	Rh I
70	2423.66	Ni I	110	2429.65	Re I	110	2437.23	As I
90	2423.68	Th II	50	2429.67	Os I	45	2437.42	Nb II
50	2423.70	U II	360	2429.71	Ta II	45	2437.54	Th II
60	2423.84	Re II	170	2429.84	W I	90	2437.67	Ta I
75	2423.94	Rh	35	2430.07	Fe II	65	2437.67	Tm II
70	2424.00	Mo II	55	2430.26	Lu II	70	2437.73	Os
70	2424.02	Os II	65	2430.43	Mo I	90	2437.79	Ag II
70	2424.03	Ni I	120	2430.44	W I	100	2437.89	Ni II
50	2424.14	Fe II	30	2430.77	Tm II	110	2437.90	Rh I
50	2424.19	Os I	170	2431.06	Ta II	29	2437.95	W I
870	2424.21	W I	580	2431.08	W I	20	2438.01	La II
95	2424.24	Ti I	28	2431.15	Th II	180	2438.46	Re I
120	2424.32	Ir I	380	2431.19	Os I	110	2438.62	Sc I
500	2424.56	Os I	540	2431.24	Ir I	110	2438.64	Ta II
120	2424.66	Ir I	490	2431.54	Re I	2400	2439.05	Co I
210	2424.89	Ir I	380	2431.61	Os I	140	2439.06	Re I
4100	2424.93	Co I	60	2431.66	Ta I	55	2439.10	V I
1400	2424.97	Os I	40	2431.85	Rh II	40	2439.45	Er II
370	2424.99	Ir I	1300	2431.94	Ir I	80	2439.74	Fe I
60	2425.23	Er II	75	2432.02	V I	260	2439.84	Dy II
60	2425.38	Re I	420	2432.18	Re I	200	2439.91	Ta I
60	2425.59	Co I	3300	2432.21	Co I	650	2440.06	Pt I
290	2425.66	Ir I	170	2432.36	Ir I	60	2440.11	Fe I
130	2425.91	Ta II	50	2432.4	U II	35	2440.21	Ti II
120	2425.98	Hf II	100	2432.58	Ir I	65	2440.28	Mo II
190	d 2425.98	W I	40	2432.66	Rh I	330	2440.34	Rh I
	2426.08	W I	150	2432.70	Re I	75	2440.41	Re I
450	2426.17	Tm II	480	2432.70	Ta II	75	2440.58	Re I
60	2426.19	Os I	55	2432.85	Th II	40	2440.68	Os I
80	2426.35	Sb I	65	2432.93	Ru I	90	2440.70	Tm II
170	2426.53	Ir II	35	2433.22	Ti I	65	2440.98	Ti I
100	2426.64	Re I	170	2433.28	Re I	530	2441.05	Co I
50	2426.78	Ir I	35	2433.47	Sn I	340	c 2441.47	Re I
240	2426.81	Os I	130	2433.57	Hf II	70	2441.64	Cu I
140	2427.00	Co I	130	2433.59	Ta II	30	2441.89	V I
65	2427.11	Rh II	100	2433.61	Re I	85	2442.00	Os I
90	2427.28	Er II	75	2433.80	Nb II	40	2442.14	Nb II
130	2427.28	W I	630	2433.98	W I	130	2442.39	Ta I
65	2427.45	U II	19	2434.10	Ti I	230	2442.51	Re I
190	2427.49	W II	45	2434.74	Hf II	110	2442.57	Fe I
540	2427.61	Ir I	55	2434.75	Tm II	28	2442.68	Nb II
360	2427.64	Ta I	60	2435.01	W II	60	2442.98	W I
130	2427.68	Rh I	770	2435.09	Co I	24	2443.33	W I
70	2427.90	Os II	270	2435.14	Ir I	95	2443.61	W I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
380	2443.84	Pb I	870	2452.00	W I	40	2460.71	Er II
50	2443.87	Fe I	35	2452.30	Hf II	480	2460.81	Co I
35	2443.96	Th II	910	2452.81	Ir I	90	2461.04	Rh II
580	2444.06	W I	85	2453.14	Re I	80	d 2461.06	Ta II
85	2444.09	Re I	60	2453.29	Os I	390	2461.20	Re I
100	2444.13	Ta II	110	2453.34	Hf II	1800	2461.42	Os I
50	h 2444.27	Rh I	60	2453.47	Fe I	85	2461.48	Ce II
28	2444.47	Th II	530	2453.90	Os I	190	2461.57	W I
40	2444.51	Fe II	65	2453.95	Nb II	40	2461.81	Mo II
90	2444.67	Ta II	85	2453.99	Ni I	800	c 2461.84	Re II
250	2444.94	Re I	85	2454.12	Ir I	60	2462.12	Co I
35	2444.99	Hf I	80	2454.21	Ta I	110	2462.18	Fe I
250	2445.34	Ir I	60	2454.37	U II	85	2462.36	Ir I
140	2445.47	Tm II	100	2454.48	Ta I	85	2462.54	Re I
190	2445.51	Sb I	50	2454.70	Ta II	700	2462.64	Fe I
50	2445.53	Ta II	430	2454.72	W I	480	2462.79	W I
30	2445.56	Fe II	110	2454.91	Os II	65	2462.89	Nb I
70	2445.88	Os I	35	2454.91	Tm II	55	2462.94	Ru I
35	2445.94	Tm II	65	2454.92	Ru I	130	2462.97	Ce II
360	2446.02	Os I	630	2454.98	W I	85	2463.03	Ir I
700	2446.19	Pb I	90	2455.15	Dy II	110	2463.31	Re I
140	2446.39	Er II	50	2455.24	Sn I	30	2463.61	Rh I
160	2446.39	W II	780	2455.51	W I	35	2463.73	Fe I
610	2446.98	Re I	180	2455.53	Ru II	85	2463.78	Co I
100	2447.17	Ta I	1300	2455.61	Ir I	160	2463.82	Ta II
390	2447.25	Hf II	35	2455.68	U II	70	2463.97	Hf II
25	2447.26	Yb II	30	2455.70	Rh II	110	2464.00	Os
65	2447.38	Tm II	200	2455.83	Re II	430	2464.19	Hf II
30	2447.45	Ru I	230	2455.87	Ir I	85	2464.20	Co II
40	2447.49	Ir I	60	2455.99	Re I	270	2464.30	W I
70	2447.71	Fe I	240	2456.24	Co I	55	2464.36	Ce II
250	2447.76	Ir I	90	2456.30	Th II	180	2464.50	Os I
1100	2447.91	Pd I	150	2456.44	Ru II	460	2464.50	Yb I
30	2447.93	Ag II	530	2456.46	Os I	50	2464.62	Co I
120	2448.20	Re I	360	2456.53	As I	60	2464.63	Er III
190	2448.23	Ir I	780	2456.53	W I	85	2464.70	Ru I
270	2448.39	W I	370	2456.57	Ru II	85	2464.90	Ir I
65	2448.84	Rh I	23	2456.87	Th II	80	2464.95	Tm II
65	2448.93	U II	210	2457.03	Ir I	90	2465.06	Hf II
40	2449.02	Ir I	70	2457.16	Os I	120	2465.09	Ir I
85	2449.03	Re II	210	2457.23	Ir I	120	2465.13	Re I
50	2449.04	Rh I	21	2457.44	Zr II	140	2465.15	Fe I
60	2449.16	Co II	180	2457.60	Fe I	70	2465.16	Os
140	2449.44	Hf II	40	2458.03	Er II	95	2465.20	W I
80	2449.44	Ta II	55	2458.09	Nb II	80	2465.26	Ta I
85	2449.52	Re II	80	2458.58	Tm II	35	2465.67	Hf I
610	2449.71	Re I	65	h 2458.62	Ru I	90	2466.13	Th II
150	2449.85	Zr II	100	2458.68	Ta I	230	2466.52	W II
35	2449.88	Os	70	2458.76	Os	50	2466.68	Mo II
95	2450.00	Co II	70	2458.78	Fe II	35	2466.73	Nb I
750	2450.07	Ga I	65	2458.90	Rh II	1400	2466.85	W I
24	2450.44	Ti II	28	2459.01	Th II	50	2466.97	Mo II
65	2450.44	U II	1100	2459.30	W I	130	2466.99	Ta II
75	2450.56	Rh I	130	2459.64	Lu II	35	2467.26	Er II
30	2450.58	Ru I	40	2459.75	Er II	870	2467.30	Ir I
900	2450.74	Os I	110	2459.84	Os I	130	2467.37	Ta II
28	2450.79	Th II	110	2459.99	Dy II	440	2467.44	Pt I
85	2450.89	Re I	60	2460.08	In I	200	2467.57	Re II
60	2450.97	Pt I	270	2460.16	W I	290	2467.69	Co I
70	2451.19	Os I	29	2460.21	Co I	35	2467.73	Fe I
80	2451.20	Tm II	85	2460.24	Re I	120	2467.85	Re II
270	2451.35	W I	28	2460.25	Yb II	140	2467.97	Hf II
780	2451.48	W II	450	2460.49	Hf II	30	h 2468.02	In I
530	2451.73	Os I	100	2460.55	Ta I	110	2468.09	Os I
65	2451.87	Nb II	60	2460.61	Y II	55	2468.15	Th II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
100	2468.22	Gd II	200	2476.67	Ta II	900	2484.19	Fe I
50	2468.26	U II	900	2476.84	Os I	29	2484.40	W II
50	2468.41	Ta II	85	2476.87	Ni I	80	2484.72	Ta II
50	2468.78	Mo II	100	2476.88	Ru I	580	2484.74	W I
140	2468.88	Fe I	35	2476.97	Th II	40	2484.75	Mo II
110	2468.90	Os II	80	2476.97	Tm II	14	2484.89	Yb II
55	2469.08	Nb I	40	2477.18	U II	500	2484.95	Ta I
210	2469.18	Hf II	110	2477.38	Nb II	14	2485.06	Th II
80	2469.27	Lu II	75	2477.43	Re II	35	2485.17	Er II
150	c 2469.36	Re II	15	2477.54	Rh II	40	h 2485.31	Mo I
30	2470.04	Mo II	70	2477.57	Mo II	60	2485.32	Os I
60	h 2470.05	Re I	20	2477.59	Er II	29	2485.36	Co II
45	2470.13	Th II	290	2477.80	W II	100	2485.38	Ir I
480	2470.28	Co I	210	2478.11	Ir I	35	2485.67	Gd II
75	2470.39	Rh I	150	2478.22	Ta I	390	2485.81	Re I
120	2470.61	Re II	65	2478.29	Nb II	530	2486.24	Os II
85	2470.64	U II	40	2478.32	Er II	130	2486.30	W I
75	2470.80	W II	180	2478.32	Sb I	45	2486.37	Ce II
60	2470.82	Os I	100	2478.56	C I	90	2486.37	Fe I
380	2470.90	Ta II	280	2478.93	Ru II	40	2486.37	Ir I
35	2471.01	Pt I	200	2479.02	Re I	95	2486.44	Co II
75	2471.05	Re II	70	2479.05	V II	50	2486.53	Pd II
75	2471.21	W I	40	2479.16	Ir I	70	2486.69	Fe I
18	2471.37	Tm II	70	2479.48	Fe I	120	2486.70	Ta I
120	2471.38	Ta I	45	2479.52	V II	40	2486.75	Ir I
90	2471.40	Dy II	80	2479.58	Ta II	120	2486.78	Re I
90	2471.47	Rh I	1000	2479.78	Fe I	60	2486.97	Re I
55	2471.58	Gd II	35	2479.85	La II	90	2487.06	Fe I
65	2471.90	La II	65	2479.94	Nb II	55	2487.16	Hf I
150	h 2471.97	Mo I	770	2480.13	Tm II	1000	2487.17	Pt I
160	2472.06	Ni I	870	2480.13	W I	75	2487.29	Zr II
120	2472.13	Ta I	35	2480.44	Sb I	980	2487.33	Re I
290	2472.28	Os I	40	2480.66	W I	35	2487.37	Fe I
140	2472.34	Fe I	30	2480.71	Os I	70	2487.46	Gd II
35	2472.44	La II	180	2480.82	Re I	40	2487.47	Er II
30	2472.51	Rh I	110	2480.93	Dy II	150	2487.47	Rh I
480	2472.51	W I	390	2480.96	W I	390	2487.50	W I
900	2472.88	Fe I	28	2481.11	Ru II	130	2487.52	Tm II
	2472.91	Fe I	150	2481.15	Tm II	65	2487.59	La II
130	2473.09	Rh I	2100	2481.18	Ir I	2600	2488.15	Fe I
150	2473.13	Ta I	55	2481.44	Hf II	4500	2488.55	Os I
120	2473.31	Ta II	1500	2481.44	W I	600	2488.70	Ta II
45	2473.39	Ce II	21	h 2481.72	Lu II	110	2488.72	Gd II
95	d 2473.70	W I	180	2481.79	Os I	25	2488.74	Pt II
	2473.82	W I	70	h 2481.81	Mo I	270	2488.77	W II
150	2473.72	Re II	120	2481.86	Ta II	130	2488.92	Pd II
120	2473.90	Co I	25	2482.04	Rh I	120	2488.93	W I
100	2473.92	Hf II	100	2482.10	Ta I	70	2489.04	Os I
30	2474.04	Ru I	480	d 2482.10	W I	40	2489.20	Ir I
1200	2474.15	W I		2482.21	W I	390	2489.23	W II
18	2474.57	Sb I	45	2482.31	V II	150	2489.44	Tm III
600	2474.62	Ta I	360	2482.43	Os I	70	2489.62	Th II
160	2474.73	Re I	65	2482.57	Mo II	70	2489.72	W I
290	2474.78	Os I	100	2482.58	Ta II	1800	2489.75	Fe I
220	2474.81	Fe I	55	2482.65	Hf I	30	2489.91	Ru I
3300	2475.12	Ir I	2800	2483.27	Fe I	200	2490.12	Pt I
160	2475.17	Re II	50	2483.33	Rh I	75	2490.16	Re II
120	2475.33	Ta I	1100	2483.39	Sn I	25	2490.42	Y I
110	2475.41	Ru I	80	2483.46	Ta II	500	2490.46	Ta I
15	2475.64	Rh II	430	2483.61	Co I	170	2490.61	Dy II
110	2475.69	Os I	35	2483.88	Nb II	1800	2490.64	Fe I
75	2476.28	Re I	1200	2483.92	Re I	100	2490.77	Rh II
1300	2476.38	Pb I	50	2484.01	U II	75	2490.85	W I
1700	2476.42	Pd I	35	2484.04	Os I	35	2490.93	Tm II
480	2476.64	Co I	100	2484.04	Ta II	20	2490.93	U II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
290	2491.02	Os I	2600	2498.41	Os I	15	2503.84	Rh II
1400	2491.16	Fe I	140	2498.42	Ru II	20	2503.9	U II
60	2491.56	Er II	240	2498.50	Pt I	40	2503.96	W I
250	2491.60	Tm II	140	2498.57	Ru II	100	2504.28	Th II
290	2491.69	Os I	60	2498.78	Pd II	300	2504.29	Rh II
18	2491.78	Ru I	27	2498.83	U II	190	2504.31	Cr I
360	2492.15	Cu I	110	2498.86	Re I	170	2504.37	Ir I
40	2492.27	Er II	55	2498.87	Th II	500	2504.39	Os I
30	2492.30	Rh I	100	2498.89	Fe I	600	2504.45	Ta I
360	2492.42	Os I	55	2498.98	Ce II	260	2504.51	Os I
200	2492.84	Re I	15	2499.02	Rh I	570	2504.52	Co I
440	2492.91	As I	45	2499.04	Gd II	70	2504.53	W I
75	2492.93	W II	90	2499.20	Tm II	24	2504.54	Ti I
620	2493.08	Ir I	21	2499.39	Eu II	230	2504.60	Re II
180	2493.18	Fe II	95	2499.43	W I	110	2504.65	Nb I
	2493.26	Fe II	100	2499.54	Tm II	680	2504.70	W I
60	2493.27	Er II	90	2499.67	Er I	65	2504.71	Tm III
55	2493.29	Gd II	140	2499.69	W II	40	2505.10	Rh II
70	2493.39	W I	85	2499.78	Ru I	100	2505.32	Ta II
180	2493.62	Os I	330	2499.92	Os I	40	2505.37	W I
65	2493.69	Ru II	40	2500.11	W II	75	2505.43	Re I
60	2493.83	Os I	1300	h 2500.17	Ga I	28	2505.48	Yb II
70	2493.93	Co I	85	2500.27	Ir I	40	2505.60	Th II
85	2494.02	Ru I	75	2500.31	Re I	95	2505.65	W I
45	2494.48	Ru II	40	2500.44	Mo II	150	2505.67	Rh I
75	h 2494.51	Rh	29	h 2500.50	Co I	120	2505.74	Ir I
700	2494.54	Be I	140	2500.57	Re I	27	2505.90	Tm II
	2494.58	Be I	40	2500.58	Rh	50	2505.93	Pt I
35	2494.62	Th II	120	2500.70	Ga I	270	2505.94	Re I
1000	2494.73	Be I	95	2500.72	Os	270	2506.02	W I
120	2494.73	Co I	70	2500.74	Hf II	70	2506.22	V II
150	2495.26	Re I	30	2500.84	Ru I	85	2506.38	Os
630	2495.26	W I	170	2500.86	U II	27	2506.45	Tm II
70	2495.35	Th II	95	2500.91	Os I	570	2506.46	Co II
380	2495.55	Co I	900	2501.13	Fe I	85	2506.60	Ir I
85	2495.69	Ru II	75	2501.48	Ru I	85	2506.66	Os
1100	2495.70	Sn I	140	2501.61	V I	360	2506.88	Co I
160	2495.82	Pt I	35	2501.70	Fe I	1700	2506.90	Si I
370	2496.04	Re I	370	2501.72	Re I	150	2506.90	V I
24	2496.24	Mo II	160	d 2501.78	W I	260	2507.01	Ru II
				2501.90	W II	130	2507.15	Tm II
50	2496.24	Ta I	60	2501.84	Os I	35	2507.18	Os II
210	2496.27	Ir I	55	2501.89	Ru I	150	2507.40	Re I
170	2496.31	Cr I	140	2501.98	Ta II	600	2507.45	Ta I
35	2496.35	Gd II	70	2502.02	Yb II	120	2507.63	Ir I
70	2496.45	Os	29	2502.28	Co I	60	2507.64	Er II
45	2496.48	Zr II	330	2502.29	Os I	290	2507.68	Co I
140	2496.53	Fe I	570	2502.35	Re II	240	2507.78	V I
65	2496.56	Ru I	130	2502.46	Rh I	100	2507.90	Fe I
60	2496.61	Os I	28	2502.49	Nb II	55	2507.92	Th II
70	2496.64	Ta I	110	2502.53	Cr I	24	2508.00	W II
230	2496.64	W II	250	2502.63	Ir I	11	2508.07	Yb II
35	2496.70	Re I	70	2502.66	Hf I	50	2508.11	Cr I
380	2496.71	Co I	55	2502.70	Tm II	130	2508.27	Ru I
2400	2496.78	B I	65	2502.84	Mo II	85	2508.35	Ir I
50	2496.97	W I	35	2502.88	Th II	95	2508.44	W I
290	2496.99	Hf II	170	2502.91	Ho II	120	2508.50	Pt I
95	2497.48	W II	4100	2502.98	Ir I	80	2508.53	Ho II
20	2497.56	Th III	100	2503.01	Ta II	170	2508.61	Os I
4800	2497.73	B I	60	2503.02	V II	50	h 2508.67	Mo I
50	2497.77	Ta II	14	2503.04	W I	190	2508.73	W I
900	2497.96	Ge I	35	2503.16	Os	100	2508.92	Ta II
200	2498.22	Re I	75	2503.30	V I	60	2508.98	Cr I
85	2498.28	Mo II	80	2503.48	Er II	1800	c 2508.99	Re I
90	2498.33	Ta II	95	2503.67	Os	110	2509.07	Ru I
55	2498.40	Th II						

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
1300	2509.08	Tm II	130	2515.48	Hf II	250	2522.17	Tm II
50	2509.56	Mo I	240	2515.58	Pt I	50	2522.44	Yb II
350	2509.70	Rh I	24	2515.66	Mo I	2800	2522.85	Fe I
170	2509.71	Ir I	25	2515.69	Bi I	780	2523.41	W I
70	2509.71	Os II	200	2515.75	Rh I	60	2523.59	W I
170	2509.94	Os I	3600	2516.11	Si I	140	2523.66	Fe I
28	2509.96	Th II	120	2516.12	Re I	150	2523.92	Sn I
250	2510.17	W I	18	2516.35	Yb II	2400	2524.11	Si I
90	2510.31	Dy II	28	2516.43	Th II	180	2524.11	Tm II
75	2510.47	W II	85	2516.55	W I	500	2524.29	Fe I
30	2510.54	Sb I	890	2516.88	Hf II	140	2524.30	Pt I
50	2510.66	Rh II	110	2516.92	Cr I	70	2524.49	Bi I
100	2510.71	Ta II	50	2517.08	Re I	75	2524.64	Ti II
900	2510.83	Fe I	180	2517.14	V I	70	2524.79	Os I
110	2511.00	Nb II	110	2517.32	Ru II	95	h 2524.81	Mo I
2200	2511.02	Co I	75	2517.43	Ti II	75	2524.81	W I
300	2511.03	Rh II	50	h 2517.46	Mo I	40	2524.88	Ir II
30	2511.56	Ru I	170	2517.61	Dy II	290	2524.96	Co II
180	2511.65	V I	35	2517.61	Os I	28	2524.99	Nb I
50	d 2511.69	Ta II	55	2517.62	Ru I	60	2525.02	Fe I
70	2511.76	Fe II	90	2517.66	Fe I	170	2525.05	Ir I
50	2511.80	Mo II	24	2517.83	Mo I	28	2525.17	Ru I
45	2511.84	Tm II	70	2517.86	Hf I	70	2525.39	Fe II
170	2511.94	Ir I	860	2517.87	Co I	110	2525.55	Re I
180	2511.95	V I	500	2517.92	Os I	360	2525.60	Ti II
140	2512.06	Yb II	700	2518.10	Fe I	140	2525.68	W I
70	2512.36	Fe I	60	2518.14	W II	90	2525.81	Nb II
29	2512.40	Co II	660	2518.44	Os I	14	2525.92	Th II
75	2512.55	Re I	23	2518.48	Tm II	13	2525.99	Rh I
170	2512.58	Ir II	29	2518.50	W I	170	2526.01	Os I
240	2512.65	Ta I	110	2518.51	Ce II	140	2526.02	Ta II
580	2512.69	Hf II	80	2518.71	Cr I	28	d 2526.22	Th II
110	2512.81	Ru I	95	2518.73	Ho II		2526.34	Th II
660	2512.87	Os I	85	2518.97	U II	410	2526.22	V I
95	2512.90	Co I	45	2519.02	Ce II	50	2526.30	Fe II
29	2512.94	W I	40	2519.04	Ti I	1200	d 2526.35	Ta I
580	2513.03	Hf II	1200	2519.20	Si I		2526.45	Ta I
100	2513.10	Ta II	200	2519.29	Os I	95	2526.42	W I
120	2513.12	Co I	390	2519.52	Cr I	40	2526.77	Ir I
2400	2513.25	Os I	240	2519.62	V I	60	2526.81	Re I
85	2513.30	Ce II	60	2519.63	Fe I	70	2526.83	Os I
110	2513.32	Ru II	100	2519.78	Ta I	75	2526.83	Ru I
30	2513.33	Mo I	100	2519.78	Tm III	130	2527.02	Tm I
75	2513.36	Rh II	330	2519.79	Os I	130	2527.09	Os I
170	2513.55	Dy II	290	2519.82	Co II	190	2527.12	Cr I
110	2513.55	Ho II	95	2519.87	W I	70	2527.14	Mo II
40	2513.62	Cr I	30	2519.95	Ru I	110	2527.42	Tm II
210	2513.71	Ir I	570	2520.01	Re I	1400	2527.43	Fe I
90	d 2513.78	Tm I	310	2520.46	W I	430	2527.76	W I
	2513.87	Tm II	40	2520.51	Nb I	35	2527.85	Tm I
70	2513.88	Ta II	130	2520.53	Rh II	210	2527.90	V II
140	2513.93	W I	140	2520.54	Ti I	29	2527.98	Ti I
50	2513.94	Er II	80	2520.66	Th II	40	2528.10	U II
50	2514.07	Pt I	200	2520.87	Tm II	120	2528.47	V II
1600	2514.32	Si I		2520.94	Tm II	60	2528.51	Ba II
75	c 2514.51	Re I	26	2520.95	Er II	2000	2528.51	Si I
75	2514.64	V II	60	2520.98	W I	3200	2528.52	Sb I
85	2514.77	U II	780	2521.32	W I	1100	2528.62	Co II
60	2515.03	Pt I	4300	2521.36	Co I	150	2528.84	V II
660	2515.04	Os I	100	2521.37	In I	55	2528.88	Ru I
65	2515.08	Mo II	110	2521.40	Nb II	2900	2528.97	Co I
70	2515.15	V I	70	2521.49	Hf II	500	2529.13	Fe I
65	2515.28	Ru I	540	2521.50	Re I	40	2529.41	Pt I
120	2515.36	Ir I	55	2521.61	Ru I	140	2529.50	Re I
60	2515.47	Re I	270	2522.04	W II	60	2529.55	Fe II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
190	2529.72	W I	130	2535.87	Ti II	120	2543.44	W I
160	2529.83	Fe I	2900	2535.96	Co I	50	2543.45	Mn II
210	2529.85	Ti I	860	2536.49	Co I	40	2543.61	Mo II
720	2530.13	Co I	50	2536.49	Pt I	110	2543.67	Re I
240	2530.18	V I	15000	2536.52	Hg I	28	2543.68	Gd II
50	2530.34	Mo II	110	2536.71	Rh	130	2543.80	Os I
40	2530.45	Cr I	120	2536.82	Fe II	130	2543.81	Dy II
55	2530.64	Ru I	70	2536.85	Mo I	60	2543.84	Re I
70	2530.69	Fe I	130	2536.86	Ho II	160	2543.92	Fe I
120	2530.72	Te I	370	2536.95	Lu II	7900	2543.97	Ir I
55	2530.97	Nb II	100	2537.02	Er II	30	2544.03	Tm II
24	2530.99	W I	110	2537.04	Rh II	29	2544.17	W I
340	2531.19	Hf II	120	2537.17	Fe	16	2544.19	Au I
28	2531.25	Nb II	580	2537.22	Ir I	110	2544.22	Re I
190	2531.25	Ti II	85	2537.30	U II	40	2544.22	Rh
50	2531.29	Ta I	200	2537.33	Hf II	280	2544.22	Ru I
18	2531.45	Tm II	65	2537.65	Yb II	1700	2544.25	Co I
13	2531.74	Rh I	170	2537.68	Ir I	50	2544.27	Ta I
600	2532.12	Ta II	160	2537.94	Ta II	50	2544.37	Ta II
860	2532.18	Co I	780	2538.00	Os II	35	2544.36	U II
50	2532.20	Ir I	240	2538.10	Os I	70	2544.71	Fe I
70	2532.31	Mo II	150	2538.43	U II	740	d 2544.74	Re I
45	2532.43	Th II	440	2538.46	Mo II	740	d 2544.88	Re I
200	2532.44	Os I	270	2538.67	Yb II	390	2544.80	Nb II
180	2532.46	Zr II	40	2538.73	U II	190	2544.86	Co I
120	2532.52	Ir I	70	2538.81	Fe II	60	2544.90	Er II
50	2532.66	Rh	40	2538.88	Ir I	90	2545.12	Dy II
80	2532.97	Hf II	70	2539.00	Fe II	560	2545.22	Sc II
120	2533.00	Ta I	160	2539.20	Pt I	55	2545.34	Th II
75	2533.06	Mn I	70	2539.31	W I	580	2545.34	W I
990	2533.13	Ir I	110	2539.33	Re I	370	2545.48	Re I
45	2533.14	La II	50	2539.44	Mo II	240	2545.49	Ta II
700	2533.23	Ge I	90	2539.65	Zr I	150	2545.54	Ir I
50	2533.23	U II	30	2539.72	Rh	50	2545.64	Cr I
45	2533.24	Ru I	130	2539.73	Os I	350	2545.70	Rh I
150	2533.31	Re I	170	2540.14	Os I	35	2545.74	Th II
13	2533.59	Rh	12	2540.28	Y	800	2545.98	Fe I
70	2533.63	Fe II	40	2540.40	Ir I	60	2545.98	V I
780	2533.64	W I	110	h 2540.45	Mo I	790	2546.03	Ir I
60	2533.80	Fe I	570	2540.51	Re I	160	2546.17	Os I
170	2533.80	Ho I	90	2540.62	Nb II	2400	2546.55	Sn I
29	2533.98	W I	180	2540.74	Os I	120	2546.67	Ru I
220	2534.01	P I	800	2540.98	Fe I	23	2546.74	Co II
50	2534.07	Rh	45	2541.28	Ru I	240	2546.80	Ta I
150	2534.10	Re II	40	2541.37	U II	40	2546.87	Lu II
70	2534.16	Ta I	90	2541.42	Nb II	1200	2547.14	W I
120	2534.17	Os I	100	2541.48	Ir I	120	2547.20	Ir I
70	2534.34	Cr II	70	2541.65	Os I	110	2547.28	Er II
60	2534.42	Fe II	75	2541.70	W I	14	2547.57	Y
1100	2534.46	Ir I	190	2541.92	Ti I	120	2547.69	Ir I
50	2534.47	Ta I	150	2541.94	Co II	140	2547.70	Os I
30	2534.52	V II	580	2542.02	Ir I	150	2547.90	Th II
190	2534.62	Ti II	160	2542.10	Fe I	160	2548.10	Os I
50	2534.68	W I	220	2542.10	Zr II	35	2548.13	Th II
370	2534.80	Re I	90	d 2542.23	Ta I	110	2548.14	Re I
50	2534.82	W II	90	2542.35	Ta II	35	2548.15	W I
50	2534.95	U II	1000	2542.51	Os I	110	2548.20	Hf II
120	2534.97	Ta I	35	2542.64	Th II	330	2548.22	Mo I
50	2534.99	Er II	120	2542.66	Tm II	340	2548.34	Co I
85	2535.11	W I	330	2542.67	Mo II	35	2548.56	W I
60	2535.36	Co I	40	2542.80	Ir II	13	2548.60	Rh
150	2535.59	Ru II	85	2543.09	Ce II	28	2548.63	Nb II
700	2535.60	Fe I	65	2543.25	Ru II	200	2548.68	Ce II
600	2535.65	P I	65	2543.35	Mo I	60	2548.69	V II
45	2535.87	Th II	35	2543.38	Fe II	30	2548.83	Os II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
150	2548.88	Re I	26	2554.78	Eu II	90	2560.21	Dy II
50	2549.09	W II	55	2554.86	V I	2300	2560.25	Sc II
110	2549.28	V II	410	2554.86	W II	130	2560.26	Ru I
230	2549.30	Co I	120	2554.91	Ta II	45	2560.37	La II
85	2549.30	U II	150	2554.93	P I	50	2560.47	Os I
60	2549.37	Re I	60	2554.93	Re I	180	2560.68	Ta I
140	2549.38	Ta I	240	2555.05	Ta I	130	2560.69	Cr I
20	2549.44	Lu I	310	2555.07	Co I	29	2560.76	W I
18	2549.46	Pt I	580	2555.09	W II	120	2560.83	Ru I
280	2549.48	Ru I		2555.21	W I	8	2560.93	Th II
160	2549.54	Cr I	160	2555.11	Os I	150	2561.46	Re I
550	2549.58	Ru I	20	2555.17	Th III	85	2561.53	W I
650	2549.61	Fe I	120	2555.27	Os I	540	2561.65	Tm II
20	2549.72	Lu I	210	2555.35	Ir I	35	2561.80	Lu II
11	2549.98	Th II	550	2555.36	Rh I	80	2561.94	Th II
25	2550.02	Fe II	65	2555.42	Mo II	730	2561.97	W I
14	2550.06	Yb II	55	2555.63	Nb II	65	2562.08	Mo II
160	2550.09	Re II	160	2555.80	Os I	460	2562.10	Ta I
40	2550.10	W II	560	2555.82	Sc II	210	2562.13	V I
10	2550.17	Y	23	2555.86	Ru I	960	2562.15	Co I
780	2550.38	W I	170	2555.88	Ir I	130	2562.41	Nb II
45	2550.51	Zr I	65	2555.99	Ti II	35	2562.42	Ce II
220	2550.74	Zr II	30	2556.00	Ru I	200	2562.53	Fe II
110	h 2550.85	Mo I	110	2556.08	Os I	160	2562.66	Os I
140	2551.00	W I	270	2556.19	U II	200	2562.94	U II
460	d 2551.07	Ta I	40	2556.27	W I	150	2563.01	Re I
	2551.19	Ta I	25	2556.30	Ge I	110	2563.15	Ru I
60	2551.09	Fe I	35	2556.31	Ru I	190	2563.16	Os II
14	2551.23	Th II	45	2556.43	Zr I	230	2563.16	W II
2700	2551.35	W I	1000	2556.51	Re I	1100	2563.21	Sc II
110	2551.38	Nb II	140	2556.51	Ta II	150	2563.28	Ir I
320	2551.40	Hf II	75	2556.57	Mn II	80	2563.33	Ta I
210	2551.40	Ir I	40	2556.75	Mo II	130	2563.47	Fe II
30	2551.51	Tm II	310	2556.75	W I	250	2563.61	Hf II
140	2551.73	Ta II	190	2556.76	Co I	150	2563.65	Mn II
28	2551.77	Ce II	80	2556.84	Ho I	140	2563.70	Ta I
27	2551.85	Hf II	130	2556.94	Nb II	150	2563.86	Tm II
29	2551.99	W I	80	2557.15	Cr I	110	2563.91	W II
300	2552.02	Re I	75	2557.57	W I	310	2564.04	Co II
70	2552.15	Yb II	180	2557.71	Ta II	160	2564.17	Eu II
50	2552.25	Pt I	95	2557.77	Os I	910	2564.18	Ir I
150	2552.29	Dy II	180	2557.94	Dy II	340	2564.19	Re I
2900	2552.37	Sc II	150	2558.06	Re I	75	h 2564.23	V I
120	2552.46	Tm III	120	2558.09	Os I	85	2564.34	Mo II
120	2552.65	V I	29	2558.48	W I	120	2564.37	Os I
55	2552.70	Yb II	45	2558.54	Ru I	28	2564.58	Ru I
35	2552.73	Re I	25	2558.58	Pr II	150	2564.70	W I
360	2552.76	Tm I	95	2558.59	Mn II	40	2564.78	Er II
90	2552.96	V II	25	2558.62	Rh I	110	2564.82	V I
230	2553.00	Co I	80	2558.88	Mo II	130	2565.17	Os I
40	2553.06	Cr I		2558.94	Mo I	130	2565.41	Nb I
170	2553.17	W I	40	2558.90	V I	440	2565.41	U II
70	2553.18	Ta II	75	2558.94	Nb I	21	2565.57	Yb II
380	2553.28	P I	60	2559.02	Hf I	500	2565.59	Th II
310	2553.37	Co I	250	2559.08	Re I	60	2565.72	Os I
150	c 2553.59	Re II	26	2559.18	Eu II	50	2565.79	Rh I
40	2553.67	V II	130	2559.19	Hf II	75	2565.84	Re I
450	2553.82	W I	230	2559.41	Co II	65	2565.98	Tm II
75	2554.18	Re I	1200	2559.43	Ta I	45	2566.04	Rh I
190	2554.40	Ir I	50	2559.49	U II	90	2566.25	Dy II
310	2554.46	Os I	75	2559.71	Re I	40	2566.26	Mo II
460	2554.62	Ta II	75	2559.88	Re I	600	2566.49	Os I
370	2554.63	Re II	290	2560.12	W I	35	2566.57	Re I
12	2554.64	Sb I	1100	2560.15	In I	55	2566.59	Ru I
11	2554.65	Th II	50	2560.19	Os I	270	2566.59	Th II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
290	2566.88	Os I	28	2572.28	Ru I	340	2577.78	Ta I
60	2566.91	Fe II	320	2572.34	Mo I	90	2577.92	Fe II
25	2566.92	Rh II	70	2572.37	Ir I	50	2578.12	Re I
250	2567.05	Mo I	55	2572.41	Ru I	300	2578.14	Hf II
30	2567.11	U II				85	2578.16	Os I
50	2567.28	Rh	75	2572.48	Os	55	2578.20	Nb I
1100	2567.35	Co I	50	2572.65	Ti II	70	2578.24	Ta II
60	2567.45	Zr I	230	2572.70	Ir I	25	2578.27	Pr I
70	2567.51	Nb I	580	2572.76	Mn I	150	2578.32	Os II
140	2567.51	W I	50	2572.93	Cd II	40	2578.36	Mo II
570	2567.64	Zr II	75	2573.09	Os I	100	2578.57	Ru I
80	2567.73	Ho II	70	2573.14	Ce II	100	2578.71	Ir I
28	2567.94	Th II	13	2573.15	Yb II	200	2578.74	Nb I
85	2567.96	U II	65	2573.40	Co I	95	2578.77	Mo I
240	2567.98	Al I	40	2573.48	Os I	1700	2578.79	Lu II
110	2568.17	Eu II	190	2573.53	W I	70	2578.91	Ir I
130	2568.21	W I	75	2573.54	Co I	55	2578.95	Ru I
35	2568.26	Tm II	430	2573.54	Ta I	150	2579.01	Re I
40	2568.39	V I	150	2573.76	Re I	85	2579.16	U II
95	2568.56	W I	390	2573.79	Ta I	45	2579.22	Ru I
540	2568.64	Re II	320	2573.90	Hf II	190	2579.26	W II
160	2568.77	Ru I	75	2573.95	W II	30	2579.31	Pr I
480	2568.83	Os I	230	2574.02	V I	190	2579.41	W I
85	2568.87	U II	80	2574.06	Sb I		2579.54	W II
1600	2568.87	Zr II	50	2574.21	Re I	100	2579.43	Th II
30	2568.98	U II	960	2574.35	Co I	85	2579.44	U II
75	2568.99	W I	40	2574.37	Fe II	35	2579.49	Ir II
100	2569.03	Nb I	150	2574.38	Ta I	100	2579.53	Ru I
120	2569.13	Ta II	50	2574.42	Mo II	85	2579.57	U II
55	2569.17	Ce II	70	2574.48	Th II	50	2579.59	Er II
190	2569.25	W I	45	2574.52	Tm III	100	2579.62	Ta I
	2569.30	W II	25	2574.66	Rh	130	2580.03	Os II
35	2569.34	Tm II	27	2574.74	Os I	700	2580.14	Tl I
12	2569.47	Sr I	26	2574.76	Eu II	210	2580.16	Ta I
340	2569.71	U II	45	2574.84	Nb II	45	2580.28	Nb II
28	2569.74	Ru I	35	2574.86	Co II	100	2580.31	Re I
35	2569.88	Ce II	60	2574.89	Hf I	770	2580.33	Co II
210	2569.88	Ir I	480	2575.10	Al I	290	2580.34	W I
160	2570.10	W I	28	h 2575.24	Ru I	23	2580.35	Th II
60	2570.52	Fe II	40	2575.40	Al I	870	2580.49	W I
100	2570.62	Ir I	150	2575.47	Ta I	55	2580.70	Th II
150	2570.67	U II	50	2575.47	W I	90	2580.80	Ru I
55	2570.71	Hf II	480	2575.51	Mn I	18	2580.82	La II
28	2570.78	Nb I	35	2575.73	Co I	50	2580.82	Ti I
100	2570.97	Ru I	60	2575.74	Fe I	120	2580.84	Co I
110	2571.03	Ti II	25	2575.75	Rh I	360	2581.05	Os I
28	2571.05	Nb I	40	2575.77	Mo I	140	2581.06	W I
75	2571.14	Os I	12000	2576.10	Mn II	75	2581.14	Ru I
930	2571.23	Lu II	13	2576.23	Rh	40	2581.20	W II
150	2571.26	Re I	75	2576.32	Re I	150	2581.44	Re I
110	2571.33	Nb II	11	2576.32	Th II	90	2581.56	Er II
28	2571.36	Yb II	40	2576.56	Mo II	35	2581.60	Ta II
2100	2571.39	Zr II	55	2576.60	Nb I	26	2581.86	Eu II
530	2571.44	W II	100	2576.69	Fe I	65	2581.91	Ru I
20	2571.45	Mo II	200	2576.69	Th II	740	2581.96	Os I
340	2571.51	Ta II	320	2576.82	Hf II	40	2582.11	U II
1000	2571.58	Sn I	140	2577.03	W I	80	h 2582.13	Lu II
890	2571.67	Hf II	230	2577.14	Eu II	250	2582.16	Mo I
150	2571.74	Cr I	740	2577.26	Ir I	310	2582.24	Co II
340	2571.78	Os I	1100	2577.27	Pb I	50	2582.30	Fe I
370	2571.81	Re II	45	2577.29	V I	320	2582.54	Hf II
70	2572.07	Ir I	130	2577.32	U II	22	2582.56	La II
70	2572.10	Nb I	600	2577.37	Ta II	90	2582.58	Fe II
95	2572.24	Co I	100	2577.65	Cr I	110	2582.62	Os I
170	d 2572.24	W II	29	2577.73	Tb II	110	2582.77	Re I
	2572.35	W II						



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
55	2583.04	Ru I	45	2589.71	Mn II	560	2595.26	Ta I
60	2583.11	Nb I	75	2589.81	Ta II	100	2595.40	Mo I
35	2583.18	Ir I	30	2590.04	Au I	120	2595.59	Ta II
45	2583.22	Nb I	21	2590.20	Ta II	250	2595.76	Mn I
75	2583.22	W I	35	2590.26	Ti I	170	2596.00	Os II
75	2583.40	Zr II	29	2590.31	Tb II	50	2596.00	Pt I
35	2583.42	Tm I	150	2590.59	Co I	35	2596.09	La II
35	2583.45	Th II	1000	2590.76	Os I	85	2596.12	Ta I
40	2583.48	U II	390	2590.94	Nb II	18	2596.16	Yb II
390	2583.99	Nb II	65	2590.97	Ru I	28	2596.32	Yb II
340	2584.03	Ta II	60	2591.05	Ho II	50	2596.35	W I
75	2584.14	Ru I	170	2591.12	Ru I	27	2596.37	Os I
550	2584.31	Mn I	65	2591.13	Re I	110	2596.40	Re I
390	2584.39	W I	340	2591.25	U II	310	2596.45	Ta II
130	2584.42	U II	130	2591.33	Hf II	170	2596.49	Tm I
140	2584.49	Ta II	29	2591.42	Tb II	65	2596.58	Ti I
260	2584.54	Fe I	170	2591.49	W II	60	2596.61	Ta I
110	2584.61	Tb II	90	2591.54	Fe II	70	2596.67	W I
150	2584.69	Ta I	90	2591.56	Dy II	150	2596.69	Os I
75	2584.77	Re I	180	2591.59	Re I	40	2596.77	Mo I
85	2584.90	U II	35	2591.64	Ru I	160	2596.78	Re I
40	2585.24	W I	120	2591.69	Co I	110	2596.95	Re I
220	2585.30	Dy I	40	2591.77	Mo II	230	2597.05	Th II
120	2585.34	Co I	380	2591.85	Cr I	55	2597.14	Nb I
110	2585.43	W I	35	2591.91	Er II	150	2597.20	Os I
100	2585.61	Ta I	70	2591.98	Mo I		2597.29	Os I
45	2585.74	Ru I	200	2591.98	Os I	30	2597.22	Mo I
650	2585.88	Fe II	120	2592.02	Ru I	45	2597.33	Ru I
30	2585.95	Mo II	740	2592.06	Ir I	40	2597.38	Mo II
130	2586.08	Os	270	2592.20	Nb I	130	2597.58	Os I
28	2586.13	Gd II	28	2592.34	Ce II	240	2597.69	U II
14	2586.15	Th II	70	d 2592.44	Ta I	55	2597.71	Tb II
85	2586.20	U II			Ta II	75	2597.73	W I
40	2586.35	W I	75		Dy II	65	2597.96	Re I
80	2586.52	Ho I	5000		Ge I	40	h 2598.04	Pr II
50	2586.64	W I	130	2592.57	Er II	6000	2598.05	Sb I
290	2586.73	Er II	130	2592.57	U II		2598.09	Sb I
380	2586.79	Re I	24	2592.64	Tb II	30	2598.07	Rh
120	2586.94	W I	30	2592.78	Fe II	100	2598.21	Ta II
65	2587.00	Re I	90	h 2592.84	Re I	650	2598.37	Fe II
110	2587.04	Er II	250	2592.94	Mn I	70	2598.42	W I
100	d 2587.07	U II	95	2592.99	Ho I	110	2598.74	W II
310	2587.22	Co II	430	2593.08	Ta I	45	2598.75	Ta I
11	2587.24	Th II	70	2593.39	W I	120	2598.86	U II
40	2587.29	Rh II	150	2593.57	U II	95	2598.90	Mn II
35	2587.34	Er II	190	2593.64	Ti I	740	2599.04	Ir I
130	2587.49	Os I	410	2593.66	Ta II	110	2599.13	Os I
95	2587.77	W I	250	2593.70	Mo II	55	2599.22	Hf II
90	2588.00	Fe I	100	2593.70	Ru I	2000	2599.40	Fe II
50	2588.20	Cr I	90	2593.73	Fe II	300	2599.57	Fe I
40	2588.26	Os I	6200	2593.73	Mn II	50	2599.64	Mo I
430	2588.27	Tm II	30	2593.90	Os I	290	2599.86	Re I
85	2588.44	Os I	30	2594.12	Hf I	150	2599.91	Os I
65	2588.78	Mo II	150	2594.14	Os I	270	2599.92	Ti I
35	2588.88	Ta II	75	2594.16	Co I	220	2600.14	Ta I
230	2589.06	Th II	310	2594.25	Ta II	130	2600.16	Dy II
130	2589.07	Zr II	45	2594.34	Nb II	110	2600.45	Os I
390	2589.17	W II	550	2594.42	Sn I	70	2600.73	Ta II
280	2589.19	Ge I	95	2594.74	Nb II	75	2600.73	W I
28	2589.27	Nb I	160	c 2594.85	Re I	65	2600.75	Os I
85	2589.39	Os I	110	2594.85	Ru I	130	2600.76	Dy II
55	2589.51	Os I	35	2594.98	Tm II	65	2600.87	Re I
100	2589.57	Ru I	120	2595.03	Er II	230	2600.88	Th II
50	2589.59	U II	55	2595.03	Th II	55	2600.98	Co I
22	2589.65	Zr I	180	2595.23	Re I	140	2601.06	Ta I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
110	2601.09	Tm I	160	2606.82	Fe I	340	2612.31	Sb I
85	2601.29	Nb II	75	2606.89	W I	60	2612.37	Er II
85	2601.46	Ru I		2606.98	W II	75	2612.38	Nb I
190	2601.54	U II	450	2607.03	Hf II	85	2612.46	U II
80	2601.69	Mo I	810	2607.06	Tm II	22	2612.59	Hf I
200	2601.76	In I	650	2607.09	Fe II	110	2612.61	Ta II
40	2601.84	Nb I	55	2607.24	Hf II	470	2612.63	Os I
90	2601.87	Re I	55	2607.32	Re I	1800	2613.06	Os I
370	2601.96	W I	250	2607.37	Mo I	290	2613.08	Mo I
35	2602.01	Nb I	320	2607.38	W I	970	2613.08	W I
150	2602.04	Ir I	28	2607.48	Th II	1800	2613.40	Lu II
40	2602.14	Mn I	190	2607.52	Ir I	95	2613.49	Co II
95	2602.33	Os I	120	2607.84	Ta II	80	2613.59	Tm II
85	2602.38	Ta I	50	2608.20	Ta I	230	2613.60	Hf II
75	2602.51	W II	130	2608.20	U II	75	2613.60	Rh
55	2602.55	Re I	700	2608.25	Ir I	500	2613.65	Pb I
80	2602.66	Er I	23	2608.32	Th II	110	2613.74	Re I
55	2602.67	Hf I	370	2608.32	W I	320	2613.82	Fe II
250	2602.80	Mo II	120	2608.45	Hf I	480	2613.82	W I
130	2602.80	W I	660	2608.50	Re II	13	2613.85	Nb II
27	2602.87	Hf I	110	2608.57	Tb II	70	2613.90	Ce II
90	2602.93	Re I	1400	2608.63	Ta I	150	2613.95	U II
40	2602.93	Tb II	75	2608.69	Dy II	95	2613.99	Ho II
75	2603.02	W II	35	2608.84	Nb I	55	2614.06	Os I
70	2603.14	Pt I	30	2608.86	Mo I	90	2614.07	Ru I
65	2603.22	Os	25	2608.92	Pr II	75	2614.13	Co I
27	2603.31	Nb I	35	2608.96	Nb II	7000	2614.18	Pb I
28	2603.32	Mo I	60	2608.99	Tl I	70	2614.29	Hf II
30	2603.32	Rh II	210	2609.00	Ta I	150	2614.36	Co II
570	c 2603.33	Lu III	370	2609.06	Ru I	27	2614.50	Os I
130	2603.46	Re I	210	2609.20	Os I	50	2614.54	Er II
600	2603.49	Ta II	65	2609.26	U II	160	2614.56	Re I
270	2603.54	W I	45	2609.43	Zr I	55	2614.59	Ru I
27	2603.55	U II	60	2609.46	Tm II	210	2614.98	Ir I
35	2603.57	Cr I	45	2609.48	Ru I	100	2615.09	Ru I
45	2603.72	Mn II	70	2609.50	Ce II	230	2615.12	W I
65	2603.80	Os I	380	2609.56	Os I	70	2615.25	Ta I
60	2603.82	Ta I	100	2609.85	Th II	21	2615.26	Yb II
290	2603.89	Re I	28	2609.90	Ce II	130	2615.39	Mo I
85	2604.31	U II	35	2609.96	Hf I	18000	2615.42	Lu II
150	2604.38	W I	45	2610.07	Sm	70	2615.44	W II
190	2604.55	Ir I	35	2610.13	Ta I	340	2615.46	Ta I
190	2604.60	Os I	190	2610.20	Mn II	310	2615.66	Ta I
26	2604.61	Eu I	85	2610.28	Nb I	55	2615.68	Re I
80	2604.86	Er I	400	2610.34	La II	25	2615.75	Pr II
40	2604.96	Os I	110	2610.51	Ho II	70	d 2615.88	Ir I
40	2605.08	Mo II	50	2610.74	W I		2616.00	Ir I
340	2605.15	Ti I	40	2610.76	Co I	50	2615.95	U II
60	2605.32	Ta I	400	2610.78	Os I	65	2615.96	Os I
75	2605.35	Ru I	85	2611.05	Ru I	40	2615.99	Tm II
170	2605.51	W I	190	2611.20	Mo I	100	2616.07	U II
80	2605.65	Fe I	40	2611.22	Sc II	120	2616.26	Co I
4300	2605.69	Mn II	510	2611.28	Ti I	80	2616.32	Tm II
190	2605.86	Ho II	1800	2611.30	Ir I	130	2616.48	Nb I
65	2605.86	Ru I	110	2611.33	Os I	90	2616.61	Hf I
40	2605.93	Mo II	310	d 2611.34	Ta I	160	c 2616.72	Re II
220	2606.02	Tm II		2611.46	Ta I	400	2616.78	Mo I
95	2606.12	Co I	75	2611.48	Ti I	60	2616.87	Er II
390	2606.37	Hf II	610	d 2611.54	Re I	40	2616.90	Tb
680	2606.39	W I		2611.60	Re I	40	2616.99	Tm II
70	2606.43	Ta II	23	2611.62	Th I	100	2617.01	Yb II
75	2606.44	Rh II	800	2611.87	Fe II	100	2617.11	Re I
130	2606.52	U II	70	2612.04	Ir I	55	2617.18	Os I
30	2606.69	Er II	830	2612.07	Ru I	90	2617.44	Re I
130	2606.73	U II	180	2612.19	W I	320	2617.62	Fe II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
330	2617.78	Ir I	85	2625.46	Ta I	190	2632.35	Mn II
75	2617.79	Ru I	200	2625.58	Mn II	170	2632.42	Ti I
75	2617.86	Co I	440	2625.67	Fe II	400	2632.48	W I
120	2618.02	Fe I	40	2625.67	Ir I	45	2632.50	Ru I
400	2618.37	Cu I	270	2625.74	Th II	95	2632.52	Nb II
160	2618.81	W I	65	2625.86	U II	170	2632.66	U II
230	2618.91	Th II	230	2625.88	Rh I	400	2632.70	W I
210	2619.18	W I	80	2626.24	W I	110	2632.89	Os I
1800	2619.26	Lu II	28	2626.40	Th II	240	2632.98	U II
55	2619.28	Os	18	2626.60	Cr I	45	2633.01	Re I
70	2619.34	Mo II	95	2626.64	Mn I	810	2633.13	W I
50	2619.57	Pt I	100	2626.76	Ir I	45	2633.33	Th II
90	2619.67	Ru I	70	2626.95	Hf II	28	2633.46	Ru I
210	2619.88	Ir I	45	2627.43	Ta I	130	2633.61	Re I
800	2619.94	Os I	130	2627.44	Nb I	85	2633.79	Ta II
300	2619.94	Ti I	320	2627.55	Mo I	700	2634.17	Ir I
170	2620.03	Re I	270	2627.64	Co I	65	2634.29	Os I
50	2620.18	Ta I	55	2627.65	Ru I	55	2634.31	Yb II
400	2620.25	W I	40	2627.77	Er II	65	2634.44	Os I
90	2620.29	V I	700	2627.91	Bi I	40	2634.71	Nb I
170	2620.34	Re I	1100	2628.03	Pt I	100	2634.78	Ba II
90	2620.41	Fe II	50	2628.20	Ir I	440	2634.80	Dy II
80	2620.45	Nb II	210	2628.26	W I	40	2634.99	Rh I
85	2620.61	Ru I	240	2628.28	Pb I	85	2635.15	Ce II
230	2620.62	Os I	320	2628.29	Fe II	170	2635.27	Ir I
40	2620.93	Tm II	380	2628.48	Os I	80	2635.42	Zr I
140	2621.07	Mo I	130	2628.49	Nb I	30	2635.50	Eu II
170	2621.67	Fe II	85	2628.50	U II	610	2635.53	U II
80	2621.72	Er II	130	2628.69	Tb II	27	2635.57	Hf I
65	2621.81	U II	160	2628.74	Mo I	70	2635.57	Mo I
530	2621.82	Os I	55	2628.81	Th II	1200	2635.58	Ta II
13	2622.00	Nb I	70	2628.85	Ta II	60	2635.79	Hf II
95	2622.06	Co I	160	d 2628.89	W I	160	2635.81	Fe I
80	2622.21	Tm II	200	2629.00	W II	310	2635.83	Re II
400	2622.21	W I	200	2628.93	U II	220	2635.86	Ru I
95	2622.43	Co I	80	2628.97	Mo I	70	2635.93	Ta I
150	2622.58	Rh I	35	2629.15	U II	50	2636.25	U II
450	2622.74	Hf II	40	2629.41	Ir I	50	2636.37	Ta I
200	2622.76	Re I	40	2629.59	Fe I	290	2636.54	W I
35	2622.86	Cr I	70	2629.78	Tm II	550	2636.64	Re I
140	2622.90	Mn I	18	2629.82	Cr I	330	2636.67	Mo II
90	2623.28	Re I	440	2629.85	Mo I	170	2636.67	Ru I
35	2623.32	Hf I	18	2630.02	Th II	470	2636.67	Ta I
270	2623.45	Th II	30	2630.26	Mn I	860	2636.90	Ta I
130	2623.51	Nb I	100	2630.42	Rh I	160	2637.00	Hf I
150	2623.53	Fe I	75	2630.53	Ta II	190	2637.01	Re II
85	2623.54	U II	60	2630.57	Mn I	3800	2637.13	Os I
65	2623.61	Os I	140	2630.67	V II	60	2637.23	Tm II
70	2623.64	Ir II	55	c 2630.75	Re I	100	2637.70	U II
370	2623.69	Dy I	150	2630.91	Zr II	35	2637.78	Er III
28	2623.83	Ru I	550	2631.05	Fe II	50	2637.93	Ta II
150	2624.04	Mn I	27	2631.22	Os II	35	2637.98	Nb II
170	2624.12	Ta I	85	2631.26	U II	65	2637.98	Os I
140	2624.18	Er II	240	2631.28	Si I	130	2638.17	Mn II
730	2624.33	Tm II	220	2631.30	Ru I	250	2638.30	Mo I
65	2624.57	Os I	550	2631.32	Fe II	70	2638.41	Tm II
40	2624.80	Mn II	65	2631.50	Mo I	90	2638.51	Ru I
25	2624.82	Ga I	170	2631.54	Ti I	27	2638.6	U II
130	2624.92	U II	90	2631.57	Re I	400	d 2638.62	W I
45	2625.04	Re I	55	2631.57	Ru I	85	2638.75	W I
60	2625.20	Ho II	45	2632.13	Ru I	85	2638.67	Ta II
400	2625.22	W I	40	2632.23	Tm II	1100	2638.71	Hf II
130	2625.26	U II	130	2632.24	Co II	30	2638.74	Rh II
22	2625.32	Cr I	80	2632.24	Fe I	720	2638.76	Mo II
250	2625.32	Ir I	100	2632.27	Ta II	1000	2638.77	Eu II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
35	2638.97	Ir I	1900	2644.11	Os I	30	2649.25	Mo I
50	2639.01	U II	130	2644.12	U II	30	2649.30	Ti I
210	2639.09	Zr II	60	2644.19	Ge I	35	2649.33	Ce II
75	2639.12	Ru I	210	2644.19	Ir I	380	2649.34	Os I
50	2639.19	Ta II	800	2644.26	Ti I	640	2649.46	Mo I
130	2639.35	Pt I	110	2644.31	Yb II	45	2649.48	Th II
250	2639.42	Ir I	600	2644.35	Mo II	65	2649.51	Ru I
45	2639.45	Yb II	45	2644.36	V II	240	2649.52	Nb I
30	2639.49	Mo I	40	2644.48	U II	45	2649.58	Re I
40	2639.51	Th II	120	2644.60	Ta II	60	2649.68	Ho II
30	2639.68	Mo I	80	2644.60	W I	50	2649.79	Yb II
3500	2639.71	Ir I	55	2644.78	Co I	45	2649.87	Th II
80	2639.84	Mn II	120	2645.10	Ta II	75	2649.94	Co I
130	2639.84	U II	150	2645.26	V I	80	2649.98	W I
14	2639.88	Th II	110	2645.35	Dy II	50	2650.02	Ta I
65	2639.89	U II	470	2645.47	U II	95	2650.27	Co I
27	2639.98	Os I	210	2645.69	W I	160	2650.27	Tm II
80	2640.09	Ho I	30	2645.79	Mo I	70	2650.28	Ta I
90	2640.27	Sm	85	2645.84	V II	110	2650.38	Zr II
14	2640.27	Th II	28	2646.02	Ru I	1400	c 2650.45	Be I
80	2640.28	Mo I	650	2646.18	W I		2650.55	Be I
80	2640.30	Ho II	510	2646.22	Ta I		2650.61	Be I
110	2640.33	Ru I	320	2646.26	Nb II		2650.62	Be I
50	2640.38	Ir I	600	2646.37	Ta I		2650.69	Be I
14	2640.39	Th II	310	2646.42	Co I		2650.76	Be I
40	2640.69	V I	28	2646.44	Yb II	170	2650.58	Th II
210	2640.76	Tm II	130	2646.45	Tm II	40	2650.68	Mo I
95	2640.92	Nb I	370	2646.49	Mo II	65	2650.68	Os I
410	2640.99	Mo I	950	2646.64	Ti I	28	2650.73	Yb II
90	2641.02	Re II	400	2646.73	W I	500	2650.86	Pt I
27	2641.06	Nb II	150	d 2646.74	Ta II	27	2650.99	Mn II
640	2641.10	Ti I		2646.89	Ta II	340	2651.01	Ce II
65	2641.17	Os I	340	2646.89	Os I	85	2651.12	Nb II
380	2641.27	Eu II	1000	2646.89	Pt I	100	2651.16	Hf II
1100	2641.41	Hf II	35	2647.02	U II	12000	2651.18	Ge I
260	2641.49	Au I	160	2647.09	W I	270	2651.22	Ta II
270	2641.49	Th II	35	2647.11	Ce II	110	2651.29	Ru I
65	2641.55	U II	160	2647.13	Re I	35	2651.35	Er II
170	2641.60	Os I	40	2647.14	Er II	5500	2651.58	Ge I
60	2641.65	Fe I	30	2647.25	Mo I	330	2651.84	Ru I
85	2641.89	Yb II	110	2647.28	Rh I	660	2651.90	Re I
100	2641.93	U II	670	2647.29	Hf II	140	2651.90	V I
70	2642.08	Hf I	110	2647.32	Ru I	45	2652.32	Ta I
35	2642.12	Cr I	28	2647.46	Yb II	150	2652.48	Al I
110	2642.15	Dy I	2400	2647.47	Ta I	160	2652.59	W I
130	2642.21	V II	330	2647.50	Nb I	320	2652.60	Sb I
200	2642.24	Nb II	24	2647.53	U II	400	2652.66	Rh I
80	2642.56	Yb III	30	2647.56	Fe I	200	2652.83	U II
14	2642.60	Th II	90	2647.71	V I	30	2652.86	Hf II
160	2642.75	Hf I	380	2647.73	Os I	130	2652.91	Re I
270	2642.75	Re I	75	2647.74	W II	45	2652.92	V I
40	2642.83	Tm II	55	2647.78	Zr I	35	2652.94	Nb I
460	2642.96	Ru I	70	2648.14	Tm II	150	2652.98	Os I
75	2643.00	Rh I	28	2648.30	Ce II	2600	2653.27	Ta I
160	2643.12	W I	30	2648.45	Ru I	480	2653.35	Mo II
45	2643.16	V I	65	2648.46	Re II	95	2653.38	Nb I
24	2643.24	U II	25	2648.48	Pr II	35	2653.40	Tm II
14	2643.28	Th II	770	2648.64	Co I	40	2653.42	W II
70	2643.40	Zr II	28	2648.78	Ru I	80	2653.57	W II
40	2643.50	Tm II	65	2648.79	U II	250	2653.59	Cr II
24	2643.54	U II	28	2648.80	Yb II	40	2653.61	Eu II
85	2643.63	Os I	270	2649.05	Re I	70	2653.73	Er II
40	2643.81	Mo I	250	2649.07	U II	990	2653.75	Yb II
170	2643.89	Ta I	45	2649.15	Hf II	170	2653.76	Ir I
120	2644.00	Fe I	35	2649.17	Sm	150	2653.78	Os I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
45	2653.83	V I	70	2658.69	Zr I	50	2664.24	Ta II
70	2653.95	Ir I	120	2658.86	Ta II	40	2664.29	Os II
21	2654.01	Ta I	27	2658.88	Nb II	160	2664.32	W I
40	2654.11	Er II	30	2658.98	V II		2664.34	W II
400	2654.12	Re I	30	2659.01	Rh I	50	2664.45	Tm II
330	2654.45	Nb I	65	2659.02	Re I	70	2664.66	Fe II
100	2654.58	U II	65	2659.02	U II	200	2664.76	Ru I
130	2654.66	W I	21	2659.27	Yb II	2700	2664.79	Ir I
30	2654.75	Pr II	85	2659.41	Ta II	65	2664.81	Re I
15	2654.93	Ti I	2800	2659.45	Pt I	260	2664.97	W I
560	h 2655.03	Mo I	85	2659.46	U II	80	2665.04	Er II
45	2655.18	Re I	30	2659.61	V II	200	2665.04	Yb II
65	2655.19	Os I	400	2659.62	Ru I	110	2665.10	Mo I
70	2655.25	Er II	35	2659.66	Ta I	110	2665.25	Nb II
80	d 2655.56	W I	65	2659.79	Re I	80	2665.57	Tl I
	2655.67	W II	640	2659.83	Os I	220	2665.60	Ta II
35	2655.68	Ta I	340	2659.87	Ga I	100	2665.70	U II
55	2655.68	V II	27	2660.04	Nb II	160	2665.78	W I
40	2655.70	Nb I	250	2660.09	Tm II	100	2665.87	U II
55	2655.78	Os I	130	2660.14	U II	18	2665.89	Th II
45	2655.84	Re I	200	2660.39	Al I	35	2665.94	Ta I
60	2655.91	Mn II	80	2660.53	W I	30	2665.96	V I
40	2655.93	Mo I	45	2660.54	Re I	90	2665.97	Hf II
55	2655.96	Tb II	640	2660.58	Mo II	120	2665.99	Os I
310	2656.08	Nb II	95	2660.92	Os I	440	2666.02	Cr II
45	2656.08	Ta I	23	2661.17	Ru II	85	2666.13	Yb III
70	2656.10	Er II	65	2661.17	U II	120	2666.21	Os I
35	2656.12	Yb II	380	2661.18	Os I	80	2666.24	Ho II
40	2656.15	Fe I	1400	2661.24	Sn I	90	2666.30	Er II
150	2656.22	V I	1500	2661.34	Ta I	75	2666.49	W II
28	2656.25	Ru II	35	2661.39	Th II	75	2666.50	Ce II
65	d 2656.46	U II	50	2661.40	Tb II	130	2666.54	U II
40	2656.49	Mo I	180	2661.42	V I	110	2666.59	Nb II
1600	2656.54	W I	28	2661.50	Gd II	50	2666.64	Fe II
13	2656.56	Ru I	80	2661.55	W I	25	2666.70	Pr II
1900	2656.61	Ta I	330	2661.61	Ru II	50	2666.75	Mo I
490	2656.68	Os I	24	2661.64	Tb II	100	2666.82	Fe I
13	2656.69	Ru I	70	2661.73	Cr II	85	2666.99	Yb III
100	2656.81	Ir I	40	2661.86	Nb I	45	2667.00	Mn I
35	2656.84	Ce II	210	2661.88	Hf II	45	2667.00	Ta II
65	2656.98	Nb I	150	2661.89	Ta I	65	2667.13	Re I
60	2657.00	Er II	40	2661.93	Os I	40	2667.15	Nb II
90	2657.05	Lu I	85	2661.97	Ti I	50	2667.17	Ta I
16	2657.09	Pb I	1800	2661.98	Ir I	110	2667.30	Nb II
35	2657.19	Ti I	30	2662.06	Fe I	30	2667.40	Ru II
70	2657.30	Ta I	130	2662.10	Ta I	11	2667.55	Th II
400	2657.38	W I	55	2662.35	Th II	55	2667.64	Tb II
60	2657.50	Hf II	70	2662.42	Sm	85	2667.76	Nb II
160	2657.62	Nb I	110	2662.55	Os I	180	2667.80	Zr II
45	2657.68	Sm	350	2662.63	Ir I	110	2667.94	Dy I
35	2657.71	Ir I	810	2662.84	W I	35	2667.97	Ru I
2700	2657.80	Lu II	40	2662.86	Th II	50	2668.02	U II
160	2657.84	Hf II	3000	2663.16	Pb I	220	2668.07	Ta I
24	d 2657.86	U II	110	2663.22	Os I	140	2668.20	Tm II
400	d 2658.04	W II	80	2663.31	Ir I	90	2668.28	Hf I
	2658.18	W I	320	2663.42	Cr II	130	2668.29	Nb I
290	2658.11	Mo I	150	2663.53	Co II	640	2668.34	Eu II
50	2658.14	Ta II	27	2663.56	Nb II	600	2668.62	Ta I
20	2658.17	Pt I	220	2663.63	Re I	280	2668.71	Cr II
24	d 2658.36	U II	70	2663.68	Cr II	55	2668.75	Yb II
45	2658.40	Ru I	26	2663.88	Ta II	50	2668.86	Tb II
190	2658.48	Tm II	80	2663.94	W I	140	2668.99	Ir I
250	2658.59	Cr II	23	2664.06	Th II	80	2669.00	Hf II
1900	2658.60	Os I	170	2664.15	U II	340	2669.17	U II
150	2658.66	Th II	65	2664.22	Re I	140	2669.29	Tb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
210	2669.30	W I	130	2675.12	U II	25	2680.28	Rh I
55	2669.46	Ir I	40	2675.13	W I	18	2680.34	Cr II
18	2669.46	Th II	120	2675.15	Sm	45	2680.34	Mn II
55	2669.49	Zr II	100	2675.35	Er II	21	2680.40	Yb II
150	2669.53	Os I	40	2675.40	W I	100	2680.63	Rh I
150	2669.58	Ta II	35	2675.68	Th II	220	2680.66	Ta II
95	2669.60	Ti I	130	2675.87	W I	55	2681.10	Ir I
40	2669.78	W I	130	2675.88	U II	95	2681.36	Mo II
520	2669.91	Ir I	770	2675.90	Ta II	2100	2681.42	W I
65	2670.24	Re I	200	2675.94	Nb II	26	2681.63	Ta I
490	2670.26	Er II	3400	2675.95	Au I	20	2681.65	Y I
65	2670.32	Mo I	120	2675.98	Co I	40	2681.72	Mn I
130	2670.52	U II	65	2676.11	Rh I	35	d 2681.73	U II
380	2670.64	Sb I	30	2676.33	Mn I	35	2681.76	Zr II
110	2670.79	Re I	220	2676.41	U II	30	2681.78	Rh I
50	2670.89	U II	50	2676.48	Ta II	110	2681.87	Ta I
120	2670.96	Zr II	22	2676.63	Hf II	27	2682.13	Nb I
30	2671.06	Rh I	35	2676.69	U II	35	2682.19	Hf I
45	2671.25	Hf II	120	2676.83	Ir I	110	2682.19	Os I
810	2671.47	W I	55	2676.84	Dy II	95	2682.32	Tm III
18	2671.48	Th II	160	2677.03	Re I	27	2682.46	Ir I
100	2671.63	Ta I	60	2677.12	Tm II	30	2682.62	Mo I
30	2671.67	V I	110	2677.13	Te I	60	2682.73	Ce II
350	2671.81	Cr II	440	2677.15	Pt I	140	2682.76	Sb I
55	2671.83	Mo II	1800	2677.16	Cr II	180	2682.87	V II
520	2671.84	Ir I	90	h 2677.25	Lu I	45	2683.02	Mn I
160	2671.84	Re I	650	2677.28	W I	180	2683.09	V II
400	2671.93	Nb II	50	2677.34	Dy II	640	2683.23	Mo II
390	2671.96	Yb I	18	2677.58	Hf II	470	2683.28	U II
290	2672.00	V II	27	2677.66	Nb II	290	2683.35	Hf II
100	2672.21	U II	130	2677.76	Re I	290	2683.35	W I
330	2672.25	Er II	160	d 2677.79	W II	14	2683.42	Yb II
100	2672.50	Ta II		2677.91	W I	130	2683.56	Re I
20	2672.52	Pr II	380	2677.80	V II	23	2683.75	Mn I
110	2672.59	Mn II	50	2678.09	Tm II	40	2683.97	Tb II
390	2672.66	Yb II	29	2678.15	Tb II	110	2684.04	Ir I
50	2672.69	U II	35	2678.16	Cr I	150	2684.04	U II
75	2672.77	Re I	250	2678.29	Eu II	95	2684.07	Tm II
280	2672.83	Cr II	18	2678.43	Hf II	880	2684.14	Mo II
720	2672.84	Mo II	40	2678.53	W I	19	2684.23	Sc II
55	2672.91	La II	270	2678.57	V II	600	2684.28	Ta I
18	2672.94	Th II	1800	2678.63	Zr II	360	2684.29	Th II
50	2673.07	Ce II	65	2678.66	Nb II	24	2684.29	U II
40	2673.23	V II	30	2678.67	Mo I	75	2684.36	Os I
250	2673.27	Mo II	690	2678.76	Ru II		2684.41	Os
55	2673.37	Mn II	320	2678.79	Cr II	55	2684.55	Mn II
110	2673.42	Eu II	70	2678.80	Ta II	70	2684.75	Yb II
55	2673.48	Ru I	24	2678.86	U II	26	2684.80	Ti I
200	2673.57	Nb II	400	2678.88	W I	570	h 2685.08	Lu I
24	2673.58	U II	18	2678.94	Th II	30	2685.14	Ti I
80	2673.59	W II	95	2679.01	Nb I	45	2685.14	V I
45	2673.60	Ru I	180	2679.06	Fe I	1500	2685.17	Ta II
330	2673.61	Ir I	95	2679.06	Ir I	30	2685.19	Pr II
20	2673.84	Mo I	130	2679.10	Re I	55	2685.22	Hf II
40	2674.13	Tb II	380	2679.32	V II	65	2685.31	Re I
50	2674.18	Ta II	55	2679.38	Os I	170	2685.34	Co I
940	2674.34	Re I	310	2679.57	Tm II	90	h 2685.54	Lu I
55	2674.43	Mn II	75	2679.74	Os I	65	2685.61	U II
35	2674.49	Ta I	120	2679.76	Co I	250	2685.66	Eu II
580	2674.57	Os I	1000	2679.85	Mo I	70	2685.69	V II
40	2674.57	Pt I	160	2679.91	Re I	45	2685.70	Pr II
40	2674.69	Tb II	130	2679.93	Ti I	55	2685.94	Mn II
65	2674.69	W I	130	2680.05	W I	270	2685.98	U II
400	2674.88	Os I	45	2680.06	Nb II	35	d 2686.20	Tm II
40	2674.98	Tm II	270	2680.06	Ta II		2686.32	Tm II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
220	2686.29	Ru I	50	2691.90	Tb II	40	2696.05	Nb I
35	2686.29	Ta I	550	2692.03	Eu II	120	2696.07	Ce II
18	2686.36	Hf I	330	2692.06	Ru II	65	2696.07	Mo I
45	2686.36	V I	40	2692.16	W I	60	2696.08	Sm
	2686.51	V I	50	2692.25	Sb I	70	2696.18	Hf I
65	2686.39	Nb II						
30	h 2686.50	Rh	270	2692.34	Ir I	40	2696.30	U II
30	h 2686.91	Rh	200	2692.36	U II	45	2696.49	Ni I
230	2687.09	Cr II	260	2692.40	Ta I	40	2696.61	Os I
130	2687.13	Th II	480	2692.42	Th II	14	2696.62	Yb II
			90	2692.60	Zr II	280	c 2696.76	Bi I
130	2687.15	Nb I	30	2692.61	Mo II	240	2696.81	Ta I
80	2687.37	W I	85	2692.66	Mn I	30	2696.83	Mo II
28	2687.50	Ru II	150	2692.70	Os I	50	2696.83	Tb II
90	2687.75	Zr I	120	2692.78	Sc I	40	2696.83	Th II
35	2687.82	Tb II	85	2692.83	Dy II	120	2696.99	V I
1100	2687.96	V II	45	2692.83	Ta II	1000	2697.06	Nb II
25	2687.98	Yb II	27	2692.88	Ir I	85	2697.24	Os I
30	2687.99	Ce II	22	2692.92	Zr I	90	2697.26	Re I
560	2687.99	Mo II	28	2693.04	Mo I	100	2697.40	U II
60	2688.04	Cr I	35	2693.05	Tb II	170	2697.50	Tm II
110	2688.08	Os I	27	2693.19	Mn II	130	2697.51	W I
30	2688.11	Ru I	35	2693.29	Ru I	45	2697.55	Th II
	2688.16	Ru II	130	2693.34	Sm	210	2697.71	W II
110	2688.25	Mn II	95	2693.34	Ta I	120	2697.74	V I
55	2688.29	Cr II	55	2693.41	Tb II	85	2697.81	Mo I
18	2688.34	Th II	35	2693.46	Tm II	35	2697.91	Cr II
18	2688.35	Hf I	27	2693.49	Ir I	270	2698.06	U II
40	2688.40	Er II	50	2693.50	Ta I	40	h 2698.21	Tm III
220	2688.53	Re I	35	2693.52	Cr II	1000	2698.30	Ta I
100	2688.60	Sm	20	2693.53	Mo I	60	2698.39	Er III
50	2688.64	Mo I	160	2693.53	Zr II	180	2698.41	Cr II
30	2688.71	Au I	45	2693.74	Sm	200	2698.43	Pt I
170	2688.72	V II	170	2693.77	U II	100	2698.45	U II
65	2688.82	Ti I	18	2693.96	Th II	180	2698.69	Cr II
70	2689.03	Ho II	180	2694.06	Zr II	45	2698.73	V I
24	2689.13	U II	60	2694.21	Y	70	2698.74	Th II
120	2689.21	Fe I	50	2694.22	U II	45	2698.79	Re I
100	2689.24	Ta II	3000	2694.23	Ir I	160	2698.84	W I
85	2689.31	Dy II	50	2694.31	Rh I	320	2698.86	Nb II
110	2689.35	Os I	75	2694.39	Re I	50	2698.92	Pr II
2100	2689.82	Os I	140	2694.52	Os I	27	2698.97	Mn II
150	2689.88	V II	470	2694.52	Ta II	80	2699.11	Fe I
18	2689.90	Ru I	55	2694.68	Co II	60	2699.11	Sc III
40	2689.93	Er II	65	2694.75	Os I	30	2699.11	V I
35	2689.99	Tm II	150	2694.76	Ta I	24	2699.37	U II
230	2690.24	V II	18	2695.02	Th II	55	2699.41	Mo II
110	h 2690.25	Re I	95	2695.04	Nb I	40	2699.49	Tm III
26	2690.26	Cr I	80	2695.21	Th II	35	2699.58	Re I
130	2690.51	U II	55	2695.22	Mo II	510	2699.59	Os I
35	2690.54	Ta I	55	2695.36	Mn II	650	2699.59	W I
45	h 2690.79	Re I	26	2695.39	Y I	95	2699.60	Zr II
240	2690.79	V II	28	2695.43	Yb II	60	2699.63	Hf I
45	2690.90	Sm II	70	2695.43	Zr II	40	2699.80	Tm III
280	2691.04	Cr II	35	2695.46	Tb II	90	2699.88	Ru I
320	2691.04	U II	60	2695.47	La II	400	2700.01	W I
55	2691.06	Ir I	200	2695.49	U II	750	2700.13	Zr II
23	2691.06	Th I	45	2695.54	Ta II	40	2700.15	Nb II
210	2691.09	W I	110	2695.55	Th II	50	2700.18	Tm II
45	2691.18	Th II	160	2695.56	Re I	65	2700.21	Mo I
340	2691.31	Ta I	650	2695.67	W I	60	2700.38	Pr II
5000	2691.34	Ce I	26	2695.71	Ta II	20	2700.56	Nb II
30	2691.69	Ce II	28	2695.82	Th II	18	2700.60	Cr I
160	2691.77	Nb II	190	2695.85	Co I	18	2700.60	Th II
50	2691.80	Ta II	50	2695.91	U II	26	2700.67	Er II
100	2691.80	U II	60	2695.96	Ce II	50	2700.70	Ta I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
110	2700.75	Os I	60	2706.02	Fe I	45	2710.22	Re I
18	2700.80	Yb II	80	2706.02	W I	1600	2710.26	In I
80	2700.89	Au I	45	2706.06	Re I	80	2710.33	Mn II
680	2700.94	V II	95	2706.12	Mo I	11	2710.48	Th II
50	2700.96	Cu II	530	2706.17	V II	65	2710.54	Yb II
65	2700.96	U II	90	2706.17	Zr I	20	2710.55	Fe I
85	2701.00	Mn II	95	2706.28	Tb II	50	h 2710.67	Tl I
140	2701.03	Mo I	95	2706.40	Nb II	26	2710.72	Ta II
700	2701.14	Eu II	7000	2706.51	Sn I	65	2710.74	Mo I
110	2701.34	Ru I	180	2706.58	Fe I	40	2710.78	W II
480	2701.42	Mo II	400	2706.58	W I	65	2711.10	U II
40	2701.48	W II	470	2706.69	Ta I	580	2711.35	Sc I
35	2701.52	Tb II	580	2706.70	Os I	35	2711.45	Th II
85	2701.55	U II	150	2706.70	V II	30	2711.49	Mo II
60	2701.69	Er II	110	2706.73	Hf II	110	2711.50	Tm II
160	2701.70	Mn II	360	2706.77	Sc I	280	2711.51	Zr II
4200	2701.71	Lu II	120	2706.88	Ce II	60	2711.53	Er II
28	2701.82	Th II	27	2706.88	Ir I	110	2711.58	Mn II
30	2701.87	Mo II	30	2706.92	Ta I	80	2711.65	Fe I
800	2701.90	Eu II	370	2706.95	U II	170	2711.74	V II
40	2701.96	Tm II	80	2707.03	Tm III	65	2711.76	U II
110	2701.99	Cr I	40	2707.03	W I	25	2711.78	Yb II
160	2702.11	W II	40	2707.23	Rh I	70	2711.83	Hf I
380	2702.19	V II	100	h 2707.37	Pr II	45	2711.99	Hf II
320	2702.20	Nb II	35	2707.40	Re I	130	2712.06	U II
30	2702.25	Pr II	180	2707.42	Os I	100	2712.12	Er II
2000	2702.40	Pt I	80	2707.53	Mn II	22	2712.14	Hf II
75	2702.46	Nd II	35	2707.83	Nb II	140	2712.31	Cr II
150	2702.52	Nb II	110	2707.86	V II	50	2712.35	Mo II
210	2702.52	W I	65	2707.88	W I	200	2712.41	Ru II
18	2702.53	Cr I	210	2707.95	Sc I	210	2712.42	Hf II
30	2702.63	Ba I	85	2707.96	Sm	140	2712.42	Zr II
75	2702.67	Re I	35	2707.97	Ru I	65	2712.48	Re I
120	2702.80	Ta II	35	2708.13	Ce II	55	2712.66	Yb II
75	2702.83	Os I	110	2708.18	Os	160	2712.74	Ir I
110	2702.83	Ru I	170	2708.18	Th II	90	2713.02	Re I
85	2703.06	Ta I	19	2708.18	Tm II	60	2713.05	V II
70	2703.48	Cr I	40	2708.19	W I	60	2713.13	Pt I
	2703.55	Cr II	110	2708.45	Mn II	65	2713.16	Re I
400	2703.73	Rh I	27	2708.50	U II	75	2713.19	Ru I
35	2703.86	Cr II	70	2708.57	Fe I	50	2713.22	Tb II
270	2703.96	Th II	400	2708.59	W I	60	2713.25	Er II
40	2703.99	Fe II	60	2708.79	Cr II	190	2713.51	Mo II
110	2704.03	Ir I	400	d 2708.80	W I	210	2713.65	Ho II
190	2704.07	Tb II		2708.93	W I	140	2713.84	Hf I
45	h 2704.18	Ho II	21	2708.84	Yb II	65	2713.91	U II
40	2704.26	Nb II	55	2709.01	Dy II	300	2713.94	In I
85	2704.31	Ta I	50	d 2709.03	U II	20	2714.16	Pr II
130	2704.37	Re I	170	2709.20	Ru I	20	2714.20	Nb I
75	2704.45	Os I	420	2709.23	Tl I	120	2714.20	V II
75	2704.54	Nd	50	2709.25	Mo I	140	2714.26	Zr II
35	2704.80	U II	310	2709.27	Ta II	190	2714.41	Fe II
40	2704.93	Ir I	45	2709.30	Ho II	75	2714.41	Rh I
30	2704.93	Mo II	35	2709.31	Cr II	100	2714.58	U II
200	d 2705.19	U II	70	2709.33	Zr I	35	2714.62	Th II
45	2705.22	V II	35	2709.41	Ce II	3000	2714.64	Os I
50	2705.24	Mo I	100	2709.51	U II	2600	2714.67	Ta I
240	2705.28	Eu II	80	2709.58	W II	40	2715.09	Th II
18	2705.43	Cr I	8500	2709.63	Ge I	75	2715.17	Ce II
670	2705.61	Hf I	95	2709.74	Tm III	50	2715.17	Mo I
40	2705.63	Rh II	190	2709.86	Os I	35	2715.24	Ce II
130	2705.74	Mn II	45	2709.96	Mn II	100	2715.31	Rh II
27	2705.77	U II	180	2709.99	Eu I	27	2715.34	Nb II
55	2705.85	Co I	1200	2710.13	Ta I	580	2715.36	Os I
1600	2705.89	Pt I	40	2710.19	Mo II	1300	2715.47	Re I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
27	2715.50	Nb I	80	2720.17	Mo I	130	2725.94	U II
400	2715.50	W I	60	2720.17	Pr II	50	2725.95	Mo I
100	2715.54	U II	27	2720.26	Nb II	80	2726.05	Fe I
150	2715.64	Os I	70	2720.45	Ir I	55	2726.08	Nb I
27	2715.69	Nb I	70	2720.50	Gd II	180	2726.22	Er II
640	2715.69	V II	30	2720.52	Rh I	26	2726.32	Ta I
180	2715.77	Re I	60	2720.74	Er II	35	2726.49	Tb II
40	2715.88	Nb II	470	2720.76	Ta I	40	2726.49	Th II
90	h 2715.91	Lu I	35	2720.89	Tb II	800	2726.49	Zr II
190	2715.99	Co I	1200	2720.90	Fe I	50	2726.50	Pr II
65	2716.10	Nb I	540	2721.19	Tm II	420	h 2726.51	Cr I
45	2716.18	Cr I	90	2721.56	Ru I	28	2726.65	Mo I
26	2716.25	Ti II	60	2721.59	Er II	80	2726.70	Hf I
60	2716.31	Nb II	40	2721.63	Nb II	85	2726.97	Mo II
90	2716.31	Th II	30	2721.64	Ca I	60	2727.02	Zr I
80	2716.32	W II	230	2721.69	Th II	55	2727.17	Dy II
85	2716.39	U II	60	2721.77	Ag I	50	2727.23	Sb I
30	2716.60	Er II	45	c 2721.77	Ho II	28	2727.24	Th II
470	2716.62	Nb II	170	2721.83	Ta I	45	2727.26	Cr II
65	2716.75	Re I	850	2721.86	Os I	100	2727.34	U II
65	2716.80	Os I	30	2721.90	Pr II	75	2727.42	Ti I
700	2716.98	Eu II	29	2721.90	Tm II	27	2727.43	Nb II
80	2717.16	Mo I	470	2721.98	Nb II	470	2727.44	Ta II
240	2717.18	Ta I	21	2722.20	Yb II	180	2727.54	Fe II
35	2717.28	Ce II	180	2722.21	Re I	110	2727.55	Re I
35	2717.33	Nb II	27	2722.31	Nb I	200	2727.56	Tm III
290	2717.35	Mo II	170	2722.38	Th II	4200	2727.78	Eu II
45	2717.40	Ru I	150	2722.56	V I	410	2727.78	Ta I
12	2717.48	Zr I	65	2722.60	Os I	150	2727.94	Os I
55	2717.51	Cr II	1300	2722.61	Zr II	130	2727.95	W I
75	2717.51	Rh I	130	2722.65	Ru I	60	2728.02	Fe I
80	2717.53	W I	160	d 2722.67	W I	35	2728.08	Nb I
	2717.61	W I		2722.81	W II	120	2728.27	Os I
40	2717.56	Tm III	190	2722.70	Re I	45	2728.32	Ho II
50	2717.56	U II	170	2722.75	Cr II	16	2728.34	Mo I
27	2717.63	Nb II	95	2723.00	Y I	120	2728.55	U II
80	2718.04	W II	200	2723.03	U II	55	2728.61	Mn II
170	2718.35	Yb II	30	2723.22	V II	45	2728.63	Re I
150	2718.38	Ta I	18	2723.32	Th II	240	2728.64	V II
45	2718.43	Cr II	120	2723.38	Ce II	120	2728.7	U II
100	2718.44	Fe I	700	2723.58	Fe I	85	2728.70	Mo I
60	2718.51	Hf II	35	2723.66	Nb II	50	2728.82	Fe I
180	2718.54	Rh I	35	2723.76	Ir I	55	2728.83	Ru I
250	2718.59	Hf I	100	2723.84	Re I	45	2728.91	Th II
110	2718.71	Os I	70	2723.96	Eu I	160	2728.94	Rh I
23	2718.83	Ru I	60	2723.98	Nb I	480	h 2728.95	Lu I
170	2718.90	Sb I	18	2724.04	Cr II	150	2729.04	Tm II
110	2718.91	Os I	75	2724.06	Ru I	70	2729.10	Hf I
2100	2718.91	W I	35	2724.29	Tb II	55	2729.13	Mo I
2600	2719.02	Fe I	2600	2724.35	W I	30	2729.16	Ce II
1300	2719.04	Pt I	110	2724.41	Mo I	50	2729.26	U II
180	d 2719.09	Lu I	210	2724.62	W I	190	2729.33	Eu II
130	2719.33	U II	70	2724.88	Th II	250	2729.33	Th II
320	2719.33	W I	35	2724.95	Ce II	380	2729.44	Eu II
35	2719.46	Th II	80	2724.96	Fe I	23	2729.46	Ru I
200	2719.47	Tm III	400	2725.03	W I	85	2729.50	Dy II
690	2719.52	Ru I		2725.06	W I	40	2729.56	Ir I
45	2719.54	Re I	85	2725.07	Ti I	80	2729.62	W II
800	2719.65	Ga I	35	2725.07	U II	65	2729.64	Re I
210	2719.86	W I	180	2725.15	Mo I	140	2729.68	Mo II
55	2719.93	Th II	110	2725.42	Ta II	27	2729.83	Nb I
35	2719.98	Ce II	140	2725.47	Ru II	130	2729.92	Pt I
27	2720.02	Nb I	140	2725.47	Zr I	22	2730.08	Y I
1300	2720.04	Os I	100	2725.52	U II	120	2730.10	Er II
65	2720.14	Rh I	55	2725.58	La I	80	2730.20	Mo II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum					
65	d	2730.21	Tb	II	21	2734.09	Yb	II	750	2739.55	Fe	II	
100		2730.26	Th	II	30	2734.27	Fe	I	100	2739.71	V	II	
170		2730.31	U	II	50	2734.30	Pr	II	85	2739.81	Ti	I	
55		2730.32	Nb	II	55	2734.31	Re	I	35	2739.87	Sm		
55		2730.33	Ru	I	20	2734.35	Nb	II	120	2739.94	Re	I	
140	d	2730.50	Bi	I	310	2734.35	Ru	II	35	2740.00	Ir	I	
580		2730.61	Os	I	160	2734.40	Th	II	70	2740.10	Cr	II	
10		2730.70	Ce	II	22	2734.85	Y	II	35	2740.18	Ir	I	
90		2730.71	Hf	I	1400	2734.86	Zr	II	85	2740.18	Nb	II	
55		2730.71	Ir	I	120	2734.96	U	II	170	2740.32	Os	I	
35		2730.72	Tm	II	80	2735.25	Eu	I	70	2740.35	Zr	II	
50		2730.73	Ta	II	100	2735.26	Ta	II	400	2740.43	Ge	I	
90		2730.74	Fe	II	55	2735.29	Ti	I	65	2740.46	Co	I	
15		2730.80	Ce	II	50	2735.33	Tm	II	18	2740.47	Th	II	
45		2730.83	Re	I	35	2735.45	Tb	II	110	2740.51	Zr	II	
120		2730.85	Hf	I	280	2735.48	Fe	I	140	2740.61	Os	I	
90		2730.93	Ru	I	85	2735.58	U	II	160	2740.62	Eu	II	
130		2731.12	Co	I	40	2735.61	Ti	I	85	2740.70	Dy	II	
21		2731.13	Ti	I	28	2735.65	Mo	I	30	2740.70	Ta	II	
100		2731.27	U	II	1800	2735.72	Ru	I	130	2740.75	Os	I	
180		2731.35	V	I	55	2735.79	Dy	I	75	2740.79	W	II	
40		2731.36	Os	II	28	2735.83	Th	II	65	2740.86	U	II	
50		2731.37	Eu	I	24	2735.88	Mo	I	35	2741.06	U	II	
70		2731.38	Tm	III	40	2735.98	W	I	95	2741.07	Cr	I	
80		2731.56	Er	II	35	2735.99	Tb	II	40	2741.15	Nb	I	
200		2731.56	Re	II	130	2736.24	Tb	II	150	2741.17	Ta	I	
40		2731.58	Th	II	310	2736.25	Ta	II	50	2741.18	Li	I	
40		2731.58	Ti	I	35	2736.33	Ce	II	40	2741.32	Mo	II	
12		2731.78	Pr	II	85	2736.39	Os	I	65	2741.38	Os	I	
280	h	2731.91	Cr	I	28	2736.42	Mo	I	140	2741.55	Zr	II	
35		2731.92	Th	II	23	2736.44	Th	II	55	2741.62	Mo	II	
30		2732.04	Ce	II	170	h	2736.47	Cr	I	55	2741.71	Yb	II
85		2732.06	Ta	I	40	2736.76	Rh	I	75	2741.75	Rh	I	
50		2732.17	Ce	II	160	2736.96	Mo	II	130	2741.75	U	II	
220		2732.21	Re	I	100	2736.97	Fe	II	110	2741.96	Ce	II	
50		2732.42	Sm		85	d	2737.07	U	II	65	2741.97	Re	I
40		2732.61	Eu	I	110	2737.09	Nb	II	95	2742.03	Cr	II	
70		2732.67	Ir	I	700	2737.31	Fe	I	40	2742.12	Pr	II	
35		2732.68	Hf	II	70	2737.42	Th	II	95	2742.17	Cr	I	
490		2732.72	Zr	II	70	2737.83	Hf	I	80	2742.26	Fe	I	
110		2732.74	Yb	II	80	h	2737.88	Mo	II	65	2742.26	Tb	II
580		2732.80	Os	I	35	2737.89	Zr	I	250	2742.32	Ti	I	
250		2732.81	Th	II	25	2737.90	Pr	II	550	2742.41	Fe	I	
60		2732.83	Ce	II	40	2738.00	W	I	90	2742.41	V	II	
330		2732.88	Mo	II	100	2738.13	U	II	70	2742.53	Y	I	
70		2732.92	Ta	I	75	c	2738.17	Lu	II	1100	2742.56	Zr	II
50	d	2732.95	U	II	90	2738.32	Re	I	85	d	2742.60	U	II
610		2733.04	Re	II	45	2738.32	Th	II	30	2742.67	V	II	
25		2733.12	Pr	II	55	2738.33	Os	I	40	2742.69	Os	I	
80		2733.18	W	I	50	2738.41	U	II	65	d	2742.74	Re	I
11		2733.21	Th	II	65	2738.46	Os	I	26	2742.86	Re	I	
310		2733.26	Nb	II	70	2738.48	Pt	I	26	2742.92	Ta	I	
170		2733.26	Ti	I	50	2738.60	Mo	II	95	2742.95	Tm	II	
30		2733.34	Ta	II	710	2738.76	Hf	II	180	2743.06	Th	II	
250		2733.39	Mo	I	45	2738.79	Ho	I	240	2743.07	Mo	I	
80		2733.46	Nb	II	23	2738.82	Th	II	280	2743.20	Fe	II	
700		2733.58	Fe	I	30	2738.86	Mn	I	100	2743.22	U	II	
45		2733.59	Ru	I	100	2738.98	U	II	70	2743.28	Eu	I	
50		2733.77	U	II	170	2739.22	Ru	I	160	2743.43	W	I	
35		2733.90	Tb	II	210	2739.26	Ta	II	85	2743.50	Tb	II	
40		2733.90	V	II	40	2739.30	Dy	II	50	2743.56	Fe	I	
230		2733.95	Ho	II	270	2739.31	Er	II	210	2743.59	Ta	I	
1800		2733.96	Pt	I	35	2739.32	Ir	I	250	2743.64	Cr	II	
370		2733.97	U	II	70	2739.38	Cr	I	200	2743.64	Hf	I	
30		2734.00	Fe	I	170	2739.39	U	II	100	2743.66	U	II	

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
95	2743.71	Mo I	120	2749.18	Fe II	40	2755.27	W I
90	2743.87	Re I	130	2749.18	Os I	95	2755.29	Nb I
75	2743.94	Ru I	600	2749.32	Fe II	30	2755.37	Mo I
140	2744.00	Ir I	27	2749.32	Ir I	110	2755.59	Os I
300	2744.07	Fe I	100	2749.53	Th II	610	2755.63	Er II
200	2744.08	Tm II	18	2749.71	Th II	80	2755.64	Nb I
120	2744.26	Eu II	860	2749.83	Ta I	750	2755.74	Fe II
35	2744.27	U II	100	2749.96	U II	220	2755.75	Dy II
80	2744.34	W I	50	2750.13	U II	80	2755.94	W I
170	2744.40	U II	700	2750.14	Fe I	18	2755.96	Th II
130	2744.45	Ru I	310	2750.19	Er II	110	2756.07	Mo II
60	2744.53	Fe I	430	2750.22	Gd II	240	2756.26	Fe I
25	2744.66	Pr II	270	2750.35	Ho II		2756.33	Fe I
27	2744.96	Nb II	70	2750.41	Ta II	35	h 2756.45	Zn I
440	2745.00	As I	1300	2750.48	Yb II	150	2756.69	Tm II
80	2745.09	Mo I	390	2750.73	Cr II	22	2756.75	Cr I
190	2745.10	Co I	110	2750.76	Tm II	35	2756.80	Ce II
60	2745.30	Nb II	30	2750.88	Fe I	60	2756.91	Hf II
40	2745.38	Mo I	100	2750.89	Ce II	55	2757.08	Dy II
40	2745.61	Eu I	60	2750.92	Er II	150	2757.10	Cr I
75	2745.72	Ce II	85	2751.15	Os I	60	2757.26	Nb II
65	2745.73	Nb II	85	2751.45	Yb II	70	h 2757.26	Ta II
660	2745.86	Zr II	320	2751.47	Mo I	80	2757.32	Fe I
130	2746.16	U II	45	2751.60	Cr I	65	2757.40	Ti I
35	2746.21	Cr II	360	2751.81	Hf II	35	2757.41	Tb II
40	2746.21	W I	280	2751.87	Cr II	55	2757.49	Re I
20	2746.28	Pr II	90	2752.17	Eu II	60	2757.55	U II
60	2746.3	U II	410	2752.17	Th II	350	2757.72	Cr II
290	2746.30	Mo II	660	2752.21	Zr II	45	2757.77	Ho II
420	2746.48	Fe II	150	2752.30	Ta I	170	2757.81	Os I
35	2746.62	Hf I	75	2752.45	Ru II	65	d 2757.92	U II
510	2746.68	Ta I	410	2752.49	Ta II		2758.18	U II
80	2746.74	W I	75	2752.77	Ru II	220	2758.00	Re I
120	2746.83	Ta II	60	2752.78	Hg I	95	2758.08	Ti I
200	2746.91	Nb I	75	2752.85	Re I	80	2758.23	Ir I
380	2746.98	Fe I	110	h 2752.88	Cr I	30	2758.31	Hf I
50	2747.15	U II	190	2753.01	Nb I	1000	2758.31	Ta I
520	2747.16	Th II	130	2753.05	Re I	130	2758.50	U II
85	2747.25	Ta I	160	2753.05	W I	280	2758.61	Nb I
70	2747.29	Eu II	18	2753.09	Th II	65	d 2758.63	Mo II
100	2747.36	U II	75	2753.14	Nb II	55	2758.71	Re I
140	2747.44	Re I	110	2753.18	Tm II	90	2758.78	Hf I
60	2747.48	V II	80	2753.29	Fe II	27	2758.78	Nb II
27	2747.51	Ir I	140	2753.40	V II	530	2758.81	Zr II
55	2747.58	Yb II	90	2753.44	Ru I	140	2758.82	Os I
18	2747.59	Th II	110	h 2753.64	Re II	18	2758.96	Th II
70	2747.61	Pt I	40	2753.69	Fe I	150	2758.96	U II
80	2747.83	Eu I	65	2753.72	Os I	90	2758.97	Tm II
30	2747.85	Ta I	80	2753.86	Pt I	60	2758.98	Cr II
45	2747.85	Th II	700	2753.88	In I	21	2759.00	Yb II
150	2747.91	Os I	40	2754.04	Fe I	70	2759.06	Ta II
35	2747.97	Ru II	27	2754.07	Nb I	70	2759.32	Ir I
18	2748.04	Yb II	470	2754.16	U II	110	c 2759.35	Ho II
1100	h 2748.26	Au I	3600	2754.17	Lu II	80	2759.39	Cr II
110	2748.29	Cr I	35	2754.28	Cr II	45	2759.41	Th II
170	2748.45	U II	30	2754.29	Mo I	160	2759.47	Tb II
55	2748.49	Mo I	65	2754.52	Nb II	12	2759.48	Zr I
230	2748.66	Yb II	6500	2754.59	Ge I	40	2759.55	Tm II
1200	2748.78	Ta I	22	2754.90	Cr I	28	2759.58	Mo I
40	2748.80	Th II	200	2754.92	Pt I	45	2759.73	Cr II
650	2748.84	W I	80	2754.92	W I	130	2759.79	U II
200	2748.85	Nb I	230	2755.01	Er II	20	2759.82	Fe I
130	2748.86	Os I	130	2755.13	U II	55	2759.91	Ir I
330	2748.98	Cr II	55	2755.21	Re I	40	2760.04	W I
40	2749.06	Ti I	22	2755.27	Cr I	140	2760.10	Y I

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
60	2760.12	V II	75	2764.98	Nd I	110	2770.10	Os I
35	2760.33	U II	340	2765.04	Os I	230	2770.17	Gd II
60	2760.35	Pr II	100	2765.12	Th II	350	2770.42	Re I
130	2760.39	Th II	65	2765.28	Nb II	55	2770.46	Hf II
20	2760.53	Mo II	200	2765.40	U II	960	2770.71	Os I
90	2760.70	V II	35	2765.44	Ru II	200	2770.82	Th II
40	d 2760.74	W II	65	2765.45	Os I	60	d 2770.86	Zn I
	2760.84	W I	110	2765.61	Er II		2770.98	Zn I
65	2760.78	Yb II	140	2765.67	V II	810	2770.88	W I
45	h 2760.93	Mn I	750	h 2765.74	Lu I	21	2770.98	Gd II
65	2760.96	Tb II	35	2765.93	Nb II	40	2771.04	Os I
55	2761.00	Nb I	17	2766.18	Nb I	110	2771.04	Tm II
150	2761.08	Os I	130	2766.22	Co I	85	2771.32	Yb II
27	2761.18	U II	110	2766.26	Mo I	18	2771.36	Ba II
15	2761.29	Ti II	80	2766.37	Cu I	28	2771.36	Mo I
95	2761.37	Co I	120	2766.38	Er II	65	2771.40	Nb II
65	2761.37	Yb II	200	2766.39	Re I	30	2771.44	Mn I
150	2761.42	Ce II	60	2766.46	V II	18	2771.45	Cr I
690	2761.42	Os I	70	2766.50	Dy II	100	2771.51	Rh I
190	2761.53	Mo I	750	2766.54	Cr II	200	2771.51	Th II
80	2761.59	W II	35	2766.57	Tb II	80	2771.61	Ir I
450	2761.63	Hf I	40	2766.72	Mo I	20	2771.65	Nb II
430	2761.68	Ta II	70	2766.81	Tm II	500	2771.67	Pt I
90	h 2761.76	Cr I	110	2766.85	Ho II	70	2771.83	Ta II
150	2761.78	Fe I	190	2766.88	U II	18	2772.01	Th II
	2761.81	Fe II						
110	2761.78	Sn I	20	2766.91	Fe I	180	2772.08	Fe I
70	2761.91	Zr II	160	2766.96	Hf I	95	d 2772.18	U II
110	2761.93	Re I	35	2767.01	Ce II	45	2772.32	Hf II
160	2762.03	Fe I	35	2767.02	Tb II	70	2772.42	Dy II
			50	2767.09	Tm II	330	2772.46	Ir I
60	2762.05	Ta II	130	2767.12	Os I	390	2772.58	Lu III
85	2762.22	Ce II	30	2767.22	Mo I	190	2772.59	U II
29	2762.28	Sm	180	2767.50	Fe II	70	2772.60	Ho II
35	2762.31	Ru I		2767.52	Fe I	110	2772.61	Dy II
400	2762.34	W I	22	2767.54	Cr I	110	2772.83	Ho II
750	2762.59	Cr II	27	2767.65	Ir I	170	2773.02	Hf I
60	2762.69	Hf I	50	2767.73	Rh I	18	2773.02	Th II
65	2762.70	Mo I	310	2767.74	Re I	120	2773.07	Os I
340	2762.85	U II	85	2767.85	Sm II	170	2773.11	Re I
35	2762.90	Ce II	4400	d 2767.87	Tl I	310	2773.20	Nb I
65	2763.03	Mo I	40	2768.09	Mo I	30	2773.24	Fe I
90	2763.03	Zr I	50	2768.09	Ta II	40	2773.24	Pt I
22	2763.06	Cr I	240	2768.13	Nb II	980	2773.36	Hf II
1900	2763.09	Pd I	40	2768.51	Gd II	150	2773.61	U II
50	2763.11	Fe I	85	2768.56	V II	45	2773.68	V I
470	2763.27	Os I	200	d 2768.73	Zr II	210	2773.70	W I
90	2763.30	Re I		2768.85	Zr II	160	2773.78	Mo II
110	2763.37	Ta II	270	2768.84	Th II	90	2773.79	Tm II
80	2763.38	Nb I	220	2768.85	Re I	70	2773.84	Ho II
260	2763.42	Ru I	90	2768.93	Ru II	140	d 2773.95	Th II
							2774.07	Th II
150	2763.61	Th II	210	2768.98	W I			
220	2763.62	Mo II	220	2769.32	Re I	20	2774.00	Pt I
210	2763.79	Re I	270	2769.53	Tb II	810	2774.00	W I
40	2763.93	Mo I	17	2769.57	Nb II	180	2774.02	Hf II
150	2763.94	Os I	50	2769.60	Pr II	120	2774.02	Os I
460	2764.08	Gd II	400	2769.74	W I	170	d 2774.04	Zr I
35	2764.18	Sm	240	2769.76	Mo II		2774.16	Zr II
190	2764.19	Co I	320	2769.81	Gd II	90	2774.28	V II
100	2764.25	U II	30	2769.84	Pt I	110	2774.38	Os I
400	2764.27	W II	160	2769.88	Os I	190	2774.39	Mo II
20	h 2764.33	Fe I	270	2769.89	Ho II	35	2774.48	Ru I
80	2764.35	Cr I	250	h 2769.92	Cr I	810	2774.48	W I
35	2764.41	Yb II	900	2769.95	Sb I	27	2774.58	Ir I
55	2764.56	Nb II	510	2770.02	Er II	90	2774.62	Er II
100	2764.64	Th II	390	2770.04	U II	45	2774.72	V II

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
30	2774.73	Fe I	55	2779.36	Nb I	170	2784.67	U II
120	2774.74	U II	390	2779.37	Hf I	75	2784.92	U II
60	2774.77	Sm	170	2779.41	U II	150	2784.95	Er II
70	2774.77	Tm II	70	2779.48	Mo I	150	2784.97	Ta II
45	2774.84	Th II	75	2779.54	Rh I	70	2784.98	Th II
100	2774.88	Ta I	270	2779.55	Tm II	400	2784.99	Mo II
110	2774.90	Os I	40	2779.58	Dy II	320	2785.03	Sn I
180	2774.97	Tm II	60	2779.61	Er II	40	2785.04	Os
120	2775.02	U II	50	2779.70	Ta I	350	2785.07	Tm II
20	2775.05	Th III	65	2779.72	Nb I	60	2785.17	U II
130	2775.11	Ta II	160	2779.73	W I	160	2785.21	Re I
85	2775.22	U II	1000	2779.81	Sn I	30	2785.21	Y II
55	2775.27	Hf II	900	2779.83	Mg I	330	2785.22	Ir I
35	2775.35	Ta II	30	2780.00	Mn I	100	2785.35	Ce II
40	2775.37	In I	50	2780.01	Ce II	35	2785.50	Tb II
1700	2775.40	Mo II	880	2780.04	Mo II	26	2785.54	V I
250	2775.55	Ir I	190	2780.04	U II	12	2785.59	Y II
45	2775.76	V II	1400	2780.22	As I	35	2785.61	Th II
85	2775.78	U II	270	2780.24	Nb II	55	2785.65	Ru I
770	2775.88	Ta I	80	2780.28	W I	55	2785.69	V I
50	d 2775.94	Pr II	80	2780.30	Cr II	70	2785.70	Cr II
	2776.03	Pr II	100	2780.34	Ta II	60	2785.79	Nd I
85	2776.11	Sm	360	2780.52	Bi I	40	2785.90	W I
30	h 2776.23	Mn I	610	2780.70	Cr I	120	2786.11	Er II
170	2776.28	Yb II	45	2780.70	Th II	30	2786.11	Mo I
85	d 2776.29	U II	220	2780.77	U II	55	2786.14	Re I
160	2776.50	W II	110	2780.87	Tm II	95	2786.18	Tm II
50	2776.68	Tm II	30	2780.89	Ta	18	2786.24	Th II
380	2776.69	Mg I	220	2781.04	U II	45	2786.30	Hf II
26	2776.71	Ta II	100	2781.19	Er II	640	2786.31	Os I
300	2776.91	Os I	520	2781.29	Ir I	120	2786.56	Re I
120	2777.04	Tm II	100	2781.37	Ta I	85	2786.64	Sm
140	2777.10	Ho II	440	2781.40	Gd II	60	2786.77	Ta II
80	d 2777.43	Ir I	320	2781.42	Mg I	130	2786.80	Os I
	2777.53	Ir I	180	2781.43	Re I	80	2786.86	Zr I
90	2777.50	Tm II	60	2781.54	Er II	70	2786.91	Th II
75	2777.71	Re I	190	2781.62	U II	100	2787.13	Th II
140	2777.73	V II	26	2781.79	Ta I	55	2787.20	Ho II
130	2777.74	Mo I	35	2781.84	Fe I	170	d 2787.33	U II
70	2777.80	Th II	35	2781.89	Ce II	60	2787.40	Er II
65	2777.86	Mo II	480	2781.89	Eu II	35	2787.63	Cr II
40	2778.02	Th II	35	2781.99	Ce II	35	2787.67	Th II
45	2778.06	Cr II	40	2782.00	Er II	70	2787.68	Gd I
50	2778.06	Rh I	120	2782.07	U II	390	2787.69	Ta I
90	2778.09	Re I	35	2782.35	Tb II	180	2787.71	Er II
150	2778.22	Fe I	130	2782.36	Nb I	180	2787.83	Mo I
320	2778.29	Mg I	18	2782.37	Th II	110	2787.83	Ru II
100	2778.38	Ru II	740	2782.55	Os I	35	2787.84	Cr I
50	2778.39	Tm II	360	2782.97	Mg I	50	2787.96	Tm II
75	2778.45	U II	35	2783.00	Tb II	18	2787.96	Yb II
75	2778.50	Re I	130	2783.03	Rh I	210	2787.98	W I
40	2778.57	Os I	110	2783.05	Th II	700	2788.10	Fe I
40	2778.69	W II	160	2783.13	W I	150	2788.13	U II
70	2778.71	Th II	170	d 2783.29	U II	130	2788.30	Ta I
45	2778.76	Gd I	50	2783.31	Pr II	30	2788.33	Er II
40	2778.80	Pr II	70	2783.49	Th II	50	2788.47	Er II
130	2778.82	Co I	550	2783.57	Re I	35	2788.68	Th II
50	2778.82	Ta II	70	2783.69	Hf I	70	2788.94	Mo I
30	2778.84	Fe I	55	2783.78	V I	30	2789.05	Pr II
55	2778.87	Ho II	40	2783.88	Os II	130	2789.07	W I
230	2778.97	Er II	45	2784.06	Th II	50	2789.15	Ta II
100	2779.10	Ta I	120	2784.27	Ce II	55	2789.20	Mn I
22	2779.14	Cr I	410	2784.45	U II	90	c 2789.27	Re I
45	2779.14	Gd II	130	2784.49	Tb II	150	2789.38	Sm II
85	2779.23	Sm II	100	2784.66	Yb II	100	2789.50	Hf II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
40	2789.68	W I	6200	2794.82	Mn I	80	2799.54	Er II
140	2789.73	Hf II	20	2795.01	Fe I	35	2799.72	Er II
	2789.80	Hf II	21	2795.07	Yb II	40	2799.74	Ir I
50	2789.77	Ta I	30	2795.13	Zr I	220	2799.84	Mn I
20	2789.80	Fe I	27	2795.14	Nb II	400	2799.93	W I
24	2790.01	Mo I	50	2795.20	Ta II	100	2799.99	Ho II
200	2790.14	Zr I	190	2795.23	U II	50	2800.00	Yb II
95	2790.31	Mo I	18	2795.29	Yb II	35	2800.06	Yb II
	2790.41	Mo II	10000	2795.53	Mg II	30	2800.11	Y II
60	2790.36	Mn I	20	2795.86	Nb I	40	2800.32	Nb I
45	2790.42	Th II	95	h 2796.09	Tm II	120	h 2800.33	Dy II
100	2790.53	Ce II	21	2796.11	Os I	95	2800.39	Tm II
27	2790.57	Nb II	80	2796.15	W I	180	2800.51	Tb II
170	2790.66	U II	40	2796.23	Co I	110	2800.53	Dy II
100	2790.71	Ta I	680	2796.34	Ta I	50	2800.57	Ta I
130	2790.79	Mg II	80	2796.46	Ir I	70	2800.57	Th II
65	2790.90	Os I	75	2796.56	Ta I	75	h 2800.63	Tb II
140	2790.94	Re I	2700	2796.63	Lu II	140	h 2800.75	Re I
70	2791.01	Th II	75	2796.63	Rh I	70	2800.77	Cr II
120	2791.07	U II	130	h 2796.70	Sm	410	2800.82	Ir I
55	2791.08	Ho II	530	2796.73	Os I	90	d 2800.87	Zn I
60	2791.08	Mn I	30	2796.78	Mo I		2801.06	Zn I
25	2791.16	Rh I	160	2796.90	Zr II	160	d 2801.05	W II
12	2791.20	Y I	930	2796.93	Gd II		2801.17	W I
75	2791.26	U II	40	2796.95	Tb II	3700	2801.06	Mn I
220	2791.29	Re I	70	2797.02	Th II	110	2801.41	Dy II
140	2791.37	Ta II	70	2797.02	V II	220	2801.47	Mo I
140	2791.42	Ce II	55	2797.08	Co I		2801.55	Mo I
35	2791.43	Th II	290	2797.14	U II	95	2801.93	Os I
29	2791.43	Tm II	40	2797.20	W I	10000	2801.99	Pb I
55	2791.44	Dy II	730	2797.27	Tm II	50	2802.05	Pr II
55	2791.51	La II	85	2797.30	U II	20	2802.07	Nb I
40	2791.54	Mo II	540	2797.35	Ir I	380	2802.07	Ta I
120	2791.61	Tm II	60	c 2797.69	Nb II	55	h 2802.25	Re I
120	2791.67	Ta I	1600	2797.70	Ir I	250	2802.50	Ti I
80	2791.74	Nb II	70	2797.74	Th II	230	2802.53	Er II
25	2791.79	Fe I	680	2797.76	Ta II	870	2802.56	U II
390	2791.96	Gd II	85	2797.77	U II	6000	2802.70	Mg II
340	2791.96	W I	80	2797.78	Fe I	250	2802.75	Tb II
120	2792.04	Zr I	75	2797.80	V II	90	2802.80	V II
90	2792.16	Cr II	35	2797.80	Yb II	140	2802.81	Ru I
180	2792.16	Tm II	240	d 2797.93	Mo I	1900	2802.84	Eu II
35	2792.51	Pr II		2798.01	Mo I	100	2802.87	Er II
60	2792.52	Er III	60	2797.98	Tm II	80	2802.96	W I
35	2792.64	Ru I	160	2798.06	Mg II	45	2803.04	Ce II
810	2792.70	W I	100	2798.10	Re I	70	2803.10	Tm II
80	2792.96	Mo I	380	2798.18	Ir I	140	2803.24	Pt I
110	2793.05	Nb II	100	2798.21	Yb II	120	2803.28	Re II
50	2793.27	Pt I	5100	2798.27	Mn I	35	2803.38	Th II
45	2793.28	Yb II	55	2798.27	Th II	120	2803.47	V II
90	2793.39	Zr I	190	2798.40	Ta I	80	2803.54	Er II
45	2793.66	Re I	55	2798.56	La II	95	2803.77	Co I
50	2793.84	Er II	150	2798.65	Ni I	60	2803.81	Nb II
50	2793.86	Ta II	55	2798.67	Cr II	120	2803.83	U II
55	2793.90	Ho II	28	2798.67	Th II	80	2804.02	W I
70	2793.94	Ge I	85	2798.76	V II	320	2804.07	Os I
830	2793.94	U II	45	2798.91	Nb II	70	2804.10	Mn I
230	2793.99	Os I	80	2799.03	W II	130	2804.24	W I
230	2794.19	Os I	55	2799.11	Th II	310	2804.35	Er II
16	2794.21	Pt II	120	2799.12	U II	150	2804.52	Fe I
90	2794.26	Th II	110	2799.15	Zr II	80	2804.68	W I
140	2794.41	Ho II	35	2799.36	Nb I	50	2804.76	Ta I
25	2794.44	Yb II	45	2799.38	Yb II	170	2805.24	U II
680	2794.60	Tm II	90	2799.45	V II	30	2805.54	V II
100	2794.66	Gd II	35	2799.53	Os	130	2805.63	W I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
55	2805.70	Ti I	50	2811.09	Dy II	80	2815.42	W I
130	2805.92	W II	220	2811.36	Ho II	30	2815.54	Mo I
60	2806.14	Mn I	290	2811.38	U II	150	2815.56	Co I
430	2806.30	Ta I	85	2811.42	Dy II	120	2815.76	U II
30	2806.50	Ti II	30	2811.50	Mo I	300	2815.78	Os I
510	2806.58	Ta I	21	2811.56	Os I	45	2815.82	Hf I
100	2806.72	Ho II	40	2811.63	Nb I	70	2815.91	Mo I
35	2806.74	Ru II	70	2811.72	Ta II	170	2815.98	U II
150	2806.75	Er II	220	2811.75	Eu II	45	2816.07	Hf II
40	2806.77	Tm III	30	2811.87	Ce II	45	2816.07	Th II
90	2806.78	Zr I	180	2812.00	Ho II	1700	2816.15	Mo II
2800	2806.91	Os I	80	2812.01	Cr II	550	2816.18	Eu II
160	2806.98	Fe I	55	2812.07	Re I	170	2816.32	Re I
630	2807.05	U II	95	2812.25	Tm II	28	2816.32	Yb II
70	2807.31	Ho II	40	2812.25	W II	300	2816.39	Dy II
30	2807.36	Mo I	27	2812.32	Hf I	40	2816.55	Tm II
85	2807.36	Sm	75	2812.36	Re I	27	2816.68	Nb II
40	2807.48	Os I	20	2812.42	Th II	60	2816.74	U II
55	2807.72	Th II	28	2812.58	Mo II	100	2816.96	Re I
80	2807.72	W I	120	2812.59	Sn I	390	2817.01	Y III
400	2807.76	Mo II	180	2812.64	Tb II	75	2817.09	Ru I
40	2807.80	Os	40	2812.80	Ir I	260	2817.10	Ta II
110	2807.83	Th II	55	2812.82	Ru I	18	2817.14	Th II
100	2807.86	Re I	60	2812.84	Mn I	85	2817.20	Sm II
180	2807.98	Tm II	30	2812.98	Ti I	90	2817.31	Tm II
230	2808.00	Hf II	40	2813.02	Tm II	30	2817.40	Ti I
55	2808.02	Mn I	170	2813.04	U II	220	2817.44	Mo II
40	2808.05	Nb I	30	2813.08	Eu II		2817.50	Mo I
35	2808.16	Zr II	55	2813.11	Re I	60	2817.50	Ce II
30	2808.24	Os I	40	2813.13	W I	50	2817.50	Ta I
70	2808.37	Mo I	420	2813.29	Fe I	60	2817.50	V II
60	2808.38	Gd II	70	2813.47	Mn I	20	2817.51	Fe I
420	2808.39	La II	600	2813.58	Sn I	40	2817.51	Os I
170	2808.42	Tm II	26	2813.64	Y I	230	2817.68	Hf I
10	2808.51	Pt I	29	2813.82	Tm II	65	2817.84	Ti I
65	2808.57	W I	420	2813.84	Os I		2817.87	Ti II
470	2808.94	Os I	230	2813.86	Hf II	630	2817.96	U II
440	2808.98	U II	3400	2813.94	Eu II	85	2817.97	Mn I
180	2808.99	Th II	170	2813.96	Re I	810	2818.06	W I
80	2809.09	Ho II	45	2814.01	Gd II	110	2818.14	Tm II
110	2809.11	Mn I	740	2814.20	Os I	50	2818.25	Pt I
27	2809.17	Nb II	100	2814.31	Ta II	40	2818.30	Mo I
40	2809.17	Ti I	70	2814.32	Th II	60	2818.36	Cr II
250	2809.30	Tb II	140	2814.41	Tm II	350	2818.36	Ru I
150	2809.50	Sm	80	2814.44	Ho II	250	2818.47	Tm II
140	c 2809.62	Bi I	170	2814.48	Hf II	40	2818.48	Tb II
750	2809.72	Gd II	140	2814.50	Tm II	390	2818.74	Zr II
220	2809.95	U II	65	2814.53	Yb II	40	2818.77	Mn I
30	2809.96	Mo I	45	2814.58	Th II	100	2818.86	Er II
160	c 2809.99	Ho II	24	2814.67	Mo II	18	2818.86	Y I
350	2810.03	Ru I	220	2814.68	Re I	140	2818.94	Hf I
90	2810.16	V II	190	2814.74	Ho II	35	2818.95	Ru I
35	2810.18	Ce II	29	2814.74	Tm II	120	2818.98	U II
90	2810.27	V II	90	2814.76	Hf II	70	2819.08	Tm II
75	2810.30	Ti II	95	2814.80	Ta I	45	2819.14	Ta II
120	d 2810.35	U II	85	2814.81	Ce II	55	2819.21	Nb I
24	2810.43	Mo I	40	2814.84	Os I	100	2819.32	Th II
1700	2810.55	Ru I	620	2814.90	Zr I	26	2819.34	Er II
14	2810.72	Yb II	70	2814.91	Ho II	95	2819.37	Ta I
75	2810.81	Nb II	60	2814.96	Ce II	30	2819.54	Sc II
85	2810.85	Dy II	95	2815.01	Ta I	70	2819.56	Zr I
120	2810.86	Sm II	60	2815.02	Mn II	45	2819.68	Ho II
180	2810.91	Zr II	95	2815.12	Ta I	200	2819.74	Hf I
140	2810.92	Ta I	55	2815.22	Dy II	75	2819.78	Re II
160	2810.93	Gd II	40	2815.27	Os I	40	2819.78	Tb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
90	2819.80	Ho II	75	2825.18	Nb I	60	2829.81	Zr I
40	2819.81	Er II	190	2825.35	U II	260	2829.82	W I
220	2819.84	U II	22	2825.37	Y II	20	2829.93	Th II
880	2819.95	Re I	140	2825.42	Dy II	70	2829.94	Mo I
23	2820.01	Co I	100	2825.46	Re I	50	2830.16	Tm II
140	2820.18	Os I	150	2825.56	Fe I	70	2830.17	Ir I
410	2820.19	Er II	530	2825.56	Zr II	40	2830.29	W I
1200	2820.22	Hf II	30	2825.66	Er II	1400	2830.30	Pt I
24	2820.22	Tm II	50	2825.67	Mo I	55	2830.35	Re I
190	2820.27	U II	30	2825.69	Fe I	80	2830.42	Er II
45	2820.34	Th II	23	2825.86	Nb II	70	2830.44	Th II
55	2820.42	Hf II	280	2826.16	Tl I	180	2830.47	Cr II
40	2820.46	Er II	70	2826.18	Ta I	55	2830.51	Ir I
95	2820.56	Os I	220	2826.19	U II	80	2830.79	Mn I
2000	2820.78	Eu II	45	2826.38	Y II	270	2830.90	Ce II
40	2820.80	Nb II	35	2826.42	Ta I	55	2830.92	Ho II
29	2820.96	Sm II	150	2826.43	Rh I	220	2830.94	Sm II
870	2821.12	U II	95	2826.43	Tm II	190	2830.99	Yb II
140	2821.15	Yb II	65	2826.48	Nb I	40	2831.21	Er II
35	2821.23	Lu III	240	2826.54	Mo I	40	2831.36	Ir I
190	2821.25	Os I	140	2826.64	Ho II	1600	2831.38	W I
250	2821.29	Ni I	180	2826.68	Rh I	40	2831.44	Mo II
55	2821.45	Mn I	60	2826.68	Sc II	200	2831.55	Tm II
55	2821.56	Zr I	22	2826.75	Cr I	21	2831.59	Os I
40	2821.60	Th II	50	2826.75	Mo I	270	c 2831.69	Ho II
20	2821.92	Nb I	170	2826.86	Th II	920	2832.06	U II
50	2821.99	Ta I	95	2827.00	U II	30	2832.07	Mo II
45	2822.01	Cr II	250	2827.02	Tm II	130	2832.16	Ti II
100	2822.02	Th II	190	2827.08	Nb II	18	2832.20	Yb II
50	2822.03	Mo II	130	d 2827.15	W I	130	2832.24	Os I
110	2822.03	Ru I		2827.29	W I	800	2832.31	Th II
110	2822.12	Re I	95	2827.18	Ta I	320	2832.44	Fe I
35	2822.15	Sc II	30	2827.31	Rh I	70	2832.70	Ta II
35	2822.36	Th II	85	2827.41	Tb II	75	2833.03	Tb II
180	2822.37	Cr II	95	d 2827.48	Ta II	9500	2833.06	Pb I
30	2822.43	Mo I		2827.60	Ta II	110	2833.24	Ir II
55	2822.55	Mn I	90	2827.50	Zr II	140	2833.26	Eu II
20	2822.56	Th II		2827.54	Zr I	180	2833.28	Hf I
45	2822.56	Y I	110	2827.52	Re I	100	2833.31	Ce II
160	2822.57	W II	80	2827.74	Mo II	55	2833.33	Th II
490	2822.68	Hf II	20	2827.76	Th II	810	2833.63	W I
20	2822.69	Th II	80	2827.76	Tm II	170	2833.64	Ta I
24	2822.86	Mo I	200	2827.87	Ru I	300	2833.75	Gd II
20	2823.17	Pr II	580	2827.92	Tm II	55	2833.79	Ho II
680	2823.18	Ir I	45	2827.99	Th II	70	2833.81	Tm II
4100	2823.20	Pb I	65	2828.07	Ti I	220	d 2833.82	U II
500	2823.28	Fe I		2828.15	Ti II	270	d 2833.91	Er II
80	2823.36	Ho II	20	2828.29	Pr II	110	2833.91	Zr II
40	2823.54	Tm II	55	2828.37	Dy II	130	2834.00	Ru I
20	2823.55	Th II	150	2828.58	Ta II	310	2834.08	Re I
70	2823.73	Ho II	400	cw 2828.72	Eu II	75	2834.12	Rh I
20	2824.14	Pr II	40	2828.79	Mo I	110	2834.13	Hf I
130	2824.17	Os I	25	2828.81	Fe I	70	2834.26	Cr II
300	2824.20	Ho II	680	2828.90	U II	270	c 2834.35	Lu II
110	2824.25	Re I	80	2829.01	Ge I	80	2834.39	Mo II
50	2824.32	Er II	21	2829.03	Os I	80	2834.40	Zr II
500	2824.37	Cu I	400	2829.16	Ru I	70	2834.41	Ta I
390	2824.37	U II	420	2829.27	Os I	160	2834.48	Th II
1200	2824.45	Ir I	120	2829.30	Eu II	95	2834.55	U II
40	2824.67	Os I	80	2829.32	Hf II	70	2834.71	Pt I
60	2824.76	Tm II	190	2829.37	U II	28	2834.97	Yb II
45	2824.81	Ta I	60	2829.38	Er II	210	2834.99	Ho II
120	2824.86	U II	40	2829.75	Nb II	50	d 2835.12	Dy II
50	2824.90	Er II	40	2829.79	Mo I		2835.29	Dy II
100	2824.97	Yb II	35	2829.79	Ta II	95	2835.12	Nb II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
80	2835.33	Mo II	80	2839.24	Th II	24	2843.73	Mo II
45	2835.44	Rh I	14	2839.34	Th II	80	2843.78	W I
25	2835.46	Fe I	130	2839.34	W I	75	2843.95	Tb II
45	2835.60	Ce II	120	2839.34	Zr II	80	2843.96	Eu II
2500	2835.63	Cr II	35	2839.36	Ce II	260	2843.98	Fe I
210	2835.64	W I	55	2839.58	Mo I	20	2844.01	Pr II
110	2835.66	Ir I	70	2839.85	Tm II	100	2844.16	Re I
150	2835.80	U II	460	2839.89	U II	110	2844.18	Ho II
110	2835.85	Ho II	14000	2839.99	Sn I	640	2844.25	Ta I
20	2835.91	Mo I	110	2840.02	Cr II	220	2844.39	Mo I
10	2836.03	Mo I	70	2840.15	Th II	2300	2844.40	Os I
130	2836.05	Th II	820	2840.22	Ir I	27	2844.44	Nb II
50	2836.16	Tm II	560	2840.23	Gd II	290	2844.46	Ta II
150	2836.24	Nb I	60	2840.30	Sm	660	2844.58	Zr II
80	2836.25	W I	200	2840.35	Re I	310	2844.67	Tm II
27	2836.31	Mn I	75	2840.39	Ta II	100	2844.68	Ho II
820	2836.40	Ir I	25	2840.42	Fe I	85	2844.68	Os I
45	2836.44	Th II	110	2840.44	Os I	170	2844.76	Ta I
45	2836.48	Cr II	95	2840.47	U II	30	2844.93	V I
35	2836.49	Zr I	16	2840.51	La II	150	2844.99	U II
60	2836.52	V II	150	2840.54	Ru I	330	2845.13	Lu I
35	2836.57	Ru I	190	2840.62	U II	20	2845.19	Th II
35	2836.62	Ta I	100	2840.63	Er II	45	2845.24	V II
35	2836.69	Gd II	110	2840.94	Nb I	290	2845.35	Ta I
75	2836.69	Rh I	60	2841.04	V II	60	2845.35	Tm II
55	2836.70	Ho II	250	2841.15	Nb II	35	2845.45	Ce II
50	2836.91	Cd I	90	2841.16	Th II	70	2845.60	Fe I
180	2836.92	In I	140	2841.33	Gd II	190	2845.60	U II
55	2837.00	Dy II	120	2841.38	Tm II	55	2845.80	Nb II
70	2837.00	Gd II	70	2841.49	Hf I	410	2845.83	Hf I
60	2837.11	Er II	400	2841.57	W I	35	2845.84	Ta I
75	2837.15	Co I	740	2841.60	Os I	20	2845.84	Th II
360	2837.19	U II	35	2841.68	Ru II	120	2845.86	Er II
710	2837.23	Zr I	22	2841.72	Ce II	75	2845.93	Tb II
1200	2837.30	Th II	20	2841.81	Th II	150	2845.96	U II
40	2837.32	Mo I	50	2841.89	Er II	22	2846.02	Cr I
160	2837.33	Ir I	190	2841.94	Ti II	95	2846.14	U II
220	2837.33	U II	40	2842.00	Tb II	60	2846.26	Er II
110	2837.34	W I	23	2842.02	Nb I	160	2846.28	Nb II
230	2837.42	Os I	55	2842.04	Dy II	35	2846.32	Ru I
200	2837.55	Re I	360	2842.09	U II	420	2846.39	Os I
55	2837.61	Dy II	160	2842.15	Mo II	150	2846.55	Os I
95	2837.73	U II	95	2842.24	U II	120	2846.57	V I
40	2837.77	W I	160	2842.28	Ir I	70	2846.75	Ta I
17	2837.89	Ce II	65	2842.37	Mo I	100	2846.97	Re I
50	2837.90	Mo I	40	2842.42	Tm II	40	2847.02	Er II
50	2837.94	Ta I	95	2842.48	U II	230	2847.18	Yb II
12	2837.99	Ce II	30	2842.52	Ce II	23	2847.24	Nb II
55	2838.02	Zr II	40	2842.57	W I	95	2847.34	U II
30	2838.06	V I	14	2842.59	Yb II	90	2847.35	Th II
100	2838.12	Fe I	280	2842.65	Nb II	60	2847.49	Sm II
470	2838.17	Os I	29	2842.76	Tm II	3000	2847.51	Lu II
85	2838.24	Ta II	320	2842.81	Th II	110	2847.57	V II
11	2838.45	La II	260	2842.82	Ta I	50	2847.72	U II
75	2838.62	U II	22	2842.83	Ce II	160	2847.83	W I
5100	2838.63	Os I	20	2842.98	Pr I	20	2848.01	Th II
40	2838.63	Tm II	220	2843.00	Re I	810	2848.02	W I
390	2838.71	Er II	75	2843.17	Ru I	150	2848.05	Ta I
85	2838.72	Tb II	1700	2843.25	Cr II	60	2848.05	U II
55	2838.79	Cr II	20	2843.30	Th II	80	2848.06	Er II
40	2838.89	W I	70	2843.39	Ho II	210	2848.19	Zr II
160	2838.93	Tm II	70	2843.51	Ta II	1700	2848.23	Mo II
95	2839.10	Tm II	130	2843.52	Zr II	420	2848.25	Os I
1100	2839.16	Ir I	90	2843.63	Fe I	65	2848.30	Nb II
	2839.24	Ir I	27	2843.64	Nb II	270	2848.37	Er II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
100	2848.44	Yb II	190	2852.14	Tb II	70	2856.69	Ta II
560	2848.52	Ta I	60	2852.36	Ta II	90	2856.77	Cr II
350	2848.52	Zr I	23	2852.50	Th II	17	2857.01	Dy II
85	2848.58	Ru I	29	2852.59	Tm II	40	2857.11	Dy II
16	2848.72	Fe I	190	2852.75	U II	80	2857.14	W I
70	2848.77	V I	90	2852.84	Re I	100	2857.28	Ta II
95	2848.86	Tm II	140	2852.87	V I	45	2857.29	Nb I
50	2848.92	Er II	45	2852.89	Ho II	70	2857.40	Cr II
70	2848.93	Dy I	40	2852.91	W I	95	2857.47	U II
29	2848.98	Tm II	50	2852.94	U II	55	2857.49	Th II
45	2849.03	Ce II	16	2853.11	Pt I	55	2857.54	Os I
95	2849.05	Os I	55	2853.22	Cr II	55	2857.65	Hf II
30	2849.05	V II	370	2853.23	Mo II	110	2857.68	Tb II
270	2849.10	Ho II	29	2853.25	Tm II	11	2857.87	Y I
70	2849.18	V I	21	2853.41	Yb II	60	h 2857.94	V I
270	2849.21	Hf II	190	2853.42	U II	75	2858.01	Ce II
45	2849.29	Cr I	80	2853.50	W I	160	2858.04	W I
40	2849.30	Os I	190	2853.57	U II	30	c 2858.14	In I
21	2849.34	Yb II	40	2853.58	Mo I	45	2858.33	Yb II
160	2849.38	Mo I	18	2853.68	Yb II	220	2858.44	Ta II
160	d 2849.47	W I	40	2853.84	W I	45	2858.46	Yb II
		W I	40	2853.91	Gd II	120	2858.56	Er II
360	2849.48	U II	40	2853.93	Ti II	290	2858.90	U II
75	2849.56	Nb II	25	2853.99	Pr II	610	2858.91	Cr II
150	2849.7	U II	90	2854.02	Tm II	40	2859.04	Nb II
3800	2849.72	Ir I	640	2854.07	Ru I	100	2859.39	Yb II
100	2849.82	Ta I	45	2854.13	Th II	35	2859.52	Ce II
1200	2849.84	Cr II	55	2854.14	Yb II	50	2859.57	Mo I
95	2849.98	U II	65	2854.17	Nb I	260	2859.67	Eu II
55	2850.04	Co I	200	2854.17	Tm I	50	2859.72	Dy II
70	2850.15	Hf II	75	2854.20	Tb II	120	2859.74	U II
1500	2850.49	Ta I	140	2854.34	V II	19	2859.78	Gd II
190	2850.49	U II	70	2854.43	Y II	430	2859.80	Yb II
20	2850.62	Pr I	70	2854.43	Zr II	310	2859.84	Er II
1700	2850.62	Sn I	45	2854.49	Yb II	95	2859.96	Nb I
150	2850.65	Er II	24	2854.58	Pd II	180	2859.97	V I
75	2850.69	V II	85	2854.67	Ce II	180	2860.02	Ru I
	2850.77	V II	40	d 2854.87	Mo I	110	2860.06	Os I
1500	2850.76	Os I	85	2854.88	Ce II	55	2860.07	Re I
65	d 2850.79	Mo I	60	2854.89	Tm II	200	2860.12	Tm II
		Mo I	23	2854.92	Th II	55	2860.17	Dy II
130	2850.81	W I	95	2854.92	U II	55	2860.25	Re I
95	2850.82	U II	75	2854.96	Tb II	40	2860.26	Er II
270	2850.96	Hf I	55	2855.07	Cr II	55	2860.31	Hf II
270	2850.98	Re I	200	2855.22	V I	50	2860.36	Tm II
1900	2850.98	Ta I	45	2855.32	Ce II	55	2860.39	Yb II
55	2851.04	Tb II	130	2855.34	Os I	900	2860.44	As I
110	2851.10	Ti II	80	2855.35	W I	390	2860.47	U II
70	2851.11	Sb I	250	2855.41	Er II	70	2860.55	Tm II
360	2851.13	Yb II	45	2855.45	Ce II	180	2860.56	Hf I
30	2851.18	Mo I	75	2855.65	Tb II	40	2860.66	Ir I
180	2851.21	Hf II	880	2855.68	Cr II	70	2860.67	Dy II
270	2851.26	Th II	45	2855.72	Ce II	50	d 2860.68	Rh I
60	2851.35	Sm I	40	d 2855.82	Ir I		2860.76	Rh I
120	2851.36	Cr II		2855.93	Ir I	170	2860.80	U II
80	2851.44	Th II	45	2855.90	La II	95	2860.85	Zr I
110	2851.45	Nb I	55	2855.90	Th II	40	2860.87	Ho II
380	2851.80	Fe I	150	2855.96	U I	60	2860.88	Ta II
120	2851.81	U II	50	2856.00	Mo II	440	2860.93	Cr II
55	2851.86	Yb II	650	2856.03	W I	1500	2860.96	Os I
350	2851.97	Zr II	27	2856.06	Zr II	760	2861.01	Hf II
85	2851.98	Nb I	50	2856.16	Rh I	240	2861.09	Nb II
60	2852.05	Eu II	26	2856.30	Y II	50	2861.12	Ta I
150	2852.09	U II	85	2856.42	Dy II	170	2861.13	U II
60000	2852.13	Mg I	60	2856.52	Gd II	140	2861.21	Yb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
100	2861.23	Ho II	40	2865.62	Mo II	550	2870.41	Th II
320	d 2861.33	Th II	30	2865.64	Pr II	210	2870.44	Cr II
	2861.42	Th II	85	2865.68	Os I	30	2870.52	Er II
95	2861.34	Tb II	970	2865.68	U II	210	2870.55	V I
100	2861.34	Yb II	650	2866.06	W I	28	2870.82	Th II
22	2861.35	Ce II						
420	2861.41	Ru I	120	2866.09	Sm II	28	2870.90	Mo I
250	2861.49	Ho II	70	2866.14	Ta I	40	2870.91	W I
45	2861.62	Ce II	150	2866.16	U II	340	2870.97	U II
760	2861.70	Hf II	85	2866.26	Dy II	45	2871.08	Ce II
			40	2866.33	Gd II	50	2871.35	Rh I
200	2861.74	Tm II	30	2866.35	Er II	130	2871.36	W I
360	2861.98	Ta I	2100	2866.37	Hf I	470	2871.42	Ta I
95	2862.32	Ti II	40	2866.39	W I	1700	2871.51	Mo II
120	2862.41	U II	35	2866.41	Th II	25	2871.63	Ce II
120	2862.48	Gd II	75	2866.42	V I	110	2871.63	Cr I
790	2862.57	Cr II	170	2866.59	V I	90	2871.64	Ru I
280	2862.57	Eu II	25	2866.63	Fe I	90	2871.68	Er II
40	2862.60	Er II	550	2866.64	Ru I	40	2871.75	Gd II
75	2862.61	Co I	35	2866.65	Th II	160	2871.82	Re I
55	2862.61	Th II	40	2866.67	Nb I	28	2871.89	Mo I
95	2862.62	U II	55	2866.69	Ir I	210	2871.99	Ho II
140	2862.70	Dy I	220	2866.69	Mo II	55	2872.30	Re I
150	2862.72	Ho II	610	2866.74	Cr II	50	2872.32	Tb II
50	2862.79	Ce II	90	2866.79	Ho II	50	2872.34	Fe I
75	2862.80	U II	35	2866.81	Ce II	170	2872.40	Os I
30	2862.84	Mo I	200	2867.06	Yb II	90	2872.44	Ho II
280	2862.94	Rh I	90	2867.10	Cr II	27	2872.50	Co I
26	2862.98	La II	240	2867.19	Re I	35	2872.53	Zr II
130	2863.01	W I	100	2867.41	Ta II	40	2872.55	Tb II
24	2863.20	Mo II	50	2867.42	Tb II	45	2872.67	Re I
10000	2863.33	Sn I	40	2867.59	Os	60	2872.83	Er II
95	2863.35	Tm II	70	2867.62	Dy II	85	2872.88	Mo II
35	2863.37	Os II	35	2867.63	Ir I	80	2873.00	Tm II
50	2863.44	Fe I	480	2867.65	Cr II	95	2873.00	U II
95	2863.44	U II	55	2867.70	Hf I	2800	2873.32	Pb I
95	2863.54	U II	95	2867.80	U II	270	2873.36	Ta I
150	2863.75	Tm II	160	2868.01	Tm II	170	2873.42	Os I
370	2863.81	Mo II	210	2868.10	V I	160	2873.48	Cr II
110	2863.84	Ir I	40	2868.11	Mo II	45	2873.49	Yb I
40	2863.86	Fe I	85	2868.19	Ru I	260	2873.56	Ta I
130	2863.89	W I	190	2868.19	U II	30	2873.62	Rh I
50	2863.95	Nd	110	2868.31	Ru I	40	2873.64	Mo I
150	2864.10	U II	40	2868.32	Mo II	27	2873.65	Hf I
40	2864.26	Os I	70	2868.40	Sm II	150	2873.80	Er II
150	2864.28	U II	35	2868.46	Th I	90	2873.82	Cr II
160	2864.31	Mo I	500	2868.52	Nb II	70	2873.88	Ho II
100	2864.32	Nb I	310	2868.65	Ta I	230	2874.06	Ho II
240	2864.36	V I	45	2868.68	Th II	220	2874.08	U II
65	2864.40	Rh I	55	2868.74	Ti II	250	2874.14	Ce II
25	2864.42	Eu II	140	2869.13	V II	95	2874.15	Os I
40	2864.48	Tb II	30	2869.19	Er II	100	2874.17	Fe I
150	2864.50	Ta I	1600	2869.23	Tm II	210	2874.17	Ta I
55	2864.56	Re I	80	2869.31	Fe I	5000	2874.24	Ga I
140	2864.66	Mo I	190	d 2869.37	U II	160	2874.43	Ho II
70	2864.66	Th II	40	2869.39	Os I	95	2874.57	Nb I
29	2864.75	Tm I	70	2869.56	Mo I	40	2874.59	Os I
60	2865.06	Gd II	80	2869.70	Ir I	110	2874.78	Er II
55	2865.10	Zr II	340	2869.81	Zr II	360	2874.96	Os I
750	2865.11	Cr II	28	2869.82	Dy II	1800	2874.98	Ru I
290	2865.14	U II	130	2869.82	Hf II	220	2875.20	U II
75	2865.32	Ta II	70	2869.92	Th II	130	2875.21	W I
55	2865.33	Cr II	30	2869.96	V II	200	2875.28	Re I
50	2865.50	Ni I	25	2870.06	Yb II	25	2875.30	Fe I
90	2865.60	Zr II	60	2870.08	Mn II	800	2875.39	Nb II
100	2865.61	Nb II	28	2870.18	Mo I	380	2875.60	Ir I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
380	2875.98	Ir I	190	2880.59	U II	70	2884.81	Dy II
490	2875.98	Zr I	40	2880.63	W I	30	2884.89	Pr II
320	2875.99	Cr II	75	2880.64	Ce II	150	2884.92	U II
60	2876.06	Eu II	90	2880.65	La II	65	2884.97	Nb I
140	2876.11	Ta I	100	2880.72	Nb II	360	2885.05	Th II
230	2876.24	Cr II	75	2880.76	Rh I	130	2885.14	La II
150	2876.33	Hf II	80	2880.77	Cd I	570	2885.14	Lu I
95	2876.39	Dy II	35	2880.83	Zr I	95	2885.19	U II
70	2876.42	Th II	95	2880.87	Cr II	50	2885.29	Ce II
190	d 2876.43	U II	460	2880.98	Ho II	85	2885.40	Ta II
50	2876.54	Mo I	85	2881.06	Dy II	55	2885.47	Hf II
270	2876.95	Nb II	35	2881.13	Ce II	120	2885.53	Dy I
530	2877.03	Nb II	30	2881.14	Cr I	130	2885.60	Gd II
85	2877.05	Ta II	45	2881.14	Th II	65	2885.74	Mo I
95	2877.05	U II	55	2881.16	Ir I	75	2885.90	Tb II
45	2877.16	Hf I	20	2881.23	Cd I	75	2885.97	Rh I
80	2877.26	Er II	35	2881.23	Ta I	28	2885.97	Yb II
50	2877.30	Fe I	75	2881.25	Tb II	95	2886.05	U II
190	2877.35	Os I	45	2881.28	Ru I	21	2886.06	Os I
180	2877.44	Ti II	460	2881.33	Gd II	80	2886.11	Er II
90	2877.55	Zr II	70	2881.34	Sm	45	2886.24	Th II
270	2877.68	Ir I	2600	2881.58	Si I	70	2886.26	Yb II
100	2877.69	Ta II	50	2881.60	Pr I	230	2886.29	Tb II
110	2877.69	V II	85	2881.68	Sm	190	2886.44	Co I
50	2877.83	U II	45	2882.01	Th II	140	2886.45	Tm II
190	2877.88	Dy II	55	2882.04	Ho II	190	d 2886.45	U II
1400	2877.92	Sb I	35	2882.09	Zr II	95	2886.48	Y I
180	2877.98	Cr II	55	2882.12	Ru II	40	2886.50	Os I
40	2878.20	Tm II	40	2882.13	Gd II	45	2886.51	Th II
60	2878.36	Tm II	30	2882.31	Pr II	740	2886.54	Ru I
40	2878.38	Mo I	35	2882.33	Ta II	85	2886.61	Mo I
300	2878.40	Os I	95	2882.34	U II	70	2886.68	Mn II
70	2878.45	Cr II	140	2882.37	Rh I	170	2887.00	Cr I
50	2878.54	Er II	380	2882.50	V II	100	2887.09	Er II
110	2878.66	Rh I	40	2882.51	Th II	210	2887.14	Hf I
85	2878.70	Dy II	40	2882.54	Mo I	460	2887.25	U II
230	2878.72	W I	30	2882.60	Er II	65	2887.31	Re I
65	2878.74	Nb II	75	2882.61	Ce II	75	2887.44	Tb II
100	2878.87	Eu I	820	2882.64	Ir I	100	2887.54	Hf I
95	2878.87	U II	490	2882.74	U II	150	2887.59	U II
60	2878.90	Er II	40	2882.90	Mn I	28	2887.62	Mo I
220	2879.05	Mo II	50	2882.93	Cu I	90	2887.66	W I
70	2879.05	Ta II	240	2882.93	U II	2900	2887.68	Re I
55	2879.11	Hf II	18	2883.04	Tm II	23	2887.69	Nb II
610	2879.11	W I	60	2883.09	Sm	10	2887.81	Fe I
110	2879.16	V II	570	2883.18	Nb II	360	2887.82	Th II
40	2879.20	Th II	200	2883.44	Re I	80	2887.85	Eu II
30	2879.22	Er II	16	2883.45	Au I	95	2887.91	U II
120	2879.27	Cr I	35	2883.47	Ho II	60	h 2887.95	Tm II
65	2879.27	Re I	130	2883.60	Ru I	75	2888.00	Ru I
45	2879.36	Nb II	23	h 2883.62	Th II	200	2888.04	Yb II
35	2879.39	Os II	85	h 2883.75	U II	90	2888.04	Zr II
610	2879.40	W I	55	2883.80	Zr II	130	c 2888.06	Re II
140	2879.41	Ir I	30	2883.94	Os I	50	2888.10	Tb II
80	2879.49	Mn II	65	2884.04	Re I	65	2888.15	Mo II
45	2879.49	Nb I	280	2884.11	Ti II	100	2888.16	Er II
35	2879.52	Ta I	90	2884.18	W I	25	2888.20	Pt I
23	2879.53	Th II	110	2884.28	Dy II	140	2888.25	V II
240	d 2879.59	U II	320	2884.29	Th II	410	2888.26	U II
120	2879.74	Ta I	85	2884.41	Os I	40	2888.31	Tb II
220	2879.76	Ru I	65	2884.51	Ru I	45	2888.70	Ce II
380	2880.02	Ta I	80	2884.64	Ho II	55	2888.74	Cr II
350	2880.03	V II	110	2884.64	Re I	190	2888.74	U II
30	2880.20	Os II	95	2884.68	Tb II	40	2888.82	Tb II
360	2880.26	Ho II	380	2884.78	V II	280	2888.83	Nb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
65	2888.93	Ti II	50	2893.49	Er II	150	2898.01	U II
45	2889.06	Sm	100	2893.60	Hg I	150	2898.1	U II
75	2889.11	Rh I	50	2893.62	Tm II	1800	2898.26	Hf I
700	2889.29	Cr I	45	2893.62	Yb II	35	2898.26	Th II
95	2889.38	Ta I	95	2893.76	U II	95	2898.37	U II
45	2889.43	Zr II	360	2893.83	Eu I	35	2898.42	Ta I
90	2889.45	Re I	600	2893.86	Pt I	90	2898.54	Cr II
160	2889.58	Mn II	150	2893.90	Er II	55	2898.54	Ru I
800	2889.62	Hf I	50	2894.09	Ce II	95	2898.56	U II
380	2889.62	V II	320	2894.14	U II	80	2898.65	Mo I
1200	2889.63	U II	100	2894.15	Ta I	200	2898.71	As I
95	2889.64	Tm II	190	2894.17	Cr I	130	2898.71	Hf II
75	2889.66	Tb II	60	2894.22	Ce II	150	2898.71	U II
55	2889.82	Cr II	40	2894.26	W I	90	2898.71	Zr II
40	2889.84	Mo I	110	2894.32	Re I	35	2898.79	Re I
75	2889.84	Rh I	40	2894.42	Nb II	14	2898.82	Y II
35	2889.90	Nb I	950	2894.45	Mo II	160	2898.86	Tb II
29	2889.93	Tm II	160	2894.45	Tb II	260	2899.04	Ta I
35	2890.17	Ce II	170	2894.47	Tm II	90	2899.20	V I
75	2890.25	Ta II	80	2894.50	Fe I	80	2899.21	Cr I
70	2890.44	Dy II	23	2894.50	Th II	400	2899.24	Nb II
120	2890.74	Dy II	410	2894.51	U II	45	2899.37	Th II
35	2890.74	Tm II	60	2894.58	V I	40	2899.42	Fe I
40	2890.85	Os I	18	2894.84	Hf I	55	2899.48	Cr II
630	2890.94	Tm II	6300	2894.84	Lu II	110	2899.60	V I
1300	2890.99	Mo II	95	2894.84	U II	80	2899.63	Ir I
70	2891.02	Dy II	95	2894.89	U II	85	2899.70	Yb II
85	2891.04	Ta I	340	2894.99	Ho II	250	2899.72	Th II
55	2891.07	Ti II	40	2895.04	Fe I	55	2899.82	Co I
160	2891.25	Th II	95	2895.06	Os I	65	2899.96	Rh I
95	2891.28	Mo II	140	2895.10	Ta I	80	2900.16	Mn II
70	2891.29	Ho II	130	2895.14	Th II	4500	2900.30	Lu II
60	2891.34	Sm	190	d 2895.54	U II	170	2900.36	Ta I
3600	2891.38	Yb II	160	2895.62	Ho II	35	2900.39	Ir I
55	2891.42	Cr I	45	2895.65	Re I	50	2900.52	W I
100	2891.48	Re I	50	2895.92	Er II	60	2900.75	Ta II
900	2891.64	V II	490	2896.01	Re I	70	2900.80	Mo II
35	2891.65	Ru I	440	2896.01	W I	120	2900.82	Dy II
160	d 2891.73	Th II	55	2896.04	Tb II	170	2900.84	Ho II
	2891.82	Th II	260	2896.06	Os I	45	2901.05	Ta I
150	d 2891.80	U II	360	2896.21	V II	190	2901.22	U II
55	2891.83	Os I	35	2896.41	Ta I	65	2901.32	Os I
770	2891.84	Ta I	28	2896.44	Mo I	110	2901.54	Tb II
180	2891.88	Re I	1500	2896.44	W I	60	2901.62	Zr II
17	2892.03	Ce II	55	2896.46	Cr II	50	2901.79	W I
17	2892.15	Ce II	75	2896.53	Ru I	55	2901.82	Zr II
40	2892.17	Th II	60	2896.57	Er II	20	2901.92	Fe I
120	2892.26	Zr I	240	2896.68	U II	110	2901.94	Ru I
85	2892.35	Os I	85	2896.73	Ce II	260	2901.95	Ir I
55	2892.39	Mn II	210	2896.75	Cr I	560	2902.05	Ta I
530	2892.44	V II	28	2896.90	Yb II	55	2902.10	Ru I
40	2892.49	Tb II	310	2896.96	Er II	55	2902.19	Ho II
200	2892.54	Eu I	85	2896.96	U II	150	2902.41	U II
60	2892.56	Hf I	28	2896.97	Mo I	18	2902.41	Yb II
180	2892.56	Ru I	70	2897.07	Th II	830	c 2902.48	Re I
160	2892.63	Re I	650	2897.15	Ir I	95	2902.81	U II
900	2892.66	V II	320	2897.44	Tb II	21	2902.92	Yb II
190	2892.81	Mo II	390	2897.52	Er II	300	2903.05	Lu I
140	2893.03	Eu I	140	2897.63	Mo II	95	2903.05	U II
160	2893.07	La II	55	d 2897.67	Cr II	290	2903.07	Mo II
				2897.73	Cr II			
40	2893.12	W I				65	2903.07	Os I
25	2893.22	Pt I	18	2897.69	Y II	18	2903.08	Ru I
65	2893.23	Mo I	470	2897.81	Nb II	130	2903.08	Tm II
370	2893.25	Cr I	300	2897.87	Pt I	360	2903.08	V II
1400	2893.32	V II	4000	2897.98	Bi I	45	2903.17	Th II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
27	2903.20	Co I	470	2908.24	Nb II	1100	2911.92	Mo II
130	2903.21	Os I	90	d 2908.27	W I	90	2912.01	Th II
65	2903.24	Tb II		2908.40	W I	450	2912.08	Ti I
80	2903.44	Er II	780	2908.28	U II	200	2912.16	Fe I
150	2903.55	U II	28	2908.33	Yb II	120	2912.26	Pt I
			100	2908.34	Re I			
95	2903.65	Nb I				30	2912.30	Er II
60	2903.70	V I	80	2908.36	Th II	2100	2912.33	Os I
26	2903.97	Cr II	190	2908.41	U II	150	2912.58	U II
120	2904.02	U II	110	2908.42	Ce II	75	2912.62	Rh I
150	2904.07	Ta I	45	2908.44	V II	40	2912.65	Tb II
29	2904.10	Tm II	100	2908.53	Er II	90	d 2912.66	Th II
85	2904.13	V I	60	2908.69	Tm II		2912.76	Th II
23	2904.27	Th II	2400	2908.82	V II	95	2912.75	U II
1200	2904.41	Hf I	80	2908.88	Nb II	40	2912.82	Er II
150	2904.41	U II	370	2908.88	Ru I	18	2912.86	Yb II
1000	2904.47	Er II	170	2908.91	Ta I	30	2912.91	Ce II
240	2904.51	U II	160	2908.99	Eu I	60	2913.08	Gd II
110	2904.62	Dy II	260	2909.05	Cr I	65	2913.15	Re I
55	2904.68	Cr I	9600	2909.06	Os I	35	2913.17	Ru I
890	2904.75	Hf I	600	2909.12	Mo II	35	2913.32	Ta I
260	2904.80	Ir I	90	2909.12	W I	40	2913.39	Tb II
25	2904.81	Rh I	35	2909.19	Yb II	150	2913.44	U II
160	2905.23	Zr II	30	2909.22	Ru I	35	2913.45	Ta II
170	2905.24	Ta II	190	2909.25	U II	70	2913.52	Mo I
160	2905.27	Mo I	70	2909.37	Dy II	120	2913.54	Pt I
95	2905.42	Tm II	570	c 2909.41	Ho II	240	h 2913.54	Sn I
180	2905.49	Cr I	55	2909.48	Yb II	60	2913.73	Cr I
210	2905.58	Re I	70	2909.56	Ir I	35	2913.74	Dy II
40	2905.64	Ir I	210	2909.58	Er II	55	2913.81	Mo II
140	2905.65	Ru I	110	2909.67	Os I	140	2913.84	Os I
55	2905.66	Ti I	35	2909.69	Dy II	390	2913.95	Dy II
190	2905.73	Os I	23	2909.77	Th II	130	2913.96	Tm II
65	2905.83	Ru I	550	2909.82	Re I	25	2914.01	Ni I
60	2905.90	Pt I	35	2909.88	Dy II	70	2914.09	Ho II
45	2905.93	Th II	140	2909.91	Hf II	210	2914.12	Ta I
110	2905.97	Os I	30	2909.92	Ti II	170	2914.21	Yb II
180	2906.02	Re I	710	2910.02	V II	320	2914.25	U II
65	2906.06	Mo I	55	2910.08	Re I	35	2914.30	Ru I
28	2906.12	Th II	65	2910.17	Rh II	55	2914.30	V I
150	2906.13	V I	90	2910.25	Zr II	140	h 2914.60	Mn I
75	2906.32	Ru I	130	2910.28	Sm II	360	2914.63	U II
190	2906.39	Dy II	110	2910.30	Tb II	100	2914.66	Er I
900	2906.46	V II	1500	2910.36	Er II	75	2914.71	Os I
120	2906.50	Er II	29	2910.37	Tm II	160	2914.75	Tb II
3200	2906.68	Eu II	530	2910.39	V II	170	2914.84	Tm I
780	2906.80	U II	55	2910.40	Ho II	95	2914.84	U II
21	2906.88	Yb II	230	2910.48	W I	380	2914.93	V I
190	2906.91	U II	170	2910.53	Gd II	26	2914.94	Ta I
40	2907.10	Tb II	670	2910.59	Nb II	45	2915.12	Ho II
80	2907.12	Mo II	200	2910.60	Th II	90	2915.12	W I
70	2907.17	Tm II	170	2910.82	U II	22	2915.23	Cr II
160	2907.21	Rh I	260	2910.90	Cr I	50	2915.26	Mo I
40	2907.22	Mn I	270	2911.00	W I	140	2915.28	Yb II
200	2907.24	Ir I	560	2911.06	V II	160	2915.30	Tb II
50	2907.26	W I	70	2911.07	Er II	60	2915.33	V I
70	2907.38	Zr II	250	2911.14	Cr I	170	2915.34	Ta I
35	2907.44	Gd II	90	2911.32	Th II	55	2915.38	Mo I
60	2907.46	Ni I	35	2911.34	Os I	90	2915.42	Rh I
490	2907.47	V II	9000	2911.39	Lu II	22	2915.46	Cr II
25	2907.52	Fe I	85	2911.52	Yb II	310	2915.49	Ta I
28	2907.78	Mo I	95	2911.55	U II	220	d 2915.54	U II
85	d 2907.88	Sm II	45	2911.68	Cr II	30	2915.56	Ce II
			470	2911.74	Nb II	90	2915.59	W I
30	2908.03	Os I	75	2911.77	Tb II	190	2915.60	Tb II
24	2908.16	Mo I	50	2911.87	Tm II	270	2915.62	Er II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
170	2915.82	Ho II	80	2920.24	Er II	120	2925.20	Re I
300	2915.99	Zr II	45	2920.37	Th II	95	2925.22	U II
45	2916.02	V I	380	2920.38	V II	40	2925.28	Os I
50	2916.10	Mo I	50	2920.69	Fe I	110	2925.35	Ho II
120	2916.24	Tb II	45	2920.93	Th II	190	2925.57	Mn I
27	2916.25	Zr I	70	2920.98	Tm II	300	2925.57	Os I
1100	2916.26	Ru I	55	2921.07	Os I	270	2925.57	U II
440	2916.36	Ir I	55	2921.12	Yb II	270	2925.65	Tm II
40	2916.37	Th I	90	2921.24	Cr II	35	2925.66	Ta I
18	2916.43	Yb II	50	2921.26	Nd	70	2925.92	Tm II
220	2916.46	U II	60	2921.26	Tm II	65	2925.94	Tb II
2000	2916.48	Hf I	23	2921.37	Th II	170	2925.98	U II
130	2916.53	Tm II	30	2921.38	Pt I	160	2926.09	Ho II
110	2916.64	Zr II	440	2921.52	Tl I	95	2926.13	U I
45	2916.68	Ce II	160	2921.53	Th II	60	2926.26	V I
65	2916.73	Re II		2921.62	Th II	95	2926.39	U II
45	2917.03	Th II	440	2921.68	U II	100	2926.46	Ta I
65	2917.05	Nb II		2921.72	U II	60	2926.59	Fe II
35	2917.12	Ta I	60	2921.82	Cr II	220	2926.59	U II
530	2917.26	Os I	55	2921.85	Ho II	680	2926.74	Tm II
120	2917.37	V II	95	2922.06	U II	65	2926.93	Re I
160	2917.41	Th II	70	2922.09	Tm II	90	2926.99	Ho II
30	2917.44	Eu II	35	2922.11	Ta II	90	2926.99	W I
30	2917.49	Hf II	35	2922.37	Ce II	320	2926.99	Zr II
35	2917.56	Ta II	520	2922.49	Pd I	70	2927.06	Dy II
50	2917.67	W I	25	2922.58	Ce II	60	2927.08	Cr II
28	2917.77	Ru I	70	2922.60	Ho II	28	2927.12	Ru I
55	2917.79	Th II	70	2922.60	Th II	29	2927.31	Tm II
130	2917.83	Os I	45	2922.80	Th II	60	2927.36	Er II
45	2917.90	Th II	70	2922.84	Ta II	320	2927.38	U II
60	2917.93	V I	70	2922.84	Tm II	830	2927.42	Re I
80	2918.03	Fe I	23	2922.99	Th II	65	2927.54	Mo II
270	2918.24	Zr II	30	2923.10	Rh I	35	2927.54	Ru II
360	2918.25	W I	360	2923.10	W I	95	2927.67	Co I
210	2918.27	Tm II	95	2923.17	U II	50	2927.67	Tm II
2800	2918.32	Tl I	35	2923.18	Os	150	2927.71	Er II
95	2918.37	U II	80	2923.29	Fe I	1100	2927.81	Nb II
45	2918.52	Gd II	80	2923.30	Er II	25	2927.85	Yb II
230	2918.57	Ir I	95	2923.32	Gd II	50	2927.93	W I
580	2918.58	Hf I	1300	2923.39	Mo II	80	2928.15	Cr II
50	2918.63	W II	270	2923.50	U II	90	2928.19	W I
70	2918.65	Dy II	230	2923.54	W I	110	2928.22	Tm II
100	2918.67	Ce II	710	2923.62	V I	250	2928.25	Th II
95	2918.68	U II	50	2923.85	Fe I	160	2928.28	Er II
25	2918.78	Ce II	70	2923.85	Zr I	95	2928.30	Cr II
40	2918.83	Er II	180	2924.02	Rh I	300	2928.30	Ho II
120	2918.83	Mo II	2400	2924.02	V II	35	2928.34	Gd II
65	2918.88	Re I	23	2924.10	Th II	340	2928.34	Ti I
120	2918.89	Tb II	120	2924.16	Tb II	110	2928.45	Er II
95	2918.96	Ta II	45	2924.24	Yb II	490	2928.60	U II
170	2918.97	U II	35	2924.25	Gd II	29	2928.63	Tm II
65	2919.00	Tb II	140	2924.32	Mo II	50	2928.66	W I
160	2919.05	Y I	110	2924.49	Os I	27	2928.68	Mn I
24	2919.20	Mo I	120	2924.53	Tb II	40	2928.70	Th III
100	2919.28	Er II	170	2924.58	U II	16	2928.75	Mg II
70	2919.34	Pt I	160	2924.60	Re I	30	2928.81	Co I
280	2919.35	Yb II	180	2924.62	Hf I	200	2929.01	Fe I
55	2919.38	Mo I	1700	2924.64	V II	60	2929.01	Hf I
100	2919.41	Re I	45	2924.64	Zr II	30	2929.11	Ce II
320	2919.59	Hf II	4400	2924.79	Ir I	130	2929.11	Rh I
150	2919.61	Ru I	850	2925.04	Eu II	170	2929.12	U II
300	2919.62	Ho II	250	2925.05	Th II	350	2929.27	Er II
2100	2919.79	Os I	230	2925.13	W I	40	2929.30	Th II
140	2919.84	Th II	75	2925.19	Ce II	26	2929.44	Cr II
210	2919.99	V II	410	2925.19	Ta I	95	2929.51	Co I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
360	2929.51	Os I	27	2934.02	Mn I	190	2939.27	Ir I
180	2929.53	Re I	55	2934.14	Th II	150	2939.28	Ta I
490	2929.63	Hf II	800	2934.30	Mo II	1500	2939.30	Mn II
220	2929.64	U II	110	2934.31	Dy II	50	2939.32	Er II
100	2929.73	Er II	25	2934.35	Ce II	60	2939.47	Er II
170	2929.78	U II	35	2934.36	Yb I	120	2939.49	U II
1700	2929.79	Pt I	210	2934.40	V II	45	2939.53	Yb II
450	2929.90	Hf I	80	2934.51	Er II	35	2939.54	Ce II
18	h 2930.03	Y II	250	2934.52	Dy II	100	2939.56	Th II
50	2930.06	Mo II	160	2934.61	Zr II		2939.62	Th II
55	2930.13	V II	60	2934.64	Er II	35	2939.94	Ru I
80	2930.15	W I	1200	2934.64	Ir I	95	2940.04	U II
110	2930.19	Os I	260	2934.64	Os I	150	2940.05	Tb II
190	2930.43	U II	55	2934.80	Tb II	470	2940.06	Ta I
1100	2930.50	Mo II	65	2934.84	Mo I	95	2940.10	Mo II
50	2930.56	Tm II	70	2934.85	Ta I	45	2940.22	Cr II
120	2930.57	Os I	690	2935.00	W I	1200	2940.22	Ta I
120	2930.59	U II	55	2935.11	Yb II	55	2940.36	Ru I
270	2930.61	Re I	90	2935.14	Cr II	530	d 2940.37	U II
80	2930.63	Ir I	65	2935.20	Mo II	250	h 2940.39	Mn I
120	2930.64	Er II	27	2935.29	Nb II		2940.48	Mn I
55	2930.77	Mo II	29	2935.49	Tm II	45	2940.52	Yb II
710	2930.81	V II	170	2935.62	U II	140	2940.54	Ir I
35	2930.85	Cr II	50	2935.63	W I	35	2940.59	Th II
45	2930.91	Th II	110	2935.87	V I	35	2940.67	Th II
35	2930.99	Ta I	26	2935.96	Ti	2000	h 2940.77	Hf I
70	2931.00	Dy II	630	2935.99	Tm II	45	2940.79	Ce II
15	2931.03	Ti I	95	2936.01	W I	50	2940.98	Mo I
50	2931.08	Mo I	130	2936.19	Th II	90	2940.99	Ho I
40	2931.09	Tm I	55	2936.24	Ho II	60	2941.04	Mn I
510	2931.28	Os I	160	2936.31	Zr II	110	2941.05	Dy II
75	2931.41	Tb II	55	2936.39	Tb II	40	2941.08	Ir I
580	2931.41	U I	270	2936.45	U II	120	2941.17	Er II
110	2931.47	Nb II	170	2936.47	Th II	110	2941.22	Mo II
80	2931.55	Er II	80	2936.50	Mo I	50	2941.25	W I
60	2931.66	Er II	130	2936.50	Re I	130	2941.34	Fe I
20	2931.83	Sr I	30	2936.54	Mg II	28	2941.34	Th II
220	2931.89	U II	29	2936.59	Tm II	220	2941.34	U II
130	2931.94	Rh I	50	2936.66	W I	150	2941.37	Ta I
120	2932.18	U II	880	2936.68	Ir I	900	2941.37	V II
16	2932.19	Au	95	2936.78	U II	450	2941.49	V II
65	2932.31	Re I	27	2936.81	Os I	60	2941.50	Ta I
70	2932.32	V II	800	2936.90	Fe I	870	2941.54	Nb II
35	2932.36	Er II	130	2936.99	Os I	45	2941.56	Re I
40	2932.45	Os I	95	2937.14	W I	85	2941.70	Tb II
70	2932.58	Tm II	21	2937.19	Yb II	90	2941.71	Er II
30	2932.60	Er II	150	2937.32	Ti I	23	2941.89	Th II
440	2932.61	U II	35	2937.33	Nb II	1300	2941.92	U II
1100	2932.63	In I	120	2937.35	U II	1100	2942.00	Ti I
28	2932.64	Th II	70	2937.44	Th II	28	2942.04	Yb II
35	h 2932.66	Nb II	85	2937.48	Sm II	220	2942.05	Ho II
26	2932.70	Cr II	120	2937.66	Mo I	20	h 2942.11	Mg I
310	2932.70	Ta I	90	2937.69	V I	220	2942.12	U II
160	2932.89	Tb II	710	2937.80	Hf II	240	2942.14	Ta I
80	2932.97	Tm I	35	2938.00	Ta II	110	2942.20	Os I
1100	2933.06	Mn II	95	2938.07	Nb I	140	2942.21	Er II
55	2933.10	Th II	28	2938.10	Th II	230	d 2942.33	V I
1700	2933.55	Ta I	30	h 2938.25	V II		2942.35	V I
180	2933.55	Ti I	3200	2938.30	Bi I	55	2942.59	Ho II
29	2933.78	Tm II	40	2938.30	Mo II	130	2942.63	Th II
75	2933.79	Tb II	40	2938.38	Os I	30	2942.76	Pt I
340	2933.86	U II	35	2938.43	Ta I	55	2942.85	Mo I
40	2933.88	Tm II	250	2938.47	Ir I	200	2942.85	Os I
55	2933.97	Cr II	220	2939.04	U II	270	2942.85	U II
40	2933.98	Os I	140	2939.05	W I	340	2942.86	Th II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
440	2943.14	Re I	150	2947.06	Dy II	210	2952.29	W II
2700	2943.15	Ir I	55	2947.13	Hf II	130	2952.34	Os I
120	2943.18	U II	150	2947.21	Dy II	70	2952.36	Ho II
230	2943.20	V I	95	2947.28	Mo II	35	2952.43	Gd I
70	2943.36	Tm II	60	2947.29	Eu II	50	2952.47	Tm II
120	2943.40	U II	480	2947.39	W I	35	2952.50	Ru I
70	2943.49	Sm II	270	2947.43	U II	200	2952.68	Eu II
9500	2943.64	Ga I	35	2947.80	Gd II	55	2952.73	Ho II
35	2943.77	Ta I	800	2947.88	Fe I	100	2952.99	Ta II
830	2943.90	U II	140	2948.00	Tm II	55	2953.03	Dy II
500	2943.91	Ni I	70	2948.01	Gd II	250	2953.11	Ho II
75	2943.92	Ru I	340	2948.09	U II	150	2953.19	Sm II
30	2943.97	Pr II	95	2948.15	Tm II	55	2953.36	Cr II
100	2944.07	Er II	1100	2948.23	Os I	50	2953.56	Mo I
1500	2944.18	Ga I	1300	2948.26	Ti I	340	2953.56	Ta I
170	2944.19	U II	250	2948.31	Dy II	60	2953.58	Tm II
140	2944.21	Mo I	390	2948.40	Y I	140	2953.70	Dy II
65	2944.32	Re I	35	2948.43	Fe I	45	2953.71	Cr II
60	2944.35	Ce II	95	2948.44	U II	600	2953.94	Fe I
35	2944.40	Fe II	150	2948.80	Er II	20	2954.02	Nb II
2400	2944.40	W I	290	2948.94	U II	1100	2954.20	Hf I
300	2944.49	Ho II	320	2948.94	Zr II	70	2954.28	Ho II
140	2944.56	Dy II	55	2949.04	Tb II	120	2954.33	V I
1100	2944.57	V II	150	2949.07	Th II	120	2954.34	Re I
160	2944.71	Hf I	120	2949.09	Re I	220	2954.39	U II
30	2944.75	Pt I	60	2949.17	V II	150	2954.49	Ru I
150	2944.82	Mo II	1900	2949.20	Mn II	40	2954.53	Nb II
85	2944.90	Tb II	30	2949.26	Er II	30	2954.58	Ti
23	2944.95	Th II	370	2949.50	Ru I	390	2954.77	U II
35	2945.04	Ho II	1400	2949.53	Os I	45	2954.89	Th II
270	2945.28	Er II	220	2949.61	U II	95	2954.90	W I
80	2945.43	Mo I	230	2949.63	V I	70	2954.94	Ho II
90	2945.46	Zr II	270	2949.73	Lu I	85	2955.00	Os I
140	2945.66	Mo I	200	2949.76	Ir I	55	2955.04	Th II
180	2945.67	Ru II	210	2949.81	Os I	50	2955.05	Tm II
35	2945.69	Ta I		2949.90	Os I	35	2955.27	Ho II
95	2945.70	Tb II	65	2949.88	Re I	100	2955.32	Ta II
55	2945.83	Ho II	35	2949.92	Ta II	45	2955.32	Yb II
110	h 2945.88	Nb II	90	2949.93	Th II	60	2955.37	Er II
220	2945.89	U II	95	2949.97	U I	30	2955.41	Rh I
140	2945.91	Yb II	55	2950.04	Tb II	35	2955.45	Nb I
280	h 2945.94	Y III	80	2950.07	Er II	45	2955.60	Ce II
190	2945.95	Mo II	35	2950.07	Tm II	50	2955.60	Er II
	2946.01	Mo I	50	2950.30	Ce II	35	2955.60	Gd II
110	2946.12	Nb II	170	2950.33	Dy II	55	2955.60	Th II
28	2946.26	Th I	28	2950.33	Yb II	240	2955.65	U II
45	2946.30	Yb II	300	2950.35	V II	60	2955.78	Lu II
85	2946.31	Dy II	80	2950.44	Th II	320	2955.78	Zr II
140	2946.42	Mo I	110	2950.50	La II	90	2955.80	V I
40	2946.43	Er II	1200	2950.68	Hf I	95	2955.84	Mo II
110	2946.53	V I	130	2950.83	Re I	35	2955.85	Th II
65	2946.57	Re I	1100	2950.88	Nb II	120	2955.94	Ce II
28	2946.61	Th II	70	2951.20	Th II	240	2956.06	Mo II
230	2946.62	Er II	1200	2951.22	Ir I	580	2956.06	U II
140	2946.69	Mo II	90	2951.26	Er II	1600	2956.13	Ti I
18	2946.76	Yb II	350	2951.26	Tm II	250	2956.21	Tb II
95	2946.77	Dy II	210	2951.48	Zr II	60	2956.45	Er II
95	2946.83	Tm II	1200	2951.69	Lu II	30	2956.71	Ce II
60	2946.84	Cr II	50	2951.80	Tm II	170	2956.78	U II
75	2946.87	Tb II	27	2951.90	Hf I	170	2956.80	Ti I
110	2946.90	Nb II	510	2951.92	Ta I	120	c 2956.84	Ta II
150	2946.91	Ta I	120	2951.93	U I	40	2956.89	Nb II
230	2946.97	Ir I	640	2952.08	V II	70	2956.90	Mo II
180	2946.99	Ru I	110	2952.12	Dy II	80	2956.95	Er II
2400	2946.99	W I	95	2952.24	Zr II	20	c 2957.01	In I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
29	2957.04	Tm II	410	2962.77	V I	45	2966.05	Cr II
95	2957.08	Os I	55	2962.78	Tb II	170	2966.12	U II
40	2957.32	Tb	240	2962.78	U II	60	2966.17	Er II
85	2957.33	V I	65	2962.87	Re I	95	2966.58	W I
320	2957.36	Fe I	55	2962.88	Nd II	240	2966.66	U II
70	2957.41	Ho II	140	2962.89	Mo I	1700	2966.90	Fe I
260	2957.52	V II	150	2962.99	Ir I	620	2966.93	Hf I
60	2957.54	Tm II	35	2963.06	Ta I	50	2967.07	W I
170	2957.58	Th II	21	2963.26	Yb II	190	2967.22	Ti I
170	2957.60	Ta I	4200	2963.32	Lu II	140	2967.23	Hf II
18	2957.63	Yb II	1500	2963.32	Ta I	90	2967.25	Re I
29	2957.66	Tm II	18	2963.40	Ru II	1200	2967.28	Hg I
27	2957.68	Co I	45	2963.46	Yb II	50	2967.55	W I
40	2957.70	Tb II	65	2963.58	Nd II	30	2967.58	Pr II
170	d 2957.74	U II	130	2963.60	Gd II	480	2967.64	Cr I
85	2957.75	Dy II	28	2963.61	Th II	120	2967.75	Tm II
85	h 2957.75	Mo I	40	2963.68	Nb I	80	2967.94	Er II
35	2957.88	Ta II	150	2963.70	Er II	580	2967.94	U II
130	h 2957.91	Re II	55	2963.72	Ru I	180	2968.04	Re I
90	2957.92	Th II	250	2963.79	Mo II	26	2968.23	Ti I
75	2958.00	Ru I	28	2963.88	Th II	35	2968.28	Ta II
540	2958.02	Hf I	80	2963.90	Er II	600	2968.38	V II
120	2958.10	U II	120	2963.91	Ta I	170	2968.40	U II
70	2958.14	Th II	95	2963.97	Tb II	30	2968.45	Os I
55	2958.34	Os I	28	2964.00	Th II	60	2968.47	Er II
30	2958.77	Ti	450	2964.06	Os I	55	2968.48	Ru I
90	2958.89	Er II	55	2964.11	Th II	35	2968.49	Ir I
30	2958.91	Eu I	60	2964.25	Er II	230	2968.66	Rh I
25	2959.10	Pt I	240	2964.25	U II	270	2968.69	Th II
50	2959.11	Ce II	70	c 2964.40	Ho II	410	2968.76	Er II
35	2959.47	Eu II	1500	2964.52	Er II	710	2968.81	Hf II
80	2959.48	Mo I	440	2964.52	W I	170	2968.87	Tb II
180	2959.64	Tm II	220	2964.60	Dy I	85	2968.95	Ru I
26	2959.71	Ti I	55	2964.62	Os I	320	2968.96	Zr II
28	2959.74	Ru I	55	2964.74	Dy II	90	2968.98	Re II
80	2959.80	Mo I	85	2964.76	Tb II	160	2969.02	Sm II
240	2959.85	U II	130	2964.76	Yb II	120	2969.19	Zr I
28	2959.88	Th II	110	2964.80	Ce II	40	2969.36	Fe I
20	2959.97	Nb I	60	2964.83	Er II	28	2969.38	Th II
80	2959.99	Fe I	1400	2964.88	Hf I	340	2969.47	Ta I
35	2959.99	Ti I	110	2964.92	Th II	80	2969.48	Fe I
60	2960.12	Er II	50	2964.96	Mo II	120	2969.50	Tm II
95	2960.15	W I	350	2964.96	Y I	80	2969.62	W I
260	2960.21	Eu II	460	2965.03	U II	230	2969.63	Zr II
95	2960.24	Mo II	35	2965.10	Os	2400	2969.82	Lu II
65	2960.58	Tb II	720	2965.11	Re I	45	2969.82	Th I
60	2960.75	Pt I	770	2965.13	Ta II	70	2969.90	Ta I
60	2960.82	Hf II	550	2965.16	Ru I	150	2970.06	Er II
320	2960.87	Zr I	50	2965.20	Ir I	340	2970.10	Fe I
70	2960.93	Gd II	60	2965.21	Er II	45	2970.32	Ce II
300	2961.01	Os I	180	2965.26	Fe I	75	2970.38	Ti I
240	2961.16	Cu I	85	2965.27	Ce II	35	d 2970.40	Nb II
50	2961.39	Tm II	210	2965.27	Mo II		2970.47	Nb II
75	2961.69	Ru I	55	2965.32	Tb II	120	2970.48	U II
55	2961.73	Cr II	80	2965.43	Gd II	2000	2970.56	Yb II
140	2961.74	Re I	80	2965.48	Nb I	35	2970.69	Os I
120	2961.80	Hf II	110	2965.50	Th II	60	2970.96	Er II
530	2962.15	Os I	770	2965.54	Ta I	740	2970.97	Os I
270	2962.27	Re I	170	2965.55	Ru II	580	2971.06	U II
110	2962.33	Os I	170	2965.71	Ti I	480	2971.11	Cr I
85	2962.36	Dy II	1500	2965.76	Re I	30	2971.13	Pr II
120	h 2962.49	Er II	340	2965.86	Sc I	50	2971.26	Er II
65	2962.52	Yb II	430	2965.86	Tm II	40	d 2971.40	Pr II
320	2962.68	Zr II	80	2965.87	Er II		2971.46	Pr II
85	2962.74	Sm II	95	2965.92	Ta II	110	2971.48	Th II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
80	d 2971.63	Er II	310	2976.29	Re I	160	2981.02	Zr II
	2971.73	Er II	410	2976.35	U II	120	2981.04	U II
150	2971.68	W I	380	2976.52	V II	60	2981.19	Ta I
210	2971.91	Cr II	140	2976.59	Ru II	60	2981.20	V II
70	2971.91	Mo II	130	2976.61	Zr II	160	2981.34	Th II
80	2972.22	Th II	28	2976.65	Th II	280	2981.45	Fe I
110	2972.25	Os I	30	2976.72	Cr II	180	2981.46	Ho II
120	2972.25	V II	60	2976.76	Ta I	540	2981.48	Tm II
150	2972.27	Er II	95	2976.80	W I	160	2981.49	Th II
55	2972.43	Ho II	400	2976.91	Ce II	120	2981.52	Mo I
400	2972.57	Nb II	550	2976.92	Ru I	65	2981.64	Nb I
100	2972.58	Ce II	480	2977.11	W I	570	2981.65	Ni I
250	2972.61	Mo II		2977.21	W I	28	2981.84	Th II
29	2972.74	Gd II	45	2977.23	Ru II	12	2981.85	Fe I
150	2972.92	W I	50	2977.27	Mo I	85	2981.91	Ce II
80	2972.96	Mo I	290	2977.27	U II	55	2981.94	Ru I
390	2973.00	Ho II	65	2977.30	Re I	40	2981.99	Tb II
130	2973.06	Os I	110	2977.42	Dy II	28	2982.00	Th II
240	2973.08	U II	150	2977.46	Ce II	200	2982.11	Nb II
600	2973.13	Fe I	240	2977.54	V I	220	2982.19	Re I
490	2973.22	Tm I	70	2977.60	Hf II	45	2982.49	Yb II
1200	2973.24	Fe I	450	2977.64	Os I	75	2982.56	Os
290	2973.26	U II	210	2977.68	Nb II	150	2982.61	W I
110	2973.37	Hf I	160	2977.68	Rh I	21	2982.66	Yb II
160	2973.38	Tm II	170	2977.78	Tb II	210	2982.72	Hf I
110	2973.54	Th II	320	2978.05	Zr II	320	2982.74	U II
150	2973.74	Er II	240	2978.14	U II	510	2982.90	Os I
18	2973.91	Y II	210	2978.15	Re I	28	2983.02	Th II
35	2973.99	Ru I	100	2978.18	Ta II	50	2983.04	Mo I
1200	2974.01	Sc I	110	2978.21	Os I	110	2983.06	Er II
220	2974.01	Th II	180	2978.28	Mo I	70	2983.12	Tm II
25	2974.03	Rh I	150	2978.42	Tm II	40	2983.14	Nb I
27	2974.10	Ir I	95	2978.53	Os I	140	2983.22	Er II
320	2974.10	Nb II	170	2978.75	Ta I	170	2983.31	Ti I
40	2974.15	Tb II	60	2978.94	Nb II	100	2983.43	Sm II
45	2974.22	V I	230	2979.18	Zr II	340	2983.49	Os
110	2974.28	Tm II	150	2979.28	Hf I	1400	2983.57	Fe I
28	2974.34	Ru I	85	2979.43	Os I	55	2983.57	Th II
210	2974.47	Er II	35	2979.44	Tm II	28	2983.70	Yb II
50	2974.48	Ce II	410	c 2979.63	Ho II	35	2983.74	Gd II
480	2974.59	Y I	50	2979.65	Dy II	270	2983.80	Er II
29	2974.60	Tm II	730	d 2979.71	W I	65	2983.81	Mo I
50	2974.61	Ce II		2979.86	W I	140	2983.82	Th II
30	2974.93	Ti I	75	2979.72	Ru I	200	2983.99	Yb II
200	2974.95	Ir I	190	2979.74	Cr II	55	2984.05	Hf I
75	2975.02	Re I	55	2979.88	Nb II	80	2984.07	Ho II
240	2975.22	U II	40	2979.95	Er II	250	2984.13	Ni I
55	2975.24	Ho II	75	2979.96	Ru II	95	2984.14	W I
120	2975.25	Re I	28	2980.11	Th I	750	2984.26	Y I
110	2975.34	Os I	560	2980.15	Gd II	60	2984.36	Ta I
80	2975.40	Mo II	120	2980.28	U II	50	2984.56	Ce II
480	2975.48	Cr I	55	2980.33	Th II	530	2984.61	U II
40	2975.55	Dy II	120	2980.41	Ce II	65	2984.75	Re I
430	2975.56	Ta I	10	2980.54	Fe I	120	2984.78	Fe I
170	2975.64	U II	30	2980.55	Y II		2984.83	Fe II
90	2975.65	V II	160	h 2980.63	Cd I	50	2984.98	Pr II
230	2975.68	Er II	55	2980.64	Ho II	55	2985.05	Nb II
85	2975.85	Dy II	440	2980.65	Ir I	70	2985.08	Tm II
890	2975.88	Hf II	120	2980.69	U II	95	2985.08	U II
290	2975.88	U II	95	2980.72	Nb II	90	2985.08	Yb II
110	2976.02	Th II	1400	2980.75	Sc I	50	2985.16	Mo I
85	2976.10	Ta I	350	2980.79	Cr I	160	2985.24	Th II
10	2976.13	Fe I	1100	2980.81	Hf I	110	2985.32	Cr II
120	2976.20	V II	220	2980.82	Re I	130	2985.37	Tm II
85	2976.26	Ta II	65	2981.01	Re I	820	2985.39	Zr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
140	2985.48	Ho II	40	2989.84	Tb II	35	2994.96	Ca I
130	2985.52	Er I	290	2989.88	U II	460	2994.96	Ru I
130	2985.61	Os I	95	2990.21	U II	300	2995.10	Cr I
150	2985.80	Ir I	30	2990.22	Pr II	30	2995.15	Co I
170	d 2985.80	U II	330	2990.26	Nb II	35	2995.22	Eu II
60	2985.82	Ce II	250	2990.27	Ho II	240	2995.26	W I
50	2985.84	Mo I	45	2990.37	Yb II	70	2995.26	Y I
480	2985.85	Cr I	50	2990.39	Fe I	28	2995.27	Th II
35	2985.88	Yb II	150	2990.51	W I	170	2995.40	Re I
35	2985.91	Ce II	630	2990.54	Tm II	50	2995.43	Dy II
110	2985.97	Dy II	190	2990.62	Ir I	40	2995.47	Er II
1500	2986.00	Cr I	50	2990.71	W I	320	2995.64	Ce II
30	2986.18	Pr II	250	2990.87	Ce II	110	2995.86	Ho II
450	2986.20	Rh I	30	2990.99	As I	28	2995.86	Yb II
12	2986.46	Fe I	150	2991.06	Th II	130	2996.00	Tb II
2100	2986.47	Cr I	100	2991.25	Ta I	75	2996.00	V II
350	2986.52	Tm II	300	2991.33	Eu II	300	2996.08	Ir I
25	2986.67	Ce II	85	2991.36	Dy II	120	2996.10	U II
80	2986.79	Th II	50	2991.41	Zr II	90	2996.37	Er II
120	2986.81	Ta II	40	2991.52	Gd II	10	2996.39	Fe I
90	2986.99	Rh I	60	2991.57	Sm II	120	2996.39	U II
110	2987.03	Tb II	70	2991.61	Dy II	700	2996.58	Cr I
690	2987.16	Co I	35	2991.62	Ru II	55	2996.90	Ru I
120	2987.29	Fe I	90	2991.70	Th II	140	2996.94	Y I
85	2987.29	Nb I	35	2991.72	Ce II	110	2996.99	Th II
40	2987.31	Er II	65	2991.87	Yb II	70	2997.19	Ir I
50	2987.45	Rh I	480	2991.89	Cr I	28	2997.20	Th I
410	2987.64	Ho II	25	2991.90	Ce II	20	2997.31	Ca I
150	2987.65	Si I	80	2991.95	Nb II	40	2997.36	Cu I
28	2987.67	Th I	85	2991.96	Tb II	180	2997.41	Ir I
170	2987.80	U II	150	2992.11	Os I	28	2997.43	Ru I
25	2987.80	Zr II	1800	2992.36	Re I	260	2997.65	Os I
35	2987.88	Dy II	55	2992.41	Dy II	190	2997.79	W I
110	2987.92	Mo I	50	2992.54	Tb II	80	2997.87	Er II
95	2987.95	U II	500	2992.60	Ni I	1800	2997.97	Pt I
90	2988.02	V II	90	c 2992.71	Ho II	70	2998.06	Er II
30	2988.20	Er II	410	2992.72	U II	90	2998.29	Ho II
80	2988.23	Mo I	65	2992.82	Re I	90	2998.35	Ru I
360	2988.23	Th II	95	2992.84	Mo II	120	2998.36	U I
65	2988.26	Os I	35	2992.88	Tm II	50	2998.77	Ce II
290	2988.42	U II	95	2993.04	Gd II	210	2998.79	Cr I
220	2988.47	Re I	80	2993.20	Nd II	110	2999.03	Tb II
110	2988.57	Tb II	200	2993.26	Tm II	170	2999.03	U II
190	2988.58	Ta I	110	2993.27	Ru I	1200	2999.04	Gd II
660	2988.65	Cr I	700	2993.34	Bi I	180	2999.09	Th II
160	2988.68	Mo I	50	2993.52	Mo II	170	2999.22	U II
65	d 2988.69	Nb I	110	2993.57	Os I	45	2999.24	V I
50	2988.79	Nb I	400	2993.61	W I	28	2999.27	Th II
240	2988.71	Dy II	70	2993.63	Th II	70	2999.37	Ta II
1400	2988.95	Ru I	170	2993.70	U II	22	2999.43	Ce II
340	2988.95	Sc I	160	2993.80	Th II	22	2999.48	Ce II
2800	2989.03	Bi I	120	2993.90	Tm II	360	2999.51	Fe I
60	2989.05	Ta I	28	2993.94	Yb II	5500	2999.60	Re I
110	2989.13	Os I	230	2994.07	Cr I	130	2999.60	Tm II
160	2989.19	Cr II	30	2994.09	Er II	20	2999.64	Ca I
1800	2989.27	Lu I	29	2994.33	Tm II	45	2999.80	Th II
140	2989.31	Er II	110	2994.42	Ce II	75	3000.07	Ce II
190	2989.50	Ta I	1200	2994.43	Fe I	170	3000.09	U II
80	2989.56	Er II	120	2994.45	U II	170	3000.10	Hf II
690	2989.59	Co I	1000	2994.46	Ni I	27	3000.12	Nb I
45	2989.60	V II	110	2994.47	Er I	50	3000.23	Mo I
35	2989.66	Ru I	75	2994.54	V II	50	3000.24	W I
70	2989.77	Dy II	470	2994.73	Nb II	50	3000.45	Fe I
190	2989.80	Mo I	40	2994.73	Nd II	70	3000.46	Yb II
			170	2994.80	Yb II	120	3000.55	Co I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
70	3000.69	Ho II	190	3005.52	U II	90	3011.16	Er II
20	3000.86	Ca I	800	3005.56	Hf I	40	3011.16	Mn I
35	3000.87	Ti I	65	3005.77	Nb II	80	3011.24	Hf II
1100	3000.89	Cr I	310	3005.77	Yb II	40	3011.38	Mn I
1100	3000.95	Fe I	35	3006.00	Th II	50	3011.48	Fe I
70	3000.97	Th II	40	3006.26	Eu II	120	3011.48	U I
350	3001.14	Re I	60	3006.35	Tm II	55	3011.60	Th II
35	3001.15	Tm II	200	3006.42	Re I	160	3011.69	Ir I
260	3001.20	V II	40	3006.56	Ta I	820	3011.75	Zr I
120	3001.21	U II	440	3006.59	Ru I	50	3011.88	Ce II
180	3001.26	Th II	70	3006.86	Ca I	210	3011.88	Ta I
50	3001.54	Ta I	110	3006.93	Th II	130	3011.92	Re I
55	3001.64	Ru I	45	3007.08	Ho II	3700	3012.00	Ni I
80	3001.98	W I	55	3007.11	Tb II	55	3012.07	Ho II
160	3002.14	Ce II	35	3007.14	Fe I	130	3012.19	Gd II
190	3002.21	Mo I	100	3007.28	Fe I	95	3012.45	U II
65	3002.21	Nb II	130	3007.62	Th II	230	3012.47	Er II
220	3002.25	Ir I	40	3007.66	Mn I	1800	3012.54	Ta II
220	3002.27	Pt I	110	3007.80	Th II	85	3012.71	Th II
85	3002.38	Dy II	95	3007.90	Os I	170	3012.71	U II
220	3002.40	Th II	360	3007.91	U II	1100	3012.90	Hf II
1200	3002.41	Er II	70	3007.95	Th II	55	3012.92	Ru I
75	3002.45	Tb II	95	3007.97	Nd II	140	3013.03	Cr I
4000	3002.49	Ni I	320	3008.10	Ho II	330	3013.07	Os I
25	3002.61	Yb II	85	3008.13	Ce II	90	3013.10	V II
120	3002.64	U II	900	3008.14	Fe I	190	3013.14	Re I
310	3002.65	Er II	150	3008.19	Er II	100	3013.32	Zr II
650	3002.65	Pd I	35	3008.26	Ru I	55	3013.36	Ru I
190	3002.75	Ce II	70	3008.28	Th II	240	3013.37	U II
50	3002.83	W I	180	3008.50	Th II	130	3013.39	Mo I
370	3002.86	Gd II	45	3008.61	V II	170	3013.44	U II
35	3002.98	Ta II	400	3008.79	Ce II	80	3013.46	Pr II
100	3003.03	Fe I	55	3008.80	Ru I	70	3013.59	Tm II
240	3003.07	U II	55	3008.81	Dy II	330	3013.60	Co I
290	3003.32	U II	120	3008.91	Tm II	70	3013.60	Th II
90	3003.46	V II	190	3009.09	W I	65	3013.61	Tb II
170	3003.48	Os I	7000	3009.14	Sn I	710	3013.71	Cr I
120	3003.56	Ce II	30	3009.20	Ca I	230	3013.71	Tm II
70	3003.58	Gd II	29	3009.20	Tm II	140	3013.76	Mo I
600	3003.63	Ir I	170	3009.30	Tb II	360	3013.79	W I
2200	3003.63	Ni I	70	3009.37	Gd II	60	3013.84	Er II
320	3003.74	Zr II	100	3009.39	Yb II	30	3013.96	Er II
110	3003.76	Dy II	290	3009.42	U II	95	3014.19	Nd II
90	3003.83	Er II	40	3009.44	Er II	55	3014.43	Yb II
120	3003.85	U II	160	3009.48	Ho II	65	3014.44	Zr I
220	3004.14	Re I	280	3009.57	Fe I	220	3014.60	Ho II
70	3004.15	Ta I	35	3009.65	Gd II	30	3014.62	Er II
240	3004.15	U II	50	3009.70	Er II	430	3014.65	Tm II
29	3004.16	Tm II	70	3009.77	Th II	40	3014.67	Mn I
65	3004.34	Re I	45	3009.78	Pd I	710	3014.76	Cr I
40	3004.46	Mo II	40	3009.90	Ir I	140	3014.82	V II
110	3004.46	Rh I	55	3010.12	Tb II	120	3014.88	U II
85	3004.58	Tb II	2100	3010.13	Gd II	1400	3014.92	Cr I
75	3004.92	Ta II	50	3010.26	Mo I	40	3014.93	Th II
60	3005.05	Er II	80	3010.31	Er II	140	3015.07	Dy II
750	3005.06	Cr I	120	3010.37	U II	710	3015.19	Cr I
100	3005.09	Gd II	40	3010.38	Nb II	1500	3015.30	Tm II
220	3005.10	U II	230	3010.59	Tb II	2200	3015.36	Sc I
40	3005.14	Nb I	65	3010.62	Yb II	120	3015.65	Os I
80	3005.21	Ir I	40	3010.69	Nb II	220	3015.68	Dy II
70	3005.26	Y I	170	3010.75	U II	120	3015.68	U II
45	3005.29	Ho II	70	3010.84	Cu I	85	3015.72	Th II
100	3005.37	Zr I	110	3010.84	Ta II	500	3016.02	Re I
160	3005.50	Zr I	80	3010.90	Gd II	95	3016.05	U II
130	3005.52	Tb II	180	3011.12	Ta I	70	3016.09	Tm II
						d	3016.18	Tm II

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
75	3016.16	V I	50	3020.33	Er II	190	3026.15	U II
80	3016.18	Fe I	350	3020.47	Zr II	390	3026.16	Dy II
230	3016.18	Tb II	600	3020.49	Fe I	120	3026.37	Co I
110	3016.21	Ho II	1200	3020.53	Hf I	120	3026.43	U II
			3000	3020.54	Lu II	180	3026.46	Fe I
70	3016.37	Ta I	120	3020.57	U II	80	3026.47	Nd II
120	3016.43	Ir I	2800	3020.64	Fe I	26	3026.49	Y II
60	3016.45	Mn I	430	3020.67	Cr I	150	3026.57	Th II
520	3016.47	W I	65	3020.67	Nb I	35	3026.62	Ce II
300	3016.49	Re I	95	3020.86	Os	85	3026.65	Cr II
540	3016.78	Hf I	75	3020.88	Ce II	310	d 3026.67	W I
80	3016.78	Mo I	310	3020.88	Ru I		3026.79	W I
180	3016.78	V II	120	3020.92	U II	160	3026.67	Yb II
35	3016.79	Tm II	100	3021.01	Sm	190	3026.70	U II
230	3016.84	Er II	50	3021.04	Ce II	120	3027.29	Lu II
1100	3016.94	Hf II	1600	3021.07	Fe I	170	3027.33	Tb II
180	3016.95	Dy II	320	3021.22	U II	290	d 3027.48	Ta I
290	3016.96	U II	40	3021.49	Th II		3027.61	Ta II
40	3016.97	Re I	200	3021.50	Hg I	85	3027.56	Dy II
270	3017.09	Tm II	2800	3021.56	Cr I	50	3027.58	Tb II
			130	3021.73	Y I	1900	3027.60	Gd II
85	3017.13	Th II	120	3021.88	Re I	25	3027.63	Ce II
120	3017.19	Ti II	55	3021.95	Tb II	240	3027.66	U I
370	3017.20	Ce II	35	3022.07	Tm II	95	3027.77	Mo II
330	3017.24	Ru I	110	3022.09	Th II	1500	3027.91	Pd I
570	3017.25	Os I	40	3022.10	Gd II	500	3028.04	Zr II
70	3017.26	Tm II	35	3022.15	Eu I	110	3028.18	Ho II
270	3017.31	Ir I	630	3022.21	U II	320	3028.19	U II
170	3017.35	U II	90	3022.28	Y I	270	3028.27	Er II
27	3017.37	Hf I	80	3022.41	Ir I	50	3028.43	Rh I
770	3017.44	W I	60	3022.73	Er II	350	3028.44	Nb II
690	3017.55	Co I	65	3022.74	Nb II	130	3028.58	Th II
160	3017.56	Yb II	70	3022.75	Mn I	55	3028.73	Tm II
2800	3017.57	Cr I	30	3022.79	Ce II	90	3028.78	Ta I
200	3017.63	Fe I	60	3022.99	Re I	60	3028.96	Ce II
45	3017.73	Ho II	160	3023.14	Ho II	120	3028.98	Gd II
120	3017.74	Er II	25	3023.43	Ce II	220	3029.13	U II
30	3017.88	Pt I	110	3023.43	Tb II	170	3029.16	Cr I
4400	3018.04	Os I	35	3023.49	Ce II	320	3029.20	Au I
150	3018.10	U II	75	3023.70	Tb II	85	3029.23	Tb II
70	3018.16	Ho II	130	3023.91	Rh I	50	3029.27	Pr II
29	3018.26	Tm II	260	3024.03	Fe I	380	3029.36	Ir I
980	3018.31	Hf I	90	3024.09	Ta I	120	3029.42	U II
95	3018.35	Nd II	1100	3024.35	Cr I	880	3029.52	Zr I
110	3018.49	Th II	130	c 3024.38	Ho II	140	3029.73	Ti II
430	3018.50	Cr I	170	3024.38	U II	35	3029.74	Nb II
			110	3024.50	W II	210	3029.81	Dy II
95	3018.59	Tm II	320	3024.51	U II	500	3029.83	Sb I
120	3018.59	U II	35	3024.57	Ce II	190	3030.15	Fe I
240	3018.82	Cr I	80	3024.60	Hf I	710	3030.24	Cr I
55	3018.95	Y I	2400	3024.64	Bi I	110	3030.29	Ta I
180	3018.98	Fe I	40	3024.67	Th II	170	3030.31	Ce II
			140	3024.74	Nb II	110	3030.40	Dy II
350	3019.14	Ni I	80	3024.76	Hf II	380	3030.45	Re I
130	3019.17	Tb II	210	3024.93	W I	40	3030.49	Th I
140	3019.23	Ir I	250	3025.00	Mo I	45	3030.65	Gd II
2700	3019.34	Sc I	180	3025.16	Ta I	1100	3030.70	Os I
18	3019.37	Ru I	140	3025.29	Hf II	360	3030.76	Sc I
			170	3025.59	Dy II	120	3030.83	U II
480	3019.38	Os I	180	3025.64	Fe I	40	3030.86	Th II
110	3019.42	Th II	110	3025.82	Ir I	180	3030.92	Zr II
50	3019.54	Rh I	380	3025.84	Fe I	120	3031.01	Os I
60	3019.67	Ta I	290	3025.95	Er II	70	3031.01	V I
100	3019.76	Er II	330	3026.07	Tm II	55	3031.06	Mn II
			70	c 3026.13	Ho II	920	3031.11	Yb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
85	3031.15	Dy II		3036.50	Zr II	50	3042.07	Tb II
	3031.19	Dy II	60	3036.55	Re I	50	3042.09	Dy II
410	3031.16	Hf II	30	3036.59	Y II	90	3042.26	V II
85	3031.20	Th I	120	3036.61	U II	60	3042.29	Re I
	3031.29	Th II	120	3036.70	Dy II	280	3042.35	Tm II
190	3031.22	Fe I						
			550	3037.04	Cr I	110	3042.44	Ta II
60	3031.27	Re I	50	3037.04	Tb II	210	3042.48	Co I
75	3031.30	Os I	950	3037.39	Fe I	220	3042.48	Ru I
370	3031.31	Er II	110	3037.50	Ta II	50	3042.50	Tb II
140	3031.35	Cr I	210	3037.73	Ce II	800	3042.64	Pt I
230	3031.60	Tb II	95	3037.75	Ir I	35	3042.65	Ir II
190	3031.64	Fe I	1700	3037.94	Ni I	80	3042.65	Yb II
75	3031.67	Tm II	100	3037.96	Re I	190	3042.66	Fe I
40	3031.70	Th II	25	3037.99	Yb II	27	3042.73	Mn I
120	3031.87	Ni I	190	3038.05	U II	95	3042.73	U II
70	3031.96	Th II	60	3038.18	Ru I	120	3042.74	Os II
630	3031.99	U II	610	3038.28	Dy II	60	3042.83	Ru I
70	3032.41	Ir I	85	3038.60	Th II	40	3042.83	Tb II
25	3032.71	Pr II	85	3038.66	Tb II	130	3043.01	Gd I
35	3032.73	Ce II	270	3038.69	Ho II	130	3043.06	Th II
300	3032.77	Nb II	50	3038.98	Nd II	230	3043.12	V I
60	3032.79	Re I	7500	3039.06	Ge I	280	3043.13	Dy II
400	3032.80	Sn I	100	3039.13	Sm II	30	3043.25	Zr I
95	3032.81	Os I	190	3039.14	U II	50	3043.29	Nd
85	3032.83	Tb II	330	3039.26	Ir I	85	3043.36	Mn I
2100	3032.84	Gd II	240	3039.26	U II	170	3043.43	Dy II
80	3032.85	As I	160	3039.31	W I	210	3043.50	Os I
28	3032.93	Cr II	8000	3039.36	In I	230	3043.56	V I
75	3033.12	Ce II	35	3039.41	Nb II	120	3043.64	Os I
95	3033.19	Dy II	45	3039.51	Ce II	95	3043.65	Tb II
490	3033.19	U II	55	3039.67	Yb II	190	3043.79	U II
130	3033.44	Ho II	65	3039.68	Nb I	270	3043.80	W I
240	3033.45	Ru I	80	3039.78	Cr I	75	3043.92	Ta I
270	3033.45	V II	50	3039.82	Mo I	3100	3044.00	Co I
160	3033.56	W I	40	3039.82	Nb II	21	3044.00	Yb II
40	3033.62	Ir I	30	3039.93	Sc II	55	3044.07	Os I
290	3033.82	V II	95	3039.93	U II	100	3044.08	Re I
1600	3034.05	Gd II	130	3040.03	Re I	490	3044.16	U II
65	3034.06	Ru I	70	3040.05	Th II	45	3044.40	Ce II
370	3034.06	Th II	200	3040.31	Ru I	90	3044.40	Ho II
75	3034.08	Tm II	60	3040.34	Gd II	55	3044.41	Os I
75	3034.09	Tb II	170	3040.43	Fe I	70	3044.54	Dy II
8500	3034.12	Sn I	120	3040.46	U II	330	3044.57	Mn I
390	3034.19	Cr I	55	3040.47	Ir I	100	3044.76	Nb II
160	3034.19	W I	95	3040.60	Mn I	45	3044.84	Y I
55	3034.43	Co I	40	3040.70	Ta II	150	3044.91	Os I
130	3034.55	Re I	30	3040.77	Eu II	230	3044.94	V I
55	3034.64	Yb II	550	3040.85	Cr I	230	3044.96	Tb II
150	3034.84	Sm II				150	3045.01	Ni I
60	3034.87	Bi I	2900	3040.90	Os I	50	3045.16	Pr II
85	3034.91	Tb II	75	3040.98	Ta I	55	3045.32	Os I
170	3035.11	Th II	100	3041.00	Re I	190	3045.37	Y I
50	3035.33	Mo I	120	3041.25	U II	95	3045.46	U II
60	3035.47	Ru I	45	3041.42	V II	130	3045.56	Th II
220	3035.51	U II	70	3041.64	Fe I	120	3045.59	Mn I
40	3035.54	Th II	300	3041.70	Mo I	110	3045.71	Ru I
170	3035.65	Ho II	440	3041.73	W I	70	3045.72	Sc II
120	3035.96	U II				30	3045.77	Rh I
85	3035.98	Tm II	55	3041.74	Cr II	100	3045.83	Zr I
60	3036.10	Cu I	120	3041.74	Fe I	110	3045.96	Ta I
			95	3041.86	U II			
310	3036.22	Er II				110	3046.08	Hf II
100	3036.31	Mo I	95	3041.9	U II	55	3046.38	Dy II
350	3036.39	Zr II	60	3041.99	Re I	70	3046.44	Ho II
130	3036.45	Pt I	60	3042.02	Fe I	440	3046.44	W I
190	3036.45	U II	290	3042.06	Ta II	190	3046.46	U II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
160	3046.48	Gd I	70	3050.85	Er II	70	3057.22	Zr II
45	3046.48	Yb II	170	3050.89	V I	300	3057.28	Ir I
190	3046.57	U II	85	3050.98	Th II	130	3057.40	Ti II
110	3046.68	Ti II	50	3051.11	Nd II	650	3057.45	Fe I
60	3046.71	Ce II	190	3051.13	Tb II	500	c 3057.45	Ho II
30	3046.76	Rh I	240	3051.14	U II	1900	3057.64	Ni I
340	d 3046.76	Tm II	120	3051.17	Os I	40	3057.64	Th II
	3046.87	Tm I	180	3051.45	Dy II	90	3057.66	Re I
40	3046.79	Pr II	85	3051.79	Th II	25	3057.89	Rh I
150	3046.80	Mo I	200	3051.98	Ce II	140	3057.90	Lu III
190	3046.84	U II	80	3052.15	Nd II	28	3057.90	Th II
120	3046.93	Sm II	40	3052.16	Ir I	630	3057.91	U II
170	3046.95	Th II	95	3052.18	Tb II	170	3058.09	Ti II
50	3047.00	Tb II	70	3052.19	V I	75	3058.35	Tm II
200	3047.04	Mn I	180	3052.32	Dy II	85	3058.43	Th II
35	3047.05	Yb II	240	3052.91	U II	45	3058.55	Ce II
22	3047.11	Y I	85	3052.93	Sc II	140	3058.64	Ta I
300	3047.16	Ir I	110	3053.09	Nb I	8600	3058.66	Os I
240	3047.25	Re I	130	3053.24	Tb II	200	3058.78	Re I
210	3047.31	Mo I	80	3053.25	Pr II	120	3058.98	Eu I
210	3047.56	Dy II	180	3053.39	V II	75	3058.98	Tm II
240	3047.57	U II	460	3053.55	Tb II	1000	3059.09	Fe I
1300	3047.60	Fe I	280	3053.57	Gd II	85	3059.47	Dy II
150	3048.10	Nb I	80	3053.60	Ir I	24	3059.52	Cr II
230	3048.22	V II	100	3053.63	Re I	25	3059.74	Ce II
70	3048.39	Er II	450	3053.65	V I	85	3059.74	Ti II
60	3048.50	Ru I	75	3053.70	Tm II	100	3059.92	Gd I
290	3048.64	U I	70	3053.78	Er II	110	3060.02	Dy II
110	3048.66	W I	710	3053.88	Cr I	120	3060.05	Co I
110	3048.78	Ru I	70	3053.89	V II	120	3060.06	U II
170	3048.81	Tm II	410	c 3054.00	Ho II	100	3060.11	Zr II
40	3048.86	Mn I	55	3054.01	W I	180	3060.18	Th II
180	3048.86	Ta I	150	3054.04	Tm II	70	3060.24	Ho II
420	3048.89	Co I	1500	3054.32	Ni I	140	3060.29	Ta I
90	3048.89	V II	250	3054.36	Mn I	290	3060.30	Os I
80	3049.00	W I	210	3054.42	Er II	130	3060.32	Re I
95	3049.04	Os I	80	3054.52	Hf II	85	3060.44	Th I
420	3049.09	Th II	120	3054.73	U II	1400	3060.46	V I
150	3049.12	Dy II	690	3054.84	Zr II	280	3060.64	Dy II
20	3049.17	Pr I	130	c 3054.87	Ho II	100	3060.78	Mo II
50	3049.21	Er II	130	3054.90	Re I	35	3061.11	Nb I
80	3049.29	Hf I	320	cw 3054.94	Eu II	75	3061.14	Tm II
90	3049.30	Er II	150	3054.94	Ru I	35	3061.24	Nb I
70	3049.33	Zr I	95	3054.97	Os I	50	3061.29	Er II
480	c 3049.38	Ho II	150	3055.21	Os I	90	3061.35	Zr II
300	3049.44	Ir I	60	3055.22	Y II	120	3061.36	Dy II
230	3049.46	Os I	350	3055.24	Ce II	70	3061.41	Ir I
530	3049.56	Ta I	60	3055.26	Fe I	85	3061.49	Dy II
85	3049.64	Th II	210	3055.32	Mo I	160	3061.59	Mo I
810	3049.69	W I	45	3055.44	Hf II	100	3061.61	Re I
95	3049.84	U II	100	3055.52	Nb II	460	3061.62	U II
40	3049.86	Th II	240	3055.59	U II	140	3061.68	Er II
70	3050.00	Er II	340	3056.07	Tm II	220	3061.70	Th II
110	3050.10	Ta I	120	h 3056.31	Sc I	50	3061.80	Tb II
110	3050.14	Cr II	1200	3056.33	V I	1700	3061.82	Co I
580	3050.20	U II	75	3056.62	Nb I	75	3062.05	Tm II
210	3050.39	Os I	75	3056.62	Ta II	40	3062.06	Pr II
45	3050.40	V I	140	3056.71	Nd II	140	3062.12	Mn I
50	3050.57	Tb II	2100	3056.72	Lu II	110	3062.18	Dy II
35	3050.59	Ce II	190	3056.72	U II	570	3062.19	Os I
160	3050.73	Ho II	130	3056.74	Ti II	50	3062.20	Co I
320	3050.73	Tm II	320	3056.78	Ce II	110	c 3062.53	Ho II
710	3050.76	Hf I	95	3056.96	Dy II	630	3062.54	U II
45	3050.80	Sm II	1100	3057.02	Hf I	390	3062.62	Dy II
3500	3050.82	Ni I	110	3057.22	Ta II	130	3062.78	Tb II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
680	3063.01	Ce II	450	3067.73	Th II	580	3073.08	Tm II
220 d	3063.03	Th II	100	3068.00	Mo I	160	3073.13	Mn I
	3063.13	Th II	55	3068.11	Tm II	100	3073.24	Nb II
45	3063.12	Yb II	90	3068.26	Ru I	180	3073.28	W I
80	3063.14	Ho II	1000	3068.64	Gd II	610	3073.34	Er II
140	3063.25	V II	270	3068.65	U II	90	3073.34	Ru I
40	3063.41	Cu I	35	3068.66	Pr I	60	3073.39	Ta I
180	3063.56	Ta I	60	3068.68	Ce II	150	3073.48	Tm II
70	3063.57	Zr I	1600	3068.89	Ir I	190	3073.50	U II
21	3063.67	Yb II	220 d	3068.91	Th I	280	3073.54	Dy II
80	3063.68	Pr II		3068.98	Th II	85	3073.68	Cr I
130	3063.78	Hf I	270	3069.03	Tb II	170	3073.82	V I
75	3063.79	Nb II	190	3069.09	Ir I	75	3073.84	Tm II
40	3063.88	Ta I	35	3069.11	Eu II	360	3074.08	Os I
95	3063.88	U II	90	3069.18	Hf I	170	3074.10	Hf I
75	3064.00	Tm II	120	3069.22	Er II	230	3074.30	Ho II
230	3064.09	Tb II	60	3069.23	Pr II	800	3074.37	Mo I
95	3064.18	U II	530	3069.24	Ta I	25	3074.58	Pr I
180	3064.19	Ho II	40	3069.26	Th II	55	3074.71	Tb II
800	3064.28	Mo I	70	3069.42	Gd I	250	3074.79	Hf I
65	3064.37	Co I	85	3069.64	Ce II	290	3074.96	Os I
40	3064.51	Ir I	140	3069.64	V I	270	3075.04	U II
50	3064.51	Tb II	110	3069.68	Nb II	55	3075.18	Dy II
220	3064.53	Nb II	190	3069.71	Ir I	1600	3075.22	Ti II
70	3064.60	Re I	130	3069.73	Nd II	100	3075.27	V I
500	3064.62	Ni I	210	3069.94	Os I	27	3075.30	Hf I
100	3064.63	Zr II	320	3069.94	Re I	160	3075.38	Nd II
130	3064.68	Hf II	460	3070.05	Tb II	120	3075.45	U II
3200	3064.71	Pt I	170	3070.27	Mn I	100	3075.53	Ho II
60	3064.83	Er II	85	3070.46	Dy II	340	3075.72	Fe I
390	3064.84	Ru I	450	3070.74	Er II	28	3075.84	Th II
110	3064.93	W I	270	3070.82	Th II	260	3075.90	Zn I
70	3064.97	Er II	250	3070.90	Mo I	18	3076.01	Yb II
250	3065.04	Mo II	100	3070.90	Nb II	95	3076.06	Tb II
110	3065.04	Yb II	75	3071.11	Ce II	35	3076.07	Eu II
85	3065.07	Cr I	260	3071.16	Re I	90	3076.14	Re I
130	3065.11	Sc II	35	3071.18	Nb II	45	3076.25	Ce II
50 h	3065.17	Tb II	70	3071.24	Ti II	40	3076.38	Ta I
50	3065.21	Zr II	120	3071.29	Sm II	140	3076.66	Bi I
75	3065.26	Nb II	65 d	3071.43	Nd II	170	3076.69	Ir I
1100	3065.31	Pd I		3071.50	Nd II	400	3076.87	Nb II
110	3065.69	Tb II	85	3071.44	Mo I	110	3076.89	Dy II
85	3065.78	Sm II	110	3071.56	Nb II	640	3076.92	Gd II
75	3065.86	Tb II	180	3071.58	Ba I	180	3077.06	Os I
85	3065.93	Th II	85	3071.62	Ce II	150	3077.08	Gd II
170	3066.02	Mn I	330	3071.91	Dy II	360	3077.24	Ta I
35	3066.10	Nb II	30	3071.94	Pt I	60	3077.33	Ce II
75	3066.12	Os I	100 h	3072.06	Zn I	120	3077.33	U II
230	3066.22	Er II	370	3072.11	Th II	85	3077.34	Th II
1300 d	3066.22	Ti II	600	3072.11	Ti II	220	3077.36	Eu II
	3066.35	Ti II	920	3072.34	Co I	290	3077.44	Os I
2400	3066.38	V I	95	3072.34	U II	110	3077.52	W II
40	3066.41	Th II	50	3072.39	Ce II	7500	3077.60	Lu II
120	3066.87	U II	40	3072.41	Nb I	50	3077.64	Ce II
220	3066.99	Dy II	85	3072.45	U II	85	3077.66	Mo II
600	3067.01	Ge I	65	3072.51	Nb II	1100	3077.72	Os I
200	3067.12	V II	560	3072.53	Er II	55	3077.83	Cr I
28	3067.16	Cr II	560	3072.56	Gd II	70	3077.93	Th II
230	3067.20	Tb II	270	3072.60	Tb II	360	3078.11	Os I
400	3067.24	Fe I	580	3072.78	U II	140	3078.23	Ta I
65	3067.30	Rh I	85	3072.82	Th II	70	3078.25	Er II
1600	3067.40	Re I	2100	3072.88	Hf I	140	3078.33	Dy II
850	3067.41	Hf I	100	3072.89	Ce II	230	3078.38	Os I
150	3067.54	Sm	200	3072.96	Re I	80 c	3078.41	Ho II
36000 c	3067.72	Bi I	1100	3072.97	Ti II	2300	3078.64	Ti II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
220	3078.68	Dy II	180	3084.21	Re I	140	3090.30	Os I
670	3078.83	Th II	120	3084.24	U II	190	3090.36	U II
100	3078.86	Re I	910	3084.36	Ho II	200	3090.37	Ce II
670	3078.86	Tb II	250	3084.44	Ce II	55	3090.44	Zr I
210	3078.87	Er II	55	3084.60	Os I	120	3090.49	Os I
35	3078.95	Pr II	85	3084.68	Dy II	75	3090.52	Ce II
150	3079.33	Dy II	180	d 3084.83	W I	95	3090.55	U II
95	3079.38	Nd II		3084.91	W I	65	3090.58	W I
90	3079.63	Mn I	30	3084.90	Pr II	55	3091.25	Os I
100	3079.64	Ce II		3085.02	Pr II	120	3091.25	U II
150	3079.88	Mo I	70	3085.06	Gd II	60	3091.29	Ce II
50	3079.89	Th II	110	3085.34	Zr I	35	3091.33	Pr II
85	3079.91	Ce II	170	3085.54	Ta I	200	3091.58	Fe I
270	3079.95	U II	800	3085.62	Mo I	95	d 3091.62	Tb II
110	3079.96	Ta I	50	3085.86	Pr II	55	h 3091.70	Y I
390	3080.11	Lu I	65	3085.99	Tb II	60	3091.87	Ru I
65	3080.11	Tb II	60	3086.07	Ru I	140	3092.06	Gd II
480	3080.22	Th II	55	3086.27	Os I	30	3092.06	Ta I
110	3080.35	Nb II	240	3086.44	Ir I	190	3092.07	Mo II
210	3080.41	Mo I	100	3086.45	Sm II	90	3092.24	Hf II
75	3080.64	Ce II	430	c 3086.54	Ho II	180	3092.44	Ta I
150	3080.66	Hf II	190	d 3086.73	U II	6500	d 3092.71	Al I
290	3080.74	U II	670	3086.78	Co I		3092.84	Al I
420	3080.76	Ni I	120	3086.78	Tb II	95	3092.73	Nd
430	3080.84	Hf I	60	3086.85	Y II	240	3092.92	Nd II
90	3080.90	Ru I	150	3087.01	Tm II	95	3092.96	Tb II
95	3080.92	Dy II	95	3087.05	Gd I	40	3092.99	Ta I
95	3080.94	Nd II	45	3087.06	V I	580	3093.01	U II
360	3081.12	Tm I	120	3087.11	U II	85	3093.05	Th II
40	3081.16	Mo I	60	3087.12	Er II	120	3093.10	Dy II
170	3081.19	U II	90	3087.15	Re I	180	3093.11	Tm II
50	3081.33	Mn I	29	3087.42	Rh I	3800	3093.11	V II
70	3081.38	Er II	140	3087.53	Ta I	150	3093.14	Er II
5100	h 3081.47	Lu I	65	3087.54	Tb II	65	3093.20	Tb II
95	3081.55	Tb II	270	3087.62	Mo II	370	3093.50	W I
50	3081.66	Th II	60	3087.76	Ta II	270	3093.59	Os I
180	3081.85	Ta I	70	3087.80	Er II	200	3093.64	Re I
200	3081.98	Th II	75	3087.86	Nb II	22	3093.76	Y II
2100	3081.99	Gd II	3600	3088.02	Ti II	95	3093.82	Dy II
65	3082.01	Tb II	390	3088.04	Ir I	150	3093.87	Ta I
270	3082.02	U II	90	3088.11	V I	70	3093.87	Yb II
23	3082.05	Mn I	250	3088.43	Tb II	25	3093.99	Cu I
720	3082.08	Er II	240	3088.47	Th II	70	3094.01	Ir I
110	3082.11	Pr II	70	3088.76	Er II	1800	3094.18	Nh II
150	3082.11	V I	340	3088.76	Re I	200	3094.20	V II
3200	3082.15	Al I	240	3088.99	U II	560	3094.66	Mo I
140	3082.15	Th II	50	3089.10	Tb II	55	3094.69	V I
100	3082.30	Ce II	100	3089.10	Yb II	110	3094.80	Zr I
500	c 3082.34	Ho II	100	3089.12	Mo I	120	3094.83	U II
480	3082.36	Tb II	45	3089.13	V I	290	3095.04	U II
550	3082.43	Re I	170	3089.14	Ru I	200	3095.06	Re I
140	3082.51	Dy II		3089.06	W I	250	3095.07	Zr II
540	3082.62	Co I	95	c 3089.18	W I	190	3095.23	U II
140	3082.99	Th II		3089.31	W I	180	3095.39	Ta I
320	3083.22	Ir I	35	3089.35	Eu II	45	3095.59	Ce II
140	3083.30	Th II	180	3089.40	Ti II	120	3095.74	Dy II
95	3083.35	Gd II	480	3089.58	Tb II	320	3095.75	U II
190	3083.61	U II	270	3089.60	Co I	180	3095.79	Re I
320	3083.67	Ce II	100	3089.71	Mo I	110	3095.82	Zr I
240	3083.74	Fe I	120	3089.80	Ru I	120	3095.84	Er II
150	3083.74	Os I	110	3089.94	Re I	28	3095.86	Cr I
75	3083.81	Tb II	280	3089.95	Gd II	95	3095.88	Y II
180	3083.96	Rh I	230	3090.08	Os I	50	3096.26	Th II
140	3084.01	Gd II	130	3090.09	Th II	100	3096.41	Re I
610	3084.02	Er II	60	3090.23	Ru I	100	3096.43	Th II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
170	3096.50	Ce II	1300	3101.88	Ni I	200	3108.31	Ho II
65	3096.50	Nb I	230	3101.91	Gd II	130	3108.36	Gd II
330	3096.57	Ru I	280	3101.93	Dy II	110	3108.37	Zr I
85	3096.68	Sm II	28	3102.07	Yb II	95	3108.41	Tb II
200	3096.76	Hf I	100	h 3102.30	Sm II	60	3108.46	La II
95	3096.86	Tb II	3000	3102.30	V II	150	3108.65	Ho II
60	3096.88	Ce II	580	3102.39	U II	700	3108.81	Re I
120	3096.88	Sm II	230	3102.54	Tb II	100	3108.96	Ce II
120	3096.88	U II	580	3102.55	Gd II	310	3108.98	Os I
140	hl 3096.90	Mg I	45	3102.56	Ce II	710	3109.12	Hf II
120	3096.96	Tm II	150	3102.61	U II	65	3109.15	Tb II
40	3097.06	Mn I	200	3102.66	Th II	28	3109.34	Cr I
35	3097.08	Ce II	150	3102.69	Er II	620	3109.38	Os I
260	3097.12	Ni I	180	3102.69	Ho II	410	3109.76	Dy II
180	3097.19	Ti II	75	3102.87	Tm II	40	3109.78	Pr I
140	3097.27	Th II	85	3102.90	U II	65	3109.82	Tb II
50	3097.40	Tb II	480	3102.96	Tb II	200	c 3109.91	Ho II
120	3097.45	Eu II	140	3103.06	Re II	250	3110.02	Th II
120	3097.60	Ru I	20	3103.11	Pr II	220	3110.20	Sm II
50	3097.77	Pr II	220	3103.24	Dy II	320	3110.28	Ce II
320	3098.01	U II	560	3103.25	Ta I	95	3110.52	U II
220	3098.20	Co I	140	3103.26	Re II	90	3110.55	Ru I
140	3098.48	Nd II	370	3103.38	Ce II	40	3110.58	Pr II
80	3098.50	Pr II	120	3103.77	U II	50	3110.67	Ti II
740	3098.60	Tm II	230	3103.80	Ti II	40	3110.68	Mn I
460	3098.64	Gd II	190	3103.83	Dy II	2600	3110.71	V II
190	3098.90	Gd II	85	3104.01	Ce II	85	3110.75	Dy II
210	3099.12	Ni I	460	3104.16	U II	40	3110.82	Ta II
370	3099.19	Er II	40	3104.42	Ta I	150	3110.83	U II
140	3099.19	Nh II	70	3104.46	Er II	28	3110.86	Cr I
280	3099.23	Zr II	180	3104.59	La II	340	3110.86	Re I
830	3099.28	Ru I	140	3104.65	Re I	130	3110.87	Hf II
55	3099.52	Nd II	85	d 3104.97	Th I	150	3110.88	Er II
70	3099.60	Er II	95	3105.05	Th II	210	3110.88	Zr II
75	3099.60	Tm II	95	3104.98	Os I	250	3111.09	Os I
100	d 3099.74	Th II	180	3104.99	Dy II	65	3111.12	W I
	3099.86	Th II	230	3105.08	Ti II	300	3111.17	Ce II
550	d 3099.90	Fe I	150	3105.10	U II	170	3111.19	Gd I
	3099.97	Fe I	150	3105.18	Ho II	100	3111.34	Pr II
110	3099.93	Mo I	40	3105.38	Pr II	950	3111.43	Eu I
130	3100.04	Pt I	130	3105.43	Nd II	150	3111.45	Nb I
510	3100.29	Ir I	220	3105.47	Ni I	140	3111.56	Re I
260	3100.30	Fe I	120	3105.65	U II	970	3111.62	U II
510	3100.45	Ir I	280	3105.75	Th II	45	3111.81	Y I
3500	3100.50	Gd II	65	3105.88	W I	65	3111.85	Ho II
260	3100.67	Fe I	360	3105.99	Os I	55	3112.04	Y II
700	3100.67	Re I	320	3106.18	Eu I	50	3112.09	Th II
180	3100.67	Ti I	95	3106.18	Nd II	1400	3112.12	Mo I
28	3100.74	Yb I	260	3106.23	Ti II	240	3112.25	U II
200	d 3100.79	Th II	55	3106.34	Mo I	65	3112.43	Tb II
	3100.94	Th II	250	3106.52	Sm II	50	3112.48	Ti I
740	3100.84	Ru I	690	3106.58	Zr II	50	3112.53	Tb II
110	3100.88	Mo I	50	3106.69	Th II	160	3113.17	Gd II
180	3100.94	V II	230	3106.78	Er II	55	3113.31	Tm II
75	3101.03	Ta II	70	3106.81	Ti I	310	d 3113.43	Er II
120	3101.18	Gd II	200	3107.03	Th II		3113.54	Er II
40	d 3101.27	Pr II	75	3107.21	Ta I	90	3113.57	V II
560	3101.34	Mo I	240	3107.23	W I	75	3113.62	Tb II
45	3101.36	Yb II	55	3107.38	Os I	100	3113.90	Ta I
340	3101.40	Hf II	200	3107.47	Ce II	2600	3114.04	Pd I
310	3101.53	Os I	55	3107.76	Yb II	45	3114.05	Ce II
2600	3101.55	Ni I	170	3107.90	Yb II	60	3114.05	Ir I
50	3101.69	Th II	65	3108.01	Nd II	50	3114.07	Th II
40	3101.72	Ta I	240	3108.02	W I	270	3114.12	Ni I
55	3101.85	Tm II	510	3108.30	Th II	30	3114.13	Pr II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
50	3114.27	Th II	75	3120.73	V II	150	3126.01	Tm II
22	3114.28	Y I	350	3120.74	Zr I	95	3126.16	Tb II
65	3114.36	Ho II	340	3120.76	Ir I	150	3126.17	U II
170	d 3114.54	U I	150	3120.87	U II	170	3126.20	Dy II
	3114.59	U II	50	3120.88	Th I	260	3126.22	V II
90	3114.55	Ir I	40	3120.92	Ta I	45	3126.29	Hf II
120	3114.81	Os I	120	3121.09	U II	170	3126.70	U II
70	3114.91	Rh I	380	3121.14	V II	85	3127.21	Th II
60	3115.05	Sm II	150	3121.33	U II	95	3127.25	Gd I
80	3115.09	Er II	340	3121.36	Re I	60	3127.38	Er II
260	3115.18	Nd II	270	3121.42	Co I	220	3127.53	Ce II
85	3115.34	Yb II	95	3121.43	Tb II	270	3127.53	Nb II
130	3115.53	Er II	95	3121.57	Co I	150	3127.76	Ta II
75	3115.86	Ta I	140	3121.58	Pr II	70	3128.39	Ir I
150	3115.93	U II	140	3121.76	Rh I	330	3128.41	Dy II
190	3116.15	Nd II	200	3121.78	Ir I	130	3128.56	Gd II
250	3116.30	Th II	150	3121.94	Er II	120	3128.70	Cr II
75	3116.36	Nb I	230	3121.94	Tb II	90	3128.76	Hf I
120	3116.48	Os I	290	3122.00	Mo II	60	3128.77	Y II
100	3116.48	Th II	90	3122.38	Ir I	50	3128.88	Tb II
60	3116.63	Fe I	150	3122.53	Tm I	420	3128.94	Re I
50	3116.66	Tb II	28	3122.60	Cr II	500	3129.18	Zr II
55	3116.70	Yb II	65	3122.65	Nb I	85	3129.20	Pr II
150	3116.95	Er II	770	3122.72	Er II	65	3129.21	Ho II
70	3116.95	Hf II	1600	3122.78	Au I	120	3129.23	Os I
75	3117.26	Tb II	75	3122.83	Tb II	60	3129.55	Ta I
150	3117.44	Ta I	150	3122.90	V II	70	3129.58	Hf I
50	3117.50	Dy II	40	3122.96	Pr II	35	3129.64	Nb II
55	3117.54	Mo I	510	3122.96	Th II	190	3129.73	U II
230	3117.57	W I	230	3123.05	Tb II	500	3129.76	Zr II
140	3117.67	Ti II	160	3123.06	Nd II	80	3129.93	Y II
140	3117.68	Th II	190	3123.07	Ti I	110	3129.95	Ta I
200	3117.72	Sm II	80	3123.09	Er II	95	3129.96	Gd II
190	3117.81	Yh II	70	3123.16	Re I	50	3129.97	Th II
290	3117.89	Th II	40	3123.29	Tm II	530	3130.27	V II
95	3118.12	Os I	45	3123.57	Ce II	200	3130.33	Ce II
340	c 3118.19	Re I	60	3123.69	Gd II	4800	3130.42	Be II
310	3118.33	Os I	240	3123.70	Rh I	380	3130.58	Ta I
2000	3118.38	V II	370	3123.99	Gd II	120	3130.73	Eu II
3000	3118.43	Lu I	50	3124.02	Th II	95	3130.73	U II
760	3118.50	Ho II	60	3124.17	Ru I	70	3130.77	Ho II
120	3118.60	Gd II	120	3124.25	Gd II	1500	3130.79	Nb II
240	3118.65	Cr II	370	3124.39	Th II	35	3130.79	Rh I
150	3118.83	Er II	190	3124.43	U II	240	3130.80	Ti II
120	3119.01	Gd I	160	3124.54	Tb II	130	3130.81	Gd II
30	3119.03	Pr II	190	3124.58	Nd II	240	3130.87	Ce II
80	3119.05	Er II	200	3124.82	Ge I	300	c 3130.99	Ho II
150	3119.24	U II	75	3124.90	Tm II	3200	3131.07	Be II
45	3119.25	Cr I	680	3124.90	U II	80	3131.07	Er II
100	3119.35	Th II	470	3124.94	Cr II	150	3131.07	Th II
				3125.02	Cr II			
530	3119.35	U II				140	3131.11	Zr I
510	3119.53	Th II	380	3124.97	Ta I	480	3131.12	Os I
75	3119.59	Ta I	150	3125.18	Er II	7400	3131.26	Tm II
40	3119.60	As I	70	3125.19	Zr II	110	3131.35	Tb II
290	3119.62	Tb II	220	3125.21	Th II	320	3131.55	Hg I
40	3119.71	Cr I	1500	3125.28	V II	710	3131.81	Hf I
720	3119.72	Ti I	480	3125.51	Th II	320	3131.83	Hg I
			70	3125.52	Re I	190	3131.99	U II
50	3119.75	Nd II	150	3125.65	Er II	130	3132.03	Er II
510	3119.94	Gd II	110	3125.65	Fe I	590	3132.06	Cr II
130	3119.98	Hf I	400	3125.66	Hg I	350	3132.07	Zr I
190	3120.18	Dy II	75	3125.73	Tm II	40	3132.16	Eu I
100	3120.18	Gd II	140	3125.74	Th II	290	3132.52	Er II
260	3120.18	W I	320	3125.92	Zr II	140	3132.59	Ce II
430	3120.37	Cr II	120	3125.96	Ru I	14000	3132.59	Mo I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
270	3132.64	Ta I	45	3138.30	Ce II	300	c 3144.36	Ho II
470	3132.77	Er II	160	3138.50	Er II	160	3144.51	Er II
90	3132.88	Ru I	120	3138.51	U II	100	3144.55	Nd II
75	3133.08	Nb I	50	3138.63	Tb II	200	3144.60	Ce II
100	3133.09	Gd II	690	3138.68	Zr II	100	3144.82	Nd II
70	3133.09	Ir I	120	3138.71	Gd I	230	3144.90	Tm II
50	3133.17	Cd I	110	3138.72	Mo II	410	3144.96	U II
110	3133.23	Zr I	120	3138.83	U II	930	3145.00	Gd II
3400	3133.32	Ir I	420	3139.31	Th II	80	3145.06	Yb II
160	3133.33	Ce II	320	3139.39	Pt I	70	3145.07	Ir I
410	3133.33	V II	530	3139.60	U II	140	3145.22	Dy II
95	3133.42	U II	440	3139.64	Tb II	230	3145.22	Tb II
350	3133.48	Zr II	170	3139.65	Hf II	290	3145.28	Ce II
45	3133.50	Hf II	150	3139.74	V II	220	3145.32	Hf II
40	3133.55	Ta I	45	3139.75	Sc II	150	3145.34	V II
290	3133.60	Nd II	70	3139.79	Re I	390	3145.40	Nb II
85	3133.62	Th II	140	3139.80	Zr I	370	3145.52	Gd II
95	3133.63	U II	100	3139.87	Th II	28	3145.54	Yb II
460	3133.85	Gd II	270	3139.94	Co I	490	3145.56	U II
160	3133.88	W I	70	3139.94	Re I	50	3145.64	Th I
75	3133.89	Ta II	150	3139.97	Sm II	55	3145.72	Ni I
2300	3133.89	Tm II	190	3140.06	Tb II	55	3145.97	V II
150	3133.92	U II	100	3140.27	Th I	310	3146.04	Th II
260	3134.02	Re I	95	3140.31	Os I	70	3146.13	Ho II
2900	3134.11	Ni I	70	3140.41	Ir I	250	3146.16	Dy II
85	3134.18	Sm II	75	3140.50	Nb II	230	3146.16	Tm II
250	3134.26	Tb II	360	3140.64	Dy II	45	3146.23	Ce II
200	c 3134.39	Ho II	120	3140.76	Hf II	45	3146.23	V II
150	3134.42	Th II	230	3140.94	Yb II	190	3146.26	U II
850	3134.72	Hf II	90	3140.97	Ru I	290	3146.41	Ce II
220	3134.90	Nd II	410	3141.10	Er II	50	3146.44	Pr II
210	3134.93	V II		3141.15	Er II	150	3146.67	Tb II
210	3135.03	Gd II	500	3141.14	Dy II	150	3146.75	U II
95	3135.17	Y II	250	3141.38	Re I	230	3146.88	Gd II
25	3135.35	Pr II	130	3141.42	W I	310	3147.04	Tb II
95	3135.35	Tb II	170	3141.46	Nd II	410	3147.06	Co I
830	3135.38	Dy II	140	3141.54	Ti I	270	3147.09	U I
40	3135.60	Mo I	95	3141.67	Ti I	310	3147.15	Tb II
80	3135.62	Er II	80	3141.73	Yh II	150	3147.19	Sm II
55	3135.89	Mo I	70	3141.81	Er II	140	3147.23	Cr II
180	3135.89	Ta I	40	3141.84	Sn I	220	3147.35	Mo I
100	3136.22	Th I	210	3141.85	Th II	75	c 3147.37	Ta I
270	3136.30	Sm II	150	3141.95	U II	120	3147.53	Dy II
95	3136.46	Mo I	140	3142.30	Dy II	140	3148.04	Ta I
150	3136.51	V II	100	3142.31	Ce II	240	3148.04	Ti II
90	3136.56	Ru I	150	3142.43	Tm I	60	h 3148.18	Mn I
140	3136.68	Cr II	170	3142.44	Nd II	65	3148.21	Tb II
160	3136.72	Ce II	200	3142.48	V II	220	3148.41	Hf I
50	3136.75	Mo I	140	3142.65	Re I	85	3148.44	Cr I
50	3136.76	Yb II	130	3142.76	La II	100	3148.46	Ce II
40	3136.79	Pr II	80	3142.80	Er II	100	3148.51	Nd II
50	3136.83	Th I	270	3142.81	Pd I	150	3148.56	U II
150	3136.89	U II	420	3142.84	Th II	65	3148.65	Ce II
190	3136.93	Gd I	95	3142.90	Gd II	310	3148.71	Tb II
180	3136.96	Zr I	60	3142.96	Ta II	180	3148.82	Zr I
75	3136.97	Nb I	230	3143.13	Gd II	150	c 3148.85	Ho II
95	3137.22	Tb II	95	3143.18	Dy II	75	3149.15	Tm II
100	3137.24	Nd II	85	3143.30	Sm II	680	3149.21	U II
190	3137.30	Gd I	85	3143.38	Th II	100	3149.29	Nd II
350	3137.33	Co I	80	3143.63	Er II	45	3149.43	Ce II
60	3137.44	Ta II	220	3143.76	Ti II	100	3149.51	Nd II
130	3137.51	Hf I	220	3143.83	Dy II	65	3149.85	W II
100	3137.60	Ce II	90	3144.26	Ru I	45	3149.88	Eu II
95	3137.71	Rh I	250	3144.33	Er II	120	3149.94	Ho II
130	3137.85	Er II	55	3144.34	Mo I	75	3150.06	Tm II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
95	3150.36	U II	160	3155.69	Ce II	130	3162.42	Tb II
150	3150.46	Th II	130	3155.78	Rh I	75	3162.44	Tm II
130	3150.55	Er II	160	3155.79	Ce II	1000	3162.57	Ti II
190	3150.61	Ir I	100	3155.83	Th II	710	3162.61	Hf II
60	3150.69	Ru I	270	3155.86	U II	100	3162.62	Nd II
40	3150.85	Ta I	190	3156.07	U II	75	3162.72	Ta I
1900	3151.04	Tm II	200	3156.18	Ho II	670	3162.83	Dy II
150	h 3151.08	U II	3100	3156.25	Os I	110	3162.84	Th II
75	3151.13	Ce II	100	3156.40	Th II	290	3162.93	Tb II
70	3151.16	Re I	55	3156.51	Mo I	140	3163.13	Ta I
40	3151.32	V II	1200	3156.52	Dy II	45	3163.39	Hf I
45	3151.36	Rh I	50	3156.52	Tb II	1200	3163.40	Nb II
60	3151.54	Pr II	980	3156.53	Gd II	290	3163.42	W I
120	3151.63	Hf I	140	3156.56	Pt I	140	3163.73	Pr II
440	3151.64	Re I	450	3156.63	Hf I	95	3163.73	U II
100	3151.65	Th II	40	3156.76	Ta II	100	3163.76	Cr I
140	3151.87	Nb I	250	3156.78	Os I	70	3163.80	Yb II
120	3151.89	Dy II	270	3156.97	Ho II	70	3163.82	Ta I
95	3152.07	Os I	150	3157.00	Zr II	95	3163.85	Tb II
180	3152.10	Sm II	130	3157.24	Os I	95	3163.90	Mo I
65	3152.16	Nb II	1500	3157.34	Tm II	100	d 3164.04	Dy II
100	3152.22	Dy II	120	3157.35	Ho I		3164.13	Dy II
240	3152.25	Ti II	150	3157.45	U II	65	3164.06	Ho II
150	3152.31	U II	50	3157.49	Tb II	75	3164.10	Tb II
120	3152.37	Dy II	65	3157.55	Dy II	290	3164.15	Ce II
140	3152.37	Er II	320	3157.82	Zr I	540	3164.31	Zr II
410	3152.52	Sm II	190	3157.86	U II	130	3164.44	W I
45	3152.60	Rh I	75	3157.96	Ta II	110	3164.48	Th II
250	3152.67	Os I	6000	3158.16	Mo I	60	3164.52	Er II
95	3152.71	Co I	360	c 3158.31	Re I	220	3164.52	Re I
220	3152.82	Mo II	120	3158.40	Ho II	120	3164.53	Mo I
65	3152.95	W I	50	3158.62	Th II	85	3164.61	Os I
35	3152.96	Hf I	200	3158.63	Gd I	95	3164.77	Tb II
65	c 3153.04	Ho II	85	3158.65	Pr II	75	3164.81	Pr II
530	3153.12	U II	75	3158.66	Tb II	40	3164.83	V II
28	3153.18	Yb II	350	3158.78	Co I	75	3164.87	Tm II
60	3153.23	Pr II	200	3158.87	Ca II	50	3165.21	Yb II
100	3153.31	Dy II	60	3158.89	Ru I	95	3165.28	U II
290	3153.61	Os I	40	3159.05	Ta I	130	3165.38	W I
330	3153.79	Re I	50	3159.07	Th II	150	3165.45	Zr II
130	3153.82	Ho I	190	3159.15	Ir I	220	3165.50	U II
50	3153.82	Pr II	95	3159.18	W I	55	3165.62	Th II
120	3153.82	Ru I	95	3159.22	Tb II	120	3165.69	Ho II
90	3153.88	Yb II	95	3159.39	Tb II	90	3165.73	Hf I
240	3154.20	Ti II	200	c 3159.67	Ho II	190	3165.74	Tb II
410	3154.29	Er II	270	3159.82	Hf I	110	3165.82	Th II
310	3154.30	Th II	150	3159.82	U II	880	3165.97	Zr II
130	3154.51	Ce II	290	3159.92	Ru I	140	3166.10	Th II
70	3154.55	Ir I	190	3160.35	Er II	140	3166.24	Ce II
110	d 3154.68	Co I	65	3160.47	Ho II	150	3166.26	Zr II
	3154.79	Co I	120	3160.50	Dy II	310	3166.51	Os I
65	3154.69	Tb II	140	3160.69	Gd II	100	3166.61	Ce II
190	3154.74	Ir I	190	3160.77	U II	580	c 3166.62	Ho II
310	3154.77	Th II	110	3161.03	Dy II	190	3167.10	Er II
65	3155.09	W I	90	h 3161.04	Mn I	220	3167.10	U II
65	3155.10	Tb II	500	3161.20	Ti II	50	3167.16	Re I
100	3155.15	Cr I	60	3161.36	Er II	80	3167.20	Gd I
50	3155.18	Yb II	980	3161.37	Gd II	45	3167.23	Ce II
40	3155.25	Ta II	120	3161.44	Os I	45	3167.32	Ce II
95	3155.26	U II	70	3161.69	Th II	120	3167.40	Dy II
150	3155.41	U II	120	3161.73	Os I	380	3167.52	Tb II
120	3155.62	Tb II	780	3161.77	Ti II	75	3167.53	Ta I
55	3155.64	Mo II	85	3162.15	Sm II	85	3167.56	Th II
240	3155.67	Ti II	28	3162.29	Yb I	65	3167.58	W I
290	3155.67	Zr II	150	3162.30	Sm II	80	h 3167.76	Dy II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
160	3167.89	Ho II	85	3173.61	Eu II	390	3180.29	Nb II
55	3168.14	V II	95	3173.71	U II	170	3180.35	Ir I
80	3168.15	Dy II	190	3173.76	Tb II	380	3180.54	Tb II
140	3168.18	Ir I	810	3173.78	Ho II	150	3180.56	Tm I
70	3168.18	Ta II	180	3173.93	Os II	240	3180.70	Cr II
190	3168.19	Tm II	110	3174.20	Th II	65	3180.74	W I
270	3168.24	Pr II	220	3174.61	Re I	45	3180.82	Ce II
120	3168.28	Os I	380	3174.66	Tb II	120	3180.92	Yb II
140	3168.32	Tb II	140	3174.78	Re I	600	3180.95	Ta I
700	3168.37	Re I	390	3174.84	Ho II	220	3181.01	Hf I
450	3168.39	Hf I	130	3174.88	Dy II	120	3181.15	Hf I
200	3168.52	Ru I	5500	3175.05	Sn I	110	3181.19	Th II
1600	3168.52	Ti II	100	3175.14	Te I	50	3181.22	Tb II
50	3168.59	Tb II	150	3175.36	U II	90	3181.28	Ca II
75	3168.82	Tm II	70	3175.45	Fe I	65	3181.40	Nb II
490	3168.88	Ir I	75	3175.45	Tb II	30	3181.43	Cr II
100	3168.95	Dy I	160	3175.52	Er II	810 c	3181.50	Ho II
120	3169.06	Yb II	420	3175.73	Th II	50	3181.54	Nd II
290	3169.18	Ce II	150	3175.78	Nb II	190	3181.58	Zr II
110	3169.33	Th II		3175.86	Nb II	160	3181.61	Er II
25	3169.36	Pr II	100	3175.99	Nd II	55	3181.67	Th I
80	3169.47	Gd II	340	3176.21	U II	110	3181.69	Ta I
230	3169.84	Tb II	200	3176.29	Ta I	160	3181.74	Er II
360	3169.88	Sm II	55	3176.50	Th II	55	3181.74	Ni I
1000	3169.99	Dy II	320	3176.60	W I	190	3181.82	W I
85	3170.21	Sm II	130	3176.80	Ce II	230	3181.88	Os I
95	3170.21	W I	450	3176.86	Hf II	870	3181.92	Er II
320	3170.29	Ta I	270 c	3176.97	Ho II	150	3181.92	Zr II
8700	3170.35	Mo I	60	3177.05	Ru II	80	3181.94	Dy II
55	3170.43	Th II	45	3177.14	Ce II	85	3182.40	Th II
180	3170.75	Dy II	55	3177.20	Th II	85	3182.44	Pr II
150	3170.86	U II	130	3177.27	Co I	75	3182.55	U II
80	3170.97	Dy II	340	3177.33	U II	170	3182.57	Os I
90	3171.09	Gd II	130	3177.46	Tm II	110	3182.57	Ta I
95	3171.19	Tb II	370	3177.58	Ir I	110	3182.64	Th II
21	3171.23	Pr II	440	3177.71	Re I	70	3182.66	Re I
55	3171.28	Th I	400	3177.89	Dy II	75	3182.83	U II
2400	3171.36	Lu I	95	3177.90	Mo I	880	3182.86	Zr II
150	3171.37	U II	420	3178.06	Os I	600	3182.87	Re I
55	3171.38	Mo I	190	3178.09	Zr II	370	3183.03	Mo I
65	3171.47	Dy II	180	3178.12	Sm II	65	3183.19	Dy II
80	3171.52	Er II	140	3178.16	Ta I	95	3183.28	Tb II
290	3171.61	Ce II		3178.27	Ta I	3200	3183.41	V I
150	3171.68	La III	75	3178.20	Tm II	410	3183.42	Er II
390 dl	3171.72	Ho II	85	3178.24	Th I	480	3183.52	Ce II
40	3171.73	Th II	220	3178.37	Dy II	55	3183.56	Th II
95	3172.03	Mo II	45	3178.43	Hf I	95	3183.64	Tb II
45	3172.30	Ce II	140 h	3178.50	Mn I	100	3183.73	Lu II
160	3172.31	Pr II	260	3178.61	Re I	55	3183.79	Th II
80	3172.37	Ho II	45	3178.75	Ce II	390	3183.84	Ho II
40	3172.37	Mo I	220	3179.04	U II	140	3183.88	Tb II
40	3172.51	Nb I	270	3179.05	Th II	720	3183.92	Sm II
80	3172.62	Er II	130	3179.06	W I	5300	3183.98	V I
450	3172.65	Tm I	500	3179.33	Ca II	130	3184.05	W I
160	3172.74	Mo II	220	3179.41	Y II	80 d	3184.19	Dy II
2300	3172.83	Tm II	80	3179.61	Er II	75	3184.21	Ce II
75	3172.87	Ta I	35	3179.61	Hf I	75	3184.22	Nb II
890	3172.94	Hf I	70	3179.73	Rh I	100	3184.37	Ni I
110	3173.06	Y II	95	3179.77	Mo I	130	3184.42	W I
140	3173.09	Re I	220	3179.83	U II	270 cw	3184.48	Ho II
75	3173.20	Nb II	50	3179.84	Tb II	240	3184.55	Ta I
120	3173.20	Os I	110	3180.12	Os I	120	3184.57	Mo I
55	3173.43	Th I	1100	3180.20	Th II	1100	3184.76	Re I
380	3173.58	Tm II	220	3180.20	U II	200	3184.79	Dy II
270	3173.59	Ta I	140	3180.23	Fe I	60	3184.90	Fe I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
310	3184.95	Th II	200	3190.34	Ce II	120	3195.97	Os I
370	3185.10	Mo I	750	3190.68	V II	200	d 3195.99	Pr II
120	3185.14	U II	150	3190.70	U II		3196.09	Pr II
250	3185.25	Er II	50	3190.72	Tb II	140	c 3196.07	Ho II
230	3185.33	Os I	260	3190.78	Re I	360	3196.18	Sm II
3800	3185.40	V I	1000	3190.87	Ti II	65	3196.52	Ho II
150	3185.47	Tm II	75	3190.89	U II	130	3196.54	Tm II
40	3185.54	Eu I	160	3191.02	Ho II	180	3196.59	Ru I
1100	3185.57	Re I	110	3191.09	Th II	120	3196.74	U II
80	3185.59	Rh I	300	3191.10	Nb II	240	3196.93	Fe I
180	3185.71	Mo I	120	3191.16	Ta I	200	3196.93	Hf I
270	3185.71	U II	470	3191.19	Rh I	75	3197.04	Zr I
85	3186.02	Sm II	540	3191.21	Zr I	220	3197.08	Cr II
180	3186.04	Ru I	85	3191.22	Th II	150	3197.11	Ni I
240	3186.13	Ce II	70	3191.31	Y I	190	3197.13	Rh I
95	3186.23	Tb II	110	3191.42	Pr II	50	3197.52	Ti II
120	3186.29	Re I	150	3191.43	Nb II	390	c 3197.83	Ho II
200	3186.37	Ho I	95	3191.52	Mo I	530	3198.01	V I
330	3186.38	Dy II	390	3191.57	W I	50	3198.02	Tb II
2400	3186.45	Ti I	70	3191.66	Fe I	24	3198.11	Cr I
75	3186.54	Nb I	65	3191.74	Pr II	1400	3198.12	Lu II
310	3186.98	Os I	75	3191.76	U II	110	3198.23	Th II
55	3187.00	Th II	260	3191.80	Lu II	110	3198.48	Th II
310	3187.01	Sm II	210	3191.90	Zr II	220	3198.58	Re I
430	3187.22	Sm II	3100	3191.99	Ti I	70	3198.65	Yb II
480	3187.26	Th II	75	3192.25	Ta I	200	3198.67	Ta I
55	3187.34	Os I	260	3192.36	Re I	110	3198.69	Th II
140	3187.39	Ho II	55	3192.59	Th I	390	3198.84	W I
55	3187.40	Th II	120	3192.64	Er II	120	3198.85	Mo I
200	3187.49	Nb I	65	3192.76	Tb II	370	3198.92	Ir I
120	d 3187.59	Mo II	70	3192.80	Fe I	85	3198.97	Th II
	3187.68	Mo I	95	3192.80	Mo I	110	3199.04	Pr II
240	3187.68	Dy II	390	3192.88	Yb II	200	3199.28	Ce II
410	3187.71	V II	65	3192.97	Dy II	220	3199.30	Gd I
160	3187.79	Er II	360	3193.01	Sm II	70	3199.49	Re I
360	3187.79	Sm II	75	3193.02	La II	140	3199.52	Fe I
65	h 3188.01	Cr I	55	3193.16	Th II	480	3199.56	Tb II
290	3188.03	Th II	90	3193.17	Gd II	160	3199.58	Gd I
65	3188.09	Mo I	140	3193.20	Re I	55	3199.82	V I
770	3188.23	Th II	110	3193.23	Fe I	3800	3199.92	Ti I
240	3188.34	Ru I	220	3193.23	U II	130	3199.99	Hf II
220	3188.34	U II	330	3193.30	Dy II	130	3199.99	Tm II
130	3188.37	Co I	45	3193.33	Ce II	150	3200.04	Re I
65	3188.40	Mo I	360	3193.53	Hf II	240	3200.14	U II
530	3188.51	V II	55	3193.92	V I	65	3200.21	Mo I
95	3188.55	Th II	7600	3193.97	Mo I	2200	3200.27	Y II
65	3188.66	Dy II	80	3194.10	Cu I	150	3200.48	Fe I
85	3188.72	Sm II	50	3194.18	Th II	45	d 3200.52	Ce II
50	3188.73	Nd II	670	3194.19	Hf II	65	3200.53	Nb I
180	3188.79	Ce II	310	3194.23	Os I	310	3200.58	Er II
50	3188.83	Tb II	200	3194.50	Re I	50	3200.62	Nd II
150	3189.02	U II	190	3194.69	Tb II	120	3200.71	Pt I
140	3189.05	Rh I	710	3194.83	Ce II	100	3200.72	Re I
65	3189.24	W II	65	3194.87	Mo I	150	3200.73	Tb II
75	3189.28	Nb II	1000	3194.98	Nb II	65	3200.89	Mo I
75	3189.42	U II	70	3195.09	Ho II	110	3201.00	Ho I
310	3189.46	Os I	230	3195.33	Tm II	240	3201.16	Yb II
130	3189.62	Hf I	190	3195.38	Os I	40	3201.50	Mo II
100	3189.64	Ce II	55	3195.57	Ni I	990	3201.71	Ce II
95	3189.97	Tb II	380	3195.60	Tb II	390	3201.76	Ho II
240	3189.98	Ru I	60	3195.61	Hf II	150	3201.80	Sm II
270	d 3190.07	Th II	2300	3195.62	Y II	40	3201.98	Ta I
	3190.16	Th II	55	3195.69	Th I	55	3202.14	Ni I
150	3190.17	Re I	45	3195.94	Ce II	750	3202.38	V I
220	3190.28	Gd I	290	3195.96	Mo I	780	3202.54	Ti II



TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
95	3202.70	Tb II	50	3210.01	Tb II	470	3215.19	Dy II
65	3202.95	Tb II	150	3210.22	Tb II	50	3215.26	Gd I
55	3203.23	Th II	75	3210.29	Nb I	270	3215.26	Sm II
2200	3203.32	Y II	170	3210.31	Th II	140	3215.36	Ho II
120	3203.35	Nb II	270	c 3210.41	Ho II	1000	3215.56	W I
110	3203.41	Gd I	320	3210.56	Tm II	390	3215.60	Nb II
50	3203.44	Ti II	420	3210.57	Eu I	55	3215.78	Th II
120	3203.45	Er II	320	3210.82	Tm II	35	3215.81	La I
150	3203.47	Nd II	70	3210.83	Fe I	70	3215.94	Fe I
40	3203.62	Th II	100	3210.95	Ce II	75	3216.11	Tm II
45	3203.67	Hf II	240	3210.97	Mo I	60	3216.52	Ru I
240	3203.83	Ti I	180	3210.98	Hf I	830	3216.63	Dy II
55	3203.88	Th II	85	3211.00	Nd II	3900	3216.69	Y II
80	3203.95	Er II	55	3211.20	Th I	530	3216.85	Sm II
320	3204.04	Pt I	600	3211.73	Sm II	150	3216.93	Ta I
1100	c 3204.25	Re I	140	3211.75	Re I	65	3216.95	Mn I
160	3204.28	Ho II	75	3211.77	U II	1100	3217.06	Ti II
25	3204.35	Zr II	120	3211.85	Ho II	210	3217.11	V II
30	3204.81	Pr II	150	3211.99	Fe I	100	3217.12	Nd II
50	3204.87	Ti I	320	3212.01	Tm II	80	3217.18	Yb II
150	3204.90	Sm II	540	3212.01	Zr I	90	3217.29	Nb I
95	3204.90	Zr I	130	3212.04	Dy II	180	3217.30	Hf II
75	3205.00	Ta I	610	3212.12	Ir I	80	3217.38	Dy II
230	3205.15	Er II	410	3212.43	V I	50	3217.38	Fe I
330	3205.22	Mo I	80	3212.44	Dy II	140	3217.40	Cr II
55	3205.29	Th II	45	3212.58	Zr I	170	3217.46	Th II
110	3205.40	Fe I	120	3212.59	Mo I	55	3217.73	Th II
70	3205.42	Re I	80	3212.68	Dy II	180	3217.83	Ni I
130	3205.46	Dy II	1000	3212.81	Eu I	65	3217.86	Nb I
120	3205.54	Mo I	75	3212.85	Zr II	110	3217.94	Ti I
450	3205.58	V I	220	3212.88	Mn I	260	3218.27	Ti II
880	3205.88	Mo I	120	3212.94	Re I	50	3218.32	Yb II
100	3205.96	Ce II	60	3212.97	Ru I	220	3218.34	U II
340	3206.05	U II	75	3213.09	U II	200	3218.38	Ce II
310	3206.11	Hf I	110	3213.14	Ti II	70	3218.46	Ir I
100	3206.17	Ho I	80	3213.28	Ho II	600	3218.61	Sm II
150	3206.23	U II	150	3213.31	Os II	40	3218.87	V I
300	3206.34	Nb II	65	3213.32	Mo I	1100	3218.93	Tb II
150	3206.39	Ta I	70	3213.49	Re I	710	3218.94	Ce II
240	3206.40	Dy II	70	3213.55	Ir I	95	3219.15	Co I
70	3206.47	Gd II	170	3213.57	Th II	150	3219.17	U II
80	3206.64	Dy II	50	3213.58	Pr II	110	3219.21	Ti I
200	3206.86	Ho II	90	3213.72	Hf I	150	3219.43	Sm II
55	3206.93	Th II	420	3213.75	Eu I	190	3219.48	Pr II
75	3207.09	Th II	200	3213.91	Ta II	370	3219.51	Ir I
220	3207.12	Dy II	300	3214.04	Fe I	120	3219.58	Fe I
360	3207.18	Sm II	180	3214.06	Ni I	70	3219.81	Fe I
520	3207.25	W I	55	3214.08	Th I	1200	3219.98	Tb II
450	3207.41	V I	120	3214.11	Re I	95	3220.17	Tb II
130	3207.53	Tb II	150	3214.12	Sm II	170	3220.35	Th II
55	3207.78	Th II	760	3214.19	Zr II	160	3220.46	Dy II
45	3207.85	Ta I	260	3214.24	Ti I	30	3220.57	Pb I
100	3207.89	Pr II	70	3214.32	Rh I	180	3220.61	Hf II
95	3207.96	Tb II	55	3214.38	Th I	870	3220.73	Er II
55	3208.03	Th II	60	3214.40	Fe I	5100	3220.78	Ir I
80	3208.05	Er II	35	3214.42	Pr II	65	3220.86	Mo I
180	3208.17	Sm II	270	3214.44	Er II	100	3220.87	Ce II
25	3208.23	Cu I	120	3214.44	Mo I	880	3221.17	Ce II
140	3208.28	W I	190	3214.63	Dy II	140	3221.21	W I
75	3208.35	V II	130	3214.63	Tm II	100	3221.27	Ni I
30	3208.59	Cr II	75	3214.70	U I	100	3221.28	Ir I
3000	3208.83	Mo I	190	3214.75	Ti II	560	3221.29	Th II
290	3208.85	Dy II	75	3214.75	V II	75	3221.32	Ta I
170	3209.18	Cr II	95	3215.01	Tb II	110	3221.38	Ti I
65	3209.54	Tb II	560	3215.07	Mo I	200	c 3221.42	Ho II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
240	3221.49	Dy II	170	3228.97	Dy II	80	3233.87	Ho II
170	3221.64	Dy II	560	3229.01	Th II	70	3233.97	Fe I
150	3221.65	Ni I	100	3229.12	Ce II	28	3234.06	Cr II
350	3221.74	Mo I	150	3229.19	Tb II	630	3234.12	Zr I
140	3221.91	W I	780	3229.19	Ti II	710	3234.16	Ce II
340	3222.07	Fe I	30	3229.20	Cr I	100	3234.27	Pr II
50	3222.37	Tb II	230	3229.24	Ta I	95	3234.50	Tb II
45	3222.41	Ce II	300	3229.28	Ir I	6600	3234.52	Ti II
110	3222.47	Zr II	240	3229.36	Ce II	60	3234.62	Nd
50	3222.62	Nd I	170	3229.36	Dy II	290	3234.65	Ni I
1300	3222.84	Ti II	530	3229.42	Ti II	85	3234.69	Ta I
95	3222.97	Tb II	730	3229.50	U II	330	3234.89	Ce II
180	3223.27	Ru I	140	3229.56	Nb II	55	3235.00	Th I
290	3223.28	Dy II	1200	3229.75	Tl I	45	3235.01	Ce II
610	3223.31	Er II	600	3229.79	Mo I	45	3235.13	Eu I
75	3223.32	Nb II	85	3229.88	Ta II	75	3235.23	U II
45	3223.37	Ce II	80	3229.93	Er II	190	3235.38	Mo I
65	3223.49	Mo I	110	3229.94	Dy II	25	3235.43	Pr II
220	3223.52	Ti I	250	3230.03	Tb II	470	3235.44	Tm II
690	3223.74	Gd II	65	3230.04	Ho II	75	3235.67	Ce II
	3223.78	Gd I	130	3230.06	Hf I	110	3235.78	Tb II
300	3223.83	Ta I	45	3230.08	Ce II	480	3235.84	Th II
240	3224.24	Ti II	35	3230.23	Pr II	490	3235.89	Dy II
240	3224.26	U II	30	3230.29	Pt I	380	3235.94	Re I
80	3224.27	Ho II	720	3230.56	Sm II	220	3236.12	Ti II
210	3225.02	Ni I	2300	3230.58	Er II	95	3236.20	Tb II
240	3225.08	Dy II	300	3230.72	Mn I	400	3236.40	Nb II
280	3225.41	Th II	100	3230.76	Ir I	40	3236.40	Ta I
110	3225.46	Gd II	120	3230.86	Ta I	5200	3236.57	Ti II
800	3225.48	Nb II	110	3230.87	Th II	110	3236.58	Zr II
55	3225.66	Th II	70	3230.97	Fe I	720	3236.64	Sm II
330	3225.67	Ce II	250	3231.06	Tb II	290	3236.69	Dy II
500	3225.79	Fe I	480	3231.24	Ce II	390	3236.74	Ce II
50	3225.88	Yb II	110	3231.32	Ti II	850	3236.78	Mn I
55	3225.90	Th II	95	3231.46	Tb II	1200	3236.81	Tm II
330	3225.95	Dy II	230	3231.51	Tm II	200	3236.90	Ho II
80	3226.07	Dy II	360	3231.53	Sm II	950	3237.08	Mo I
55	3226.12	Th II	80	3231.67	Ho II	140	3237.09	W I
140	3226.13	Ti I	630	3231.69	Zr II	200	3237.40	Ho II
240	3226.17	U II	150	3231.95	Sm II	150	3237.51	Re I
160	3226.32	Gd II	60	3232.00	Ir I	80	3237.66	Rh I
110	3226.37	Ru I	85	3232.00	Tb II	65	3237.73	Cr I
140	3226.38	Dy II	250	3232.03	Er II	150	3237.87	V II
55	3226.41	Th II	1900	3232.06	Os I	150	3237.89	Sm II
75	3226.81	Tm II	110	3232.12	Th I	40	3237.91	Nd II
270	3226.84	Sm II	680	3232.16	U II	330	3237.98	Er II
710	3227.11	Ce II	240	3232.28	Ti II	110	3237.98	Mo I
210	3227.16	Er II	40	3232.30	Th I	590	3238.12	Th II
180	3227.32	Ta I	190	3232.49	W I	75	3238.46	U II
150	3227.46	Re I	1000	3232.52	Sb I	220	3238.53	Ru I
50	3227.48	Tb II	170	3232.63	Li I	90	3238.62	Gd II
190	3227.75	Fe II	140	3232.64	Dy II	290	3238.63	Os I
	3227.80	Fe I	80	3232.65	W I	40	3238.86	Pr II
110	3227.77	Th II	50	3232.73	Tb II	55	3238.93	Th I
100	3227.88	Ru I	220	3232.78	Gd I	4100	3239.04	Ti II
50	3228.04	Nd II	130	3232.87	Co I	45	3239.20	Yb II
1000	3228.09	Mn I	1100	3232.96	Ni I	100	3239.29	Th II
880	3228.22	Mo I	1100	3233.14	Mo I	300	3239.44	Fe I
180	3228.50	Sm II	55	3233.19	V I	130	3239.44	Hf I
220	3228.53	Ru I	320	3233.34	Ho II	35	3239.58	Yb I
530	3228.60	Ti II	150	3233.34	U II	210	d 3239.60	Tb II
70	3228.73	Re I	20	3233.42	Pt I	720	3239.66	Sm II
270	3228.78	Sm II	140	3233.44	Ce II	220	3239.66	Ti II
200	3228.81	Zr II	430	3233.68	Sm II	70	3239.99	Ta I
75	3228.90	Tm II	75	3233.74	Tm I	250	3240.00	Tb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
1600	3240.23	Tm II	320	3246.96	Tm I	140	3252.48	Ce II
75	3240.35	U II	260	3247.18	Co I	140	3252.72	Th II
65	3240.42	Ho II	50	3247.18	Tb II	1200	3252.91	Ti II
140	3240.48	Er II	80	3247.22	Ho II	310	3252.95	Mn I
110	3240.48	Th II	45	3247.32	Eu II	360	3253.40	Sm II
190	3240.49	Mo I	420	3247.46	Tm II	65	3253.54	Tb II
55	3240.64	Th I	200	3247.47	Nb II	890	3253.70	Hf II
190	3240.65	Tb II	75	3247.49	U II	150	3253.75	U II
65	3240.71	Mo II	50000	3247.54	Cu I	80	3253.91	Dy II
140	3240.86	Dy II	100	3247.55	Eu I	270	3253.94	Sm II
120	3240.94	Ta II	110	3247.59	Th II	140	3254.01	Ce II
190	3241.04	Os I	360	3247.66	Hf I	65	3254.04	Mn I
760	3241.05	Zr II	120	3248.00	Os I	320	3254.07	Nb II
240	3241.11	Th II	95	3248.07	U II	100	3254.08	Nd II
530	3241.16	Sm II	200	3248.36	Dy II	380	3254.21	Co I
120	3241.24	Ru I	100	3248.46	Ni I	1200	3254.25	Ti II
95	3241.40	Eu I	110	3248.49	Th II	200	3254.28	Zr I
80	3241.47	Re I	650	3248.52	Mn I	4800	3254.31	Lu II
470	3241.52	Ir I	40	3248.52	Ta I	210	3254.36	W I
2300	3241.54	Tm II	80	3248.55	Re I	850	3254.38	Sm II
180	3241.59	Sm II	1200	3248.60	Ti II	80	3254.40	Ir I
2600	3241.99	Ti II	120	3248.94	Nb II	80	3254.48	Dy II
220	3241.99	U II	95	3249.14	U II	80	3254.54	Ru I
140	3242.03	W I	100	3249.19	Ce II	60	3254.71	Ru I
180	3242.04	Sm II	330	3249.34	Er II	140	3254.77	V II
200	3242.05	Ta I	260	3249.35	La II	140	3254.81	Th II
6200	3242.28	Y II	45	3249.43	Ce II	220	3254.84	U II
11000	3242.70	Pd I	160	3249.52	Nb I	70	3254.86	Hf I
200	3242.83	Ta I	220	3249.53	Hf I	190	3254.91	Os I
80	3243.00	Ho II	55	3249.57	V I	65	3255.22	Tb II
600	3243.06	Ni I	65	3249.61	Tb II	270	3255.28	Hf II
75	3243.20	Th II	240	3249.75	Sm II	140	3255.51	Th II
180	3243.25	Er II	75	3249.83	Tm II	110	3255.63	Sm II
130	3243.35	Hf I	100	3249.86	Th I	40	3255.65	V I
390	3243.37	Ce II	65	3249.92	Mo I	1500	3255.69	Sc I
90	3243.47	Er II	100	3250.19	Gd II	160	3255.92	Pt I
120	3243.50	Ru I	150	3250.28	U II	13000	3256.09	In I
100	h 3243.72	Dy II	20	3250.36	Pt I	310	3256.14	Mn I
	3243.78	Dy II	40	3250.36	Ta I	950	3256.21	Mo I
330	3243.78	Mn I	720	3250.37	Sm II	290	3256.26	Dy II
220	3243.84	Co I	320	3250.39	Zr I	910	3256.27	Th II
440	3244.17	U II		3250.46	Zr II	80	3256.28	Ho II
220	3244.19	Fe I	120	3250.74	Ni I	90	3256.35	Er II
110	3244.45	Th I	50	3250.75	Th II	50	3256.91	Nd II
50	3244.47	Mo I	55	3250.78	V II	190	3256.92	Os I
50	3244.60	Tb II	50	3250.95	Tb II	180	3257.16	Th II
150	3244.69	Sm II	90	3250.99	Dy II	75	3257.26	U II
150	3244.79	U II	100	3251.14	Mn I	80	3257.37	Dy II
490	3245.12	Dy II	150	3251.25	Th II	180	3257.37	Th I
510	3245.13	La II	1200	3251.27	Dy II	200	c 3257.45	Ho II
100	3245.17	Ce II	990	3251.32	Sc II	130	3257.82	Cr I
95	3245.17	Tb II	75	3251.33	Tm II	1900	3258.05	Tm II
50	3245.42	Tb II	75	3251.62	Nh I	85	3258.25	Sm II
100	3245.48	Pr II	160	3251.63	Tm II	220	3258.41	Mn I
120	3245.54	Cr I	2700	3251.64	Pd I	120	c 3258.45	Ho II
280	3245.76	Th II	130	3251.84	Cr I	90	3258.48	Er II
85	3245.80	Sm I	40	3251.87	V II	3000	3258.56	In I
130	3245.86	Tm II	170	3251.90	Dy II	3500	3258.78	Pd I
65	3245.92	Mo I	950	3251.91	Ti II	600	3258.85	Re I
45	3246.03	Eu I	280	3251.92	Th I	100	3258.87	Ce II
35	3246.06	Yb II	40	3251.98	Pt I	560	3259.05	Er II
220	3246.11	U II	200	3252.19	Dy II		3259.11	Er II
220	3246.39	U II	150	3252.26	Re I	110	3259.06	Th I
200	3246.67	Ce II	140	3252.29	W I	110	3259.16	Mo I
40	3246.78	Nb I	480	3252.32	Th II	220	3259.24	Nd II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
110	3259.25	Gd II	180	3264.71	Mn I	800	3270.90	Mo I
95	3259.38	Tb II	2700	3264.78	Er II	150	3271.00	Fe I
140	3259.43	W I	40	3264.81	Zr II	100	3271.12	Ni I
600	3259.55	Re I	230	3264.90	Tb II	900	3271.12	V II
110	3259.62	Th II	430	3264.94	Sm II	150	3271.13	Zr II
210	3259.66	W I	220	3265.12	Nd II	100	3271.15	Ce II
95	3259.98	Cr I	130	3265.14	Mo I	75	3271.45	U II
170	3260.02	Dy II	90	3265.29	Hf I	100	3271.55	Ce II
190	3260.05	Tb II	50	3265.38	Nd II	520	3271.61	Rh I
200	3260.11	Zr I	45	3265.42	Ce II	90	3271.64	V I
75	3260.14	Nb I	110	3265.58	Th II	310	3271.65	Ti II
70	3260.18	Ta I	130	3265.62	Fe I	130	3271.78	Co I
180	3260.23	Mn I	550	3265.67	La II	16	3271.96	Ce II
190	3260.30	Os I	340	3265.81	U II	110	3272.03	Th I
280	3260.35	Ru I	75	3265.93	Tb II	27	3272.06	Ce II
65	3260.48	Mo I	170	3266.00	Dy II	200	3272.07	Nb I
230	3260.56	Nb II		3266.02	Dy II	310	3272.08	Ti II
100	3260.66	Nd II	200	3266.21	Dy II	80	3272.09	Dy II
50	3260.66	Tb II	80	3266.34	Ho II	190	3272.16	Os I
140	3260.70	Dy II	100	3266.39	Eu II	75	3272.22	Nb II
260	3260.82	Co I	400	3266.40	Tb II	540	3272.22	Zr II
95	3260.83	Tb II	390	3266.44	Ir I	990	3272.25	Ce II
110	3260.92	Th II	120	3266.44	Ru I	150	3272.35	Tb II
200	3260.98	Ce II	210	d 3266.62	W I	430	d 3272.48	Sm II
320	3261.06	Cd I		3266.77	W I		3272.60	Sm II
140	3261.21	Dy II	1600	3266.64	Tm II	200	3272.73	Dy II
130	3261.51	Yb II	90	3266.66	Er II	150	3272.77	Eu II
110	3261.54	Th II	540	3266.73	Gd I	430	3272.81	Sm II
200	3261.56	Re I	120	3266.85	Re I	75	3273.03	V I
1200	3261.60	Ti II	180	3267.00	Th II	1000	3273.05	Zr II
400	3261.65	Tm II	70	3267.01	Hf I	200	3273.08	Ru I
290	3261.72	U II	75	3267.05	Nb I	100	3273.18	Nd II
190	3261.74	Tb II	430	3267.10	Er II	90	3273.32	Er II
45	3261.90	Hf I		3267.18	Er II	85	3273.32	Sm II
200	3262.01	Ir I	70	3267.18	Hf I	430	3273.48	Sm II
80	3262.20	Ho II	170	3267.25	Nd II	5500	3273.63	Sc I
360	3262.28	Sm II	90	3267.36	Ho II	180	3273.66	Hf II
3100	3262.29	Os I	1200	3267.40	Tm II	310	3273.92	Th II
5500	3262.34	Sn I	850	3267.51	Sb I	25000	3273.96	Cu I
120	3262.47	Hf I	250	3267.64	Gd I	250	3274.14	Tb II
300	3262.63	Mo I	1100	3267.70	V II	110	3274.18	Gd II
910	3262.67	Th II	3100	3267.94	Os I	250	3274.33	Tb II
95	3262.68	Tb II	190	3268.10	Tb II	200	3274.71	Ru I
380	3262.75	Os I	200	3268.21	Ru I	330	3274.86	Ce II
120	3262.77	Re I	140	3268.34	Gd II	210	3274.95	Ta II
180	3262.80	Er II	25	3268.42	Pt I	310	3275.07	Th II
250	3262.97	Tb II	150	3268.48	Re I	530	3275.20	Os I
110	3263.03	Th II	150	3268.52	Tb II	320	3275.22	Nd II
120	3263.12	U I	300	3268.89	Re I	65	3275.66	Tb II
520	3263.14	Rh I	790	3268.99	Tm II	85	3275.68	Ta II
140	3263.24	V I	240	3269.11	Dy II	85	3275.87	Sm II
160	3263.37	Nb II	620	3269.21	Os I	120	3275.93	Dy II
140	3263.45	Ce II	330	3269.41	Er II	750	3276.12	V II
50	3263.65	Tb II	110	3269.47	Th II	140	3276.25	Ce II
70	3263.66	Ho II	1100	3269.49	Ge I	50	3276.66	Pr II
110	d 3263.83	Mo I	190	3269.66	Zr I	430	3276.75	Sm II
230	d 3263.87	Tb II	75	3269.78	U II	1100	3276.81	Tm II
200	3263.88	Ce II	4400	3269.91	Sc I	80	3277.16	Ho II
50	3264.06	Tb II	440	3270.12	U II	160	3277.28	Ir I
320	3264.10	Tm II	120	3270.47	Nb I	210	3277.32	Tb II
480	3264.40	Mo I	180	3270.49	Sm II	100	3277.57	Ru I
110	d 3264.43	Th II	75	3270.63	Tb II	160	3277.67	Nb I
120	d 3264.55	Ru I	180	3270.68	Sm II	90	3277.70	Er II
	3264.66	Ru I	100	3270.76	Nb I	160	3277.71	Re I
160	3264.59	Nb I	110	3270.82	Th II	110	3277.73	Tb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
210	3277.78	Eu II	200	3283.46	Nb II	45	3290.58	Ce II
330	3277.97	Os I	2300	3283.57	Rh I	100	3290.65	Nd II
390	c 3278.15	Ho II	65	3283.68	Ce II	180	3290.65	Sm II
250	3278.22	Er II	50	3283.81	Tb II	950	3290.82	Mo I
200	3278.29	Ti II	45	3284.22	Ce II	270	c 3290.96	Ho II
260	3278.92	Ti II	80	3284.36	Dy II	2300	3291.00	Tm II
3800	3278.97	Lu I	55	3284.36	V I	160	3291.05	Hf I
140	3279.01	Ce II	85	3284.68	Tm II	85	3291.06	Nb II
270	3279.25	Ho II	880	3284.71	Zr II	100	3291.12	Dy II
1300	3279.26	Zr II	240	3285.02	Mo I	90	3291.27	Er II
70	3279.29	Ta I	1000	3285.04	Tb II	730	3291.34	U II
720	3279.33	Er II	290	3285.10	Nd II	430	3291.48	Gd I
65	3279.44	Mo I	150	3285.21	Tb II	310	3291.56	Tb II
100	3279.45	Dy II	330	3285.22	Ce II	910	3291.74	Th II
110	3279.53	Gd II	290	3285.22	U II	160	3292.02	Nb II
75	3279.55	U I	320	3285.36	Mo I	290	3292.08	Ti I
160	3279.70	Dy II	1200	3285.61	Tm II	370	3292.21	Gd II
40	3279.82	Cu I	160	3285.64	Re I	190	3292.31	Mo II
200	3279.84	Ce II	230	3285.66	Nb I	30	3292.48	Ta I
110	3279.84	V II	180	3285.66	Sm II	620	3292.52	Th II
270	3279.98	Hf II	130	3285.75	Th I	1500	3293.07	Tb II
150	3280.00	U II	140	3285.88	Zr II	240	3293.37	Sm II
890	3280.09	Dy II	100	3286.03	Ce II	75	3293.56	U I
720	3280.22	Er II	180	3286.18	Er II	45	3293.59	Ce II
760	3280.31	Tb II	430	3286.23	Sm II	130	3293.60	Th II
310	3280.37	Th II	85	3286.54	Sm II	150	3293.71	W I
75	3280.49	Ce II	90	3286.57	Dy II	70	3293.84	Nd II
2300	3280.55	Rh I	310	3286.58	Th II	200	3293.88	Dy II
55000	3280.68	Ag I	100	3286.62	Nd II	40	3293.93	Ta I
270	3280.84	Sm II	65	3286.67	Os I	240	3293.95	Th II
70	3280.87	Ta I	280	3286.76	Fe I	110	3294.00	Tb II
310	3280.91	Y II	470	3286.77	Er II	430	3294.08	Gd I
65	3280.92	Os I	50	3286.98	Tb II	490	3294.11	Ru I
45	3281.10	Ce II	60	3287.06	Ir I	210	3294.28	Rh I
120	3281.18	Ho II	80	3287.13	Re I	85	3294.36	Nb II
760	3281.40	Tb II	80	3287.19	Co I	120	3294.44	U II
50	3281.49	Nd II	460	3287.25	Pd I	70	3294.68	Nd II
100	3281.61	Gd II	65	3287.38	Mo I	200	3294.83	Re I
80	3281.65	Dy II	220	3287.45	U II	130	3294.85	Mo I
110	3281.70	Rh I	310	3287.55	Tb II	130	3295.00	Th II
7600	3281.74	Lu I	100	3287.59	Ir I	240	3295.28	Ce II
150	3281.94	W I	200	3287.59	Nb I	180	3295.32	Th II
980	c 3281.97	Ho II	530	3287.66	Ti II	140	3295.33	Ta I
25	3281.97	Pt I	620	3287.79	Th II	210	3295.33	Tb II
250	3282.25	Gd I	160	3287.92	Nb I	30	3295.43	Cr II
	3282.30	Gd II	200	3287.94	Dy II	360	3295.44	Sm II
220	3282.33	Ti II	140	3287.99	Er II	75	3295.52	Pr II
200	3282.33	Zn I	440	3288.21	U II	130	3295.52	Th II
150	3282.48	U II	390	3288.46	Ho II	430	3295.81	Sm II
55	3282.53	V II	130	3288.62	Dy II	320	3296.01	Nb I
120	3282.70	Ni I	150	3288.80	Zr II	60	3296.11	Ru I
320	d 3282.73	Zr I	190	3288.84	Os I	140	3296.18	Ce II
	3282.83	Zr II	1100	3289.02	Mo I	200	3296.30	Dy II
490	3282.77	Dy II	280	3289.14	Rh I	25	3296.38	Pr II
50	3282.78	Nd II	18000	3289.37	Yb II	100	3296.40	Mo I
100	3282.89	Dy II	90	3289.39	V II	75	3296.40	Zr II
55	3282.98	Th II	50	3289.52	Nd II	150	3296.61	Th II
140	3283.08	Ho II	45	3289.64	Rh I	280	3296.70	Re I
520	3283.10	Tb II	190	3289.84	Mo I	45	3296.72	Rh I
190	3283.10	U II	130	3290.13	Th II	200	3296.88	Ce II
90	3283.31	V I	120	3290.22	Pt I	65	3296.88	Mn I
100	3283.35	Ce II	1200	3290.26	Os I	280	3296.99	Re I
45	3283.38	Hf II	720	d 3290.28	Sm II	120	c 3297.06	Ho II
1200	3283.40	Tm II		3290.39	Sm II	130	3297.37	Th II
510	3283.46	Co I	100	3290.33	Ce II	130	3297.60	Dy II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
240	3297.83	Th II	120	3304.83	Nb I	1200	3309.80	Tm II
95	3297.89	U II	240	3304.84	Ce II	40	3309.89	Zr II
60	3297.96	Ru I	210	3304.95	Tb II	50	3310.10	Tb II
55	3298.05	Th I	540	3305.15	Zr II	180	3310.25	Th II
720	3298.10	Sm II	200	c 3305.16	Ho II	340	3310.27	Hf I
90	3298.12	Ho II	340	3305.18	Sm II	75	3310.37	Tb II
140	3298.14	V I	130	3305.25	Yb I	100	3310.38	Nd II
110	3298.20	Tb II	55	3305.30	Th I	120	3310.47	Nb I
65	3298.22	Mn I	85	3305.33	Nd	75	3310.50	U II
70	3298.61	Nd	110	3305.37	Tb II	160	3310.52	Ir I
310	3298.66	Tb II	200	3305.40	Dy II	640	3310.59	Tm II
90	3298.74	V II	200	3305.51	Dy II	850	3310.66	Sm II
270	3299.06	U II	370	3305.56	Er II	160	3310.77	Mo I
170	3299.41	Ti I	320	3305.56	Mo I	110	3310.80	Tb II
160	3299.61	Nb I	140	3305.73	Yb II	45	3310.86	Hf II
220	3299.70	U II	130	3305.90	Mo I	140	3310.91	Nd II
120	3299.77	Ta I	1100	3305.90	U II	620	3310.91	Os I
100	3299.99	Ce II	280	3305.97	Fe I	100	3310.97	Dy II
220	3300.15	Ce II	210	3306.01	Tm II	1100	3311.16	Ta I
300	3300.16	Nd II	210	3306.12	Hf I	85	3311.34	Nb I
260	3300.46	Rh I	220	3306.17	Ru I	40	3311.34	Zr II
55	3300.62	Th II	240	3306.19	Dy II	440	3311.38	W I
730	3300.82	W I	250	3306.23	Os I	140	3311.50	Ce II
140	3300.91	Nd II	880	3306.28	Zr II	290	3311.72	U II
80	3300.92	Dy II	280	3306.35	Fe I	6200	3312.11	Lu I
80	3300.97	Re I	1700	3306.39	Sm II	80	3312.13	Ir I
170	3300.98	Sm II	75	3306.41	Tb II	200	3312.22	Ce II
240	3301.26	Th II	170	3306.61	Sm II	80	3312.29	Re I
	3301.35	Th II	140	3306.63	Ce II	95	3312.33	Mo I
130	3301.34	Ho I	170	3306.88	Ti I	130	3312.39	Ho II
7600	3301.56	Os I	210	3306.91	Tm II	2300	3312.42	Er II
370	3301.59	Ru I	80	3307.01	Re I	600	3312.42	Sm II
280	3301.60	Re I	24	3307.02	Cr II	150	3312.53	Tb II
240	3301.65	Th I	850	3307.02	Sm II	400	3312.60	Nh I
340	3301.68	Sm II	320	3307.12	Mo I	110	3312.69	Ti I
30	3301.73	Sr I	130	3307.15	Co I	510	3312.72	Dy II
500	3301.86	Pt I	140	3307.23	Ce II	200	3312.75	Nd II
90	3301.93	Er II	420	d 3307.44	Th II	150	3312.78	Tb II
150	3301.95	Eu II	80	3307.46	Er II	670	3312.86	Hf I
3600	3302.13	Pd I	75	3307.55	U II	55	3313.07	Th I
240	3302.23	Re I	85	3307.80	Th II	100	3313.16	Nd II
300	3302.37	Na I	80	3307.95	Cu I	65	3313.30	Ce II
2000	3302.46	Tm II	55	3307.99	Ce II	120	3313.31	Dy II
900	3302.59	Zn I	210	3308.01	Tm II	140	3313.33	Eu II
75	3302.67	Zr II	150	3308.02	Ce II	90	3313.49	Er II
280	3302.94	Zn I	140	3308.02	Eu II	100	3313.62	Mo II
150	3302.98	Na I	120	3308.05	Nb I	180	3313.65	Th I
800	3303.11	La II	45	3308.08	Ce II	180	3313.66	Er II
25	3303.18	Pr II	80	3308.25	Re I	150	3313.70	Zr II
320	3303.21	Re II	220	3308.39	Ti I	330	3313.73	Gd II
100	3303.34	Mo I	19	3308.47	Y II	290	3313.94	U II
130	3303.48	Th II	210	3308.51	Tb II	240	3313.95	Re I
290	3303.60	U II	440	3308.79	Dy II	100	3314.03	Ce II
280	3303.75	Re I	220	3308.81	Ti II	190	3314.08	Co I
330	d 3303.88	Er II	1100	3308.88	Dy II	40	3314.38	Pr II
	3303.95	Er II	130	3309.14	Th II	210	3314.38	Tb II
90	3304.07	Er II	110	3309.17	Tb II	840	3314.42	Ti I
110	3304.10	Tb II	55	3309.18	V I		3314.52	Ti I
180	3304.22	Mo I	120	3309.19	Hf I	180	3314.43	Er II
480	3304.24	Th I	100	3309.27	Ce II	210	3314.50	Zr II
110	3304.26	Tb II	130	3309.36	Th I	50	3314.70	Tb II
70	3304.38	Ta I	260	3309.50	Ti I	240	3314.72	Ce II
45	3304.50	Eu II	340	3309.52	Sm II	240	3314.83	Th II
340	3304.52	Sm II	60	3309.73	Ti I	80	3314.94	Er II
70	3304.66	Nd II	75	3309.78	Ta I	60	3315.05	Pt I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
60	3315.05	Ru I	45	3320.42	Ce II	380	3326.76	Ti II
110	3315.07	Tb II	190	3320.44	Gd II	380	3326.80	Zr II
50	3315.10	Yb II	110	3320.59	Sm II	350	3326.99	Co I
200	3315.22	Nb I	65	3320.69	Mn I	130	3327.08	Dy II
290	3315.23	Ru I	40	3320.81	Nb II	110	3327.11	Tb II
290	3315.32	Ti II	190	3320.90	Mo II	130	3327.19	Th I
120	3315.42	Os I	600	3321.01	Be I	80	3327.30	Dy II
200	3315.59	Gd II		3321.08	Be I	360	3327.30	Mo I
140	3315.66	Ho II	80	3321.11	Ho II	310	3327.42	Os I
660	3315.66	Ni I	340 d	3321.15	Tb II	150	3327.50	U II
95	3315.69	Os I	1200	3321.18	Sm II	85	3327.58	Tm II
100	3316.02	Nd II	1000	3321.34	Be I	45	3327.66	Ce II
75	3316.09	W I	510	3321.45	Th II	50	3327.69	Nd II
85	3316.17	Tm II	55 d	3321.54	V II	340	3327.88	Sm II
70	3316.19	Hf I		3321.68	V I	4700	3327.89	Y II
780	3316.32	Dy II	550	3321.70	Ti II	65	3327.91	Ce II
560	3316.39	Er II	95	3321.86	Eu II	130	3328.21	Hf II
290	3316.39	Ru I	55	3322.09	Th I	55	3328.26	Th II
90	3316.56	Gd II	220	3322.12	U II	410	3328.28	Nd II
410	3316.58	Sm II	240	3322.20	Co I	30	3328.35	Cr II
95	3316.69	Os I	85	3322.26	Eu I	90	3328.80	Dy II
400	3316.88	Tm II	420	3322.28	Tb II	140	3329.01	Ce II
240	3317.12	Dy II	310	3322.31	Ni I	120 c	3329.02	Ho II
150	3317.47	Er II	75	3322.46	U II	65	3329.04	Mo I
50	3317.58	Th II	600	3322.48	Re I	30	3329.05	Cr I
55	3317.75	Th II	200	3322.60	Ir I	520	3329.08	Tb II
200	3317.80	Ce II	80	3322.87	Ir I	130	3329.34	Gd II
60	3317.89	Ru I	2900	3322.94	Ti II	170	3329.36	Nb I
210	3317.93	Ta I	380	3322.99	Zr II	2100	3329.46	Ti II
180	3317.99	Hf II	4200	3323.09	Rh I	85	3329.62	Sm II
330	3318.02	Ti II	770	3323.19	Er II	290	3329.66	Er II
100	3318.13	Dy II	160	3323.21	Tm II	55	3329.73	Th I
80	3318.23	Er II	45	3323.36	Hf II	110	3329.86	V I
75	3318.51	Zr II	210	3323.38	Tb II	290	3329.92	U II
70	3318.53	Ta I	110	3323.74	Ho II	30	3329.99	Sr I
210	3318.65	Tm II	340	3323.77	Sm II	430	3330.34	Gd II
160	3318.67	Re I	35	3323.80	Pt I	250	3330.48	Th I
90	3318.77	Er II	210	3323.89	Tb II	75	3330.49	Ce II
75	3318.79	U II	640	3323.95	Mo I	1100	3330.62	Sn I
60	3318.82	Ru I	55	3324.06	Cr II	70	3330.67	Mn I
	3318.91	Ru I	250	3324.33	Os I	330 d	3330.99	Ta II
680	3318.84	Ta I	3800	3324.40	Th II		3331.02	Ta I
75	3318.96	Ce II	40	3324.56	Pr II	60	3331.09	Rh I
55	3318.98	Ce II	390	3324.75	Th II	45	3331.23	Ce II
200	3318.98	Nh I	70	3324.93	Re I	45	3331.24	Rh I
55	3318.98	Th II	100	3325.00	Ru I	100	3331.27	Dy II
150	3319.02	Zr II	45	3325.06	Ce II	1400	3331.38	Gd II
110	3319.16	Tb I	840	3325.12	Th II	65	3331.40	Mo I
150	3319.21	U I	190	3325.24	Co I	200	3331.52	Re I
120	3319.26	Nb I	340	3325.26	Sm II	250	3331.57	Nd II
150	3319.32	U II	180	3325.34	Ce II	440	3331.69	W I
80	3319.41	Yb I	170	3325.48	Sm II	45	3331.89	Hf I
240	3319.48	Co I	150	3325.49	Tb II	200	3331.93	Ho II
85	3319.56	Sm II	150	3325.66	U II	40	3332.05	Ru I
120	3319.58	Nb II	360	3325.67	Mo I	550	3332.11	Ti II
130	3319.59	Mo I	200	3325.90	Nd II	830	3332.13	Gd II
130	3319.79	Mo I	270	3326.19	Dy II	60	3332.15	Mg I
200	3319.87	Ho II	440	3326.20	W I	110	3332.16	Nb I
1000	3319.88	Dy II	70 h	3326.26	Nd II	100	3332.40	Th II
65	3319.89	Eu II	40	3326.41	Zr I	85	3332.41	Ta I
430	3320.16	Sm II	90 d	3326.42	Dy II	75	3332.42	U II
230	3320.25	Ho II		3326.52	Dy II	770	3332.70	Er II
330	3320.26	Ni I	100	3326.46	Th II	85	3332.70	Sm II
280	3320.30	Th II	28	3326.59	Cr I	890	3332.73	Hf I
75	3320.36	W I	240	3326.62	Nb I	100	3333.04	Ce II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
50	3333.06	Yb II	130	3339.91	Ta II	1400	3345.02	Zn I
170	3333.13	Th I	250	3340.03	Er II	75	3345.09	W I
160	3333.16	Ho II	240	3340.17	Mo I	95	3345.56	U I
110	3333.21	Tb II	1100	3340.34	Ti II	300	3345.57	Zn I
170	3333.64	Sm II	55	3340.38	Y I	85	3345.71	Nd II
100	3333.66	Ce II	160	3340.44	Ho II	75	3345.86	W I
120	3333.93	Tb II	90	3340.48	Er II	100	bl 3345.89	Th ThO
90	3334.06	Gd II	760	3340.56	Zr II	150	3345.89	U I
700	3334.14	Co I	850	3340.58	Sm II	60	3345.93	Zn I
130	3334.14	Dy II	75	h 3340.89	Ce II	590	3345.98	Gd II
130	3334.16	Ir I	780	3341.00	Dy II	95	3346.02	Cr I
110	3334.25	Tb II	55	bl 3341.31	Th ThO	1300	3346.04	Er II
380	3334.25	Zr II	85	3341.43	Sm II	320	3346.20	Re I
950	3334.33	Eu I	130	3341.44	Dy II	50	3346.32	Tb II
65	3334.45	Dy II	21	3341.47	Pr II	150	3346.35	Er II
200	3334.46	Ce II	60	3341.48	Hg I	85	3346.35	Sm II
290	3334.48	Nd II	90	3341.60	Er II	95	3346.40	Mo II
210	3334.48	Tb II	130	3341.60	Nb II	80	3346.50	Yb II
620	3334.60	Th II	240	3341.66	Ru I	100	3346.52	Ce II
210	3334.62	Zr II	440	3341.66	U II	180	3346.55	Th II
85	3335.03	Sm II	290	3341.84	Er II	330	3346.73	Ti II
85	3335.05	Tm II	240	3341.87	Ce II	95	3346.74	Cr I
130	3335.06	Th II	270	3341.88	Dy II	85	3346.91	Sm II
1800	3335.20	Ti II	5700	3341.88	Ti I	130	3346.93	Nb I
160	3335.36	Re I	1300	3341.97	Nb I	190	3346.94	Co I
110	3335.42	Tb II	120	3342.15	Ti I	320	3347.02	Mo I
120	3335.69	Ru I	95	3342.23	La I	210	3347.27	Tb II
170	3336.12	Sm II	1600	3342.24	Re I	170	3347.30	Sm II
960	3336.15	Os I	110	3342.59	Cr II	50	3347.54	Yb II
1100	3336.18	Gd II	290	3342.68	U II	85	3347.56	Nd II
95	3336.33	Cr II	80	3342.70	Ho II	120	3347.64	Er II
130	3336.51	Mo I	160	3342.73	Co I	160	3347.73	Er II
90	3336.68	Mg I	70	3342.90	Rh I	200	3347.83	Dy II
150	3336.68	U II	280	d 3342.93	Yb II	95	3347.84	Cr II
250	3336.70	Tb II			Yb II	100	3347.89	Nd II
80	3336.74	Er II	50		Tb II			
90	3336.98	Gd II	55	3343.26	Th II	210	3348.07	Tb II
240	3337.17	Yb II	110	d 3343.28	Sc II	110	3348.11	Co I
630	c 3337.23	Ho II	30	3343.34	Cr I	180	3348.14	Er II
370	3337.25	Er II	30	3343.47	Ta I	170	3348.17	Nd II
1500	3337.49	La II	240	c 3343.49	Sm II	85	3348.23	Tb II
290	3337.79	Er II	980	3343.58	Ho II	150	3348.54	Tb II
390	3337.79	U II	130	3343.62	Tb II	110	3348.61	Ho II
70	3337.80	Ta I	110	3343.64	Sm II	240	3348.68	Sm II
70	3337.84	Cu I	150	3343.68	Er II	60	3348.76	Er II
620	3337.87	Th II	1300	3343.71	Nb I	310	3348.77	Th I
310	3338.03	Tb II	95	3343.72	Mo I	130	3348.95	Th II
2000	3338.18	Re I	120	3343.77	Tb II	4300	3349.04	Ti II
60	3338.37	Ir I	260	3343.77	Ti II	1700	3349.06	Nb I
130	3338.40	Th II	330	3343.86	Ce II	65	3349.07	Cr I
190	3338.41	Zr II	50	3343.93	Tb II	65	3349.19	Mo I
150	3338.48	U II	85	3343.96	Nb II	130	c 3349.21	Ta II
85	3338.49	Ta I	80	3344.20	Rh I	55	3349.32	Cr I
330	3338.54	Rh I	810	3344.32	Re I	12000	3349.41	Ti II
45	3338.75	Eu II	240	3344.35	Sm II	760	3349.42	Tb II
390	c 3338.86	Ho II	90	3344.37	Er II	420	3349.52	Nb I
250	3339.00	Tb II	200	3344.47	Ho II	100	3349.96	Ce II
290	3339.07	Nd II	60	3344.53	Ru I	45	3349.98	Ce II
100	3339.51	Ce II	870	3344.56	La II	230	3349.99	Tm I
190	3339.51	Dy II	1300	3344.75	Mo I	470	3350.06	Er II
930	3339.55	Ru I	440	3344.76	Ce II	200	3350.10	Gd II
120	3339.61	Tb II	65	3344.79	Ho II	350	3350.26	Er II
140	3339.68	Re I	380	3344.79	Zr II	40	3350.27	Pr II
190	3339.78	Co I	130	3344.87	Th II	130	3350.30	Mo I
130	3339.80	Cr II	150	3344.87	U II	110	3350.40	Eu I
						5400	3350.47	Gd II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
360	3350.49	Ho II	240	d 3356.33	Re I	330	3361.56	Ni I
220	3350.88	Sm II		3356.46	Re I	310	d 3361.62	Th II
90	3350.96	Ta I	90	3356.35	V I		3361.73	Th II
35	3351.09	Yb II	180	3356.41	Ce II	170	3361.64	Ta I
980	3351.23	Th II	85	3356.55	Nd	90	3361.67	Er II
40	3351.25	Sr I	130	3356.78	Hf I	150	3361.73	U II
50	3351.26	Yb	100	3356.82	Th II	180	3361.77	Ce II
180	3351.32	Er II	80	3356.98	Ho II	65	3361.77	Cr II
180	3351.44	Tb II	130	3357.04	Nb I	120	3361.84	Ti I
130	3351.51	Ta I	240	3357.22	Ce II	1700	3361.94	Sc II
40	3351.56	Eu II	540	d 3357.26	Zr II	60	3362.00	Ru I
30	3351.60	Cr I	65	d 3357.30	Sc II	160	3362.00	Y II
110	3351.74	Os I	120	3357.37	Tb II	60	3362.18	Rh I
55	3351.97	Cr I	220	3357.61	Gd I	100	3362.18	Th II
270	3352.05	Sc II	320	3357.91	Ho II	55	3362.21	Cr I
370	3352.06	Hf II	270	3357.93	U II	5400	3362.23	Gd II
320	3352.10	Ho II	230	3357.97	Os I	320	3362.25	Tb II
100	3352.28	Ce II	200	3358.02	Re I	130	3362.37	Mo I
100	3352.49	Yb II	1600	3358.12	Mo I	100	3362.44	Yb II
40	3352.59	Nb I	180	3358.15	Er II	130	3362.52	Th II
270	3352.69	Dy II	290	3358.28	Ti I	40	3362.53	Ta I
180	3352.89	Tb II	130	3358.30	Dy II	4000	3362.61	Tm II
100	3352.94	Ce II	70	3358.30	Hf II	70	3362.67	Th II
120	3352.94	Ti I	1700	3358.42	Nb I	95	3362.68	Zr II
65	3352.99	Ce II	270	3358.43	Gd II	200	3362.74	Re I
55	h 3353.03	Cr I	50	3358.46	Tb II	110	3362.80	Co I
	3353.13	Cr II	230	3358.47	Ta I	130	3363.07	Th II
130	3353.21	Re I	170	3358.50	Cr II	40	h 3363.24	Pr II
75	3353.33	Ce II	190	3358.60	Dy II	75	3363.34	W I
320	cw 3353.55	Ho II	620	3358.60	Th II	120	3363.41	Ho II
510	3353.58	Dy II	4300	3358.62	Gd II	50	3363.64	Yh II
320	3353.59	Nd II	230	3358.91	Hf I	130	3363.68	Th II
130	3353.66	Zr I	160	3359.22	Re I	950	3363.78	Mo I
9900	3353.73	Sc II	21	3359.26	Pr II	150	3363.82	Zr II
120	3353.91	Os	240	3359.46	Dy II	1400	3364.08	Er II
130	3353.95	Th II	7600	3359.56	Lu I	190	3364.12	Os I
410	d 3354.18	Sm II	2000	3359.68	Sc II	270	3364.24	Gd II
	3354.30	Sm II	170	3359.76	Nd II	110	3364.24	Tb II
310	3354.18	Th II	110	3359.86	Tb II	320	3364.27	Ho II
610	3354.38	Co I	60	3359.90	Rh I	100	3364.35	Ce II
40	3354.38	Eu II	180	3359.96	Zr II	85	3364.36	Tb II
180	3354.39	Zr II	150	3360.00	U I	250	3364.69	Th II
150	3354.45	W I	50	3360.05	Tb II	85	3364.80	Sm II
270	3354.50	U II	180	3360.06	Hf I	760	3364.93	Tb II
320	3354.58	Ho II	130	3360.15	Th II	270	3364.96	Nd II
85	3354.60	Nd II	50	3360.29	Th II	110	3365.27	Tb II
200	3354.62	Th II	160	3360.30	Cr II	130	3365.34	Th I
4100	3354.64	Ti I	130	3360.37	Th II	110	3365.55	V I
170	3354.72	Sm II	150	3360.46	Zr I	130	3365.58	Nb II
340	3354.74	Nb I	200	3360.54	Ce II	200	3365.59	Gd II
230	3354.86	Tm II	90	3360.65	Dy II	160	d 3365.73	Re I
130	3354.99	Mo I	780	3360.71	Gd II		3365.84	Re I
200	3355.02	Ce II	280	3360.80	Rh I	330	3365.77	Ni I
120	3355.06	Dy II	140	3360.87	Ho II	130	3365.81	Dy II
75	3355.11	U II	290	3360.99	Ti I	1200	3365.86	Sm II
60	3355.23	Fe I	150	3361.01	Er II	330	3366.17	Ni I
130	3355.27	Th II	160	3361.14	Re I	30	3366.33	Sr I
160	3355.29	Re I	250	3361.15	Os I	250	3366.52	Th II
140	3355.67	Pr II	200	3361.15	Ru I	240	3366.55	Ce II
200	3355.93	Nd II	7200	3361.21	Ti II	45	3366.66	Ta I
90	3356.09	Hf II		3361.26	Ti I	140	3366.68	Hf I
760	3356.09	Zr II	1700	3361.27	Sc II	190	3366.69	Er I
50	3356.18	Tb II	250	3361.37	Mo I	65	3366.81	Ni I
190	3356.21	Dy II	85	3361.43	Sm II	340	3366.96	Nb I
90	3356.21	Er II	110	3361.56	Co I	570	3367.11	Co I

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
150	3367.18	Tb II	160	3371.81	Dy II	50	3376.62	Yb II
150	3367.27	Sm II	100	3371.86	Ru I	40	3376.65	Pr II
85	3367.38	Nb I	400	3371.99	Ni I	160	3376.66	Tb II
150	3367.56	U I	220	3372.01	U II	85	3376.73	Nb I
45	3367.64	Eu II	160	3372.08	Os I	70	3376.84	Th II
150	3367.66	Gd II	65	3372.09	Nb I	80	3376.99	Er II
390	3367.82	Th II	6600	3372.15	Sc II	160	3377.10	Dy II
150	3367.82	Zr II	35	3372.21	Hf I	480	3377.13	Ce II
65	3367.89	Ni I	140	3372.21	Ti II	110	3377.14	Rh I
120	3367.90	U II	1100	3372.25	Rh I	150	3377.39	U II
1400	d 3368.02	Er II	520	3372.36	Tb II	55	3377.39	V I
	3368.13	Er I	100	3372.43	Ho II	150	3377.46	Zr II
430	3368.05	Cr II	40	3372.50	Pr II	2900	d 3377.48	Ti I
510	3368.11	Dy II	65	3372.56	Nb II		3377.58	Ti I
130	3368.33	Tm II	7700	3372.71	Er II	110	3377.62	V I
80	c 3368.36	Ho II	460	d 3372.72	Tb II	190	3377.66	Tb II
420	3368.38	Rh I	130	3372.78	Dy II	80	3377.71	Rh I
370	3368.45	Ru I	5700	3372.80	Ti II	240	3377.74	Re I
560	3368.48	Ir I	5000	3373.00	Pd I	70	3377.81	Sm II
340	3368.57	Sm II	110	3373.23	Co I	120	3378.02	Ru I
130	3368.60	Tm I	180	3373.42	Zr II	130	3378.20	Mo I
25	3368.64	Zr I	200	3373.46	Ce II	75	3378.20	U I
55	3368.70	Ce II	130	3373.49	Th I	90	3378.21	Dy II
45	3368.80	Ce II	200	3373.73	Ce II	55	3378.30	Zr II
220	3368.83	U II	390	3373.75	W I	55	3378.34	Cr II
4000	3368.95	Sc II	100	3373.84	Gd I	110	3378.40	Tb II
75	3368.98	U I	230	3374.16	Ho II	180	3378.42	Dy II
85	3369.04	Sm II	970	3374.17	Er II	130	3378.46	Mo I
140	3369.06	Eu II	260	3374.22	Ni I	390	3378.58	Th II
130	3369.16	Nb II	40	3374.25	Nb II	120	3378.68	Os I
65	3369.25	Mo I	90	3374.29	Dy II	320	3378.73	Tb II
40	3369.26	Zr II	60	3374.35	Ti II	520	3378.86	Tb II
110	3369.28	Ta I	70	3374.36	Ho II	100	3378.88	Dy II
340	3369.46	Sm II	190	3374.41	Tb II	180	3378.93	Hf I
80	3369.55	Fe I	490	3374.50	Tm II	70	3379.01	Er II
2900	3369.57	Ni I	250	3374.58	Th II	320	3379.06	Re II
150	3369.62	Gd II	130	3374.64	Ni I	85	3379.15	Tb II
160	3369.64	Tm II	130	3374.65	Ru I	140	3379.17	Ce II
45	3369.68	Rh I	220	3374.69	Gd II	30	3379.17	Cr I
65	3369.83	Nb I	380	3374.73	Zr II	290	3379.22	Ti I
100	3369.89	Ho II	350	3374.92	Nb I	30	3379.37	Cr II
120	3370.13	U II	250	3374.98	Th I	140	3379.52	Ta II
120	3370.20	Os I	520	3375.03	Tb II	100	3379.60	Ru I
40	d 3370.25	Pr II	65	3375.22	Mo I	320	3379.70	Re I
110	3370.33	Co I	85	3375.23	Nd II	220	3379.76	Gd II
1100	3370.44	Ti I	240	3375.48	Yb II	40	3379.76	Pr II
150	3370.55	Er II	65	3375.65	Mo I	95	3379.83	Cr II
960	3370.59	Os I	180	3375.74	Dy II	55	3379.92	Zr I
170	3370.59	Sm II	75	3375.78	Ce II	950	3379.97	Mo I
150	3370.59	Zr I	220	3375.78	U II	100	3380.01	Gd II
230	d 3370.61	Tb II	90	3376.00	Dy II	55	3380.04	Tm II
120	3370.79	Fe I	130	3376.05	Ta I	65	3380.05	Nb I
160	3370.85	Dy II	55	3376.06	V I	130	3380.18	Ru I
290	3370.87	Ho II	90	3376.10	Er II	65	3380.25	Eu II
150	3371.04	W I	110	3376.27	Zr II	1400	3380.28	Ti II
200	3371.18	Ce II	200	3376.33	La II	270	3380.41	Nb I
340	3371.21	Sm II	65	3376.34	Nb I	80	3380.49	Ho II
290	3371.29	U II	110	3376.36	Tb II	220	3380.52	Gd II
170	3371.33	Nb I	180	3376.37	Dy II	170	3380.53	Tm I
80	3371.35	W I	30	3376.40	Cr I	3300	3380.57	Ni I
4300	3371.45	Ti I	150	3376.48	Sm II	160	3380.60	Tb II
320	3371.50	Tb II	45	3376.49	Ta II	150	3380.70	U II
640	3371.54	Ta I	6200	3376.50	Lu I	650	3380.71	Sr II
160	3371.69	Dy II	120	3376.55	U II	240	3380.85	Ni I
250	3371.80	Th II	130	3376.62	Dy II	130	3380.86	Nb I
							3380.93	Nb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
130	3380.86	Th I	210	3386.57	Dy II	2300	3392.00	Er II
85	3380.89	Tb II	40	3387.46	Ta I	160	3392.01	Tb II
1500	3380.91	La II	140	3387.50	Yb I	1300	3392.04	Th II
130	3381.08	Er II	150	3387.66	Sm II	160	3392.05	Ho II
			95	3387.75	Mo I	95	3392.17	Mo I
290	3381.32	Er II	85	3387.75	Nb I	70	3392.31	Fe I
70	3381.34	Th II	75	3387.78	Ce II	70	3392.31	Nd II
55	3381.37	Th II	620	3387.84	Os I	350	3392.34	Nb I
100	3381.49	Ce II	1400	3387.84	Ti II	80	3392.47	Ho II
90	3381.54	Dy II	570	3387.87	Zr II	1100	3392.53	Gd II
150	3381.95	U II	110	3387.92	Th I	370	3392.54	Ru I
230	3382.06	Er I	40	3388.02	Pr II	150	3392.66	Fe I
65	3382.29	Mo I	100	3388.03	Nd II	140	3392.71	Ti I
170	3382.31	Ti I	1100	3388.17	Co I	230	3392.81	Hf I
1200	3382.40	Sm II	760	3388.30	Zr II	55	3392.99	Cr II
320	3382.48	Mo I	85	3388.37	Tb II	3300	3392.99	Ni I
28	3382.54	Yb I	110	3388.58	Th II	75	3392.99	U II
140	3382.68	Cr II	85	3388.59	Y I	55	3393.01	Tb II
75	3382.68	U II	55	3388.63	Tb II	570	3393.12	Zr II
320	3382.80	Tb II	130	3388.71	Ru I	170	3393.19	Tm I
28000	3382.89	Ag I	60	3388.76	Ti II	70	3393.23	Th II
100	3383.15	Sb I	40	3388.82	Ta I	90	3393.36	Dy II
130	3383.15	Th II	80	3388.82	W I	160	3393.49	Tb II
35	3383.36	Pr I	610	3388.85	Dy II	3800	3393.57	Dy II
200	3383.68	Ce II	410	3389.32	Sm II	150	3393.63	Gd II
40	3383.73	Pr II	70	3389.33	Nd I	290	3393.63	Nd II
5700	3383.76	Ti II	240	3389.43	Re I	160	3393.65	Mo I
85	3383.80	Nb I	100	3389.44	Dy II	70	3393.84	Cr II
80	3383.98	Fe I	130	3389.46	Th I	290	3393.91	U II
310	3384.00	Os I	100	3389.50	Ru I	100	3393.92	Ce II
100	h 3384.09	Dy II	160	c 3389.56	Ho II	140	3393.98	Dy II
140	3384.14	Hf II	150	3389.59	Er II	90	3394.09	Er II
160	3384.45	Re I	310	3389.64	Th II	80	3394.12	Re I
220	3384.45	U II	450	3389.74	Er II	65	3394.14	Ce II
85	3384.60	Os I	160	3389.80	Mo I	110	3394.14	Th II
1900	3384.62	Mo I	800	3389.83	Hf II	55	3394.30	Cr II
85	3384.66	Nb I	110	3390.02	Tb II	90	3394.39	Er II
510	3384.66	Sm II	200	3390.25	Re I	50	h 3394.44	Yb II
230	3384.70	Hf II	50	3390.25	Yb II	1100	3394.58	Ti II
150	3384.86	Sm I	110	3390.37	Th I	230	3394.59	Hf II
420	d 3384.99	Tm II	730	3390.39	U I	65	3394.59	Os I
	3385.08	Tm I	28	3390.42	Yb II	320	c 3394.60	Ho II
5300	3385.02	Dy II	100	3390.52	Ce II	110	3394.62	Pr II
360	3385.05	Ta I	210	3390.60	Tb II	110	3394.77	Tb II
1700	3385.08	Er II	85	3390.63	Nb I	340	3394.78	U II
130	3385.14	Ru I	140	3390.68	Ti I	130	3394.80	Th II
960	3385.22	Co I	290	c 3390.75	Ho II	190	3394.86	Er II
60	3385.39	Sm II	75	3390.78	Eu II	140	3394.98	Hf II
950	3385.50	Lu I	90	3390.88	Gd II	40	3394.98	Nb II
310	3385.53	Th II	120	3390.97	U I	160	3395.02	Tb II
170	3385.66	Ti I	1300	3391.05	Ni I	540	3395.12	Gd II
200	3385.76	Re I	80	3391.09	W I	290	3395.32	U II
110	3385.78	Rh I	50	3391.10	Yb II	130	3395.36	Mo II
65	3385.88	Mo I	150	3391.11	Sm II	110	3395.37	Th II
190	3385.94	Os I	140	d 3391.16	Dy II	2200	3395.38	Co I
1400	3385.95	Ti I	380	3391.28	Tb II	290	d 3395.52	U I
220	3386.13	U II	40	3391.33	Nb I		3395.58	U II
85	3386.14	Os I	95	3391.43	Cr II	95	3395.72	Os I
170	3386.21	Hf I	80	3391.52	W I	170	3395.93	Nb I
170	3386.24	Nb II	160	h 3391.55	Lu I	350	3396.07	Er II
70	3386.29	Nd II	75	3391.72	Tb II	1300	3396.16	Dy II
80	3386.41	Ho I	60	3391.89	Ru I	410	3396.19	Sm II
110	d 3386.49	Tb II	210	3391.96	Dy II	160	3396.33	Zr II
310	3386.50	Th II	5700	3391.98	Zr II	130	3396.39	Th II
100	3386.52	Nd II	190	3391.99	Eu II		3396.46	Th II

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
280	3396.58	Eu II	200	3401.59	Ho II	110	h 3406.76	Dy II
40	3396.66	Zr II	200	3401.65	Th II		3406.82	Dy II
40	3396.72	Ce II	310	3401.74	Ru I	200	3406.92	Gd I
200	3396.73	Th I	390	3401.83	Er II	450	3406.94	Ta I
1400	3396.82	Lu I	620	3401.86	Os I	70	3406.95	Er II
5600	3396.82	Rh I	75	3401.87	U II	40	3407.10	Tb II
290	3396.84	Er II	110	3402.01	Dy I	90	3407.14	Hf I
45	3397.04	Y I	200	3402.03	Th II	380	3407.16	Dy II
4100	3397.07	Lu II	540	3402.07	Gd II	60	3407.20	Ti II
75	3397.19	U I	130	3402.18	Ho II	45	3407.25	Ce II
550	c 3397.21	Bi I	420	3402.33	Tb II	300	3407.46	Fe I
80	3397.21	Re I	30	3402.40	Cr II	1100	d 3407.56	Gd II
220	d 3397.22	Gd I	60	3402.42	Ti II		3407.61	Gd II
	3397.32	Gd I	600	3402.46	Sm II	140	3407.76	Hf II
230	3397.26	Hf I	180	3402.51	Hf I	5300	3407.80	Dy II
110	3397.33	Ho II	250	3402.51	Os I	70	3407.83	Th I
1700	3397.50	Tm II	55	3402.57	V I	150	d 3407.87	U I
220	3397.52	Th I	980	3402.70	Th II		3407.97	U II
230	3397.60	Hf I	55	3402.78	Tb II	190	3408.08	Zr II
55	3397.60	Tb II	130	3402.81	Mo I	340	3408.13	Pt I
160	3397.69	Mo I	150	3402.87	Zr II	420	3408.14	Dy II
150	3397.76	Sm II	85	3403.02	Nb I	200	3408.21	Ho II
65	3397.87	Tm I	110	3403.08	Gd II	270	3408.38	Nb I
40	3397.92	Zr I	210	3403.09	Sm II	80	h 3408.38	W I
170	3398.02	Tm II	140	3403.24	Dy II	250	d 3408.64	Th II
80	3398.09	W I	200	3403.27	Th II		3408.75	Th I
85	3398.25	Nb I	170	3403.32	Cr II	240	3408.67	Re I
150	3398.26	U II	65	3403.35	Mo I	230	3408.68	Nb II
190	3398.27	Er II	110	3403.43	Dy II	850	3408.68	Sm II
90	3398.32	Dy II	290	3403.55	U II	180	3408.69	Er II
230	3398.33	Ta I	21	3403.56	Pr II	360	3408.76	Cr II
270	3398.35	Tb II	75	3403.60	Ce II	120	3408.76	Os I
250	3398.54	Th I	800	3403.65	Cd I	40	3408.78	Zr
85	3398.58	Tb II	190	3403.68	Zr II	85	3408.86	Tb II
60	3398.63	Ti I	35	3404.10	Yb II	200	c 3409.06	Ho II
8100	c 3398.98	Ho II	40	3404.13	Ce II	4500	3409.18	Co I
75	3399.01	U I	55	3404.24	Tb II	180	3409.19	Nb II
320	3399.10	Tb II	640	3404.34	Mo I	200	3409.27	Th II
4000	3399.30	Re I	150	3404.36	Fe I	310	3409.28	Ru I
85	3399.30	Tb II	24000	3404.58	Pd I	250	3409.30	Gd II
220	3399.34	Fe I	170	3404.65	Th II	100	3409.46	Dy II
380	3399.35	Zr II	160	3404.71	Tb II	130	3409.58	Ni I
90	3399.36	Dy II	650	3404.72	Re I	95	3409.81	Ti II
120	3399.40	Nb I	570	3404.83	Zr II	320	3409.83	Re I
200	3399.41	Gd II	200	3404.91	Ce II	150	3409.87	Er I
820	3399.70	Rh I	210	3404.99	Dy II	75	3409.91	Nb I
85	3399.71	Nb II	90	3405.04	Gd II	160	d 3409.94	Tb II
2300	3399.80	Hf II	11000	3405.12	Co I	850	3410.05	Tm I
150	3399.84	Sm II	65	3405.20	Mo I	230	3410.17	Hf II
420	3399.95	Tm II	230	3405.41	Nb I	150	3410.25	Nd II
110	3399.97	Tb II	200	3405.56	Th I	760	3410.25	Zr II
540	3399.99	Gd II	270	3405.65	Dy II	810	c 3410.26	Ho II
170	3400.21	Hf I	95	3405.72	U I	210	3410.40	Tb II
45	3400.25	Ce II	650	3405.89	Re I	390	c 3410.65	Ho II
170	3400.40	V I	1300	3405.94	Mo I	210	3410.68	Tb II
270	3400.53	Tb II	240	3405.98	Ce II	140	3410.71	Dy II
110	3400.60	Ho II	190	3406.01	Tb II	220	3411.02	Gd I
210	d 3400.86	Tb II	130	3406.13	Nb I	110	3411.22	Dy II
290	3401.01	U II	130	3406.24	Th II	85	3411.28	Sm II
50	3401.01	Yb II	120	3406.27	Ho II	110	3411.52	Dy II
110	3401.07	Gd II	95	3406.28	Os I	290	3411.53	U I
120	3401.17	Os I	220	3406.28	U II	290	3411.55	Ho II
80	3401.17	Re I	160	3406.55	Rh I	55	3411.57	Tm II
90	3401.20	Er II	170	3406.66	Ta II	190	3411.64	Ru I
150	3401.21	U II	95	3406.67	Os I	170	3411.78	Th II

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
40	h 3411.79	Zr I	90	3417.86	Nb I	200	3422.66	Th I
110	3412.02	Gd II	75	3417.90	Ce II	600	3422.71	Ce II
290	3412.10	U II	55	3417.91	Tb II	270	3422.74	Cr II
820	3412.27	Rh I	270	3418.10	Dy II	390	3422.75	Gd II
6700	3412.34	Co I	270	3418.15	Sm II	270	3422.86	Dy II
60	3412.34	Hf I	80	c 3418.19	Ho II	190	3422.90	Er I
150	3412.36	U II	75	3418.39	U I	75	3423.05	Tb II
70	3412.39	Nd II	140	3418.39	Yb I	220	3423.05	U II
50	3412.45	Yb I	65	3418.41	Pr II	65	3423.09	Eu II
85	3412.47	Y I	120	3418.47	Ho I	130	3423.13	Th II
340	3412.59	Tm I	150	3418.51	Fe I	110	3423.23	Dy II
2200	3412.63	Co I	130	3418.51	Sc I	1600	3423.71	Ni I
120	3412.74	Os I	430	3418.51	Sm II	180	3423.76	Nb I
150	3412.87	Ho II	240	3418.52	Mo I	90	h 3423.82	Dy II
90	3412.89	Ta I	45	3418.52	V I		3423.91	Dy II
230	3412.94	Nb II	1400	3418.73	Gd II	110	3423.85	Ce II
150	3412.96	W I	200	3418.78	Th II	1100	3423.90	Gd I
250	3413.01	Th I	55	3418.86	Tb II		3423.92	Gd II
230	3413.14	Fe I	100	3418.93	Ce II	110	3423.96	Tb II
220	3413.27	Gd II	55	3418.95	Tb II	270	3423.99	Th I
330	3413.48	Ni I	200	3418.95	Th II	290	3424.11	Ho I
150	3413.53	W I	50	3418.96	Mo I	160	3424.29	Fe I
90	3413.74	Hf II	75	3419.11	Zr II	190	d 3424.35	Tb II
80	3413.74	Re I	270	3419.17	Th II	120	d 3424.38	Rh I
520	3413.76	Tb II	410	3419.18	Hf I	140	3424.45	Ta I
1300	3413.78	Dy II	35	3419.23	Pr II	65	3424.50	Tm I
120	3413.81	U II	65	3419.36	Sc I	220	3424.51	Co I
85	3413.90	Sm II	810	3419.41	Re I	580	3424.56	U II
330	3413.94	Ni I	60	3419.42	Ir I	830	3424.59	Gd II
90	3414.07	Nb I	85	3419.54	Tb II	190	3424.60	Mo I
140	3414.14	Ta II	780	3419.63	Dy II	8000	3424.62	Re I
200	c 3414.25	Ho II	110	3419.66	Zr I	110	3424.66	Tb II
75	3414.32	U I	75	3419.74	Ta I	95	3424.76	Mo I
130	3414.50	Th II	170	3419.77	Sm II	120	3424.78	Sm II
380	3414.66	Zr I	45	3419.84	Eu II	150	3424.81	U II
510	3414.74	Co I	250	3420.04	Mo I	160	3424.82	Zr II
8200	3414.76	Ni I	70	3420.08	Ru I	150	3425.02	Eu II
530	3414.82	Dy II	60	3420.16	Rh I	530	3425.06	Dy II
1400	c 3414.90	Ho II	140	3420.18	Ce II	110	3425.07	V I
50	3415.55	Nd II	190	3420.18	Er II	270	3425.08	Er II
65	3415.69	Pr II	400	d 3420.34	Tb II	6400	3425.08	Tm II
120	3415.71	Dy II	90	3420.63	Nb II	130	3425.18	Th II
70	3415.88	Th I	160	3420.75	Re I	95	3425.19	Mo I
180	3415.97	Nb I	90	3420.79	Dy I	190	3425.22	Nd II
75	3416.12	U II	21	3421.11	Pr II	2000	c 3425.34	Ho II
270	3416.24	Tb II	210	3421.21	Cr II	75	3425.35	Ce II
5400	3416.46	Ho II	390	3421.21	Th I	90	3425.40	Dy II
90	3416.57	Ce II	330	3421.22	Rh I	230	3425.42	Nb II
340	3416.59	Tm I	13000	3421.24	Pd I	130	3425.48	Mo I
90	3416.68	Sc I	190	3421.25	Mo I	950	3425.63	Tm II
140	3416.86	Ce II	160	3421.31	Dy II	130	3425.85	Nb I
1400	3416.95	Gd II	45	3421.42	Hf II	55	3425.92	Tb II
45	3417.03	Ta II	1200	3421.63	Ho II	390	3425.93	Gd II
55	3417.06	V I	120	3421.69	Os I	130	3425.94	Th II
270	3417.13	Dy II	220	3421.69	U II	65	3425.95	Ce II
2700	3417.16	Co I	170	3421.79	Tm I	130	3426.00	Mo I
180	3417.28	Er II	250	3422.31	Mo I	360	3426.04	Yb I
130	3417.33	Gd II	75	3422.35	U II	400	3426.19	Re I
230	3417.34	Hf I	150	3422.42	W I	170	3426.20	Sm II
3100	3417.35	Ru I	190	3422.44	Tb II	390	3426.21	Ce II
290	3417.45	Ce II	6900	3422.47	Gd II	100	3426.34	Gd II
350	3417.63	Er II	45	3422.49	Ce II	70	3426.39	Fe I
85	3417.72	Tb II	45	3422.53	Ce II	170	3426.39	U II
320	3417.77	Re I	130	3422.60	Dy II	45	3426.44	Eu II
150	3417.84	Fe I	80	3422.66	Fe I	230	3426.57	Nb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
75	3426.59	Ce II	150	3431.54	U II	580	3435.49	U I
70	3426.64	Fe I	110	3431.57	Zr II	75	3435.53	Tb II
90	3426.73	Ta I	2500	3431.58	Co I	530	3435.56	Sc I
230	3426.76	Ho II	21	3431.62	Pr II	130	3435.60	Dy II
160	3426.79	Mo I	270	3431.79	Dy II	140	3435.61	Ho II
25	3426.93	Zr I	130	3431.81	Th II	40	3435.72	Eu II
320	3427.12	Fe I	55	3431.86	Tb II	770	3435.98	Th II
140	3427.44	Hf I	320	c 3432.10	Ho II	140	3436.00	Ta I
65	3427.44	Os I	100	3432.21	Ru I	130	3436.09	Dy II
230	3427.45	Nb I	110	3432.35	Tb II	160	3436.19	Cr I
40	3427.55	Pr II	140	3432.41	Zr II	160	3436.31	Ho II
300	3427.61	Re I	40	3432.42	Nb I	270	3436.73	Th I
150	3427.67	Os I	220	3432.58	Dy II	6400	3436.74	Ru I
150	3427.71	W I	180	3432.70	Nb II	150	3436.78	U II
80	3427.90	Mo I	310	3432.74	Ru I	90	3436.92	Dy II
35	3427.93	Pt I	130	3432.86	Dy II	90	3436.96	Nb II
85	3427.97	Sm II	95	3432.87	Mo I	85	3436.97	Tb II
2000	c 3428.13	Ho II	110	3432.90	Tb II	660	3437.02	Ir I
110	d 3428.16	Tb II	690	3432.99	Gd II	130	3437.02	Th II
80	3428.20	Fe I	100	3432.99	Nd II	290	3437.04	Ho I
80	3428.23	Co I	4500	3433.04	Co I	150	3437.10	Sm II
4900	3428.31	Ru I	180	3433.09	Ce II	380	3437.14	Zr II
200	3428.37	Hf II	75	3433.09	Nb I	640	3437.22	Mo I
490	3428.39	Er II	270	3433.13	Er II	990	3437.28	Ni I
80	3428.46	Yh II	190	3433.26	Ru I	340	3437.31	Th I
220	3428.47	Gd II	320	3433.26	Tb II	100	3437.50	Ir I
170	3428.61	Tm II	140	3433.31	Cr II	100	3437.63	Er II
130	3428.63	Ru I	5000	3433.45	Pd I	85	3437.63	Tm II
55	3428.71	Th II	85	h 3433.50	Pr II	320	3437.71	Re I
40	3428.79	Nb I	2600	3433.56	Ni I	45	3437.81	Ce II
170	3428.93	Nd II	270	3433.60	Cr I	35	3437.82	Ce I
110	h 3428.99	Dy II	170	3433.68	Sm II	130	c 3437.91	Ho II
200	3429.00	Th I	75	3433.71	U II	75	3437.93	U II
130	3429.04	Nb I	150	3433.90	U I	170	3438.06	Sm II
55	3429.09	Tb II	110	3433.91	Zr II	4700	3438.23	Zr II
630	c 3429.18	Ho II	980	3434.00	Th II	250	3438.24	Hf II
200	3429.21	Sc I	95	3434.04	Mo I	160	3438.31	Er II
340	3429.33	Tm I	55	3434.11	Cr I	65	c 3438.35	Ho II
110	3429.39	Th II	270	3434.15	U II	260	3438.37	Ru I
420	3429.44	Dy II	1900	3434.37	Dy II	45	3438.40	Ta
200	3429.48	Sc I	75	3434.50	Ta I	140	3438.43	Hf I
190	3429.54	Ru I	55	3434.54	Th II	80	3438.47	Er II
230	3429.59	W I	120	3434.61	U I	190	3438.57	Tb II
95	3429.75	Sm II	45	3434.61	Yb II	50	3438.71	Yb II
190	3429.88	Er II	140	3434.63	Er II	140	3438.80	Tm II
130	3429.90	Th II	140	3434.76	Ho II	100	3438.85	Yb II
850	3429.96	Tm II	130	3434.76	Th I	250	3438.87	Mo I
50	3430.18	U I	30	3434.77	Pr II	80	3438.91	Co I
110	3430.24	Gd II	380	3434.79	Mo I	330	3438.94	Dy II
85	3430.27	Pr II	8200	3434.89	Rh I	340	3438.95	Th II
65	3430.29	Zr I	55	3434.90	Tm II	75	3439.05	Tb II
130	3430.32	Ce II	75	3434.92	Tb II	1700	3439.21	Gd II
75	3430.48	U II	45	3435.05	Eu II	60	3439.30	Ti I
40	3430.50	Pr II	160	3435.19	Ru I	130	3439.33	Dy II
1000	3430.53	Zr II	35	3435.20	Ce I	70	3439.40	Th I
210	3430.61	Tb II	65	3435.20	Eu II	90	3439.41	Sc I
490	3430.77	Ru I	150	3435.20	U I	95	3439.49	Os I
180	3430.94	Ta I	27	3435.21	Ce II	530	3439.71	Th II
150	3430.98	Gd II	22	3435.25	Ce II	270	3439.72	Tb II
140	3431.06	Er I	90	3435.26	Dy II	830	3439.78	Gd II
240	3431.11	Yb I	65	3435.26	Os I	140	3439.84	Ce II
150	3431.14	U I	60	3435.27	Sm II	90	3439.92	Nb II
420	3431.19	Tm II	190	3435.35	Tm I	2700	3439.99	Gd II
270	3431.36	Sc I	50	3435.43	Nd II	65	3440.18	Sc I
65	3431.50	Ce II	320	3435.45	Mo I	220	3440.20	Ru I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
90	3440.24	Ta II	45	3445.18	Eu II	110	3450.30	Tb II
520	3440.37	Tb II	200	3445.22	Th II	80	3450.33	Fe I
90	3440.45	Dy II	190	3445.26	Mo I	1400	3450.38	Gd II
180	3440.45	Zr I	70	3445.39	Th II	110	3450.95	Th II
240	3440.50	Sm II	160	3445.55	Os I	70	3450.95	Y I
1400	3440.53	Rh I	3800	3445.57	Dy II	60	3451.15	Rh I
180	3440.59	Nb II	170	3445.62	Cr I	150	3451.21	U II
250	3440.60	Os I	160	3445.66	Ho II	1100	3451.23	Gd II
4000	3440.61	Fe I	90	3445.68	Nb I	140	3451.23	Ho I
45	3440.82	Eu II	200	3445.74	Th II	25	3451.48	Pr II
560	3440.93	Dy II	70	3445.91	Ta I	75	3451.57	Ce II
150	3440.98	U I	130	3446.08	Mo II	130	3451.70	Th I
800	3440.99	Fe I	110	3446.09	Co I	300	3451.75	Mo I
150	3441.00	Eu II	4800	3446.26	Ni I	16000	3451.88	Re I
130	3441.04	Th II	210	3446.40	Tb II	80	3451.92	Fe I
70	3441.12	Cr I	85	3446.55	Tm I	130	3452.18	La II
770	3441.13	Er II	190	3446.61	Zr I	80	3452.28	Fe I
290	3441.21	Ce II	90	3446.73	Ce II	100	3452.31	Hf I
80	3441.25	Re I	270	3446.87	Er I	90	3452.35	Nb II
130	3441.36	Th II	35	3446.89	Yb II		3452.37	Nb I
6400	3441.40	Pd I	75	c 3446.91	Ta II	110	3452.37	Tb II
140	3441.44	Cr I	830	3446.99	Dy II	85	3452.40	Yb I
250	3441.44	Mo I	30	3447.02	Cr I	60	3452.47	Ti II
1300	3441.45	Dy II	3200	3447.12	Mo I	250	3452.60	Mo I
4900	3441.50	Tm II	170	3447.26	Dy II	270	3452.68	Th II
75	3441.68	Th II	170	d 3447.26	Tm II	85	3452.78	Sm II
110	3441.79	Gd II		3447.35	Tm I	1300	3452.89	Ni I
100	3441.84	Hf I	50	3447.28	Fe I	100	3452.90	Ru I
720	3441.99	Mn II	90	3447.29	Ta I	85	h 3453.03	Tm I
140	3442.39	Ce II	75	3447.32	U II	3200	3453.14	Ho II
55	3442.50	Dy II	600	3447.36	Zr I	180	3453.17	La II
55	3442.55	Dy II	170	3447.43	Cr I	80	3453.28	Re I
110	3442.58	Th I	100	3447.52	Er II	190	3453.33	Cr I
35	3442.63	Rh I	170	3447.73	Dy II	75	3453.46	Tb II
65	3442.65	Nb I	120	3447.74	Rh I	21000	3453.50	Co I
65	3442.66	Mo I	70	3447.76	Cr I	240	3453.50	Re I
390	3442.68	Er I	35	h 3447.84	Pr I	110	3453.51	Th I
30	3442.76	Pr II	160	3448.06	Er II	170	3453.56	Sm II
35	3442.79	Nb I	40	3448.19	Pr II	360	3453.57	U II
1600	3442.93	Co I	45	3448.29	Hf I	160	3453.66	Er I
270	3442.95	U I	65	3448.49	Sc I	4900	3453.66	Tm II
65	3442.96	Ce II	60	3448.58	Rh I	40	3453.74	Cr I
60	3442.97	Re I	150	3448.78	U I	150	3453.78	U II
170	3442.99	Tm I	200	3448.82	Y II	110	c 3453.85	Ho II
240	3443.00	W I	80	3448.83	W I	810	3454.06	Tb II
70	3443.11	Th II	160	3448.95	Ru I	500	3454.08	Yh II
250	3443.26	Mo I	410	3448.97	Ir I	540	3454.14	Gd II
100	3443.32	Nd II	130	c 3449.01	Ho II	100	3454.21	Th II
90	3443.48	Dy II	640	3449.07	Mo I	100	3454.22	Mo I
120	3443.57	Zr II	4100	3449.17	Co I	320	3454.23	U II
35	3443.59	Yb II	310	3449.20	Os I	2700	3454.32	Dy II
8800	3443.64	Co I	70	3449.29	Th II	50	3454.38	Nd II
100	3443.75	Er II	390	3449.35	Ho I	440	3454.51	Dy II
30	3443.79	Cr I	400	3449.37	Re I	45	3454.80	Ce I
400	3443.88	Fe I	2100	3449.44	Co I	880	3454.90	Gd II
70	3443.98	Th I	270	3449.46	Th II	85	3454.97	Sm II
85	3444.16	Tm I	70	3449.56	Sm II	65	3455.03	Os I
130	3444.25	Dy II	390	3449.62	Gd II	400	3455.22	Rh I
890	3444.31	Ti II	170	3449.65	Th II	1000	3455.23	Co I
120	3444.46	Os I	170	3449.76	Tm II	200	3455.27	Gd I
320	3444.58	Tb II	40	3449.80	Pr II	110	3455.35	Tb II
85	3444.62	Sm II	95	3449.85	Mo I	60	3455.42	Rh I
95	3445.04	Mo I	440	3449.89	Dy II	130	3455.60	Cr I
45	3445.10	Ta I	110	3450.22	Dy II	810	c 3455.70	Ho II
160	3445.15	Fe I	120	3450.29	Rh I	240	3455.74	U II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
200	3455.91	Zr I	65	3461.18	La I	75	3466.92	Tb II
50	3455.97	Pr II	270	3461.22	Th I	330	3466.95	Gd II
55	3455.99	Tb II	90	3461.31	Dy II	65	3466.97	Mo I
16000	c 3456.00	Ho II	100	3461.35	Ce II	40	3467.02	Cr I
190	3456.15	Mo I	140	3461.36	Ho II	35	3467.03	Pr II
55	3456.36	Tm I	130	3461.38	Eu II	360	c 3467.07	Ho II
950	3456.39	Mo I	180	3461.39	Er II	95	3467.26	Ti I
180	3456.39	Ti II	600	3461.50	Ti II	1700	3467.27	Gd II
75	3456.54	Nb I	5000	3461.65	Ni I	90	3467.47	Nb I
110	3456.55	Tb II	45	3461.79	Ce II	200	3467.50	Ni I
1300	3456.56	Dy II	50	3461.83	Nd II	210	3467.51	Tm I
70	3456.62	Ru I	220	3461.95	Gd II	140	3467.60	Hf I
45	3456.67	Ce II	1600	3461.97	Ho II	800	3467.66	Cd I
100	3456.77	Ce II	5900	3462.04	Rh I	70	3467.72	Cr I
110	3456.93	Co I	180	3462.19	Sc I	45	3467.78	Ce II
160	h 3457.03	Tb II	8500	h 3462.20	Tm II	250	3467.85	Mo I
85	3457.05	Eu I	320	3462.21	U I	90	3467.86	Dy II
200	3457.05	Gd II	35	3462.34	Yb II	170	3467.87	Sm II
320	3457.05	U II	250	3462.57	Er I	85	3467.88	Eu I
180	3457.07	Rh I	140	3462.64	Hf II	110	3467.88	Y II
110	3457.18	Zr I	50	3462.65	Nb I	400	3467.96	Re I
270	3457.45	Sc I	85	3462.69	Sm II	620	3468.03	Tb II
45	3457.56	Eu II	5100	3462.80	Co I	150	3468.08	Gd II
410	3457.56	Zr II	340	3462.85	Th II	100	3468.11	Ce II
320	3457.71	U II	230	d 3462.97	Tb II	80	3468.13	Ho I
90	3457.79	Nb I	220	3463.00	Gd II	390	3468.22	Th II
220	3457.93	Rh I	820	3463.02	Zr II	80	3468.40	W I
65	3458.15	Mo I	70	3463.14	Ru I	120	3468.42	Nd II
240	3458.17	U I	100	3463.22	Ce II	720	3468.43	Dy II
190	d 3458.29	Yb II	80	3463.25	W I	90	3468.78	Dy II
	3458.39	Yb I	190	3463.34	Dy II	55	3468.89	Ce II
120	3458.38	Os I	460	3463.54	U I	1700	3468.99	Gd II
5000	3458.47	Ni I	270	3463.72	Th II	22	3469.00	Ce II
140	3458.55	Tm I	100	3463.76	Ce II	320	3469.22	Mo I
75	3458.68	U II	230	3463.77	Ta I	80	3469.31	Gd II
190	3458.71	Tb II	170	3463.81	Nb I	170	3469.34	Th I
160	3458.88	Re I	200	3463.87	Dy II	140	3469.40	Ho II
200	3458.93	Zr II	2700	3463.98	Gd II	130	3469.44	Nb I
75	3458.95	Nb I	120	3464.07	Sm II	240	3469.49	Ni I
110	3458.98	Dy II	100	3464.16	Ce II	150	3469.49	U I
170	3459.20	Sm II	75	3464.21	Ce II	490	3469.51	Er I
120	3459.42	Sm II	2400	3464.37	Yb I	45	3469.59	Cr I
90	3459.70	Nb I	70	3464.43	Sm II	180	3469.62	Rh I
75	3459.84	Ce II	950	3464.46	Sr II	65	3469.63	Mo I
160	3459.92	Mo I	270	3464.53	Er II	130	d 3469.65	Sc I
360	3459.92	U I	55	3464.63	Tb II	110	3469.70	Tb II
45	3460.17	Ce II	40000	c 3464.73	Re I	270	3469.72	Er II
130	3460.23	Mo I	70	3465.06	Th I	120	3469.78	U I
360	3460.27	Yh I	65	3465.25	Cr I	75	3469.85	Tb II
360	3460.33	Mn II	120	3465.44	Os I	1300	3469.92	Th II
380	3460.38	Tb II	95	3465.63	Zr I	40	3469.94	Zr II
220	3460.40	Dy II	110	3465.74	Pr II	130	3470.19	Dy II
100	3460.43	Cr I	450	3465.76	Th II	160	3470.36	Tb II
55000	c 3460.46	Re I	5100	3465.80	Co I	45	3470.40	Ce II
25	3460.58	Pr II	600	3465.86	Fe I	4700	3470.66	Rh I
110	3460.66	Dy II	180	3465.86	Nb I	130	c 3470.76	Ho II
7700	3460.77	Pd I	130	3465.92	Th II	120	3470.86	Nd II
640	3460.78	Mo I	110	3465.98	Tb II	190	3470.92	Mo I
4400	3460.97	Dy II	2500	3466.20	Cd I	110	3471.13	Sc I
190	3461.00	Tb II	630	3466.30	U I	560	3471.14	Dy II
200	3461.02	Th I	100	3466.50	Gd II	100	3471.19	Nb I
160	3461.09	Zr I	130	3466.54	Th I	600	3471.19	Zr I
240	3461.13	Sm II	140	3466.64	Th I	170	3471.22	Th I
140	3461.16	Tm II	40	3466.73	Pr II	95	3471.38	Co I
300	3461.18	Co I	320	3466.83	Mo I	560	d 3471.53	Dy II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
970	3471.60	Dy II	45	3477.22	Ta I	85	3481.50	Tb II
270	3471.71	Er II	35	3477.39	Ce II	55	3481.54	Cr I
70	3471.73	Tb II	45	3477.45	Ce II	340	3481.75	Tm II
120	3471.96	Th I	100	3477.45	Ta I	100	3481.79	Mo I
230	3472.25	Rh I	75	3477.50	U II	1700	3481.80	Gd II
270	3472.31	Ho II	70	3477.70	Th II	80	3481.82	W I
710	3472.37	Tb II	200	3477.75	Ho II	110	3482.10	Dy II
4800	3472.40	Hf I	60	3477.77	Ir I	120	3482.11	Os I
390	3472.48	Lu II	270	3477.84	U II	140	3482.14	Ce II
45	3472.51	U II	90	3477.93	Dy II	65	3482.23	Os I
1600	3472.52	Ta I	100	3477.93	Er II	240	3482.23	Re I
150	3472.54	Ni I	160	3477.94	W I	240	3482.35	Ce II
160	3472.56	U II	200	3478.06	Ho II	190	3482.40	Mo I
16	3472.72	Re I	130	3478.13	Th II	680	3482.49	U II
810	3472.76	Cr I	130	3478.30	Zr II	130	3482.55	Th II
25	3472.79	Tb II	130	3478.46	Th II	50	3482.56	Yb II
24	3472.90	Zr I	90	3478.48	Dy II	490	3482.60	Gd II
210	3472.91	Cr I	65	3478.50	Zr II	130	3482.76	Th II
140	3473.00	Tb II	120	3478.53	Os I	75	3482.80	Tb II
130	3473.02	Nb I	65	3478.56	Co I	190	3482.81	Zr I
1400	3473.03	Th II	290	3478.69	Nb I	290	3482.91	Mn II
65	3473.22	Gd II		3478.78	Nb II	190	3483.01	Zr I
55	3473.22	Mo I	200	3478.79	Zr I	230	3483.04	Tb II
100	3473.28	Tb II	500	3478.84	Yb II	130	3483.16	Ru I
320	3473.42	Th II	2100	3478.91	Rh I	130	3483.29	Ru I
40	3473.43	U I	60	3478.92	Ti I	1900	3483.41	Co I
380	3473.61	Cr I	200	3478.99	Hf II	60	3483.43	Pt I
260	3473.70	Dy II	180	3479.02	Zr II	760	3483.54	Zr II
75	3473.75	Ru I	120	3479.16	U I	95	3483.67	Mo I
65	3473.79	Tb II	250	3479.17	Th II	230	3483.69	Tb II
45	3473.84	Pr II	480	3479.28	Hf II	550	3483.77	Ni I
810	3473.90	Ta I	55	3479.29	Th II	190	3483.84	Mo I
130	3473.91	Ho II	1200	3479.39	Zr II	80	3483.89	Ho II
8000	3473.96	Sm II	610	3479.41	Er II	95	3484.04	Rh I
360	3474.02	Co I	180	3479.43	Mo I	100	3484.05	Nb II
75	3474.04	Mn II	130	3479.53	Sm II	80	3484.48	Ir I
5400	3474.13	Mn II	200	3479.56	Nb II	100	3484.55	Er II
220	3474.22	Ce II	100	3479.60	Ce II	45	3484.62	Ta I
150	3474.26	Ho II	70	3480.05	Th I	220	3484.68	Dy II
4700	3474.27	Dy II	100	3480.09	Mo I	55	3484.70	Ce II
120	3474.54	U II	380	3480.17	Tb II	75	3484.74	Ce II
150	3474.78	Rh I	130	3480.26	Sm II	6300	3484.84	Ho II
190	3474.89	Sr II	65	3480.28	Ce II	120	3484.88	Nd I
800	3474.99	U II	35	3480.34	Ce II	710	3485.05	Ce II
50	3475.03	Mo I	360	3480.36	U I	190	3485.16	Er II
100	3475.45	Fe I	45	3480.38	Ce II	200	3485.21	Th II
100	3475.58	Nb I	400	3480.38	Re I	160	3485.27	Pt I
55	3475.67	Ce II	150	3480.41	Zr II	130	3485.32	Zr II
80	3475.72	Th II	90	3480.42	Dy II	60	3485.34	Fe I
110	3475.82	W I	290	3480.44	Er II	380	3485.37	Co I
110	3476.12	Tb II	490	3480.52	Ta I	60	3485.69	Ti I
500	3476.29	Th II	240	3480.53	Ti I	170	3485.73	Y I
150	3476.30	Yb II	170	3480.56	Sm II	85	3485.76	Yb II
240	3476.31	Gd II	220	3480.81	Dy II	970	3485.85	Er II
150	3476.44	Re I	320	3480.85	Re I	200	3485.87	Ho II
80	3476.44	U II	75	3480.98	Ce II	130	3485.89	Ni I
170	3476.46	Ir I	340	3480.98	Tm I	190	3485.92	Dy II
340	3476.54	Th II	50	3481.05	Nb I	110	3485.92	V II
320	3476.69	Tm I	10000	3481.15	Pd I	240	3485.93	Mo I
480	3476.70	Fe I	1300	3481.15	Zr II	50	3485.93	Nb I
1300	3476.84	Ce II	75	3481.16	Ce II	220	3486.20	Gd I
75	3477.07	Dy II	2200	3481.28	Gd II	120	3486.30	U II
80	3477.07	Eu I	70	3481.30	Cr I	160	3486.34	Ho II
600	3477.14	Re I	240	3481.30	Ru I	390	3486.51	Th II
	3477.18	Ti II	150	3481.44	Nd II		3486.55	Th I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
350	3486.82	Er II	580	c 3493.09	Ho II	80	3497.65	Ho II
170	3487.08	Tm II	90	3493.11	Ce II	400	3497.81	Dy II
130	3487.20	Dy II	55	3493.17	V II	200	3497.81	Nb I
65	3487.25	Os I	390	3493.33	U II	240	3497.84	Fe I
110	3487.28	Tb II	130	3493.34	Mo I	380	3497.85	Ta I
420	3487.38	Tm I	270	3493.52	Th II	200	3498.01	Th II
170	3487.41	Sm II	80	3493.60	Ho I	160	3498.54	Os I
120	3487.46	Os I	170	3493.61	Sm II	130	3498.62	Th I
50	3487.56	Pr II	100	3493.73	Ce II	500	3498.63	Nb I
170	3487.57	Dy II	340	3493.99	U I	830	3498.71	Dy II
	3487.60	Dy II	220	3494.13	Dy II	1200	3498.73	Rh I
45	3487.57	Hf II	270	3494.21	Tb II	810	c 3498.88	Ho II
85	3487.62	Tb II	130	3494.25	Ru I	200	3498.91	Sc I
85	3488.43	Yb II	25	3494.26	Pr II	220	3498.93	Dy II
180	3488.55	Ce II	1700	3494.40	Gd II	8300	3498.94	Ru I
180	3488.68	Mn II	110	3494.44	Rh I	130	3498.96	Th I
150	3488.82	U II	4400	3494.49	Dy II		3498.99	Th II
110	3488.99	Dy II	80	3494.72	Re I	100	3498.98	Hf I
75	3489.09	Nb II	2500	c 3494.76	Ho II	60	3499.06	Pr II
270	3489.35	Er I	320	3494.84	U II	6700	3499.10	Er II
1600	3489.37	U I	160	3494.92	Tb I	95	3499.10	Ti I
4800	3489.40	Co I	55	3494.97	Cr I	160	3499.33	Tb I
45	3489.47	V I	75	3495.01	Ce II	240	3499.33	U II
290	d 3489.51	Tb II	85	3495.19	Tm II	50	3499.53	Pr II
130	3489.52	Tm I	400	3495.24	W I	190	3499.58	Zr II
220	3489.57	U II	60	3495.29	Fe I	220	3499.84	Sm II
490	3489.58	Ho II	270	3495.36	Tb II	140	d 3499.86	Dy II
60	3489.74	Ti II	45	3495.37	Zr I		3499.96	Dy II
2000	3489.77	Pd I	40	3495.38	Cr II	340	3499.95	Tm I
110	3489.78	Tb II	75	3495.60	U II	200	3499.99	Th II
140	3490.13	Ce II	50	3495.62	Os	630	3500.07	U I
290	3490.24	U II	2400	3495.69	Co I	160	3500.28	Tb II
70	3490.27	Th II	130	3495.70	Th I	75	3500.33	U II
120	3490.33	Os	250	3495.75	Hf II	170	3500.54	Sm II
70	3490.45	Th II	60	3495.75	Ti I	55	3500.68	Ce II
800	3490.58	Fe I	75	3495.75	U II	40	3500.82	V I
130	3490.65	Dy II	140	3495.84	Mn II	810	3500.84	Tb II
95	3490.74	Co I	130	c 3495.90	Re I	660	3500.85	Ni I
110	3490.86	Re I	100	hw 3495.90	Yb II	75	3501.00	U I
75	3490.93	Ta I	60	3495.92	Sm II	500	3501.11	Ba I
290	c 3490.95	Ho II	80	3495.93	Hf II	250	3501.16	Os I
230	3491.03	Nb I	100	3495.94	Cc II	130	3501.35	Zr I
480	3491.05	Ti II	130	3495.97	Ru I	160	3501.46	Ce II
80	3491.07	Rh I	75	3496.03	Nb I	140	3501.46	Th II
75	3491.24	Tb II	1700	3496.09	Y II	80	3501.49	Zr I
480	3491.32	Co I	55	3496.20	Tb II	400	3501.50	Dy II
120	3491.34	U II	4100	3496.21	Zr II	100	h 3501.58	Gd II
50	3491.48	Nb I	75	3496.33	Ce II	220	3501.86	Dy II
25	3491.49	Pr I	560	3496.34	Dy II	70	3501.87	Th I
95	3491.50	Os I	530	3496.42	U II	220	3502.14	Dy II
70	3491.58	Th II	480	3496.68	Co I	240	d 3502.24	U I
55	3491.72	Tm I	50	3496.81	Mn II		3502.24	U II
110	3491.74	Gd II	70	3496.81	Th I	9600	3502.28	Co I
130	d 3491.77	Mo I	350	3496.86	Er II	70	3502.42	Ru I
	3491.87	Mo I	70	3497.01	Th II	75	3502.50	Ta I
25	3491.94	Pr II	90	3497.03	V II	5900	3502.52	Rh I
980	3491.95	Gd II	90	3497.09	Gd I	65	3502.60	Ni I
210	d 3492.00	Tb II	80	3497.11	Fe I	570	3502.62	Co I
65	3492.11	Ho I	90	3497.13	Dy II	80	3502.73	Re I
140	3492.50	Er II	250	3497.16	Hf I	610	3502.78	Er I
160	3492.56	Tb II	70	3497.26	Th II	200	3502.78	Th II
210	3492.58	Tm II	150	3497.26	U I	130	3502.87	Ta I
85	3492.62	Sm II	980	3497.49	Hf I	65	3503.06	Pr II
5500	3492.96	Ni I	100	3497.54	Mn II	560	3503.06	Re I
110	3492.99	Tb II	150	3497.62	U II	270	3503.17	Dy II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
100	3503.20	Nb I	160	3508.73	W I	290	3513.86	Tb II
80	3503.21	Gd II	110	3508.81	Er I	260	3513.93	Ni I
130	3503.36	Tm I	320	3508.85	U II	45	3514.07	La I
140	3503.62	Th II	80	3508.93	Er I	85	3514.11	Tm I
70	3503.79	Th I	70	3509.09	Th I	640	3514.49	Ru I
240	3503.87	Ta I	130	3509.10	Sm II	200	3514.53	Th II
320	3504.00	U I	5700	3509.17	Tb II	1600	3514.61	U I
95	3504.04	Tb II	1000	3509.32	Zr I	85	3514.86	Tm I
50	3504.27	Pr II	320	3509.37	Ho II	490	3514.89	Er II
800	3504.41	Mo I	390	3509.67	U II	70	3514.96	Th II
210	3504.44	V II	2900	3509.84	Co I	290	3515.04	Tb II
830	3504.53	Dy II	75	3510.00	La II	6600	3515.05	Ni I
620	3504.66	Os I	160	3510.02	W I	120	3515.24	U II
140	3504.75	Tb II	380	3510.10	Tb II	200	3515.42	Nb II
890	3504.89	Ti II	200	3510.26	Nb II	110	3515.44	Tb II
150	3504.93	U I	2600	3510.34	Ni I	4100 c	3515.59	Ho II
130	3504.98	Ta I	1400	3510.43	Co I	220	3515.95	Ir I
270	3505.07	Er II	200	3510.46	Zr II	210	3516.14	Tb II
320	3505.07	U II	80	3510.54	Cr I	50	3516.20	Nb I
110	3505.09	Tb II	55	3510.69	Ce II	150	3516.3	U II
75	3505.18	Ta I	120	3510.70	Nd II	85	3516.30	Sm
1200	3505.23	Hf II	810	3510.73	Ho I	140	3516.35	Th II
75	3505.30	Eu II	100	3510.78	Mo I	65	3516.63	Os I
240	3505.32	Mo I	600	3510.84	Ti II	160	3516.63	Tb I
60	3505.41	Rh I	500 c	3510.85	Bi I	320	3516.65	Re I
70	3505.43	Ho II	490	3511.04	Ta I	90	3516.78	Gd II
830	3505.45	Dy II	95	3511.04	Tb II	140	3516.82	Th II
150	3505.45	U II	110	3511.16	Th I	150	3516.85	U I
350	3505.48	Zr II	85	3511.19	Nb I	85	3516.86	Nb I
140	3505.49	Th II	340	3511.23	Sm II	12000	3516.94	Pd I
1400	3505.51	Gd II	240	3511.44	U I	50	3517.00	Yb I
820	3505.67	Zr II	670 d	3511.56	Th II	150	3517.05	U II
290	3505.68	Er I	3511.67	Th II	75	3517.14	La III	
55	3505.69	V I	150	3511.58	U II	560	3517.26	Dy II
50	3505.81	Nb I	290	3511.68	Dy II	560	3517.30	V II
270	3505.84	Dy II	160	3511.76	Ho II	320	3517.33	Re I
270	3505.90	Tb II	60	3511.78	Rh I	600	3517.38	Ce II
80	3506.05	Zr II	40	3511.84	Cr II	130	3517.56	Mo I
45	3506.25	Ce II	780	3512.22	Gd II	250	3517.60	Tm I
7000	3506.32	Co I	100 c	3512.28	Re I	200	3517.67	Nb II
60	3506.50	Fe I	1100	3512.50	Gd II	3517.76	Nb I	
75	3506.56	Tb II	290	3512.56	Dy II	140	3517.72	Tm I
120	3506.64	Ti I	160	3512.60	Tb II	100	3517.89	Gd II
1300	3506.81	Dy II	4800	3512.64	Co I	390	3518.18	Er II
120	3506.85	Sm II	290	3512.70	Dy II	130	3518.22	Mo I
70	3506.85	Th II	140	3512.74	Th II	4800	3518.35	Co I
410	3506.95	Ho II	75	3512.93	La II	55	3518.37	Ce II
240	3507.05	U I	170 d	3512.93	Sm II	140	3518.40	Th I
120	3507.09	Sm II	3513.06	Sm II	310	3518.72	Os I	
2800	3507.32	Rh I	440	3512.99	Os I	130	3518.75	Hf II
780	3507.34	U I	250	3513.02	Tm II	70	3518.90	Th II
8300	3507.39	Lu II	60	3513.10	Rh I	160	3518.97	Tb I
570	3507.45	Tb II	320	3513.10	Tb II	150	3519.08	Ce II
45	3507.67	Zr II	150	3513.28	Hf I	20000	3519.24	Tl I
55	3507.69	Ni I	150	3513.37	U II	60	3519.54	Rh I
85	3507.83	Yb II	3800	3513.48	Co I	2000	3519.60	Zr I
210	3507.94	Ce II	200	3513.61	Ta I	330	3519.64	Ru I
460	3507.96	Nb I	3200	3513.64	Ir I	110	3519.76	Dy II
130	3507.99	Ho I	830	3513.65	Gd I	570	3519.76	Tb II
560	3508.12	Mo I	320	3513.68	U I	660	3519.77	Ni I
50	3508.20	Pr II	100	3513.70	Mo I	410 c	3519.94	Ho II
390	3508.38	Er II	45	3513.79	Ce II	390	3519.96	U II
1600	3508.42	Lu I	400	3513.82	Fe I	120	3520.00	Os I
90	3508.47	Ce II	65	3513.85	Ce II	150	3520.02	V II
65	3508.71	Ce II	95	3513.86	Os I	200	3520.06	Nb I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
1300	3520.08	Co I	160	3525.79	Tb II	45	3532.23	Eu II
220	3520.16	Ho II	440	3525.81	Zr II	220	3532.57	Sm II
60	3520.25	Ti II	180	3526.04	Fe I	90	3532.61	Ce II
230	3520.29	Yb II	120	3526.04	Os I	160	3532.70	Tb II
210	3520.52	Ce II	130	3526.17	Fe I	150	3532.76	Ho I
80	3520.72	Re I	240	3526.60	U II	230	3532.80	Os I
160	3520.79	Tb II	70	3526.63	Th I	240	3532.81	Ru I
190	3520.79	U II	130	3526.64	Dy II	90	3532.88	Ce II
130	3520.87	Zr II	210	3526.68	Ce II	80	3533.20	Fe I
45	3520.98	Ce II	85	3526.73	Tb II	440	3533.22	Zr I
70	3521.06	Th I	270	3526.81	Er I	1900	3533.36	Co I
470	3521.09	Eu II	6400	3526.85	Co I	120	3533.41	Os I
190	3521.16	Dy II	160	3526.85	W I	630	3533.57	U II
360	3521.26	Fe I	190	3526.90	Dy II	170	3533.59	Nd II
480	3521.41	Mo I	55	3527.06	Ta I	100	3533.66	Nb I
120	3521.48	U II	200	3527.53	Nd II	560	3533.68	V I
80	3521.53	Y I	120	3527.85	Ce II	140	3533.86	Tb II
55	3521.56	Hf I	110	3527.98	Ni I	600	3534.05	Ce II
2700	3521.57	Co I	8800	3528.02	Rh I	50	3534.12	Nb I
330	3521.88	Ce II	65	3528.05	Ce II	100	3534.24	Gd II
340	3521.91	Th II	430	3528.54	Gd II	320	3534.33	U I
80	3521.91	W I	1200	3528.60	Os I	150	3534.44	Ce II
410	3522.03	Ir I	75	3528.61	Ta I	140	3534.45	Dy II
120	3522.05	Nd II	45	3528.64	Ce II	120	3534.82	Re I
90	3522.28	Dy II	200	3528.68	Ru I	250	3534.85	Tm II
65	3522.37	Mo I	240	3528.69	U II	4400	3534.96	Dy II
170	3522.43	Tm II	140	3528.82	Th II	210	3535.16	Zr I
90	3522.45	Gd II	55	3528.90	Dy II	2000	3535.30	Nb I
210	3522.52	Er I	270	3528.95	Th II	100	3535.37	Ru I
150	3522.58	U I	2700	3529.03	Co I	310	3535.41	Ti II
150	3522.67	U I	200	3529.03	Dy II	1700	3535.52	Tm II
290	3522.86	Dy II	45	3529.04	Ce II	980	3535.54	Hf II
55	3522.92	Tb II	60	3529.21	Re I	160	3535.54	W I
980	3523.02	Hf I	5000	3529.43	Tl I	90	3535.57	Ce II
130	3523.12	Sm II	230	3529.74	V I	270	3535.65	Sm II
55	3523.20	Tb II	110	3529.76	Tb II	2700	3535.73	Sc II
75	3523.35	U II	75	3529.77	U II	130	3535.83	Ru I
3800	3523.43	Co I	7300	3529.81	Co I	75	3535.84	U I
70	3523.50	Th I	160	3530.02	Ce II	5500	3536.02	Dy II
240	3523.57	U II	230	3530.06	Os I	490	3536.21	Tm II
480	3523.64	Os I	90	3530.22	Zr I	75	3536.30	Ta I
1300	3523.66	Tb II	110	3530.51	Th I	440	3536.32	Tb II
4400	3523.98	Dy II	310	3530.60	Sm II	200	3536.56	Fe I
90	3524.07	Ce II	230	3530.77	V II	290	3536.58	Dy II
980	3524.20	Gd II	70	3530.85	Zr II	850	3536.58	Tm II
100	3524.23	Mo I	100	3530.87	Hf I	760	3536.62	Hf I
8200	3524.51	Ni I	90	3530.95	Ce II	85	3536.62	Tb I
80	3524.51	Re I	390	3531.11	U II	110	3536.70	Ce II
170	3524.63	Dy II	75	3531.15	Eu II	85	3536.77	Sm II
190	3524.65	Mo I	100	3531.23	Hf I	110	3536.94	Zr II
110	3524.72	V II	100	3531.27	Er I	75	3537.06	U I
610	3524.91	Er II	130	3531.39	Ru I	230	3537.11	Tb II
90	3524.93	Dy II	140	3531.45	Th I	65	3537.15	Ce II
240	3524.98	Mo I	150	3531.58	Ta I	150	3537.15	Gd II
85	3525.03	Tm I	65	3531.59	Ce II	200	3537.16	Th II
380	3525.14	Tb II	27	3531.62	Ce I	640	3537.28	Mo I
240	3525.14	U II	240	3531.64	U I	240	3537.28	U I
110	3525.15	Gd I	22000	3531.70	Dy II	25	3537.31	Pr II
85	3525.23	Nb I	210	3531.70	Tb II	110	3537.43	Ce II
65	3525.28	Tm I	85	3531.71	Nd II	150	3537.44	U II
85	3525.51	Sm II	360	3531.85	Mn I	160	3537.45	W I
440	3525.61	Tb II	140	3532.00	Mn I	320	3537.46	Re I
240	3525.65	U I	1100	3532.12	Mn I	1300	3537.48	Nb I
75	3525.73	U II	40	3532.21	Ta I	290	3537.66	Dy II
270	3525.74	Dy II				110	3537.69	Tb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
420	3537.91	Tm I	90	3543.29	Ce II	120	3549.05	Ta I
570	3537.94	Tb II	290	3543.35	Nd II	320	3549.20	U I
390	3537.95	Ru I	110	3543.50	V I	55	3549.21	Tb
65	3538.08	Eu II	45	3543.52	Ce II	130	3549.25	Dy II
880	d 3538.14	Rh I	120	3543.73	U I	50	3549.26	Nb I
	3538.26	Rh I	85	3543.85	Eu II	3900	3549.36	Gd II
120	3538.23	U I	810	3543.89	Tb II	150	3549.36	Tb II
4400	3538.52	Dy II	1200	3543.95	Rh I	130	3549.51	Zr II
35	3538.76	Ce II	500	3544.02	Nb I	25	3549.53	Pr II
27	3538.81	Ce II	180	3544.02	Th I	1800	3549.54	Rh I
220	3538.89	Ho II	400	3544.20	Dy II	210	3549.55	Er I
140	3538.90	Tb	150	3544.21	U II	170	3549.60	Th I
45	3539.01	Zr II	400	3544.35	Dy II	45	3549.71	Eu II
770	3539.08	Ce II	95	3544.36	Tb II	210	3549.74	Zr I
340	3539.32	Th II	250	3544.65	Nb I	100	3549.82	Yb II
160	3539.33	Re I	70	3544.99	Th II	820	3549.84	Er II
130	c 3539.35	Ho II	150	3544.99	U	240	3549.89	Re I
400	3539.37	Dy II	250	d 3545.18	Th II	85	3550.16	Tm II
790	3539.37	Ru I		3545.28	Th II	150	3550.17	U I
210	3539.47	Er II	560	3545.20	V II	4400	3550.22	Dy II
			650	3545.22	W I			
410	3539.59	Er I	55	3545.40	Tb II	130	3550.27	Ru I
670	3539.59	Th II	240	3545.44	U I	70	3550.29	Th II
110	3539.64	Dy II	210	3545.60	Ce II	300	3550.45	Nb I
100	3539.65	Nb I	240	3545.67	U I	630	3550.46	Zr I
240	3539.65	U I				540	3550.60	Co I
140	3539.81	Tb	50	3545.72	Yb II	80	c 3550.60	Ho II
50	h 3539.92	Pr II	45	3545.75	Ce II	120	3550.64	Cr I
60	3539.94	Re I	65	3545.79	Ce II	45	3550.82	La II
1100	3540.24	Tb II	4300	3545.80	Gd II	1200	3550.82	U II
530	3540.46	U II	270	3545.86	Er I	85	3550.83	Tm II
160	3540.69	Dy II	55	3545.91	Ce II	310	d 3551.03	Tb
630	3540.76	Ho II	70	3545.96	Th I	150	3551.04	U II
55	3540.82	Ta I	45	3546.01	Y II	190	3551.15	Dy II
250	3540.96	Nb II	1600	3546.05	Ho II	160	3551.29	Re I
240	3541.09	Fe I	75	3546.05	Tb II	40	3551.33	Pr I
200	3541.41	Ho I	240	3546.13	U I	140	3551.40	Th I
190	3541.60	Nd II	290	3546.19	Ce II	8	3551.41	Pr I
140	3541.62	Th II	290	3546.52	Tb	90	3551.43	Ce II
200	3541.63	Ru I	240	3546.68	U II	55	3551.53	Ni I
45	3541.66	Ce II	1400	3546.83	Dy II	2200	3551.62	Dy II
110	3541.75	Tb	150	3547.01	Ce II	110	3551.66	Ce II
100	3541.88	Ta II	190	3547.03	Ti I	85	3551.68	Tm I
75	3541.89	U II	390	3547.19	U II	22	3551.77	Ce II
100	3541.90	Nb I	140	3547.34	Th I	140	3551.79	Er II
65	3541.91	Os I	270	3547.50	Er I	130	3551.80	Y I
280	3541.91	Rh I	110	3547.58	Dy II	1800	3551.95	Zr II
220	3542.08	Fe I	1800	3547.68	Zr I	320	3551.96	Tb II
55	3542.08	Tm I	1300	3547.80	Mn I	25	3551.98	Pr II
150	3542.15	Eu II	90	3547.91	Dy II	55	3552.07	Ce II
320	3542.17	Mo I	1100	3548.03	Mn I	320	3552.17	U II
1700	3542.33	Dy II	25	3548.05	Pr II	120	3552.30	Sm II
35	3542.38	Pr II	100	3548.13	Nb I	180	3552.52	Eu II
85	3542.46	Sm II	330	3548.18	Ni I	150	3552.67	U II
70	3542.50	Th I	330	3548.19	Dy II	540	3552.69	Y I
50	3542.56	Nh I	390	3548.20	Mn I	540	3552.70	Hf II
320	3542.57	U I	310	3548.26	Er II	240	3552.73	Ce II
630	3542.62	Zr II	95	3548.44	Co I	75	3552.95	U I
230	3542.71	Os I	140	3548.48	Tm II	95	3552.99	Co I
540	3542.77	Gd II	160	3548.53	Ho II	12000	3553.08	Pd I
90	3542.86	Dy II	150	3548.62	U I	200	3553.11	Th II
90	3542.98	Nb I	140	3548.72	Dy II	310	3553.20	Er II
250	3543.02	Er II	180	3548.81	Hf I	90	3553.21	Dy II
240	3543.16	U II	110	3548.82	Tb	110	3553.27	V I
290	3543.23	Tb II	65	3548.83	Ce II	70	3553.38	Th II
270	3543.26	Co I	3900	3549.01	Y II	55	3553.42	Ta I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
150	3553.44	U I	510	3558.71	Er I	240	3564.59	U II
160	3553.65	Re I	170	3558.76	Y I	90	3564.64	Gd II
90	3553.72	Gd II	460	d 3558.77	Tb	70	3564.71	Th II
60	3553.74	Fe I	95	3558.78	Co I	80	3564.73	Re I
130	3553.85	Ru I	160	3558.94	Re I	55	3564.79	Ta I
70	3553.99	Nd II	150	3558.96	Zr I	150	3564.88	U II
150	3554.00	Hf I	320	3558.99	Ir I	880	3564.95	Co I
130	3554.07	Zr II	70	3559.03	Ho II	150	3565.05	U I
240	3554.15	Sm II	35	3559.03	Yb I	310	3565.17	Er I
95	3554.20	Mo I	510	3559.10	Sm II	160	3565.34	Tb
80	3554.21	W I	50	3559.12	Nb I	1600	3565.38	Fe I
210	3554.30	Er II	55	3559.14	Tb	140	3565.40	Th II
4800	3554.43	Lu II	440	3559.30	Dy II	90	3565.69	Dy II
250	3554.52	Nb I	290	3559.39	Tb I	570	3565.74	Tb
110	3554.64	Ce II	530	3559.45	Th II	490	3565.91	Tm II
1000	3554.66	Nb I	230	3559.76	Tb II	300	3566.05	Mo I
280	3554.93	Fe I	960	3559.79	Os I	1100	3566.10	Zr I
420	3555.00	Ce II	1000	3559.90	Er II	130	3566.16	Cr I
200	d 3555.01	Th I	270	3559.94	Th II	110	3566.18	V I
	3555.10	Th II	290	3560.14	Dy II	5000	3566.37	Ni I
40	3555.24	Pr II	410	3560.15	Ho II	1300	3566.47	Tm II
160	3555.29	Tb	85	3560.27	Sm II	2300	3566.60	U I
680	3555.32	U I	150	3560.31	U I	180	3566.72	Ta I
65	3555.43	Mo I	200	3560.33	Yb II	220	3566.84	Sm II
70	3555.70	Th I	150	3560.44	U II	70	3567.05	Th II
200	3555.77	Nd II	55	3560.60	V II	110	d 3567.12	Gd II
210	3555.82	Tm I	170	3560.70	Yb II	130	3567.16	Ru I
130	3555.97	Dy II	410	3560.75	Nd II	170	3567.26	Th I
95	3555.97	Os I	1200	3560.80	Ce II	110	3567.32	Ho II
55	3556.05	Tb	1200	3560.86	Os I	810	3567.35	Tb II
100	3556.08	Er I	1100	3560.89	Co I	270	3567.36	Hf I
110	3556.25	Tb	340	3560.92	Tm I	420	3567.36	Tm I
55	3556.25	V I	320	3561.41	U I	110	3567.65	Gd II
160	3556.39	Er I	45	3561.54	Ce II	6100	3567.70	Sc II
85	3556.57	Tm I	170	3561.59	Sm II	70	3567.70	Th II
2100	3556.60	Zr II	70	3561.61	Nd II	4800	3567.84	Lu I
100	3556.63	Ru I	1300	3561.66	Hf II	60	3568.00	Ir I
170	3556.74	Sm II	3200	3561.74	Tb II	160	3568.04	W I
1100	c 3556.78	Ho II	65	3561.75	Ni I	120	3568.13	Ce II
560	3556.80	V II	70	3561.78	Th I	90	3568.14	Zr II
100	3556.84	Er II	1200	3561.80	U I	160	3568.23	Re I
65	3556.90	Ce II	90	3562.10	Ce II	4200	3568.27	Sm II
1400	3557.05	Gd II	40	3562.24	Pr II	50	3568.51	Nb II
210	3557.07	Er I	120	3562.34	Os I	4200	3568.52	Tb II
160	3557.17	Ir I	40	3562.56	Pr II	25	3568.67	Pr II
65	3557.26	La II	480	3562.90	Tb II	100	3568.72	Nb I
85	3557.34	Tm I	400	3563.14	Mo I	160	3568.79	Ho
170	3557.38	Sm II	2200	3563.15	Dy II	150	3568.82	U II
170	3557.46	Th II	110	3563.38	Th I	340	3568.87	Nd II
110	3557.62	Dy II	160	c 3563.45	Ho II	210	3568.88	Zr I
25	3557.70	Pr II	630	3563.50	Nb I	55	3568.94	V I
420	3557.79	Tm II	210	3563.54	Er I	1600	3568.98	Tb II
390	3557.84	U I	630	3563.62	Nb I	1100	3569.04	Hf II
55	3557.95	Ta I	390	3563.66	U I	530	3569.06	U II
1500	3558.02	Er I	560	3563.69	Dy II	210	3569.27	Er I
75	3558.09	Tb	65	3563.76	Mo I	90	3569.32	Ce II
520	3558.10	Mo I	110	3563.82	Ce II	8800	3569.38	Co I
80	c 3558.15	Ho II	420	3563.88	Tm I	180	3569.47	Nb I
540	3558.19	Gd II	50	h 3563.94	Yb II	2200	3569.49	Mn I
440	h 3558.23	Dy II	200	3564.05	Gd II	50	3569.56	Pr II
430	3558.47	Gd II	240	3564.13	Rh I	100	3569.57	Gd II
80	3558.52	Cr I	120	3564.18	U I	70	3569.62	Th II
650	3558.52	Fe I	220	3564.24	Dy II	200	3569.66	Dy II
6600	3558.55	Sc II	150	3564.31	Hf I	310	3569.78	Os I
40	3558.71	Ce II	130	3564.56	Ru I	720	3569.80	Mn I
							3570.04	Mn I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum			
130	3569.80	Tm I	630	c	3574.80	Ho II	140	3580.23	Th II		
140	3569.82	Th I	1600		3574.96	Co I	190	3580.25	U I		
210	3569.93	Er I	50		3574.96	Pr II	5000	3580.27	Nb I		
4000	3570.10	Fe I	50		3575.13	Nb I	1000	3580.52	Er II		
1200	3570.18	Rh I					110	3580.54	Mo I		
240	3570.26	Re I	160		3575.22	W I	90	3580.57	Ce II		
90	3570.41	Gd II	85		3575.29	Tm I	150	3580.62	Gd II		
290	3570.44	Ho I	45		3575.30	Ce II	410	3580.75	Ho II		
160	3570.56	Er I	530		3575.32	Th II	7700	3580.94	Sc II		
25	3570.56	Pr I	2500		3575.36	Co I	390	3580.94	Sm II		
85	3570.57	Yb II	25		3575.51	Pr I	650	3580.97	Re I		
690	3570.59	Ru I	1100		3575.79	Zr I	6000	3581.20	Fe I		
240	3570.65	Mo I	1500		3575.85	Nb I	410	3581.83	Ho II		
75	3570.65	U II	160		3575.90	Tb I	360	3581.84	U II		
240	3570.65	W I	80		3575.97	W I	1400	3581.89	Mo I		
920	3570.75	Er II	110		3576.00	Dy II	980	3581.91	Gd II		
75	3570.93	U II	260		3576.05	Y I	200	3582.01	Th II		
45	3570.98	Ce II	70		3576.16	Nd II	190	3582.02	Dy II		
55	3571.04	V I	240		3576.22	U II	290	3582.02	U II		
4500	3571.16	Pd I	210		3576.23	Ce II	50	h	3582.25	Pr II	
150	3571.16	U I	4400		3576.24	Dy II	85	3582.36	Nb I		
190	3571.43	Y I	9900		3576.35	Sc II	190	3582.62	U I		
100	3571.44	Dy I	200		3576.56	Th I	190	3582.63	Nd I		
120	3571.56	U II	90		3576.58	Dy II	85	3582.67	Sm II		
110	3571.57	Th II	160		3576.64	Tb I	80	c	3582.80	Ho II	
90	3571.65	V I	100		3576.77	Gd II	55	3582.81	V I		
90	3571.67	Dy II	230		3576.83	Tb I	100	3582.88	Nd I		
150	3571.69	U II	1300		3576.85	Zr II	810	3583.02	Re I		
150	3571.85	Ta I	1700		3576.87	Dy II	140	d	3583.04	Th II	
990	3571.87	Ni I	230		3577.08	Tb I		3583.10	Th I		
690	3571.93	Gd II	150		3577.08	U II	4700	3583.10	Rh I		
320	3572.07	Tb II	1000		3577.45	Ce II	110	3583.28	Hf I		
340	3572.39	Th II	75	d	3577.47	Pr II	310	3583.39	Sm II		
120	3572.43	Ce II	180		3577.55	Zr I	85	3583.43	Tm I		
2100	3572.47	Zr II	200		3577.72	Nb I	120	3583.53	Rh I		
80	3572.48	W II	270		3577.79	Sm II	100	3583.65	Gd I		
50	3572.50	Yb II	55		3577.87	V I	90	3583.66	Ce II		
13000	3572.53	Sc II	1400		3577.88	Mn I	110	3584.18	Th I		
1100	3572.74	Pb I	360		3577.92	U I	200	3584.21	Pr II		
210	3573.08	Zr II	830		3577.98	Dy II	110	3584.21	Ta I		
200	3573.22	Th II	50		3578.08	Co I	170	3584.26	Sm II		
410	c	3573.24	Ho II	150	3578.23	Zr II	160	h	3584.33	Cr I	
150	c	3573.44	Ta I	310	3578.24	Er I	110	3584.34	Ce II		
90		3573.52	V I	240	3578.33	U I	400	3584.42	Dy II		
130		3573.64	Cr I	390	3578.36	Gd II	85	3584.51	Ta I		
90		3573.71	Ce II	19000	3578.69	Cr I	3300	3584.52	Y II		
1200		3573.72	Ir I	110	3578.70	Tb I	130	3584.66	Fe I		
120		3573.74	Ti II	630	3578.72	U II	3200	3584.88	U I		
780		3573.83	Dy II	50	d	3578.90	Co I	5400	3584.96	Gd II	
140		3573.86	Er II		3579.03	Co I	500	3584.97	Nb I		
320		3573.88	Mo I	25	h	3579.05	Pr II	710	3585.03	Tb II	
80		3574.04	Cr I	160		3579.11	Dy II	130	3585.05	Th II	
280		3574.06	Tm II	810		3579.12	Ho I	3300	3585.06	Dy II	
120		3574.08	Os I	360		3579.12	Re I	1000	3585.16	Co I	
190		3574.11	U I	1100		3579.20	Tb II	130	3585.30	Cr II	
1400		3574.15	Dy II	340		3579.33	Th II	360	3585.32	Fe I	
35		3574.20	Ho II	90		3579.44	Dy II	360	3585.47	Yb II	
60		3574.24	Ti I	190		3579.44	Er I	300	3585.71	Fe I	
200		3574.43	La I	100		3579.55	Gd II	270	d	3585.77	Th II
200		3574.58	Ru I	85		3579.67	Sm I		3585.88	Th II	
50		3574.58	Yb II	70		3579.77	Ru I	1400	3585.78	Dy II	
330		3574.74	Gd II	150		3579.90	Hf I	170	3585.83	Sm I	
320		3574.76	U I	50	h	3579.96	Pr I	240	3585.84	U I	
330	h	3574.80	Cr I	440		3580.04	Dy II	280	3586.07	Tm I	
		3574.94	Cr I	810	c	3580.15	Re II	560	3586.11	Dy II	

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
130	3586.11	Fe I	130	3590.73	Tm I	120	3595.41	Nd II
150	3586.29	Ta I	200	3590.74	Mo I	100	3595.55	Mo I
880	3586.29	Zr I	610	3590.76	Er I	70	3595.62	Th I
65	3586.51	Os I	80	3590.82	W I	150	3595.64	Ta I
720	3586.54	Mn I	70	3590.88	Re I	65	3595.71	Mo I
90	3586.58	Gd II	110	3591.06	Th II	410	3595.84	Er I
370	3586.60	Er I	150	3591.23	Ho II	120	3595.91	Nd II
90	3586.77	Ce II	45	3591.31	Eu II	240	3596.05	Ti II
85	3586.82	Nd II	55	3591.39	Tb	400	3596.06	Dy II
65	3586.86	Mo I	1100	3591.41	Dy II	380	c 3596.11	Bi I
400	3586.99	Fe I	90	3591.44	Gd II	110	3596.11	Ce II
60	3587.13	Ti II	140	3591.45	Th I	75	3596.18	Pr II
6700	3587.19	Co I	150	3591.56	U II	6400	3596.18	Ru I
150	3587.19	Gd II	110	3591.66	Tb II	4700	3596.19	Rh I
390	3587.20	Ru I	70	3591.72	Zr I	340	3596.34	Lu I
45	3587.22	Ce II	85	3591.74	Sm II	810	3596.38	Tb II
120	3587.32	Os I	390	3591.74	U I	160	3596.39	Re I
570	3587.44	Tb II	560	3591.81	Dy II	100	3596.48	Dy II
130	3587.46	Sm II	130	3591.91	Gd II	45	3596.73	Ce II
470	3587.51	Nd II	65	3592.02	Mo I	150	d 3596.76	U II
160	3587.64	Ce II	490	3592.02	V II	150	3596.88	U II
35	3587.69	Ce II	85	3592.09	Nd II	110	3596.84	Gd I
300	3587.75	Y I	560	3592.11	Dy II	5900	3597.15	Rh I
110	3587.76	Tb I	630	c 3592.23	Ho II	50	3597.26	Nb I
120	d 3587.78	U I	65	3592.32	Os I	220	3597.28	Dy I
	3587.84	U II	80	3592.42	W II	210	3597.42	Hf II
210	3587.79	Er II	560	3592.53	V I		3597.51	Hf I
130	3587.93	Ni I	300	3592.59	Nd II	1300	3597.70	Ni I
40	d 3587.93	Pr II	4200	3592.60	Sm II	110	3597.94	Dy II
440	3587.98	Zr II	1100	3592.71	Gd II	340	3598.02	Nd II
90	3588.13	Ce II	270	3592.78	Th I	440	3598.06	Tb II
80	3588.21	Gd I		3592.83	Th II	620	3598.11	Os I
170	3588.22	Th II	2800	3592.92	Y I	270	3598.12	Th I
	3588.30	Th II	120	3592.97	U I	150	3598.20	Ce II
120	3588.23	Nd II	25	h 3593.00	Pr II	110	3598.26	Dy II
210	3588.32	Er I	6900	3593.02	Ru I	50	3598.35	Nb I
180	3588.32	Zr II	170	c 3593.07	Ho II	170	3598.62	Tm I
160	3588.43	Ce II	230	3593.07	Tb II	190	3598.72	Ti I
55	3588.49	Ce II	45	h 3593.13	Zr I	1100	cw 3598.77	Ho II
25	3588.64	Pr II	100	3593.16	Dy II	80	3598.77	Re I
100	3588.95	Mo I	240	3593.20	U I	210	3598.88	Mo I
70	3589.11	Fe I	270	3593.33	V II	110	3599.04	Dy II
750	3589.11	Nb I	200	3593.44	Gd II	35	3599.13	Cu I
110	3589.15	Th II	17000	3593.49	Cr I	85	3599.16	Tm II
6400	3589.22	Ru I	460	3593.52	U II	150	3599.28	Nb I
75	3589.27	Eu I	120	3593.68	U I	340	3599.48	Ho I
500	3589.36	Nb I	85	3593.73	Sm II	610	3599.50	Er II
200	3589.36	Th II	110	3593.75	Tb II	100	3599.56	Dy II
50	3589.49	Pr II	140	3593.88	Th II	150	3599.63	Nb I
85	3589.50	Sm II	500	3593.97	Nb I	1300	3599.76	Ru I
110	3589.53	Tb	320	3594.39	Ir I	1000	3599.83	Er II
4000	3589.64	Sc II	220	3594.56	Dy I	150	3599.84	U II
240	3589.66	U I	22	3594.58	Ce II	540	3599.87	Hf I
100	3589.69	Y I	22	3594.62	Ce II	90	3599.90	Zr II
170	3589.75	Th I	22	3594.64	Ce II	90	3599.97	Ce II
560	3589.76	V II	80	3594.64	Fe I	190	3600.04	Tb
250	cw 3589.77	Ho I	75	3594.65	Tb I	70	3600.12	Nd
240	3589.79	U I	1900	3594.87	Co I	180	3600.25	Dy II
360	3590.07	Dy II	290	3594.95	U II	95	3600.28	Mo I
290	3590.32	U II	110	3594.98	Tb II	150	3600.29	U I
540	3590.47	Gd II	1800	3595.04	Dy II	560	3600.38	Dy II
4000	3590.48	Sc II	290	3595.12	Mn I	1600	3600.44	Tb II
320	3590.50	U II	80	3595.16	Re I	160	3600.58	Ce II
330	3590.60	Ce II	160	3595.28	Dy II	10000	3600.73	Y II
290	3590.66	Dy II	70	3595.33	Th II	75	3600.74	Pr II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
300	3600.91	Nd II	70	3606.30	Nd	75	3611.40	U I
540	c 3600.95	Ho II	360	3606.32	U II	270	3611.41	Tb II
540	3600.96	Gd II	100	3606.38	Dy II	75	3611.57	Eu II
390	3601.03	Th II	130	3606.48	Yb II	65	3611.61	Tm II
65	3601.06	La II	320	3606.68	Fe I	16	3611.64	Ce II
75	3601.19	U I	110	3606.69	V I	210	3611.70	Co I
3500	3601.19	Zr I	130	3606.90	Dy II	27	3611.73	Ce II
350	3601.67	Cr I	80	3607.06	W I	690	3611.89	Zr II
340	3601.69	Sm II	130	3607.12	Gd II	130	3611.94	Pr II
110	3601.75	Tb II	210	3607.20	Er I	140	3612.00	Mo I
190	3601.83	Os I	130	3607.35	Tm II	90	3612.34	Ce II
6200	3601.92	Y II	160	3607.38	Zr II	75	3612.34	La II
100	3602.00	Gd II	750	3607.41	Ta I	95	3612.39	Tm II
35	3602.03	Cu I	410	3607.42	Er I	110	3612.43	Sm II
1600	3602.08	Co I	420	3607.54	Mn I	200	3612.43	Th I
55	3602.48	Ta I	390	3607.63	Ce II	100	3612.45	Mo I
150	3602.48	U I	120	3607.72	Nd	3100	3612.47	Rh I
500	3602.56	Nb I	25	h 3607.81	Pr II	70	3612.61	Cr I
40	3602.57	Cr I	55	3608.25	Tb II	190	3612.67	U II
130	c 3602.65	Ho II	210	3608.37	Mo I	25	3612.71	Pr II
360	3602.82	Dy II	170	3608.38	Th I	530	3612.74	Ni I
270	3602.94	Mo I	40	3608.40	Cr I	85	3612.75	Nd II
140	3603.16	Dy II	420	3608.49	Mn I	290	3612.78	Dy II
150	3603.20	Eu II	100	3608.73	Ru I	70	3612.87	Th I
340	3603.20	Th II	830	3608.75	Gd II	700	3612.88	Cd I
160	3603.21	Fe I	2100	3608.77	Tm II	80	3612.88	Gd II
65	3603.36	Ce II	2000	3608.86	Fe I	85	3613.03	Tm II
70	3603.36	Th II	150	3608.96	U II	160	3613.06	Tb II
150	3603.36	U I	65	3609.15	Os I	220	3613.08	Dy II
85	3603.74	Cr I	200	3609.22	Th II	75	3613.08	La I
	3603.78	Cr II						
120	3603.74	U I	110	3609.25	Dy II	1100	3613.10	Zr II
70	3604.06	Th I	980	3609.44	Th II	340	3613.31	Ho II
65	3604.07	Mo I	40	3609.48	Cr I	95	3613.36	Tb II
50	3604.08	Nb I	3400	3609.49	Sm II	140	3613.37	Mo I
			250	3609.53	Tm II	540	3613.39	Gd II
150	3604.20	Ce II	20000	3609.55	Pd I	170	3613.58	Sm II
1700	3604.28	Sm II	240	3609.68	U II	100	3613.64	Mo I
90	3604.34	Dy I	550	3609.69	Ce II	230	3613.68	Tb II
80	3604.39	Re I	220	3609.77	Ir I	420	3613.70	Ce II
95	3604.48	Os II	320	3609.79	Nd II	140	3613.70	Zr I
110	3604.68	Th I	240	d 3610.04	Th II	140	3613.78	Th II
210	3604.71	Er II		3610.12	Th II	80	3613.79	W II
1100	3604.87	Gd I	40	3610.05	Cr I	28000	3613.84	Sc II
510	3604.90	Er II	200	3610.16	Fe I	140	3614.01	Th II
320	3604.90	Tb II	600	3610.16	Ti I	290	3614.07	Dy II
95	3605.05	Pr II	50	3610.23	Yb II	270	d 3614.21	Gd II
70	3605.19	Th I	50	3610.25	La II		3614.42	Gd I
270	3605.26	Gd II	360	3610.30	Mn I	70	3614.21	Th I
460	3605.28	U I	170	3610.40	Th II	70	3614.35	Th I
13000	3605.33	Cr I	1300	3610.46	Ni I	70	3614.45	Cd I
940	3605.36	Co I	160	3610.49	Re I	320	3614.63	Tb II
240	3605.46	Fe I	150	3610.49	U II	100	3614.70	Dy II
120	3605.48	U II	3600	3610.51	Cd I	1100	3614.77	Zr II
45	3605.59	V I	150	3610.69	U I	240	3614.78	Rh I
130	3605.64	Ru I	830	3610.76	Gd II	100	3614.95	Dy II
110	3605.65	Th II	200	3610.80	Th II	110	3615.04	Hf I
250	3605.66	Gd II	120	3610.91	Ce II	480	3615.13	Th II
160	3605.69	Er I	220	3610.91	Gd II	65	3615.15	Mo I
130	3605.77	Ho I	7800	3611.05	Y II	50	3615.16	Pr II
310	3605.86	Rh I	110	3611.23	Dy I	130	3615.24	Sm II
50	3605.96	Pr II	75	3611.24	U II	75	3615.39	Co I
290	3606.04	Tb II	70	3611.30	Yb II	150	3615.50	Nb I
240	3606.06	W I	45	3611.31	Ce II	150	3615.54	U I
1800	3606.12	Dy II	320	3611.33	Tb II	55	3615.64	Ce II
290	3606.16	Tb II	75	3611.34	Ce II	85	3615.64	Cr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
320 d	3615.66	Tb II	65	3619.95	Ce II	50	3625.15	Fe I
65	3615.74	Mo I	180	3619.97	Tm II	140	3625.17	Nb I
370	3615.82	Nd II	200	3619.98	Dy II	350	3625.20	Ru I
130	3616.08	Dy II	90	3620.04	Hf I	55	3625.23	Ta I
45	3616.15	Eu II	320	3620.08	U I	170	3625.26	Gd II
120	3616.20	Ce II	170	3620.10	Sm II	100	3625.28	Er II
320	3616.33	U I	560	3620.16	Dy II	170 c	3625.46	Ho II
110	3616.37	Dy II	60	3620.28	Ru I	810	3625.54	Tb II
3100	3616.56	Er II	200	3620.37	Th II	390	3625.63	Th II
250	3616.57	Os I	45	3620.43	Co I	80	3625.71	Ir I
320	3616.58	Tb II	390	3620.46	Gd II	140	3625.71	Nb I
75	3616.66	Pr II	200	3620.46	Rh I	200	3625.90	Th I
55	3616.72	V I	100	3620.58	Dy II	160	3625.91	Re I
320	3616.76	U II	240	3620.58	Sm II	120	3625.98	U II
70	3616.84	Mo I	4300	3620.94	Y I	330	3626.18	Mo I
800	3616.89	Hf I	200	3621.03	Nb I	120	3626.18	Nd II
75	3616.89	U I	50	3621.07	Pr II	160	3626.29	Ir I
110 c	3616.93	Ho II	270	3621.12	Th II	170 d	3626.32	Gd II
60	3616.95	Ru I	45	3621.15	Ce II	170	3626.41	Gd II
670 d	3617.02	Th II	1700	3621.23	Sm II	570	3626.50	Tb II
	3617.12	Th II						
320	3617.08	Re I	240	3621.46	Fe I	1800	3626.59	Rh I
430	3617.16	Gd II	160	3621.46	Re I	980	3626.62	Ta I
130	3617.20	Dy II	160	3622.00	Fe I	430 c	3626.69	Ho II
190	3617.21	Ir I	75	3622.04	U I	370	3626.74	Ru I
			130	3622.11	Tb II	160	3626.87	Tb II
80	3617.25	Re I	440	3622.15	Ce II	850	3627.01	Sm II
110	3617.43	Sc I	140	3622.29	Th I	130	3627.24	W I
75	3617.49	U I	65 h	3622.32	Pr II	490	3627.25	Ho II
1900	3617.52	W I	140	3622.34	Th I	40	3627.29	Ru I
75	3617.62	U I	160	3622.34	W I	120	3627.41	Nd II
110	3617.63	Dy II	65	3622.41	Ce II	95	3627.80	Rh I
110	3617.68	Hf I	170	3622.50	Sm II	1000	3627.81	Co I
90	3617.71	Nb I	95	3622.54	Eu II	170	3627.97	Sm II
100	3617.78	Dy II	25 h	3622.64	Pr II	720	3628.04	Er I
130	3617.79	Fe I		3622.74	Pr II	120	3628.11	Pt I
			320	3622.70	U I			
510	3617.85	Er II				290 d	3628.20	Tb II
380	3617.86	Tb II	110	3622.80	Th I	90	3628.25	Ce II
70	3618.08	Ho II	190	3622.81	Gd II	65	3628.35	Mo I
25	3618.08	Pr II	390	3623.06	U II	75	3628.38	U II
290	3618.10	Dy II	80	3623.19	Fe I	45	3628.61	Ce I
160	3618.18	Tb II	200	3623.23	Mo I	100	3628.66	Mo I
110	3618.36	Th I	240	3623.32	Sm II	660	3628.67	Ir I
410	3618.43	Ho I	30	3623.42	Tm II	1900	3628.71	Y II
50	3618.44	Nb I	200	3623.59	Ho I	320	3628.83	La II
150	3618.49	U II	60	3623.64	Ru I	60	3629.20	Re I
440	3618.51	Dy II	380	3623.74	Ce II	24	3629.31	Mo I
160	3618.58	Ce II	220	3623.79	Mn I	310	3629.37	Er I
2000	3618.77	Fe I	440	3623.84	Ce II	1100	3629.42	Dy II
90	3618.90	Nb I	1100	3623.86	Zr I	380	3629.44	Tb II
110	3618.90	Tb II	290	3623.92	Tb II	250	3629.51	Gd II
510	3618.92	Er II	800	3623.99	Lu II	85	3629.59	Nd II
300	3618.96	Nd II	110	3624.00	Hf II	140	3629.74	Mn I
75	3619.13	U II	50	3624.11	Ca I	170	3629.94	Nd II
25	3619.15	Pr II	130	3624.15	Ce II	65	3629.95	Os I
100	3619.20	Ru I	85	3624.20	Tm I	180	3630.02	Zr II
290	3619.28	Mn I	470	3624.27	Dy II	210	3630.06	Er II
6600	3619.39	Ni I	40	3624.33	Co I	4000	3630.24	Dy II
200	3619.41	Ho II	1400	3624.46	Mo I	90	3630.25	Gd II
120	3619.43	Os I	190	3624.65	Nd II	290	3630.28	Tb II
160	3619.45	Dy II	130	3624.73	Ni I	140	3630.30	Er II
300	3619.51	Nb II	110	3624.80	Tb II	55	3630.42	Ce II
40	3619.71	Th II	190	3624.82	Ti II	220	3630.48	Dy II
50	3619.73	Nb II	270	3624.89	Gd II	110	3630.60	Dy II
380	3619.73	Tb II	270	3624.90	Th II	150	3630.62	Nb I
200	3619.80	Yb II	75	3624.96	Co I	170	3630.67	Sm II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
460	3630.73	U II	140	3635.24	Th II	220	3639.05	Gd II
100	3630.75	Ca I	400	3635.27	Dy II	200	3639.33	Nb I
2000	3630.75	Sc II	95	3635.28	Pr II	210	3639.44	Co I
320	3630.87	Hf II	150	3635.30	U I	340	3639.45	Th II
130	3630.88	Gd II	100	3635.32	Nb I	310	3639.51	Rh I
200	3630.91	Ho I	80	c 3635.35	Ho II	5500	3639.58	Pb I
170	3630.96	Pr II	150	3635.40	U II	630	3639.80	Cr I
300	3631.02	Nd II	190	3635.42	Tb II	290	3639.82	Tb II
850	3631.13	Sm II	200	3635.42	Th II	35	3639.89	Tm II
200	3631.19	Ce II	100	3635.43	Hf I	220	3639.90	Dy II
150	3631.39	Co I	1000	3635.43	Mo I	130	c 3640.17	Ho II
2000	3631.46	Fe I	4800	3635.46	Ti I	250	3640.18	Gd II
110	3631.46	Tb II	120	3635.52	Ru I	240	3640.24	Nd II
180	3631.71	Ru I	270	3635.94	Th I	1100	3640.25	Dy II
430	c 3631.76	Ho II	120	3636.11	Sm II	450	3640.33	Os I
140	3631.78	Er I	220	3636.20	Ir I	85	3640.39	Cr I
320	3631.94	W I	180	3636.25	Dy II	220	3640.39	Fe I
80	3632.04	Fe I	680	3636.25	Lu I	140	3640.62	Mo I
220	3632.09	Er II	210	3636.41	Er I	150	3640.64	Nb I
150	3632.11	Ce II	180	3636.45	Zr II	200	3640.64	Ru I
95	3632.18	Eu II	350	3636.59	Cr I	45	3640.69	Ce II
110	3632.62	Th II	35	3636.67	La I	310	3640.76	U II
440	3632.78	Dy II	75	3636.72	Co I	90	3640.83	Dy II
100	3632.78	Er II	100	3636.96	Nb I	240	3640.95	U II
140	3632.83	Th I	240	3637.00	Nd II	95	3640.99	Mo I
130	3632.84	Co I	140	3637.06	Re I	220	3641.25	Ho I
130	3632.84	Cr I	120	3637.15	La II	270	3641.27	Er II
110	3632.95	Ho II	270	3637.16	Er II	190	3641.33	Ti II
75	3632.95	U II	240	3637.23	Nd II	330	3641.39	Gd II
100	3633.00	Nb I	360	3637.28	Dy II	240	3641.41	W II
220	3633.02	Dy II	210	3637.47	Ru I	70	3641.47	Cr I
7800	3633.12	Y II	120	3637.51	U I	190	3641.50	Nd II
270	3633.26	Er I	65	3637.52	Mo I	170	d 3641.53	La I
670	3633.29	Tb II	100	3637.54	Nb I		3641.66	La II
190	3633.29	U II	110	3637.56	Th II	95	3641.62	Pr II
90	3633.31	Nb II	55	3637.59	Hf I	670	3641.66	Tb II
45	3633.40	Ce II	40	3637.64	Pr II	130	3641.79	Co I
70	3633.47	Nd II	90	3637.75	Ce II	220	3641.83	Cr I
140	3633.49	Zr II	45	3637.76	V I	65	3641.92	Er II
1000	3633.54	Er II	240	3637.76	Yb II	500	3642.06	Ta I
150	3633.71	Nb I	190	3637.79	Nd II	70	3642.20	Mo I
55	3633.75	Ta I	150	3637.83	Nb I	310	3642.25	Th I
110	3633.76	Dy II	100	3637.83	Sb I	80	c 3642.36	Ho II
85	3633.92	Ru I	810	3637.84	Re I	160	3642.44	U I
320	3634.15	Zr I	120	3637.97	Ti I	70	3642.46	Nd II
90	3634.18	Dy II	40	3638.02	Ru I	290	3642.68	Tb II
3400	3634.29	Sm II	160	3638.20	Mo I	6600	3642.68	Ti I
340	3634.30	Nd II	840	3638.20	U I	170	3642.76	Sm II
110	3634.32	Dy II	130	3638.28	Ce II	13000	3642.79	Sc II
100	3634.44	Nb I	130	3638.30	Fe I	55	3642.83	Ce II
25	3634.47	Pr II	430	c 3638.30	Ho II	85	3642.94	Tm I
110	3634.52	Yb I	55	3638.32	Th I	35	3642.99	Re I
120	3634.56	U I	380	3638.41	Tm I	70	3643.17	Pt I
240	3634.58	Th I	670	3638.46	Tb II	150	3643.18	Co I
510	3634.67	Er I	25	3638.58	Pr II	75	3643.26	Tb II
130	c 3634.67	Ho II	70	3638.64	Th I	65	3643.32	Pr II
20000	3634.70	Pd I	120	3638.65	U I	85	3643.34	Nb I
150	3634.71	Co I	1600	3638.68	Er I	110	3643.51	Th I
330	3634.76	Gd II	70	3638.70	Nd I	190	3643.63	Nd II
170	3634.87	Nd II	30	3638.72	Zr I	950	3643.65	Tm II
3100	3634.93	Ru I	410	3638.77	Sm II	85	3643.72	Nb I
240	3634.93	Sm II	100	3638.79	Nb I	75	3643.76	Tb II
70	3635.11	Nd II	70	3638.79	Pt I	55	3643.86	V I
28	3635.14	Mo II	160	3638.89	Tb I	400	3643.92	Dy II
95	3635.20	Ti I	110	3639.02	V I	95	3644.13	Tb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
420	3644.24	U I	70	3648.61	Mo I	410	3653.15	Nd II
45	3644.30	Ce II	1000	3648.78	Dy II	140	3653.21	U I
70	3644.35	Th II	50	3648.81	Os I	40	3653.39	Ta I
800	3644.36	Hf II	90	3648.97	V I	7200	3653.50	Ti I
100	3644.41	Ca I	220	3649.00	Cr I	600	3653.61	Tm II
25	3644.55	Pr II	320	3649.10	Hf I	80	3653.62	Re I
110	3644.71	V I	310	3649.25	Th II	660	3653.67	Ce II
50	3644.85	U II	190	3649.35	Co I	21	3653.83	Ta I
100	3644.94	Nb I	95	3649.41	Tb II	160	3653.87	Tb II
310	3645.03	U II	310	3649.44	Gd II	170	3653.91	Cr I
130	3645.23	Ce II	240	3649.46	Nd	240	3654.16	Nd
360	3645.29	Sm II	160	3649.51	Fe I	110	3654.18	Dy II
6600	3645.31	Sc II	170	d 3649.51	U II	310	3654.40	Ru I
230	3645.38	Tb II		3649.58	U I	65	3654.45	Co I
300	3645.39	Sm II	90	3649.53	La I	220	3654.45	Ho II
11000	3645.40	Dy II	660	3649.53	Sm II	230	3654.49	Os I
1000	3645.42	La II	90	c 3649.60	Ho II	290	3654.59	Ti I
130	3645.45	Ce II	45	3649.73	Ce II	3900	3654.62	Gd II
100	3645.55	Pr II	170	3649.74	Th I	300	3654.83	Hg I
870	3645.62	Gd II	420	3649.85	Nb I	130	3654.86	Sm II
70	3645.63	Nd II	90	3650.12	Ce II	350	3654.87	Rh I
250	3645.66	Pr II	65	3650.13	Pr II	130	3654.88	Dy II
240	3645.78	Nd II	2800	3650.15	Hg I	810	3654.88	Tb II
60	3645.82	Fe I	390	3650.18	La II	140	3654.89	U I
110	3645.82	Tb II	340	3650.19	Sm II	310	3654.97	Ce II
360	3645.86	Dy II	290	3650.32	Ru I	120	3655.03	Nd II
170	3645.90	Sm II	2300	3650.40	Tb II	30	3655.56	Zr II
900	3645.94	Er II	520	3650.41	Er II	110	3655.62	Dy I
170	3646.11	Ru I	240	3650.42	Nd II	90	3655.73	Yb I
45	3646.16	Cr I	90	3650.53	Hf I	400	3655.78	Sn I
6100	3646.19	Gd II	50	3650.69	Nd	1800	3655.85	Ce II
180	3646.20	Ti I	170	3650.77	Th II	100	3655.98	Nb I
250	3646.30	Pr II	250	3650.81	Nb I	3100	3656.15	Gd II
95	3646.46	Tb II	180	3650.88	Ce II	100	3656.20	Th II
80	3646.52	W II	290	3650.93	Tb II	340	3656.22	Sm II
180	3646.61	Dy II	450	3650.95	Gd II	220	3656.26	Cr I
150	3646.65	Ce II	170	3651.00	Sm II	35	3656.38	Er II
180	3646.70	Tm I	80	3651.00	W I	90	3656.71	V I
65	3646.78	Er II	50	3651.04	Pr II	40	3656.89	Ta I
160	3646.89	Dy I	160	3651.19	Gd II	330	3656.90	Os I
110	3646.90	Sc I	400	3651.19	Nb II	55	3656.97	Co I
350	3646.97	Ce II	140	3651.35	Mo I	100	3657.11	Nb I
440	3647.06	Tb II	300	3651.47	Fe I	60	3657.27	Ta I
140	3647.22	Tm II	660	3651.53	U I	120	3657.32	U II
85	3647.29	Sm II	190	3651.59	Nd II	400	3657.35	Mo I
100	3647.30	Th II	80	3651.66	Re I	50	3657.42	Pr II
	3647.37	Th II	5300	3651.80	Se II	60	3657.49	Ta I
50	3647.31	Nb I	200	3651.84	Hf I	80	3657.59	W II
150	3647.65	Th II	230	3651.86	Tb II	8200	3657.99	Rh I
110	3647.66	Co I	440	3651.97	Re I	420	3658.06	Th II
240	3647.72	Tm II	490	3652.07	U I	660	3658.10	Ti I
260	3647.75	Ce II	130	3652.11	Ce II	210	3658.19	Gd I
570	3647.75	Tb II	370	3652.17	Th II	50	3658.21	Pr II
2600	3647.77	Lu I	65	3652.26	Ce II	240	3658.22	Tb II
1600	3647.84	Fe I	230	3652.26	Tb II	45	3658.26	Ce II
120	3647.93	Nd	60	3652.32	Ru I	200	c 3658.48	Ho I
260	3647.95	Ce II	35	3652.38	Pr II	85	3658.78	Ta I
70	3648.15	Yb I	120	3652.45	Nd II	2000	3658.88	Tb II
110	3648.17	Th II	680	3652.54	Co I	170	3659.01	U II
340	3648.20	Nd II	620	3652.54	Gd II	75	3659.05	Pr II
100	3648.30	Pr II	140	3652.54	Th II	960	3659.16	U I
140	3648.42	Th II	360	3652.58	Er II	440	3659.23	Ce II
180	3648.46	Dy II	500	3652.87	Er II	120	3659.45	Tb II
100	3648.48	Gd I	190	3652.97	Tb II	560	3659.51	Th II
85	3648.53	Cr I	420	3653.11	Ce II	80	3659.52	Fe I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
140	3659.58	Er I	95	3663.35	W I	70	3668.49	Mo I
170	3659.59	U I	830	3663.37	Ru I	45	3668.49	Y II
200	3659.61	Nb II	250	3663.59	V I	80	3668.50	Tb II
170	3659.62	Sm II	1100	3663.65	Zr I	130	3668.62	Nb I
120	3659.76	Ti II	90	3663.70	Ce II	80	3668.66	W I
120	3659.94	Nd II	340	3663.70	Th II	150	3668.72	Ce II
350	3659.97	Ce II	200	3664.10	Ni I	150	3668.79	Nd
40	3660.08	Pr II	110	3664.25	Sc II	370	3668.83	Pr II
180	3660.16	Ce II	80	3664.30	Mo I	150	3668.90	Dy II
150	c 3660.36	Pr II	360	3664.45	Er I	380	3668.97	Ti I
630	3660.37	Nb I	2700	3664.60	Gd II	220	3669.01	Nb I
100	3660.40	Mn I	80	3664.60	Hf I	470	3669.02	Er II
100	3660.44	Tb II	3000	3664.61	Y II	320	3669.05	Ho II
60	3660.52	Re I	700	3664.62	Dy II	120	3669.18	U I
380	3660.63	Ti I	300	3664.62	Ir I	130	3669.24	Ni I
880	3660.64	Ce II	40	3664.64	Pr II	220	3669.34	Mo I
200	3660.75	Tb II	900	3664.70	Nb I	110	3669.41	V II
110	3660.78	Er II	55	3664.73	Ce II	190	3669.45	Nd
50	3660.81	Ru I	540	3664.81	Mo I	650	3669.49	Ru I
85	3660.88	Tm II	75	3665.05	Ce II	160	3669.52	Fe I
70	3660.92	Mo I	75	3665.14	V I	450	3669.52	Ho I
120	3660.97	Nd	540	3665.18	Nd II	40	3669.53	Pr II
140	3661.05	Hf II	190	3665.23	Dy II	260	3669.64	Tb I
260	3661.20	Zr I	220	3665.35	Hf II	240	3669.69	Yb II
6200	3661.35	Ru I	90	3665.60	Tb II	100	3669.74	Nb I
2200	3661.36	Sm II	500	3665.81	Tm II	85	3669.75	Nd
100	3661.62	Pr II	45	3665.98	Cr I	120	3669.78	Re I
55	3661.62	Th I	45	3666.01	Ce I	280	3669.97	Th I
100	3661.66	Gd II	45	3666.04	Ce I	2800	3670.06	Th II
55	3661.68	Nb I	170	d 3666.10	U II	2800	3670.07	U II
65	3661.69	Ta I		3666.21	U II	40	3670.26	Pr II
300	3661.71	Ir I	1300	3666.22	Rh I	90	3670.28	Ho II
130	3661.73	Ce II	120	3666.31	Os I	80	3670.36	Re I
160	3661.78	Dy II	55	3666.53	Nb I	35	3670.42	Mo I
180	3661.78	Mo I	290	3666.54	Sc II	180	3670.43	Ni I
280	3661.86	Rh I	95	3666.64	Cr I	90	3670.52	Ce II
110	3662.04	Er II	720	3666.65	Ho I	70	3670.52	Mn I
90	3662.05	Nb I	290	3666.72	Mo I	320	3670.53	Re I
170	3662.08	La II	400	3666.84	Dy I	240	3670.53	U I
40	3662.13	Re I	180	3666.91	Rh I	340	3670.66	Sm II
95	3662.14	Zr II	110	3666.94	Mo I	50	3670.69	Yb II
280	3662.16	Co I	130	3666.98	Th I	2200	3670.84	Sm II
190	3662.24	Ti II	45	3667.00	Nb I	480	3670.89	Os I
1400	3662.26	Gd II	130	3667.05	Ho II	150	3670.92	Nd II
470	3662.26	Nd II	100	3667.13	U I	2000	3671.20	Gd II
170	3662.27	Sm II	25	3667.14	Pr II	170	3671.20	V I
1600	c 3662.29	Ho I	90	3667.28	Ce II	390	3671.27	Zr II
40	3662.32	Pr II	55	d 3667.66	Nb I	35	3671.37	Nb I
160	3662.33	U II		3667.76	Nb I	340	3671.51	Pb I
65	3662.34	Ta II	95	3667.67	Pr II	100	3671.54	Th I
220	3662.69	Sm II	80	3667.71	W I	120	3671.66	Nd II
45	3662.84	Cr I	250	3667.74	V I	600	3671.67	Ti I
180	3662.86	Er I	35	3667.82	Ta I	150	3671.69	Dy II
80	3662.88	Hg I	340	3667.93	Sm II	40	3671.91	Pr II
170	3662.90	Sm II	1400	3667.97	Ho I	130	3671.94	Ce II
100	3662.99	Ce II	880	3667.98	Ce II	80	3671.99	Pt I
430	3662.99	Ho I	100	3667.98	U II	17	3672.02	La I
140	3662.99	Mo I	65	3668.00	Mo I	220	3672.18	Ce I
85	3663.03	Nd II	40	3668.00	Tb II	200	3672.27	Hf I
50	3663.10	Pt I	55	3668.03	Cr I	990	3672.30	Dy II
450	3663.12	Tb II	1100	3668.09	Tm II	540	3672.36	Nd II
220	3663.20	Th I	140	3668.14	Th I	95	3672.40	V I
130	3663.21	Cr I	100	3668.21	Hf I	80	3672.41	Re I
240	3663.28	Hg I	80	3668.32	Gd II	55	hc 3672.44	Nb I
140	3663.30	Mo I	160	3668.45	Zr II	190	3672.58	U II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
70	3672.69	Ho I	90	3677.08	Nb I	180	3682.08	Ce II
420	3672.70	Dy II	260	3677.39	U I	650	3682.08	W I
350	3672.79	Ce II	85	3677.60	Nd	50	3682.09	Mn I
590	3672.82	Mo I	200	3677.63	Fe I	160	3682.21	Fe I
170	3673.06	U I	180	cw 3677.64	Ho II	2200	3682.24	Hf I
400	3673.14	Dy II	190	3677.67	U II	810	3682.26	Tb II
120	3673.14	Tm II	40	3677.68	Cr II	140	3682.46	U I
45	3673.19	Eu II	90	3677.70	Mo I	720	3682.65	Ho I
27	3673.23	Nb I	110	3677.78	Nb I	500	3682.70	Er II
140	3673.28	Th II	340	3677.79	Sm II	380	3683.05	Co I
190	3673.39	U II	55	3677.89	Cr II	110	3683.06	Fe I
280	3673.40	V I	300	3677.89	Tb II	60	3683.06	Ta I
580	3673.54	Nd II	410	3677.98	Tm II	570	3683.13	V I
180	3673.64	Ce II	200	3678.02	Th II	140	3683.20	Tm II
200	3673.79	Th II	200	3678.04	Th II	400	3683.30	W I
80	3674.04	Pt I	240	3678.18	Nd II	3683.39	W I	
1000	3674.05	Gd I	45	3678.26	Eu II	14000	3683.48	Pb I
100	3674.05	Tb II	240	3678.32	Ru I	180	3683.59	U II
45	3674.06	Ce II	40	3678.35	Sc II	160*	3683.93	W I
170	3674.07	Sm II	640	3678.51	Dy I	320	3684.01	Er I
1400	3674.08	Dy II	220	3678.59	Ho II	110	3684.11	Fe I
190	d 3674.13	U I	29	3678.72	Nb I	2000	3684.13	Gd I
45	3674.14	Ce II	380	3678.75	U II	45	3684.22	Mo II
50	3674.14	Pr II	100	3678.78	Tb II		3684.33	Mo I
260	3674.15	Ni I	450	d 3678.85	Tm II	380	3684.28	Er II
140	c 3674.36	Ho II		3678.95	Tm II	85	3684.29	Nd
230	3674.45	Dy I	100	3678.88	Nd II	60	3684.32	Lu I
95	3674.58	W I	140	3678.90	Zr II	75	3684.48	Co I
45	3674.63	Eu II	190	3678.95	Er I	180	3684.62	U I
100	3674.65	Nd	90	3679.16	Ce II	80	3684.65	W I
800	3674.72	Zr II	720	3679.19	Ho I	220	3684.81	Tb II
140	3674.76	Rh I	350	3679.21	Gd I	820	3684.85	Dy I
450	c 3674.77	Ho II	240	3679.38	U I	430	3685.16	Ho II
270	3674.78	Nb I	220	3679.42	Ce II	3100	3685.20	Ti II
65	3674.83	Ta I	80	3679.60	W I	25	3685.26	Pr II
21	3674.88	Pr II	670	3679.70	Ho I	120	3685.55	Cr I
320	3674.98	Ir I	280	3679.71	Th II	1300	3685.78	Dy I
190	d 3674.99	U II	280	3679.81	U II	150	3685.78	U I
	3675.08	U II	40	3679.82	Cr I	1200	3685.80	Nd II
140	3675.08	Yb II	650	3679.92	Fe I	45	3685.95	Ru I
35	3675.12	Ta I	160	c 3680.00	Ho II	120	3685.96	Ti I
27	3675.17	Nb I	50	3680.00	Pr II	130	3686.00	Fe I
80	3675.18	Er II	180	3680.08	Ce II	45	3686.04	Ce I
55	3675.26	Sc II	65	3680.10	Er II	120	3686.07	Nd II
90	3675.36	Mo I	300	3680.11	V I	35	3686.11	Mo I
120	3675.45	Os I	35	3680.21	Re I	100	3686.18	Ta I
160	3675.55	W I	55	3680.37	Zr I	190	3686.26	V I
700	3675.57	Th II	1300	3680.60	Mo I	720	3686.33	Gd II
280	3675.70	V I		3680.68	Mo I	85	3686.56	Nb I
480	3675.74	Hf I	45	3680.85	Ce II	140	c 3686.65	Ho II
220	3675.78	Tb II	240	3680.88	U I	130	3686.80	Cr I
23	3675.98	Mo I	130	3680.98	Sm I	250	3687.03	Pr II
60	3676.00	Re I	560	3681.04	Rh I	200	3687.08	Ir I
120	3676.02	Dy II	40	3681.04	Ta I	85	3687.10	Sm II
90	3676.16	Ce II	40	3681.24	Ta I	150	3687.19	Pr II
90	3676.24	Mo I	35	3681.28	Re I	130	3687.25	Cr I
90	3676.31	Nb I	180	3681.38	Ce II	440	3687.30	Nd II
65	3676.32	Cr I	90	d 3681.55	Mo I	95	3687.35	Ti I
3800	3676.35	Tb II		3681.72	Mo I	29	3687.44	Nb I
190	3676.51	Er II	85	3681.57	Os I	800	3687.46	Fe I
260	3676.55	Co I	19	3681.69	Cr I		3687.47	V I
260	3676.56	U II	270	3681.73	Sm II	75	3687.54	Cr I
2200	3676.59	Dy II	50	h 3681.85	Pr II	3100	3687.74	Gd II
170	3676.68	V I	85	3681.88	Th II	180	3687.80	Ce II
70	3676.96	Mn I	230	3682.04	U II	120	3687.97	Nb II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
570	3688.06	W I	160	3693.87	Dy I	30	3698.18	Ti I
1300	3688.07	V I	280	3693.90	Th II	990	3698.21	Dy II
320	3688.15	Tb II	80	3693.93	Ni I	280	3698.26	Rh I
85	3688.18	Nb II	1100	3693.99	Sm II	55	3698.26	Th II
65	3688.31	Mo II	240	3694.01	Fe I	110	3698.36	Ce II
120	3688.36	Dy II	210	3694.03	Gd II	100	3698.40	Hf II
6400	3688.42	Eu II	32000	3694.19	Yb II	60	3698.43	Ti I
160	3688.42	Ni I	190	3694.30	Sm II	55	3698.53	Mo I
270	3688.42	Sm II	140	3694.42	Dy II	380	3698.60	Rh I
19	3688.46	Cr I	140	3694.45	Ti I	70	3698.60	Yb II
65	3688.66	Ce II	60	3694.52	Ta II	140	3698.66	Ce II
120	3688.70	Nb I	130	3694.66	Ho I	35	3698.83	Os I
240	3688.76	Th II	150	3694.67	Nb I	200	3699.33	Tb II
70	3688.97	Mo I	410	3694.74	Tm II	80	3699.41	W I
85	3689.04	Nb I	140	3694.82	Tm II	60	3699.53	Pr II
250	3689.06	Os I	140	3694.75	Tb II	240	3699.72	Hf II
160	3689.12	Er II	4700	3694.81	Dy II	1300	3699.73	Gd II
240	3689.12	Tb II	300	3694.81	Nd II	170	3699.87	Tm II
45	3689.16	Ce II	300	3694.91	Ce II	35	3699.91	Pt I
130	3689.46	Fe I	1400	3694.94	Mo I	150	3699.92	Ce II
860	c 3689.50	Re I	60	3694.95	Rh I	95	3699.93	Nb I
410	3689.69	Nd II	80	3695.05	Fe I	70	3700.01	Mo I
100	3689.71	Pr II	450	3695.34	V I	410	3700.04	Ho I
120	3689.72	Tb II	60	3695.38	Ta I	60	3700.08	Ti I
100	3689.73	Ta I	940	3695.52	Rh I	450	3700.12	Tb I
600	3689.91	Ti I	110	3695.69	Ho I	4800	3700.26	Tm II
85	3690.08	Sm I	1000	3695.86	V I	35	3700.37	Re I
1000	3690.28	V I	95	3695.90	Nb II	230	3700.58	Dy II
5500	3690.34	Pd I	75	3695.96	Ce II	540	3700.58	U II
210	3690.49	Th II	150	3695.97	Th II	70	3700.58	Yb I
50	3690.56	Yb II	90	3696.04	Mo I	290	3700.60	Sm II
240	3690.59	Mo I	60	3696.12	Ce II	540	3700.72	Er II
580	3690.65	Ho I	450	3696.25	Er II	110	3700.77	Th II
1900	3690.70	Rh I	170	3696.30	Tb II	7600	3700.91	Rh I
65	3690.72	Co I	280	3696.51	Hf I	290	3700.92	Sm II
85	3690.93	Sm II	180	3696.57	Mn I	40	3700.98	Th I
610	3691.15	Tb II	260	3696.59	Ru I	130	3700.99	Ru I
230	c 3691.32	Ho II	25	3696.65	Pr II	300	3701.09	Fe I
50	3691.47	Pr II	70	3696.65	Th II	340	3701.15	Hf II
1500	c 3691.48	Re I	130	3696.76	Gd II	200	3701.15	Tb I
180	3691.88	Th I	320	3696.85	Tb II	130	3701.27	Ho I
540	3691.92	U II	160	3696.92	Er II	150	3701.33	Tb I
340	3691.95	Ho I	100	3696.93	Gd I	21	3701.34	Ta I
23	3692.08	Mo I	140	3696.95	Dy II	3800	3701.36	Tm II
270	3692.22	Sm II	70	3697.03	Th II	80	3701.50	Tb II
1500	3692.22	V I	190	3697.13	U I	1100	3701.52	U II
9400	3692.36	Rh I	120	3697.17	Nd II	110	3701.56	Sm II
170	3692.53	Y I	100	3697.27	Er I	190	3701.57	Er II
170	3692.57	Th I	370	3697.31	Dy II	540	3701.63	Dy II
180	3692.64	Mo II	130	3697.39	Nb I	70	3701.73	Mn I
7900	3692.65	Er II	390	3697.46	Zr II	100	3701.75	Nd
120	3692.76	Sm II	410	3697.56	Nd II	130	3701.78	Ho II
300	3692.95	Tb II	85	3697.57	Tm II	35	3701.81	La II
75	3693.05	Ta I	120	3697.66	Ce II	95	3701.81	Pr II
230	3693.11	Co I	380	3697.68	Er I	220	3702.03	Mo I
50	3693.36	Pr II	100	3697.71	Re I	280	3702.24	Co I
150	3693.37	Nb I	2000	3697.73	Gd II	27	3702.24	Ru I
160	3693.38	Mo I	110	3697.76	Ru I	120	3702.29	Ti I
100	3693.42	Ce II	1500	3697.85	Nb I	80	3702.31	W I
230	3693.48	Co I	220	3697.93	U II	490	c 3702.35	Ho II
50	3693.48	Pr II	150	3698.06	Pr II	35	3702.51	Er II
450	3693.58	Tb I	80	3698.10	Ir I	180	3702.55	Mo I
280	3693.67	Mn I	180	3698.11	Th I	230	3702.62	U I
330	3693.70	U II	60	3698.13	Ce II	120	3702.79	Ce II
50	3693.71	Ce II	960	3698.17	Zr II	240	3702.84	Nd

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
4700	3702.86	Tb II	85	3707.39	Ce II	60	3712.33	Pr II
40	3702.86	Th II	330	3707.40	Dy II	520	3712.39	Er II
300	3703.12	Tb I	40	3707.43	Th II	55	3712.53	Th II
130	3703.16	Nb I	55	3707.47	Co I	2700	3712.70	Gd II
520	3703.24	Re I				350	3712.76	Sm II
190	3703.25	Os I	50	3707.53	Ti I	200	3712.81	Nd
230	3703.27	U I	440	3707.57	Dy II	85	3712.84	Os I
80	3703.38	W I	520	3707.64	Er II	430	3712.88	Ho I
80	3703.50	Tb II	110	3707.65	U II	75	3712.95	Cr II
40	3703.51	Gd II	65	3707.80	Nb I	80	3712.95	Mo I
3800	3703.58	V I	280	d 3707.82	Fe I	3300	3713.01	Nb I
85	3703.78	Th I			Fe I	940	3713.02	Rh I
120	3703.88	Nd	810	3707.92	W I	60	3713.27	Pr II
130	3703.91	Nb I	110	3707.95	U I	60	3713.43	Rh I
250	w 3703.91	Th II	440	3708.22	Dy II	95	3713.45	Eu II
	3703.99	Th II						
2400	3703.92	Tb II	120	3708.36	Dy II	80	3713.47	Mo I
680	3704.06	Co I	480	3708.41	Sm II	550	d 3713.54	La II
	3704.08	Th II	100	3708.42	Tb I	350		U I
230	3704.09	U I	80	3708.56	Mo I			U II
			930	3708.65	Sm II	2000	3713.57	Gd I
140	3704.14	Nb I	130	3708.72	V I	470	3713.70	Nd II
190	3704.30	Ti I	35	3708.75	Th II	230	3713.73	Os I
40	3704.33	Pr II	180	3708.76	Tb II	190	3713.82	Nb I
70	3704.45	Re I	230	3708.82	Co I	160	3713.84	Dy II
80	3704.46	Fe I	60	3709.13	Gd II	40	3713.96	V I
80	3704.54	Ho II	120	3709.14	Os I	50	3713.99	Ce II
120	3704.54	La I	850	3709.25	Fe I	290	3714.05	Pr II
1800	3704.70	V I	190	3709.25	Nb II	190	3714.13	Zr I
60	3704.84	Re I			Nb I	370	3714.20	Nd II
330	3704.85	Tm II	720	3709.26	Zr II	60	3714.23	W I
			250	3709.27	Ho II			
85	d 3704.86	Th I				80	3714.37	Tb II
	3704.97	Th II	1000	3709.29	Ce II	70	3714.55	Mo I
100	3704.92	Hf I	370	3709.30	Tb II	640	d 3714.73	Nd II
240	3704.95	Nd II	130	3709.52	Sm II			Nd II
220	3704.98	Ce II	320	3709.76	Ho I	230	3714.76	U II
						110	3714.77	Ce II
100	3705.02	Re I	110	3709.87	U I			
180	3705.04	U II	1000	3709.93	Ce II	190	3714.78	Zr II
570	3705.04	V I	240	3709.93	Re I	45	3714.83	Rh I
240	3705.06	Tb I	290	3709.96	Ti I	60	3714.84	W I
120	3705.40	Hf II	420	3710.07	Dy II	140	3714.87	La II
55	3705.41	Mo I	55	3710.14	Mo I	95	3714.90	Eu II
800	3705.57	Fe I	13000	3710.30	Y II	35	3715.02	Re I
100	3705.77	Er I	50	3710.34	Yb II	60	3715.03	W I
320	3705.82	La II	65	3710.45	Nb I	250	3715.04	Nd II
110	3705.98	U II	120	3710.74	Dy II	35	3715.14	Ce II
120	3706.03	Ca II	160	c 3710.74	Ho II	40	3715.23	Gd II
95	3706.04	V I	35	3710.79	Er II	110	3715.31	Dy II
210	3706.08	Mn I	17	3710.79	Ta I	200	3715.39	Nd II
140	3706.23	Ti II	60	3710.87	Eu II	30	3715.40	Ti I
280	3706.34	Tb II	160	3710.87	Sm II	120	3715.47	Ce II
160	3706.52	Er I	60	3710.95	Lu I	230	3715.47	U I
18	3706.53	Pt I	170	c 3711.10	Pr II	320	3715.47	V II
120	3706.56	Os I	280	3711.30	Th II	270	3715.53	La II
90	3706.63	Zr I	160	3711.31	Ho II	55	3715.56	Ru I
230	3706.75	Pr II	330	3711.34	Nb I	95	3715.57	Dy II
480	3706.75	Sm II	27	3711.51	Mo I	60	3715.62	Pr II
340	3706.77	Th I	480	3711.54	Sm II	220	3715.65	Mo I
100	3706.80	Tb I	85	3711.62	Th I	470	3715.68	Nd II
100	3706.90	Ho II	330	3711.66	Dy II	100	3715.92	Gd I
110	3706.94	Ce II	1000	d 3711.76	Tb II	120	3715.97	Er I
480	3706.98	Sm II						
40	3707.00	Th I	50	3711.78	Nb I	140	3716.07	Mo I
80	3707.17	Mo I	100	3711.82	Er II	140	3716.08	Tb II
110	3707.17	Sm II	240	3712.11	Sm II	60	3716.08	W II
230	d 3707.29	U I	45	3712.18	Co I	110	3716.14	U I
	3707.39	U I	110	3712.30	Ru I	110	3716.18	Ru I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
85	3716.21	Nb I	70	3719.71	Tm II	420	3724.90	Sm II
95	3716.28	Pr II	210	3719.80	Ce II	230	3724.91	Er II
1400	3716.36	Gd II	6000	3719.94	Fe I	140	3724.92	Tb I
1400	3716.37	Ce II	450	3719.98	Th II	20000	3724.94	Eu II
200	3716.43	Tb II				16	3724.94	Rh I
60	3716.45	Fe I	230	3720.13	Os I	170	3724.97	Ru I
40	3716.53	Cr I	70	3720.25	Mo I	350	3724.99	U II
85	3716.58	Nd II	29	3720.28	Pr II		3725.07	U II
80	3716.87	Mo I	270	3720.31	Th II	75	3725.01	Pr II
110	3716.93	Ce II	230	h 3720.39	U I	70	3725.05	Ho I
160	3716.94	Dy II	85	3720.46	Nb II	90	3725.05	La II
35	3716.94	Eu II	140	3720.54	Nd I	890	3725.06	Tm II
480	3716.99	Nb I	130	3720.57	Sm II	380	3725.16	Ti I
	3717.06	Nb II	450	3720.72	Ho I	65	3725.22	Nb I
410	3717.00	Ru I	95	3721.03	Sm I	85	3725.32	Tb II
85	3717.08	W I	180	c 3721.32	Ho II	140	3725.38	Ir I
75	h 3717.10	Sc I	410	3721.35	Nd II	70	3725.39	Th I
100	3717.25	Er II	100	3721.46	Er II	430	3725.47	Gd II
95	3717.28	Dy I	65	3721.52	Nb I	55	3725.49	Ru I
360	c 3717.28	Re I	140	3721.64	Ti II	180	3725.56	Mo I
450	3717.40	Ti I	160	c 3721.80	Ho II	120	3725.65	U II
300	3717.42	U II	770	3721.82	Th II	420	3725.68	Ce II
100	3717.47	Tb II	930	3721.85	Sm II	4000	3725.76	Re I
75	3717.48	Ce II	35	3721.96	Os I	95	3725.94	Dy I
2000	3717.48	Gd I	45	3722.00	V I	180	c 3725.98	Ho II
140	3717.54	Nb I	29	3722.06	Pr II	550	3726.10	Ru I
35	3717.69	Eu II	250	3722.07	Gd II	140	3726.22	Mo I
1000	3717.80	Hf I	60	3722.10	Ce II		3726.32	Mo I
60	3717.83	Pr II	340	3722.12	Th II	2700	3726.24	Nb I
40	3717.83	Th II	45	3722.20	V I	19	3726.24	Sm II
80	3717.90	Tb I	85	3722.24	W I	50	3726.29	Pr II
7700	3717.91	Tm I	150	3722.29	Ce II	140	3726.49	Hf I
60	3718.03	Pr II	95	3722.32	Nb I	90	3726.57	Gd I
350	3718.11	U II	220	3722.42	Nd II	23	3726.66	Co I
60	3718.12	Y I	120	3722.48	Ni I	220	3726.72	Th II
80	3718.14	Dy II	800	3722.56	Fe I	190	3726.80	Sm II
40	3718.17	Th II	330	3722.57	Ti I	250	3726.90	Nd II
420	3718.19	Ce II	230	3722.68	U I	30	3726.92	Fe I
40	3718.24	Tb II	110	3722.76	Ce II	8700	3726.93	Ru I
85	3718.34	Os I	50	3722.79	Sb I	170	3726.96	Ce II
420	3718.38	Ce II	95	3722.95	Nb I	140	3727.23	Nb I
180	3718.44	Tb II	140	3723.04	Tb II	250	3727.34	V II
55	3718.48	Mo I	40	3723.07	Ta I	55	3727.38	Sm II
410	3718.54	Nd II	50	3723.29	Th II	750	3727.62	Fe I
160	3718.61	U II	780	3723.50	Nd II	500	3727.69	Mo I
270	3718.62	Ho I	70	3723.51	Mo I	110	3727.90	Th I
65	3718.84	Zr II	40	3723.57	Pr II	300	3728.00	Dy I
930	3718.88	Sm II	65	3723.64	Er II	490	3728.02	Ce II
1400	3718.91	Pd I	45	3723.66	Ce II	11000	3728.03	Ru I
45	3718.91	V I	55	3723.66	Th II	710	3728.13	Nd II
130	3718.93	Mn I	60	3723.69	Gd II	110	3728.18	Ce II
40	3719.16	Eu I	35	3723.81	Mo I	160	3728.30	Mo I
85	3719.21	Nd II	45	3723.84	Tb II	45	3728.34	V II
650	3719.28	Hf II	40	3724.02	Sm II	800	3728.42	Ce II
110	3719.29	U I	60	3724.21	Yb II	1600	3728.47	Sm II
260	3719.33	Ru I	110	3724.23	U I	150	3728.50	Mo I
320	3719.35	Er I	170	3724.36	Er II	75	3728.65	Tb I
100	3719.39	W I	80	3724.38	Fe I	55	3728.89	Mn I
60	3719.42	Pr II	1600	3724.45	Dy II	95	3728.93	Sm II
590	3719.44	Th I	270	3724.45	Ho I	130	3728.96	Tb I
1800	d 3719.45	Gd II	90	3724.49	Er II	50	3729.00	Ce II
	3719.53	Gd II	600	3724.57	Ti I	55	3729.04	V I
300	3719.45	Tb II	150	3724.64	Ce II	160	3729.10	Hf I
210	3719.52	Os I	85	3724.73	Th II	35	3729.11	Pr II
120	3719.55	Mo I	410	3724.87	Nd II	60	3729.22	Os I
	3719.74	Mo I						

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
50	3729.40	Pr II	350	3732.62	U II	320	3737.48	Sm II
1300	3729.52	Er II	85	3732.65	Tb I	100	3737.51	Th I
45	3729.68	Eu II	230	3732.67	Gd I	110	3737.52	Ce II
45	3729.74	Eu II	330	d 3732.71	Mo I	180	3737.65	Ho II
210	3729.75	Sm II			Mo I	160	3737.74	Ce II
2900	3729.82	Ti I	280	3732.76	V II	55	3737.74	Ru I
350	3729.82	U II	270	3732.78	Nd II	160	3737.88	Hf II
650	3729.91	Tb II	50	3732.98	Th I	180	3737.91	Mo I
75	3729.92	Ce II	120	3733.03	Mo I	45	3737.99	V I
120	3730.13	U II	120	c 3733.03	Pr II	600	3738.05	U II
140	3730.33	Ce II	85	3733.05	Ru I	1000	3738.06	Nd II
130	3730.37	Th I	350	3733.07	U II	45	3738.08	Eu II
85	3730.42	W I	510	3733.08	Gd II	50	3738.11	Zr II
7100	3730.43	Ru I	700	3733.32	Fe I	540	3738.16	Er II
280	3730.48	Co I	65	3733.32	Nb I	190	3738.27	Sm II
85	c 3730.55	Pr II	80	3733.40	Mo I	70	3738.31	Fe I
27	3730.56	Mo I	190	3733.49	Co I	270	3738.42	Nb I
470	3730.58	Nd II	150	3733.52	Ce II	45	3738.45	Tb
120	3730.67	Dy I	230	3733.58	U I	130	3738.53	Ir I
85	3730.73	Os I	65	3733.62	Nb I	60	3738.61	Y I
55	3730.74	Sm I	50	3733.67	Th I	45	3738.63	Ru I
170	3730.75	Th II	460	3733.79	Hf I	85	3738.76	V I
130	3730.81	Cr I	2400	3734.12	Tm II	170	3738.85	Th II
120	3730.81	Tm II	95	3734.14	Co I	60	3738.90	Ti I
1500	3730.84	Gd II	80	3734.37	Mo I	110	3738.91	Ru I
85	3731.00	Tb I	210	c 3734.41	Pr II	120	3739.04	Hf I
130	3731.02	Ta I	150	3734.43	V I	2900	3739.12	Sm II
17	3731.19	Ce I	190	3734.45	Er II		3739.20	Sm II
170	3731.22	Nd II	270	3734.58	Er II	410	3739.18	Pr II
20	3731.25	Ce I	100	3734.60	Th II	60	3739.23	Ni I
450	3731.26	Er II	180	3734.69	Yb I	930	3739.34	Dy I
2100	3731.26	Sm II	130	d 3734.80	Tb	410	3739.46	Ru I
270	3731.26	Zr II		3735.04	Tb	30	3739.48	W I
22	3731.30	Th I	7000	3734.87	Fe I	490	3739.76	Gd I
200	3731.36	Ir II	180	3734.99	Ho I	2700	3739.80	Nb I
1100	3731.40	Ho I	240	c 3735.01	Re I	110	3739.86	Dy II
40	3731.42	Th II	60	3735.28	Pr II	2800	3739.95	Pb I
95	3731.45	U I	650	3735.28	Rh I	330	3740.02	Gd II
50	3731.49	Pr II	810	3735.31	Re I	910	3740.10	Re I
150	3731.52	Tb I	1000	d 3735.54	Nd II	75	3740.13	Ce II
230	d 3731.58	U II		3735.60	Nd II	40	3740.24	V I
	3731.77	U I	80	3735.62	Mo I	180	3740.29	Er II
85	3731.63	Nd II	50	3735.67	Ti I	170	3740.32	Tb
55	d 3731.79	Er II	65	3735.71	Er I	140	3740.41	Re I
140	3731.87	Re I	250	3735.76	Pr II	670	3740.73	Nb II
110	3731.88	Ce II	35	3735.85	La II		3740.84	Nb I
130	3731.93	Mn I	90	3735.91	Mo I	27	3740.76	Mo I
100	3732.02	Nd II	150	3735.93	Co I	110	3740.85	Th II
150	3732.03	Cr I	1600	3735.98	Sm II	150	3740.99	Pr II
95	3732.03	Nb I	27	3736.17	Mo I	75	3741.01	Ce II
85	3732.03	Ru I	50	3736.22	W II	3300	3741.06	Ti I
360	3732.09	Ho I	810	3736.35	Ho I	340	3741.10	Er II
21	3732.20	Eu I	100	3736.44	Gd I	1300	3741.18	Th II
45	3732.22	Er I	190	3736.49	Pr II	220	3741.24	Tb
230	3732.26	U I	140	3736.76	Ta I	800	3741.29	Sm II
140	3732.28	Re I	150	3736.81	Ni I	350	3741.31	Eu II
270	3732.32	Gd I	40	3736.84	Re I	270	3741.42	Nd II
430	3732.39	Tb II	150	3736.90	Ca II	95	3741.50	V I
380	3732.40	Co I	440	3737.10	Nd II	220	3741.58	Tb II
120	3732.40	Fe I	3400	3737.13	Fe I	330	3741.64	Ti II
230	3732.45	Gd II	800	3737.14	Sm II	120	3741.71	W I
100	3732.46	Ce II	230	3737.25	U II	75	3741.73	Ce II
30	3732.56	Ce I	420	3737.27	Rh I	270	3741.78	Nb I
30	3732.58	Ce II	50	3737.39	Zr I	260	3741.89	Tb
220	3732.59	Ho I	280	3737.40	Ru I	90	3741.91	Gd II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
22	3742.21	Ce I	40	3746.44	Gd II	45	3751.35	Tb I
15	3742.25	Ce I	180	3746.47	Os I	35	3751.42	W I
130	3742.26	Re II	220	3746.54	Tb	250	3751.45	Ce II
240	3742.28	Mo I	400	3746.80	Hf I	160	3751.57	Sm II
3500	3742.28	Ru I	140	3746.91	Nb I	50	c 3751.59	Pr II
190	3742.35	U I	350	3747.12	U II	880	3751.60	Zr II
1700	3742.39	Nb I	870	3747.17	Tb II	45	3751.62	Tb
200	3742.40	Ho I	110	3747.19	Mo I	45	3751.63	Co I
170	d 3742.43	Tb	530	3747.20	Ir I	240	3751.72	U I
120	3742.59	Nd II	35	3747.26	Pr II	35	3751.76	Ce II
900	3742.64	Er II	870	3747.34	Tb II	40	3751.78	V I
75	3742.68	W I	900	3747.43	Er I	160	3751.80	Dy II
870	3742.78	Ru I	40	3747.47	Pr II	1700	3751.81	Tm I
150	3742.92	Th I	80	3747.49	Hf II	35	3751.97	Er II
95	3742.97	Cr I	310	3747.54	Th II	100	c 3752.07	Ho II
430	3743.09	Tb	1200	3747.55	Y II	120	3752.29	Nd I
600	3743.36	Fe I	480	3747.62	Sm II	60	3752.32	Pr II
4500	3743.47	Gd II	1200	3747.82	Dy II	140	3752.34	Ce II
40	3743.51	Th II	40	3747.98	V I	580	3752.49	Nd II
100	3743.56	Eu II	320	3748.06	Ce II	3700	3752.52	Os I
480	3743.58	Cr I	160	3748.10	Ti I	650	3752.57	Th II
170	3743.64	Tb I	3200	cw 3748.17	Ho II	350	3752.66	U II
55	3743.81	Mo I	1200	3748.22	Rh I	370	3752.67	Nd II
1200	3743.87	Sm II	1400	3748.26	Fe I	5200	3752.86	Ti I
570	3743.88	Cr I	150	3748.49	Mo I	85	3753.00	Tb I
50	3743.97	Ce I	29	3748.50	Pr II	130	c 3753.01	Ho II
120	3743.98	Pr II	160	d 3748.52	Sm I	21	3753.09	Sm II
60	3743.99	Hf I		3748.63	Sm II	250	3753.18	Nb I
190	3744.00	Nb I	170	3748.55	Nb I	140	3753.22	Hf I
50	3744.05	Ce II	55	3748.61	Cr I	35	3753.24	Th I
5000	3744.06	Tm I	950	3748.68	U II	40	3753.27	V I
27	3744.10	Mo I	110	c 3748.78	Ho II	40	3753.32	Ir I
40	3744.14	Gd II	85	3748.80	Tb II	60	3753.40	Pr II
420	3744.17	Rh I	60	3748.82	Pr II	1400	3753.51	Dy II
280	3744.22	Ru I	120	3748.88	Gd II	85	3753.52	Tb
140	3744.24	Nd II	340	3749.00	Cr I	760	3753.54	Ru I
300	3744.24	U II	55	3749.02	Er I	70	3753.61	Fe I
80	3744.37	Mo II	150	3749.10	Nd II	600	3753.64	Ti I
410	3744.40	Ru I	4000	3749.49	Fe I	320	c 3753.73	Ho II
85	3744.49	Cr I	70	3749.66	W I	1400	3753.75	Dy II
55	3744.74	Th II	130	3749.70	Tb I	75	3753.77	Ce II
620	3744.83	Gd I	200	3749.85	Nd II	55	3754.03	Th I
27	3744.94	Mo I	50	3749.89	Y I	240	3754.12	Rh I
100	3744.98	Hf II	110	3749.94	Co I	380	3754.27	Rh I
200	3744.99	Er II	170	3750.08	Ce II	190	3754.31	U II
650	3745.04	Tb I	75	3750.08	Pr II	40	3754.35	Co I
140	3745.11	Er II	90	3750.19	Ho II	50	3754.40	Pr II
300	cw 3745.44	Re I	75	d 3750.24	Tb I	160	3754.45	Ho I
930	3745.46	Sm I	75	3750.24	Tb I	160	3754.45	Ho I
	3745.46	Sm I	320	3750.31	Nd II	110	3754.52	Ta I
	3745.60	Sm II	130	3750.32	Dy II	130	3754.59	Th II
90	3745.48	Mo I	40	3750.40	Ir I	50	3754.79	Zr I
1100	3745.50	Co I	75	3750.50	Pr II	95	3754.81	Dy II
2400	3745.56	Fe I	190	3750.54	Er II	250	3754.83	Nd II
2800	3745.59	Ru I	65	3750.63	Nb I	160	3754.86	Sm II
50	3745.66	Th I	80	3750.64	Zr II	85	c 3755.00	Pr II
55	3745.71	Er II	80	3750.66	Sm II	310	3755.09	Ru I
230	3745.80	V II	100	3750.74	Nd II	140	3755.10	Mo I
600	3745.90	Fe I	210	3750.87	V II	75	3755.11	Ta I
340	3745.97	Th II	190	3750.98	Pr II	130	3755.21	Th I
560	3745.98	Zr II	150	3751.00	Ce II	80	3755.24	Gd II
60	3746.26	Ce II	40	3751.02	Th I	1100	3755.24	Tb II
75	3746.30	Tb I		3751.12	Th I	40	3755.28	Nb I
130	3746.36	Ta I	100	3751.10	Gd I	800	3755.28	Sm II
170	3746.38	Ce II	600	3751.18	U I	200	3755.43	Ce II
680	3746.41	U II	130	3751.20	Mo I	110	3755.45	Co I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
350	3755.48	U II	300	3759.79	Nd II	930	3763.47	Nd II
30	3755.54	Mo I	1200	3759.84	Ru I	530	3763.49	Nb I
80	3755.56	Gd II	120	3759.88	U II	85	3763.61	Ce II
490	3755.58	Rh I	100	3759.98	Gd I	1700	3763.79	Fe I
370	3755.60	Nd II	85	3760.02	Tb I	85	3763.96	Tb I
80	3755.62	Re I	370	3760.03	Ru I	29	3764.10	Pr II
40	3755.70	V I	350	3760.04	Sm II	680	3764.12	Ce II
170	3755.72	Ce II	60	3760.05	Fe I	150	3764.12	Nb I
210	3755.77	Nb I	120	3760.08	Pr II	370	3764.20	Gd II
30	3755.84	Mo I	120	3760.13	Tb I	70	3764.31	W I
870	3755.93	Ru I	680	3760.13	W I	1100	3764.37	Sm II
540	3756.05	Er I	23	3760.21	Ta I	480	3764.39	Zr I
50	3756.29	Th I	50	3760.27	Th II	55	3764.44	Mo I
35	3756.40	Er II	26	3760.39	Co I	490	3764.57	U II
800	3756.41	Sm I	50	3760.40	Ce II	160	3764.60	Gd II
290	3756.53	Sm II	1000	3760.40	Rh I	230	3764.77	Pr II
240	3756.66	U II	100	3760.47	Gd I	200	3765.04	Ce II
110	3756.70	Lu I	90	3760.48	Ho I	100	3765.05	Hf I
110	3756.79	Lu I	16	3760.53	Fe I	350	3765.08	Nb I
50	3756.80	Pr II	40	3760.64	Nb I	2300	3765.08	Rh I
100	3756.83	Nd II	75	3760.69	Ce II	1700	3765.14	Tb I
310	3756.86	Tm II	1900	3760.69	Sm II	90	3765.22	Mo I
240	3756.92	U II	620	3760.71	Gd II	110	3765.24	Th I
1200	3757.05	Dy I	90	3760.88	Mo I	120	3765.34	Nd II
45	3757.05	Tb I	240	3760.88	U II	270	3765.35	U I
35	3757.08	W I	290	3760.92	Gd II	130	3765.43	Sm II
100	3757.12	Os I	70	3761.10	Th II	140	3765.54	Fe I
50	3757.17	Cr I	260	3761.12	Eu II	100	3765.56	Hf I
160	3757.22	Ce II	170	3761.13	Nb I	55	3765.74	Mo I
270	c 3757.26	Ho II	350	3761.14	Tb I	70	3765.85	Tm II
4700	3757.37	Dy II	2900	3761.32	Ti II	85	3765.89	Ce II
430	3757.44	Tb II	6000	3761.33	Tm II	120	3765.92	Nd II
1200	3757.53	Sm II	45	3761.44	V I	95	3765.93	Eu II
230	3757.66	Cr I	50	3761.47	Th I	29	3765.98	Pr II
140	3757.69	Th I	600	3761.51	Ru I	250	3766.13	Nb I
140	3757.69	Ti II	140	3761.58	Nd II	230	3766.16	Er II
230	3757.74	Gd II	26	3761.61	W I	130	3766.30	Os I
23	3757.75	Ta I	90	3761.76	Mo I	60	3766.45	Ti I
95	3757.79	Zr II	680	3761.87	Pr II	60	3766.47	Pr II
510	3757.82	Nd II	50	3761.89	Ti II	140	3766.48	Re I
160	3757.86	Ce II	4800	3761.91	Tm II	160	3766.51	Ce II
430	d 3757.90	Tb II	160	3761.96	U II	300	3766.59	Nd II
510	3757.92	W I	230	3761.99	Er I	480	3766.72	Zr I
1000	3757.94	Gd I	55	3762.09	Mo I	340	3766.82	Zr II
60	3758.04	Cr I	85	3762.09	Nd II	430	3766.89	U I
3000	3758.24	Fe I	45	3762.11	Ta I	170	3766.92	Hf II
1400	3758.31	Gd II	160	3762.11	U II	870	3767.04	Gd II
490	3758.36	U I	870	3762.20	Gd I	1200	3767.19	Fe I
450	3758.45	Sm II	35	3762.36	Pr II	600	3767.35	Ru I
130	3758.47	Th I	40	3762.45	Nb I	480	3767.36	Sm II
180	3758.52	Mo I	60	3762.51	Hf II	24	3767.43	Cr I
930	3758.95	Nd II	65	3762.51	Tb I	200	3767.50	Tb II
660	3758.97	Sm II	29	3762.56	Pr II	640	3767.63	Dy I
95	3758.99	Dy II	660	3762.59	Sm II	65	3767.73	Er II
820	3759.00	Gd II	65	3762.74	Tb I	30	3767.73	Mo I
2400	3759.08	La II	510	3762.88	Th II	480	3767.76	Sm II
350	3759.23	U II		3762.94	Th I	70	3767.84	W I
130	3759.26	Th I	300	3762.98	Ce II	24	3767.88	Zr II
3300	3759.30	Ti II	150	3763.00	Gd II	200	3767.90	Th II
40	3759.32	V I	60	3763.03	Pr II	50	3768.00	Ce II
650	3759.35	Tb I	85	3763.14	V I	120	3768.14	Os I
140	3759.55	Nb I	330	3763.27	U I	260	3768.24	Cr I
30	3759.60	Mo I	50	3763.32	Th II	200	3768.25	Hf I
140	3759.60	Pr II	210	3763.33	Gd II	120	3768.26	Re I
45	3759.75	Ta I	150	3763.35	Mo I	8700	3768.39	Gd II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
1000	3768.45	W I	75	3773.12	La II	95	3776.92	Dy II
65	3768.62	Mo I	110	3773.15	Nb I	290	3776.99	Os I
65	3768.68	Ir I	55	3773.17	Ru I	140	3777.00	Nd II
100	3768.71	Nd II	190	3773.18	Nd II	95	3777.08	Sm II
95	3768.73	Cr I	85	3773.20	Ce II	110	3777.10	Ta I
65	3768.74	Mo I	230	3773.30	Dy II	60	c 3777.13	Pr II
300	3768.76	Ce II	370	d 3773.33	Sm I	50	3777.28	Nb I
160	3768.79	Er II		3773.42	Sm II	25	3777.41	Th I
240	3768.80	U II	75	3773.44	Ce II	220	3777.43	Dy I
230	3768.94	Pr II	540	3773.44	U I	120	3777.48	Tb I
100	3769.04	Ce II	210	3773.45	Gd I	35	3777.54	Co I
40	3769.07	V I	340	3773.71	W I	1500	3777.59	Ru I
340	3769.09	Ho I	170	3773.76	Th II	160	3777.62	Er II
170	3769.15	Nb I	70	3773.77	Dy I	140	3777.62	Pr II
120	3769.21	W I	110	3773.83	Ho I	1400	3777.64	Hf I
85	3769.43	Tb I	170	3774.06	Pr II	140	3777.66	Ce II
620	3769.45	Gd II	40	3774.10	Eu I	140	3777.66	Re I
330	3769.54	U II	40	3774.11	V I	60	3777.67	Nb I
510	3769.65	Nd II	50	3774.20	Th II	65	3777.72	Mo I
95	3769.68	Pr II	290	3774.29	Sm II	130	3777.84	Sm II
120	3769.86	W I	160	3774.30	Gd II	55	3777.96	Mo I
160	3769.94	Ce II	80	3774.32	Yb I	130	hc 3778.00	Ho I
490	3769.97	Rh I	10000	3774.33	Y II	380	3778.13	Rh I
140	3769.98	Nb I	120	3774.40	Os I	1100	3778.14	Sm II
65	3770.00	Mo I	65	3774.44	Nb I	110	3778.32	Er II
180	3770.06	Th I	220	3774.58	Ho I	75	3778.55	W I
550	3770.10	Yb I	55	3774.60	Co I	140	3778.67	Er I
360	3770.45	Mo I	110	3774.62	Os I	270	3778.68	V I
	3770.52	Mo I	190	3774.68	Sm II	75	3778.69	W I
60	3770.46	Pr II	370	3774.71	Dy I	150	3778.70	Ru I
40	3770.52	Ta I	10	3774.83	Fe I	60	3778.75	Pr II
1400	3770.69	Gd II	90	3774.84	Er I	95	3779.03	Dy II
75	3770.71	Nb I	180	3774.90	Ho I	120	3779.05	U II
50	3770.73	Ir I	100	3774.93	Nd II	330	3779.22	Tb I
130	3770.73	Sm II	40	3775.19	V I	150	3779.23	Dy II
210	3770.76	Ce II	160	3775.26	Tb II	710	3779.47	Nd II
140	3770.87	Nb I	110	3775.31	Er I	130	3779.56	Sm II
45	3770.93	Ta I	130	3775.37	Ho I	45	3779.61	Ce II
210	3770.97	V II	140	3775.45	Nb I	45	3779.65	V I
45	3771.03	Tb I	1400	3775.50	Nd II	220	3779.77	Mo I
270	3771.10	Er II	600	3775.57	Ni I	100	3779.83	Gd II
330	3771.11	Dy I	30	3775.65	Mo I	85	3780.26	Pr II
250	3771.26	Gd I	230	3775.66	Er II	95	3780.31	Dy I
95	3771.35	Dy I	70	3775.72	Rh I	290	3780.37	Ho II
80	3771.35	Sm II	12000	cw 3775.72	Tl I	580	3780.40	Nd II
60	3771.36	Hf II	40	3775.72	V I	720	3780.54	Zr I
200	3771.37	Th I	70	3775.90	Th II	170	3780.66	Pr II
300	3771.60	Ce II	240	3775.99	U II	120	3780.67	La II
600	3771.66	Ti I	30	3776.06	Ti II	380	3780.72	U II
530	3771.85	Nb I	75	3776.09	Pr II	660	3780.76	Sm II
180	3771.95	Mo I	30	3776.10	Mo I	1000	3780.77	W I
100	3772.24	Th II	75	3776.15	Ce II	420	3780.93	Sm II
250	3772.40	Ho I	250	3776.15	Ho I	95	3780.94	Dy I
140	3772.40	Nd II	40	3776.16	V I	50	3780.97	Th I
70	3772.42	W I	120	3776.25	Os I	110	c 3780.99	Ho II
110	3772.47	Er II	85	3776.27	Th I	410	3781.01	Er II
160	3772.64	Dy I	250	3776.34	Nd II	870	3781.01	Nb I
210	3772.64	Sm II	10	3776.46	Fe I	25	3781.10	Ce II
60	3772.65	Ce II	300	3776.48	U I	85	3781.15	Tm I
150	3772.82	Mo I	2100	3776.49	Tb II	460	3781.18	Ru I
170	c 3772.82	Pr II	30	3776.55	Mo I	510	3781.32	Nd II
190	3772.82	U II	1400	3776.56	Y II	25	3781.32	Th I
140	3772.93	Nd II	40	3776.60	Nb I	110	3781.38	Nb II
640	3773.05	Dy I	250	3776.61	Ce II	40	3781.39	V I
60	3773.12	Hf I	210	3776.83	Gd I	60	3781.40	Eu II

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
420	3781.47	Dy I	3900	3786.06	Ru I	95	3790.45	Cr I
360	3781.59	Mo I	3300	3786.18	Dy II	6000	3790.51	Ru I
620	3781.62	Ce II	30	3786.18	Lu I	40	3790.58	Pr II
120	3781.75	U I	140	3786.22	Nb I	200	3790.63	Gd I
29	3781.91	Pr II	35	3786.37	W I	180	3790.73	Os I
65	3782.18	Tb	120	3786.57	U II	200	3790.79	Th I
65	3782.19	Mo I	95	3786.61	Zr	12	3790.83	Ce II
2100	3782.20	Os I	860	3786.63	Ce II	3700	3790.83	La II
50	3782.22	Zr II	30	3786.68	Fe I	50	3790.88	Ce II
50	3782.30	Y II	120	3786.83	Dy I	270	3791.00	Ho II
1000	3782.34	Gd II	1800	3786.84	Er II	120	3791.05	Tb I
50	3782.35	Pr II	240	3786.84	U I	110	3791.16	Er I
95	3782.42	Sm II	150	3786.86	Pr II	770	3791.17	Gd II
35	3782.43	Hf I	70	3786.88	Th II	3500	3791.21	Nb I
440	3782.52	Ce II	50	3787.01	Tm I	270	3791.28	Sm II
55	3782.62	Tb I	1700	3787.06	Nb I	70	3791.30	Th II
110	3782.65	Ho II	65	3787.14	V I	130	3791.38	Cr I
45	3782.68	Sm I	170	3787.15	Gd I	560	3791.40	Zr I
600	3782.74	Ru I	320	3787.20	Sm II	45	3791.50	Eu II
70	3782.78	Hf II	410	3787.22	Tb II	340	3791.50	Nd II
1900	3782.84	U II	190	3787.23	U II	90	3791.54	Er I
190	3782.87	Dy II	130	3787.26	Dy II	220	3791.55	Ho I
170	3783.01	Th II	35	3787.37	Hf I	85	3791.68	Ce II
100	3783.03	Ce II	65	3787.38	Er II	80	3791.72	Gd II
2900	3783.05	Gd I	35	3787.46	Ce II	60	3791.74	Yb I
95	3783.06	Sm II	65	3787.48	Nb I	560	3791.83	Er II
140	3783.29	Th II	700	3787.52	Re I	700	3791.87	Dy II
50	3783.31	Pr II	1100	3787.56	Gd II	110	3791.97	Ho II
130	3783.36	Sm II	100	3787.57	Ce II	270	3792.02	Sm II
55	3783.53	Mo I	120	3787.60	Tb	110	3792.02	Ta I
700	3783.53	Ni I	85	3787.71	Tb I	130	3792.14	Cr I
600	3783.53	Tb I	560	3787.86	Er II	1300	3792.18	Rh I
260	3783.55	Tm II	460	3787.88	Fe I	390	3792.20	Tb I
200	3783.58	Ce II	120	3787.91	Ce II	300	3792.32	Ce II
150	3783.60	Dy II	24	3788.06	Pr II	110	3792.37	Th I
60	3783.73	Gd II	320	3788.08	Ho II	490	3792.39	Gd II
50	3783.73	W I	1500	3788.12	Sm II	90	3792.40	Zr I
300	3783.78	Nd II	190	3788.16	U I	120	3792.41	U I
140	3783.84	Nb I	45	3788.20	Ce II	210	3792.51	Pr II
35	3783.84	Pr II	90	3788.26	Mo I	170	3792.76	W I
	3783.98	Pr II	50	3788.36	Th II	500	3792.79	Er I
430	3783.84	U II	1600	3788.44	Dy II	150	3792.81	Nd II
65	3783.87	Er II	110	3788.44	Ho II	290	3792.95	Ho I
150	3783.94	Dy I	1000	3788.47	Rh I	50	3792.95	Pr II
55	3784.15	Tb I	7400	3788.70	Y II	570	3793.10	U II
2400	3784.25	Nd II	520	3788.75	Ce II	3800	3793.22	Rh I
19	3784.25	Ta I	40	3788.76	Eu II	75	3793.25	Tb
270	3784.73	Nd II	95	3788.86	Cr I	380	3793.28	U I
65	3784.81	La II	120	3788.97	Nd	120	3793.29	Cr I
190	3784.85	Nd II	160	3789.00	Tb	650	3793.37	Hf II
90	3785.03	Mo I	85	3789.11	Os I	50	3793.42	Ce II
150	3785.11	Nd II	310	3789.12	Th II	60	3793.45	Pr II
180	3785.23	Ho II	120	3789.30	Ti I	75	3793.51	Ce II
190	3785.35	Sm II	65	3789.50	Nb I	600	3793.55	Tb
120	3785.38	Tb	120	3789.68	Tb	380	3793.57	U II
120	3785.40	Nd II	410	3789.92	Tb I	95	3793.61	V I
330	3785.41	Dy II	60	3790.10	Fe I	110	3793.62	Mo I
1400	3785.46	Hf I	620	3790.14	Os I	120	3793.79	Ir I
150	3785.46	Pr II	1300	3790.15	Nb I	25	3793.83	Ce I
55	3785.51	Mo I	260	3790.22	Mn I	18	3793.85	Ce II
340	3785.60	Th II	120	3790.22	U II	130	3793.88	Cr I
50	3785.91	Th II	520	3790.32	V I	370	3793.91	Os I
30	3785.95	Fe I	120	3790.33	U II	1600	3793.97	Sm II
40	3786.00	Pr II	25	3790.34	Ce II	35	3794.06	Ir I
840	3786.04	Ti I	85	3790.36	Th I	100	3794.15	Th II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
30	3794.34	Fe I	320	3798.51	Fe I	570	3803.47	V I
85	3794.34	W I	770	3798.54	Tm I	65	3803.73	Er I
90	3794.43	Mo I	160	3798.59	Tb I	85	3803.78	V I
85	3794.47	Nb I	180	3798.63	Er I		3803.90	V I
85	3794.61	Cr I	100	3798.66	Hf I	15	3803.83	Ce I
						35	3803.84	Ce II
40	3794.66	Os I	240	3798.75	Tm II			
100	3794.68	Ce II	240	3798.84	U I	670	3803.88	Nb I
180	3794.69	Ho I	7600	3798.90	Ru I	160	3803.94	Sm I
55	3794.70	Th I	200	3798.95	Tb II	85	3803.98	Th I
3900	3794.78	La II	130	3799.01	Eu II	26	3804.07	W I
240	3794.92	Ru I	75	3799.04	Ce II	200	3804.10	Nd II
190	3794.93	Pr II	35	3799.09	Ce I	510	3804.14	Dy II
1100	3794.96	V I	1500	3799.19	Pd I	250	3804.15	Ho I
650	3795.00	Fe I	240	3799.20	U II	50	3804.16	Ce II
220	3795.13	U II	170	3799.24	Nd II	120	3804.35	Dy I
380	3795.16	Tm II	55	3799.26	Mn I	210	3804.39	Gd I
85	3795.18	Ru I	4900	3799.31	Rh I	120	3804.42	Tb I
170	3795.25	Ce II	7600	3799.35	Ru I	110	3804.52	Mo I
80	3795.25	Gd II	500	3799.54	Sm II	70	3804.53	Hf I
85	3795.39	Th I	480	3799.55	Fe I	530	3804.74	Nb I
340	3795.45	Nd II	240	3799.55	Nd II	530	3804.80	Cr I
140	3795.54	Nb I	240	3799.55	U II	290	3804.84	Pr II
85	3795.67	Os I	570	3799.91	V I	210	3805.09	Gd II
160	3795.75	Gd I	3100	3800.12	Ir I	120	3805.34	Fe I
7100	3795.75	Tm II	310	3800.26	Ru I	2500	3805.36	Nd II
50	3795.77	Pr II	680	3800.30	Pr II	560	3805.52	Gd II
70	3795.90	Ti I	270	3800.37	Sm II	340	3805.55	Nd II
120	3795.93	Gd II	850	3800.38	Hf I	320	3805.63	Sm II
55	3796.04	Mo I		3800.45	Hf I	110	3805.82	Th II
240	3796.20	U I	110	3800.55	Mn I	760	3805.92	Rh I
130	3796.25	Tb I	150	3800.67	Lu I	110	3805.93	Mo I
40	3796.28	Pr II	800	3800.89	Sm II		3805.99	Mo I
35	3796.28	W I	170	3800.94	Nb I	27	3806.04	Sm II
5100	3796.37	Gd II	2800	3801.02	Sn I	45	3806.05	Er II
110	3796.44	Nb I	20	3801.05	Pt	140	3806.07	Hf II
130	3796.48	Zr II	370	3801.12	Nd II	60	3806.14	Pr II
120	3796.49	Nd II	240	3801.15	U I	170	3806.20	Nb I
240	3796.54	U II	290	3801.28	Ho II	95	3806.26	Tb
110	3796.59	Nb I	720	3801.29	Gd II	580	3806.27	Dy II
160	3796.59	Re I	270	3801.30	Nb I	190	3806.47	Sm I
50	3796.67	Ce II	95	3801.35	Pr II	60	3806.63	Nb I
55	3796.73	Th I	70	3801.36	Eu	60	3806.70	Fe I
8900	3796.75	Ho II	75	3801.36	Tb	3200	3806.72	Mn I
240	3796.84	U II	200	3801.38	Nd II	1300	3806.76	Rh I
110	3796.85	Nb I	130	3801.44	Th I	130	3806.77	Sm II
75	3797.00	Tb I	70	3801.51	W I	190	3806.80	V I
560	3797.06	Er II	2500	3801.52	Ce II	110	3806.83	Cr I
140	3797.13	Cr I	330	3801.80	Tb II	760	3806.85	Tb II
200	3797.26	Ho I	290	3801.84	Mo I	80	3807.07	Er II
420	3797.28	Sm II	55	3801.91	Mn I	700	3807.14	Ni I
250	3797.30	Mo I	85	3801.91	W I	470	3807.23	Nd II
40	3797.45	Th II	120	3801.93	Dy II	300	3807.50	V I
60	3797.52	Fe I	70	3802.07	Tm I	95	3807.54	Eu II
160	3797.59	Re I	28	3802.15	Th II	30	3807.54	Fe I
200	3797.72	Cr I	160	3802.17	Tb II	150	3807.65	Gd II
1600	3797.73	Sm II	240	3802.27	U II	65	3807.65	Mo I
190	3797.77	U I	340	3802.30	Nd II	120	3807.69	Ce II
760	3798.05	Ru I	29	3802.30	Pr II	600	3807.72	Tm I
55	3798.10	Th I	150	3802.85	Gd II	190	3807.74	Re I
2700	3798.12	Nb I	2700	3802.92	Nb I	370	3807.88	Th II
80	3798.21	Er I	590	3803.08	Th I	110	3807.90	Dy II
220	3798.25	Ho II	800	3803.09	Ce II	110	3807.90	Ho I
29000	3798.25	Mo I	85	3803.20	Ru I	190	3807.92	Sm II
60	3798.31	Ti I	120	3803.35	U II	110	3807.93	Cr I
160	3798.39	Gd II	1200	3803.47	Nd II	1000	3808.11	Ce II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
70	3808.11	Co I	340	3813.07	Th II	680	3818.28	Pr II
95	3808.20	Zr	160	3813.10	Dy II	1300	3818.35	Y II
140	3808.25	Nd II	240	3813.16	Tb	45	3818.36	Sm I
420	3808.46	Sm II	900	3813.25	Ho II	70	3818.48	Cr I
520	3808.52	V I	35	3813.47	Nb I	120	3818.48	U II
55	3808.61	Th I	1000	3813.49	V I	75	3818.66	Mo I
310	3808.68	Ru I	480	3813.63	Sm II	50	3818.68	Th I
540	3808.77	Nd II	470	3813.67	Dy II	100	3818.69	Ce II
65	3808.79	La II	380	3813.79	U II	180	3818.69	Ho II
380	3808.93	U I	110	3813.83	Sm I	80	3818.69	Pt I
280	3809.02	Dy II	40	3813.89	Pr II	90	3818.71	Er II
440	3809.06	Nd II	3700	3813.97	Gd II	40	3818.74	Pr II
140	3809.18	Pr II	380	3814.07	U II	120	3818.75	Dy II
490	3809.21	Ce II	70	3814.46	Co I	430	3818.75	Gd II
380	3809.22	U II	420	3814.63	Sm II	120	3818.76	U II
290	3809.22	W I	710	3814.73	Nd II	100	3818.84	Nd II
130	3809.49	Ho II	430	3814.74	Gd II	210	3818.86	Nb II
75	3809.50	Ce II	150	3814.86	Ru I	300	3819.02	Ce II
45	3809.50	Rh I	35	3814.94	Ce II	760	3819.03	Ru I
700	3809.59	Mn I	150	3814.96	Tb	120	3819.14	Pr II
230	3809.60	V I	85	3815.01	Ce II	210	3819.15	Nb I
320	3809.75	Sm II	470	3815.01	Rh I	120	3819.25	U I
210	3809.82	Dy I	40	3815.03	Th II	100	3819.38	Hf I
55	3809.83	Th II	180	3815.43	Cr I	120	3819.44	Dy I
320	3809.88	Sm II	120	3815.50	Eu II	180	3819.56	Cr I
110	c 3809.93	Ho II	530	3815.51	Nb I	39000	cw 3819.67	Eu II
180	3809.97	Dy II	95	3815.51	V I	240	3819.70	Nd II
60	3809.97	Pr II	120	3815.66	Re I	55	3819.77	Ru I
35	3810.10	Ce II	35	3815.77	W I	140	3819.87	Mo I
95	3810.10	U I	1600	3815.84	Fe I	230	3819.96	V I
40	3810.25	Gd II	490	3815.85	Ce II	150	3820.11	Tb II
1600	3810.33	Er I	1300	h 3816.02	Pr II	35	3820.11	W I
190	3810.38	W I	230	3816.21	Dy I	5000	3820.43	Fe I
420	3810.43	Sm II	120	3816.27	Tb	1300	3820.73	Hf I
670	3810.49	Nb I	50	3816.31	Ce II	930	d 3820.82	Sm
580	3810.49	Nd II	140	3816.33	Co I	75	3821.00	Tb I
40	d 3810.57	Tb	65	3816.34	Nb I	70	3821.18	Fe I
55	3810.69	Mn I	70	3816.39	W I	35	3821.19	Nb I
380	3810.72	Tm II	120	3816.47	Co I	120	3821.22	U II
8900	c 3810.73	Ho II	760	3816.47	Rh I	170	3821.26	Ce II
260	3810.79	W I	120	3816.61	U II	170	3821.43	Th II
100	3810.90	Ce II	770	3816.64	Gd II	95	3821.47	Dy I
100	3810.99	Th I	90	3816.75	Mn I	230	3821.49	V I
530	3811.03	Nb I	1400	3816.76	Dy II	60	3821.51	Gd II
240	3811.06	Nd II	240	3816.89	Tb	60	3821.62	Tm I
120	3811.33	Eu I	120	3817.16	U II	190	3821.69	Ce II
110	3811.39	Mo I	100	3817.20	Hf II	300	3821.73	Ho II
60	3811.60	Ce II	230	3817.24	Ir I	310	3821.80	Pr II
240	3811.65	Tb I	760	3817.27	Ru I	110	3821.88	Dy I
270	3811.77	Nd II	190	3817.38	Nd II	240	3821.95	U I
320	3811.78	Hf I	550	3817.39	Tm II	570	3822.01	V I
390	3811.84	Pr II	470	3817.46	Ce II	60	3822.03	Ti I
490	3811.86	Ho I	110	3817.48	Th I	650	3822.09	Ru I
1900	3812.00	U I	1400	3817.48	W I	170	3822.15	Th II
500	3812.07	Sm II	190	3817.53	Dy I	120	3822.17	Gd II
250	3812.20	Ce II	210	3817.58	Zr II	3800	3822.26	Rh I
470	3812.27	Dy I	120	3817.66	Pr II	120	3822.35	U I
28	3812.40	Th I	80	3817.75	Er II	560	3822.41	Zr I
95	3812.45	Rh I	140	d 3817.84	V I	410	3822.47	Nd II
110	3812.47	Mo I	95	3817.98	V I	120	3822.56	U II
200	3812.53	Nd II	160	3817.87	Pr II	280	3822.58	Dy II
120	3812.58	U I	1300	3818.06	U I	60	3822.78	Pr II
600	3812.72	Ru I	70	3818.19	Rh I	450	3822.89	V I
240	3812.73	Tb	1300	3818.22	Ti I	190	3822.98	Mo I
320	3812.96	Fe I	1300	3818.24	V I	120	3823.12	Tb I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum			
150	c	3823.18	Pr II	940	3828.87	Mo I	270	3833.07	Sc II		
300		3823.21	V I	95	3828.95	Ta I	35	3833.26	Nb I		
85		3823.26	Nd II	240	3829.03	U II	30	3833.31	Fe I		
2100		3823.51	Mn I	75	h	3829.07	Lu I	540	3833.42	Tb I	
70		3823.52	Cr I	110		3829.13	W I	75	3833.54	Pr II	
85		3823.58	Th II	440		3829.16	Nd II	95	3833.68	Ti I	
40		3823.59	Pr II	390		3829.27	Ho I	210	3833.74	Ta II	
95		3823.60	Ta I	35	c	3829.32	Pr II	1700	3833.75	Mo I	
150		3823.70	Ce II	1400		3829.35	Mg I	530	3833.83	Sm II	
390		3823.89	Mn I	190		3829.39	U II	480	3833.86	Mn I	
470		3823.90	Ce II	150		3829.42	Th II	2000	3833.89	Rh I	
65		3823.99	V I	230		3829.46	Gd II	180	3834.02	Tb I	
95		3824.02	Dy I	140		3829.67	Hf I	35	3834.04	W I	
95		3824.08	Pr II	200		3829.68	Mn I	1300	3834.22	Fe I	
65		3824.14	Tb I	160		3829.69	Ce II	280	3834.22	V I	
120		3824.15	Gd I	190		3829.78	Dy I	1300	3834.36	Mn I	
35		3824.15	W I	120		3829.79	U I	560	3834.48	Sm I	
530		3824.18	Sm II	35		3830.00	Nb I	490	3834.55	Ce II	
95		3824.39	W I	35		3830.00	Ta II	560	3834.60	Sm II	
800		3824.44	Fe I	170		3830.02	Ce II	45	3834.75	Rh I	
670		3824.88	Nb I	280		3830.02	Hf I	85	3834.78	Ce II	
550		3824.93	Ru I	130		3830.03	Cr I	140	3834.93	Pr II	
75		3825.32	Mo I	55		3830.06	Th I	40	3834.97	Mo I	
220		3825.64	Ho I	1500		3830.26	Tb I	330	3834.99	Gd II	
700		3825.68	Dy II	45		3830.27	V I	220	3835.05	Ru I	
3200		3825.88	Fe I	530		3830.29	Sm II	1100	3835.06	W I	
350		3826.05	Gd II	510		3830.47	Nd II	190	3835.08	La II	
40		3826.17	Ta I	3600		3830.48	Er II	240	3835.14	U II	
95		3826.19	W I	470		3830.55	Ce II	350	3835.18	Nb I	
95	c	3826.20	Pr II	960		3830.72	Pr II	120	3835.22	U I	
1600		3826.20	Sm II	110		3830.77	Th I	75	3835.31	Mo I	
28		3826.37	Th I	75		3830.82	Mo I	410	c	3835.35	Ho II
290		3826.39	Tm I	180		3830.98	Gd II	75	3835.56	V I	
130		3826.42	Cr I	35		3831.07	Mo I	80	3835.65	Er II	
1200		3826.42	Nd II	490		3831.08	Ce II	370	3835.72	Sm II	
750		3826.51	U II	95		3831.08	Dy II	50	3835.75	Ce II	
130		3826.56	Sm II	2000		3831.46	U II	50	3835.89	Ce II	
120		3826.67	Pr II	1100		3831.50	Sm II	200	h	3835.92	U II
120		3826.68	Eu II	210		3831.64	Dy II	2200	3835.96	Zr I	
520		3826.70	Mo I	110		3831.69	Ni I	75	3836.05	V I	
75	h	3826.74	Tb I	270		3831.74	Th II	250	3836.06	Os I	
45		3826.77	V I	35		3831.76	Mo I	270	3836.10	Ce II	
85		3826.85	Ta I	370		3831.80	Gd II	120	3836.30	Re I	
110		3826.95	Th II	60		3831.80	Pr II	250	3836.45	Nb I	
110		3827.01	Nb I	760		3831.80	Ru I	2300	3836.50	Dy II	
85		3827.14	Os I	170		3831.84	Nb II	740	3836.54	Nd II	
95		3827.16	Mo I	240		3831.86	U I	70	3836.54	Th I	
100		3827.22	Ce II	320	cw	3831.9	Ho II	55	3836.58	Th I	
55		3827.27	Zr II	150		3832.11	Mo I	65	3836.60	Ta I	
65		3827.31	Er I	110		3832.22	Ce II	1300	3836.76	Zr II	
230		3827.33	Gd II	1500		3832.29	Pd I	95	3836.78	Ti I	
120		3827.37	Ce II	110		3832.31	Er II	970	3836.91	Gd II	
1300		3827.82	Fe I	3000		3832.31	Mg I	65	3837.08	Nb I	
240		3828.00	Nd II	80		3832.53	Er I	75	3837.18	Tb I	
240		3828.05	Sm II	75		3832.63	Tb I	110	3837.20	Ce II	
240		3828.19	Ti I	100		3832.74	Ce II	120	3837.26	U I	
35		3828.24	Nb II	100		3832.76	Nd II	1300	cw	3837.51	Ho II
40		3828.33	Pr II	110		3832.81	Sm I	200	3837.64	Er II	
450		3828.38	Th I	28		3832.84	V I	150	3837.83	Tb I	
2300		3828.48	Rh I	150		3832.88	Dy II	250	3837.88	Th I	
1700		3828.56	V I	4000		3832.88	Y II	340	3837.91	Nd II	
130		3828.71	Ru I	210		3832.97	Gd I	310	3838.07	Ru I	
40		3828.74	Pr II	75		3832.97	Pr II	200	3838.15	U II	
65		3828.74	Tb I	50		3832.97	Th II	1300	3838.20	Tm II	
540		3828.85	Nd II	200		3833.02	U II	5000	3838.26	Mg I	

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
160	3838.28	Zr II	85	3843.16	Ru I	100	3848.05	Ta I
220	3838.36	Ho II	60	3843.26	Fe I	250	3848.10	Ce II
110	3838.50	Er I	1400	3843.28	Gd I	1700 d	3848.24	Nd II
290	3838.51	W I	60	3843.35	Pr II		3848.31	Nd II
1100	3838.54	Ce II	1600	3843.50	Sm II	190	3848.30	Mo I
160	3838.66	Dy II	75	3843.61	Lu I	80	3848.31	Er II
40	3838.90	Gd I	80	3843.66	Os I	1500	3848.52	Nd II
500	3838.94	Sm II	200	3843.76	Ce II	860	3848.59	Ce II
1700	3838.98	Nd II	270	3843.77	Sm II	490 d	3848.62	U II
160	3839.00	V I	60	3843.78	Pr II		3848.72	U II
85	3839.03	Ta I	80	3843.80	Gd II	3700	3848.73	Tb II
90	3839.26	Er II	1100	3843.86	Ho II	640	3848.78	Sm II
35	3839.26	Fe I	65	3843.90	Mo I	190	3848.98	Cr I
110	3839.38	V I	35	3843.93	Nb I	1600	3849.02	La II
120	3839.49	Ce II	350	3843.98	Mn I	800	3849.18	Hf I
340	3839.51	Nd II	120	3844.00	U II	550	3849.25	Zr I
1200	3839.62	U I	40	3844.04	Ta I	90	3849.29	Er II
1000	3839.64	Gd II	65	3844.08	Nb I	110	3849.32	V I
930	3839.70	Ru I	100	3844.18	Nd II	140	3849.36	Cr I
840	3839.74	Th II	140	3844.23	Eu II	330	3849.39	Dy II
350	3839.78	Mn I	120	3844.23	U II	40	3849.42	Ta I
170	3839.91	Yb I	330	3844.36	Dy I	35	3849.48	Ce II
75	3840.14	V I	380	3844.44	V I	140	3849.52	Hf II
120	3840.26	Gd I	110 h	3844.50	Sm II	75	3849.56	Ce II
150	3840.30	Os I	150 c	3844.54	Pr II	45	3849.59	Tb I
800	3840.44	Fe I	1400	3844.58	Gd II	50	3849.66	Ce II
570	3840.44	V I	120 h	3845.12	U II	120	3849.71	U II
400	3840.45	Sm II	60	3845.28	Ce II	200	3849.85	U II
80	3840.61	Sm II	380	3845.32	U II	300	3849.88	Ho I
600	3840.72	La II	6900	3845.47	Co I	540	3849.91	Er I
2600	3840.75	V I	120	3845.47	Gd II	190	3849.94	Os I
85	3840.80	Th I	100	3845.48	Ce II	500	3849.97	Fe I
150	3840.82	Ru I	370 d	3845.61	Tb II	290	3850.04	Cr I
290	3840.87	Tm I	100	3845.74	Nd II	120	3850.10	Ce II
370	3840.89	Dy I	210	3845.90	Nb I	470	3850.22	Nd II
480	3840.99	Pr II	120	3845.95	Mo I	760	3850.43	Ru I
800	3841.05	Fe I	120	3846.00	La II	3300	3850.69	Gd II
670	3841.08	Mn I	730	3846.22	W I	1200	3850.79	Pr II
2700	3841.18	Lu I	120	3846.24	U I	70	3850.82	Fe I
380	3841.28	Cr I	28	3846.25	Th II	5100	3850.97	Gd II
150	3841.29	Os I	65	3846.28	Sm I	75	3851.17	V I
1400	3841.31	Dy II	420	3846.34	Dy II	110 w	3851.37	Tb II
60	3841.46	Co I	60	3846.45	Ti I	230 h	3851.54	Ho II
120	3841.71	Ce II	150	3846.49	Gd I	720 c	3851.55	Pr II
170	3841.81	Nb I	220	3846.52	Ce II	27	3851.57	W II
410 d	3841.82	Nd II	240	3846.55	U I	320	3851.60	Er II
	3841.88	Nd II	580	3846.59	Pr II	2400 d	3851.66	Nd II
110	3841.89	V I	40	3846.64	Ta I		3851.74	Nd II
280	3841.96	Th II	480	3846.68	Ru I	120	3851.72	U I
330	3842.00	Dy II	190	3846.71	Nd II	260	3851.86	Tb II
50	3842.04	Ce II	490 c	3846.73	Ho II	420	3851.88	Sm II
1400	3842.05	Co I	160	3846.76	Sm I	75	3851.99	Mo I
410 c	3842.05	Ho II	60	3846.80	Fe I	35	3852.07	Pr II
1200	3842.20	Gd II	95	3846.94	Pr II	100	3852.10	Ce II
90	3842.31	W I	100	3846.97	Nd II	40	3852.10	V I
270	3842.34	Pr II	550	3847.01	Zr I	130	3852.14	Ru I
270	3842.36	Sm II	420	3847.02	Dy I	85	3852.14	Th I
920 d	3842.50	Tb II	380	3847.25	Mo I	140	3852.22	Cr I
140	3842.71	Nb I	320	3847.33	V I	320	3852.40	Ho II
85	3842.90	Th I	250	3847.49	W I	4300	3852.45	Gd II
40	3842.93	Er I	530	3847.51	Sm II	20	3852.58	Fe I
180	3842.98	Tb II	200	3847.84	U I	960	3852.80	Pr II
120	3842.99	U II	70	3847.87	Y II	1200	3853.03	Dy II
550	3843.02	Zr II	180	3847.88	Tb I	130	3853.05	Ti I
610	3843.03	Sc II	8900	3848.02	Tm II	70	3853.10	Tm II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
860	3853.15	Ce II	75	3859.34	V I	240	3866.52	Nd II
95	3853.29	Lu I	120	3859.42	Nd II	370	3866.58	Dy II
530	3853.30	Sm I	4900	3859.58	U II	35	3866.69	Mo I
110	3853.38	Nb I	40	3859.80	Ta I	380	3866.80	U II
130	3853.73	Ti I	140	3859.84	Th II	160	3866.81	Ce II
1800	c 3854.07	Ho II	4200	3859.91	Fe I	220	3866.81	Nd II
1200	3854.18	Ce II	220	3860.72	Ru I	1600	3866.99	Gd I
140	3854.18	Gd II	35	3860.86	Nb I	240	3867.17	U I
2700	3854.21	Sm II	230	3860.91	Hf I	20	3867.22	Fe I
190	3854.22	Cr I	270	3860.94	Nd II	140	3867.26	Gd II
620	3854.22	U I	75	3861.07	W I	80	3867.34	Hf II
1200	3854.31	Ce II	160	3861.14	Gd II	210	3867.52	Pr II
390	3854.51	Th II	650	3861.16	Co I	230	3867.60	V I
480	3854.56	Sm I	490	3861.16	U I	1300	3867.84	Ru I
2400	3854.66	U II	35	3861.24	W I	95	3867.85	Dy II
35	3854.70	Nb I	75	3861.30	Pr II	270	3867.92	Nb I
130	3854.91	La II	2700	c 3861.68	Ho II	1800	3867.99	W I
65	3855.15	Nb I	75	3862.04	Pr II	200	3868.13	Ce II
620	3855.29	Ce II	660	3862.05	Sm II	50	3868.23	Er II
110	3855.29	Cr I	150	3862.22	V I	170	3868.40	Ti I
1200	3855.37	V I	350	3862.23	Sm II	120	3868.42	U II
75	3855.38	Tb I	200	3862.46	Ce II	560	3868.45	Dy II
110	3855.43	Zr II	300	3862.52	Nd II	60	3868.47	Ce II
65	3855.45	Nb I	540	3862.62	Ho I	100	3868.51	Ce II
150	3855.55	W I	650	3862.69	Ru I	65	3868.52	Pr II
470	3855.56	Gd II	7500	3862.85	Er I	1600	3868.81	Dy I
140	3855.57	Cr I	140	d 3862.93	Nb I	140	3868.90	Tb II
170	3855.58	Tb II		3863.05	Nb II	850	3869.07	Nd II
3000	3855.84	V I	250	3863.05	Gd II	580	3869.08	Mo I
95	3855.88	Pr II	120	3863.09	U I	75	3869.17	Pr II
680	3855.90	Er I	3700	d 3863.33	Nd II	300	3869.42	Dy II
800	3855.90	Sm II		3863.40	Nd II	60	3869.56	Ce II
850	3856.37	Fe I	350	3863.38	Nb I	450	d 3869.75	Tb II
480	3856.46	Ru I	450	3863.40	Th II	95	3869.85	Pr II
5900	3856.52	Rh I	190	h 3863.42	Sm II	820	3869.86	Dy II
390	cw 3856.94	Ho II	130	3863.87	V I	240	3869.94	Re I
95	c 3856.99	Pr II	2900	3863.87	Zr I	490	3870.01	Rh I
	3857.13	Pr II	150	3864.05	Sm II	240	3870.02	U II
390	3857.02	Ce II	75	3864.08	Pr II	75	3870.41	Pr II
230	3857.09	Os I	29000	3864.11	Mo I	40	3870.58	V I
170	3857.23	Ce II	240	3864.30	U II	210	3870.72	Pr II
1300	3857.55	Ru I	180	3864.34	W I	160	3870.87	Ce II
260	3857.63	Cr I	770	3864.34	Zr I	1500	3871.04	U I
370	3857.64	Ce II	240	3864.48	U II	170	3871.08	V I
720	3857.72	Ho II	80	3864.49	La II	65	3871.19	Nb I
75	3857.81	Ce II	130	3864.79	Gd I	140	3871.54	Gd II
140	3857.84	Tm II	250	3864.80	Er II	210	3871.63	Dy II
480	3857.91	Sm II	1300	3864.86	V I	3400	3871.64	La II
50	3857.93	Ce II	110	3864.91	Ho II	50	3871.75	Er I
170	3858.14	Ti I	65	3865.02	Nb II	800	3871.78	Sm II
				3865.04	Nb I			
120	3858.25	Pr II				35	3871.80	Ce II
1200	3858.30	Ni I	320	3865.24	Sm II	95	3871.88	U II
600	3858.31	Hf I	85	3865.40	Ce I	360	3872.05	Ho II
540	3858.39	Er II	130	3865.40	Ru I	7000	3872.11	Dy II
420	3858.40	Dy I	480	c 3865.45	Pr II	70	3872.39	Rh I
140	3858.45	Gd I	230	3865.47	Os I	340	3872.50	Fe I
190	3858.52	Sm I	210	3865.48	Dy II	200	3872.55	Hf II
340	3858.55	Nd II	340	3865.53	Fe I	140	3872.62	Gd II
65	3858.68	V I	190	3865.57	Eu I	40	3872.69	Pr II
400	3858.74	Sm I	170	3865.64	Ir I	45	3872.72	Eu I
290	3858.95	Nb I	80	3865.69	Sm II	340	3872.72	Th II
110	3859.14	Pr II	1900	3865.92	U II	250	3872.84	W I
60	3859.22	Fe I	170	3865.98	Nd II	340	3872.85	Yb I
150	3859.30	W I	65	3866.06	W I	85	3873.00	Tb I
250	3859.34	Ho I	240	3866.44	Ti I	50	3873.01	Pr II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
60	3873.04	Ce I	380	3877.34	Rh I	330	3883.34	Tb I
5500	3873.12	Co I	240	3877.49	Sm I	1800	3883.44	Tm II
120	3873.21	Ti I	530	3877.56	Nb I	60	3883.54	Ce II
130	3873.22	Sm II	990	3877.60	Zr I	75	3883.58	Ce II
60	3873.25	Ce II	500	3878.02	Fe I	50	3883.66	Cr I
35	3873.36	Pr II	620	3878.09	U II	100	3883.76	Nd
190	3873.47	Sm II	130	3878.23	Tb II	150	3883.77	Hf II
260	3873.52	Ru I	480	3878.28	Y II	27	3883.80	Sm II
250	3873.57	Gd I	95	3878.32	Pr II	35	3883.83	W I
65	3873.64	V I	1100	3878.36	Ce II	40	3883.89	V I
35	3873.76	Fe I	850	3878.58	Fe I	130	3884.02	Ru I
210	3873.78	Tb II	1100	3878.58	Nd II	40	h 3884.05	Pr II
370	3873.82	Th I	130	3878.71	V II	100	3884.08	Nd II
2800	3873.96	Co I	870	3878.82	Nb I	100	3884.12	Er I
1200	3873.99	Dy II		3878.97	Nb I	100	3884.21	Ce II
620	3874.04	U II	200	3879.05	Zr I	55	3884.52	Th II
320	3874.09	Ho II	120	3879.06	Ce II	120	3884.62	Co I
3500	3874.17	Tb II	470	3879.11	Dy II	65	3884.66	Gd II
27	3874.39	Sm II	270	3879.20	Pr II	100	3884.68	Ru I
110	3874.41	W I	60	3879.31	Ce II	240	3884.68	U II
95	3874.45	Pr II	65	3879.35	Nb II	100	3884.74	Nd II
160	3874.46	Gd I	240	3879.53	U I	150	3884.75	Eu I
70	3874.53	Cr I	1000	3879.55	Nd II	140	3884.82	Th II
40	3874.61	Lu I	250	3879.59	Ho II	200	3885.09	Tb I
270	3874.68	Ce II	60	3879.60	Ce II	440	c 3885.19	Pr II
630	3874.68	Ho II	140	3879.64	Th I	100	3885.20	Ta I
150	3874.83	Er I	240	3879.71	U I	570	3885.22	Cr I
250	3874.86	Th I	95	3879.99	Tb I	60	3885.29	Co I
140	3875.01	Ce II	95	3880.35	Tb I	3700	3885.29	Sm II
140	3875.06	Ce II	780	3880.38	Nd II	50	3885.38	Er II
1500	3875.08	V I	60	3880.40	Ce II	1500	3885.42	Zr I
80	3875.18	Dy II	680	3880.47	Pr II	1100	3885.44	Nb I
400	3875.19	Sm II	1500	3880.61	Er II	25	3885.51	Fe I
240	3875.22	Tb II	800	3880.77	Sm II	670	3885.68	Nb I
240	3875.26	Re I	1200	3880.78	Nd II	55	3885.77	Th II
260	3875.26	Ti I	380	3880.82	Hf II	240	3885.91	Sm II
210	3875.37	Th I	75	3880.83	Pr II	210	3886.07	Nb I
35	3875.42	Nb I	95	3881.29	Tb I	85	h 3886.09	Nd II
220	3875.46	Gd II	450	3881.38	Sm II	1800	3886.28	Fe I
560	3875.54	Sm II	730	3881.41	W I	1700	3886.37	La II
28	3875.65	Th I	1000	3881.46	U II	100	3886.50	Ce II
75	3875.68	W I	200	3881.59	Nd	90	3886.59	V I
100	3875.72	Er	540	3881.61	Ho II	40	3886.75	Os I
240	3875.74	Nd II	260	3881.76	Tb II	380	3886.79	Cr I
170	3875.76	Nb I	450	3881.79	Sm II	580	3886.82	Mo I
470	3875.87	Nd II	110	3881.84	Gd II	260	3886.82	Tb II
420	3875.90	V I	250	3881.86	Os I	100	3886.92	Th I
35	3876.08	Ru I	170	3881.87	Ce II	100	3887.02	Th I
570	3876.09	V I	790	3881.87	Co I	350	3887.05	Fe I
170	3876.13	Ce II	300	3881.99	Dy II	65	3887.11	Sm II
240	3876.13	U I	100	3882.01	Ru I	150	3887.15	Er II
480	3876.19	Pr II	170	3882.15	Ti I	75	3887.16	Gd II
120	3876.59	U II	85	3882.28	Pr II	5400	3887.35	Tm I
530	3876.65	Lu II	170	3882.33	Ti I	180	3887.45	U I
65	3876.69	Tb I	490	3882.36	U II	80	3887.49	Re I
730	3876.77	Os I	1500	3882.45	Ce II	110	3887.54	Dy I
80	3876.82	Y	320	3882.50	Sm II	160	d 3887.64	Tb II
280	3876.84	Co I	200	3882.52	Hf I	180	3887.70	U II
240	3876.86	Re I	1200	3882.89	Er II	75	3887.73	Gd I
140	3876.96	Nb I	500	3882.89	Ti I	100	3887.77	Ru I
620	3876.97	Ce II	240	3883.10	U II	30	3887.77	Y I
160	3877.10	Hf II	6800	3883.13	Tm I	540	3887.87	Nd II
1700	3877.18	Pr II	670	3883.14	Nb I	160	3887.88	Tb I
160	3877.20	Sm II	660	3883.29	Cr I	80	3887.95	Re I
70	3877.27	Eu II	380	3883.33	U II	60	h 3888.02	Ti I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
35	3888.06	Pr II	240	3891.80	U I	350	3895.66	Fe I
250	3888.08	Er II	280	3891.86	Dy II	450	3895.79	Gd II
75	3888.18	Mo I	60	3891.93	Cr I	160	3895.80	Er II
480	3888.22	Tb I	100	3892.03	Zr I	170	3895.90	Nb I
50	3888.29	Pr II	470	3892.06	Nd II	85	3895.91	Nd I
70	3888.34	Rh I	28	3892.12	Co I	330	3895.99	Tb I
100	3888.36	Ce II	650	3892.21	Ru I	80	3896.11	Re I
120	3888.39	Ce II	50	3892.31	Th II	270	3896.13	Nd II
190	3888.43	Dy II	240	3892.41	U II	90	3896.16	V I
350	3888.52	Fe I	70	3892.47	Hf I	5200	3896.23	Er II
75	3888.88	Mo I	50	3892.51	Pr II	35	3896.38	Mo I
150	3888.93	Gd I	30	3892.66	Ba I	19	bl 3896.43	Ta TaO
3000	c 3888.96	Ho II	4200	3892.68	Er I	160	3896.53	Zr I
120	3889.00	Ce II	620	3892.68	U II	330	3896.58	Tb II
190	3889.01	Dy II	45	3892.72	Gd I	440	3896.62	Tm I
660	3889.16	Sm II	110	3892.72	W I	540	3896.76	Ho II
	3889.22	Sm II	35	3892.77	Ru I	23	3896.78	Eu I
200	3889.23	Hf I	460	3892.86	V I	490	3896.78	U II
75	3889.30	Ce II	280	3892.90	Dy I	590	3896.80	Ce II
70	3889.33	Ba I	19	3893.03	Ta I	40	3896.82	Pr II
200	3889.33	Hf I	28	h 3893.07	Co I	35	3896.85	Mo I
440	c 3889.34	Pr II	290	c 3893.08	Ho II	1600	3896.98	Sm II
75	3889.48	Ce II	55	3893.11	Th II	65	3897.03	Pr II
40	3889.63	Nb I	170	3893.23	Ce II	240	3897.06	U II
370	h 3889.66	Nd II	35	3893.32	Mo I	90	3897.08	V I
30	3889.67	Ni I	160	3893.38	Tb II	100	3897.24	Ru I
150	3889.79	Er II	35	3893.39	Fe I	190	3897.25	Pr II
29	3889.80	Nb I	28	3893.42	Th II	45	3897.26	Sm II
95	3889.84	Tb II	100	3893.52	Ho II	45	3897.26	Tb I
1300	3889.93	Nd II	65	3893.69	Tb I	190	3897.26	U I
70	3889.95	Ti I	50	3893.73	Nb I	270	c 3897.27	Ho II
70	3889.96	Re I	75	h 3893.84	Zr I	65	3897.32	Gd I
24	h 3889.97	Pr II	75	3893.85	Ce II	50	3897.43	Ce II
1000	3889.98	Ce II	50	3894.03	Nb I	440	3897.63	Nd II
610	3890.08	Sm II	260	3894.04	Cr I	40	3897.65	Cr I
700	3890.18	V I	90	3894.04	V I	75	3897.66	Zr I
150	3890.20	Ru I	400	3894.05	Sm II	40	3897.71	Pr II
170	3890.22	Nd II	7900	3894.08	Co I	120	3897.71	U II
2900	3890.32	Zr I	490	3894.12	U I	40	3897.89	Au I
2200	3890.36	U II	29	3894.14	Pr II	330	3897.89	Tb I
85	3890.42	Gd I	2200	3894.20	Pd I	35	3897.90	Fe I
490	3890.42	Ho I	35	3894.24	Ru I	140	h 3897.91	W I
440	3890.53	Tm II	75	3894.30	Ce II	35	3898.01	Fe I
1300	3890.58	Nd II	160	3894.46	Tb II	280	h 3898.02	V I
400	3890.61	Er II	80	3894.53	Dy I	490	3898.27	Ce II
35	3890.71	Mo I	810	3894.63	Nd II	110	3898.28	Nb II
210	3890.75	Ce II	490	3894.64	Tb I	100	3898.36	Ru I
35	3890.75	W I	1500	3894.70	Gd II	50	3898.44	Th I
55	3890.85	Gd II	40	3894.70	Nb I	28	3898.49	Co I
1300	3890.94	Nd II	29	3894.89	Pr II	85	3898.49	Ti I
65	3890.95	Tb I	90	3894.97	Sc I	35	3898.51	Th I
210	3890.98	Ce II	550	3894.98	Co I	5800	3898.53	Dy II
13000	c 3891.02	Ho II	50	3895.04	Pr II	110	3898.56	Nb I
85	3891.05	Th II	65	3895.08	Tb I	50	3898.60	La I
90	h 3891.12	V I	45	3895.09	Sm II	35	3898.78	Ta I
320	3891.21	Sm II	620	3895.11	Ce II	210	3898.84	Pr II
580	3891.30	Nb I	40	3895.18	Os I	270	3898.94	Ce II
2000	3891.38	Zr I	170	3895.23	Gd II	250	3899.03	Er I
65	3891.41	Ru I	200	h 3895.25	Ti I	190	3899.10	U II
580	3891.51	Nd II	200	3895.27	U II	140	3899.13	V II
120	3891.68	U II	160	3895.37	Dy II	270	3899.17	Dy I
120	c 3891.71	Pr II	140	3895.37	Nd II	2400	3899.20	Tb II
28	3891.72	Th I	65	3895.37	Tb I	65	3899.25	Nb I
50	3891.77	Ce II	45	3895.42	Sm II	240	3899.27	U I
1400	l 3891.78	Ba II	340	3895.42	Th I	50	3899.39	Ce II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
240	3899.48	U II	120	3903.51	Nd II	120	3908.32	U I
85	c 3899.54	Pr II	50	3903.84	Er II	560	3908.41	Ce II
160	3899.57	Tb II	18	3903.90	Fe I	100	3908.44	Er II
130	3899.64	Ho II	65	3903.92	Pr II	3100	3908.44	Pr II
550	3899.71	Fe I	85	3903.93	Ce II	120	3908.47	U II
620	3899.78	U II	250	3903.98	Er I	390	3908.54	Ce II
620	3899.94	Hf I	35	3903.98	W I	40	3908.59	Nb I
28	3900.13	Th II	28	h 3904.05	Co I	65	3908.68	Tb I
23	3900.18	Eu I	140	3904.08	Th II	50	3908.75	Th I
140	h 3900.18	V I	75	3904.17	Tb I	960	3908.76	Cr I
75	3900.20	Ce II	120	3904.18	Nb I	130	3908.76	Ru I
2000	3900.21	Nd II	160	3904.21	Dy II	110	3908.77	Ce II
140	3900.39	Os I	29	3904.22	Rh I	210	3908.97	Nb I
70	3900.51	Eu I	240	3904.29	Gd I	35	3909.05	Ce II
400	3900.52	Zr I	460	3904.30	U II	120	3909.06	U II
530	3900.54	Ti II	250	3904.34	Ce II	760	3909.08	Ru I
55	3900.58	Th I	320	3904.44	Ho I	380	3909.14	Tb I
35	3900.65	Hf II	50	3904.47	V I	28	3909.14	Th I
40	3900.73	Pt I	250	3904.56	Er II	80	3909.18	Hf I
130	3900.74	Tb I	240	3904.56	U II	45	3909.25	Gd I
130	3900.79	Ho I	50	h 3904.58	Ce II	270	3909.31	Ce II
680	3900.79	Tm II	60	3904.59	Y I	65	3909.33	Ta I
340	3900.85	Yb I	2600	3904.78	Ti I	75	3909.55	Mo I
340	3900.88	Th II	50	3904.81	Yb II	330	3909.55	Tb I
270	3900.89	Sm II	35	3904.85	Pr II	100	3909.56	Ho I
80	3900.91	Re I	120	3904.85	U II	65	3909.60	Nb I
180	3900.96	Ti I	170	3905.19	Th II	110	3909.62	Pr II
40	3901.09	Re I	1200	3905.40	Er I	130	3909.75	Ce II
55	3901.15	Th II	110	3905.52	Si I	700	3909.89	V I
140	h 3901.15	V I	100	3905.56	Nd I	100	3909.91	Ba I
150	3901.24	Ru I	110	3905.60	Dy II	130	3909.93	Ce II
120	3901.30	Ce II	450	3905.65	Gd I	160	3909.93	Co I
1600	3901.33	Tb I	1300	cw 3905.68	Ho II	65	3909.94	Gd I
100	3901.38	Dy I	1700	3905.89	Nd II	90	3909.95	Sm I
60	3901.68	Ce II	110	3905.94	Dy I	90	3910.09	Sm II
95	3901.68	Tb II	75	3905.97	W I	95	3910.14	Tb II
190	3901.71	Os I	65	3906.08	Pr II	120	3910.30	Ho I
380	3901.77	Mo I	140	3906.09	Nd II	160	3910.40	Tb I
35	3901.83	W I	140	3906.29	Co I	110	3910.50	Er I
1300	3901.84	Nd II	11000	3906.31	Er II	140	3910.70	Ce II
95	d 3902.00	Tb II	380	3906.46	U I	100	3910.79	V I
35	3902.11	Cr I	140	3906.48	Fe I	40	3910.81	La II
50	3902.17	Th I	55	3906.54	Tb II	160	3910.84	Tb I
290	3902.23	Ho II	100	3906.75	V I	240	3910.89	U I
2400	3902.25	V I	60	3906.81	Sm II	50	3910.92	Sm II
65	3902.32	Sm II	45	3906.89	Hf I	75	3911.09	Mo I
750	3902.40	Gd II	85	3906.91	Nb I	2000	h 3911.16	Nd II
250	3902.45	Pr II	200	3906.92	Ce II	110	3911.19	Ti I
480	3902.51	Ir I	75	3906.92	Mo I	140	3911.27	Yb I
140	3902.51	Nd I		3906.98	Mo I	40	3911.29	Pr II
410	3902.56	U II	28000	cw 3907.10	Eu II	140	3911.30	Ce II
35	3902.58	La I	65	3907.12	Gd I	110	3911.54	Er II
95	3902.66	Ir I	770	3907.29	Ce II	45	3911.62	Gd I
300	3902.71	Gd I	29	3907.29	Pr II	330	3911.67	U II
810	3902.76	Er II	150	3907.45	Ce II	29	3911.77	Lu I
360	3902.92	Cr I	20000	3907.49	Sc I	35	3911.79	Pr II
550	3902.95	Fe I	100	3907.50	Nd I	320	3911.80	Ho I
19000	3902.96	Mo I	35	3907.65	Os I	35	3911.81	Os I
30	3903.08	Tb I	200	3907.70	Nd II	23000	3911.81	Sc I
110	3903.10	Th I	510	3907.84	Nd II	120	hd 3911.82	Cr I
60	3903.16	Cr I	770	c 3908.05	Pr II		3912.00	Cr I
50	3903.26	V II	480	3908.06	Tb I	50	3911.91	Er II
85	3903.33	Dy I	100	3908.09	Ce II	85	3911.91	Th I
200	3903.34	Ce II	100	3908.21	Re I	35	3911.94	Mo I
1300	3903.42	Sm II	140	3908.25	Mo I	40	3911.99	Pr II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
100	3912.11	Ru I	1300	3916.05	La II	1900	3919.16	Cr I
40	3912.13	Ta I	390	3916.14	Ce II	65	3919.16	Nb I
230	3912.19	Ce II	190	3916.24	Cr I	320	3919.45	Ho I
220	3912.21	V I	60	3916.36	Sm II	40	3919.47	Ta I
850	3912.23	Nd II	100	3916.41	V II	480	3919.52	Tb II
50	3912.25	Pr II	50	3916.42	Th I	420	3919.63	Pr II
110	3912.26	Tb II	3500	3916.48	Tm I	35	3919.72	Nb II
110	3912.28	Th II	2200	3916.51	Gd II	480	3919.81	Ce II
140	3912.42	Er II	120	3916.53	U I	35	3919.82	Ti I
980	3912.44	Ce II	65	3916.64	Tb I	220	3919.92	Nd II
110	3912.44	Ho II	160	3916.64	Zr I	50	3920.10	Sm II
40	3912.44	Ta I	20	3916.73	Fe I	530	3920.20	Nb I
120	3912.54	Dy I	24	3916.78	Pr II	360	3920.26	Fe I
65	3912.63	Pr II	140	3916.80	Th II	100	3920.49	V I
75	3912.75	Gd I	140	3916.90	Ce II	250	3920.53	Pr II
75	3912.77	Tb II	75	3916.92	Mo I	150	3920.72	Tb II
23	3912.83	Rh I	45	3916.94	Tb I	60	c 3920.85	Re I
85	3912.86	Dy II	140	3917.11	Co I	260	3920.92	Ru I
50	3912.89	V I	40	3917.18	Fe I	1100	3920.96	Nd II
630	3912.90	Pr II	95	3917.24	Pr II	600	3921.02	Cr I
120	3912.98	Sm II	70	3917.25	Ce II	290	3921.42	Ti I
100	3913.00	Th II	240	3917.25	U I	1100	3921.54	La II
	3913.08	Th I	380	c 3917.27	Re I	190	3921.55	U II
130	3913.01	Nb I	55	3917.27	Th I	590	3921.73	Ce II
75	3913.36	Mo I	540	d 3917.29	Dy I	610	3921.79	Zr I
				3917.38	Dy I			
120	3913.37	Sm II	230	3917.29	Eu I	280	3921.88	Er II
500	3913.46	Ti II	75	3917.30	Tb I	100	3921.90	V I
280	3913.48	Tb I	620	3917.44	Sm II	35	3922.03	Os I
120	3913.51	Rh I	80	3917.45	Hf II	190	3922.05	Sm II
310	3913.55	Pr II	150	3917.54	Mo I	300	3922.10	Tb II
140	3913.62	Dy I	35	3917.60	Cr I	240	3922.19	Rh I
90	3913.62	Sm II	230	3917.64	Ce II	55	3922.22	Th II
340	3913.69	Nd II	340	3917.65	Nd II	65	3922.23	Pr II
65	3913.78	Gd II	23	3917.70	Eu II	75	3922.32	Mo I
55	3913.82	Th II	75	3917.78	Mo I	110	3922.35	Nb I
130	3913.92	Re I	120	3917.82	U II	2500	3922.40	Sm II
160	3913.97	Dy II	75	c 3917.96	Pr II	55	3922.42	Ta II
110	3913.99	Ce II	280	3918.05	Er I	230	3922.43	V I
190	3914.20	U II	120	3918.06	Gd II	90	3922.70	Sm II
190	3914.27	U II	80	3918.06	U II	480	3922.74	Tb II
140	3914.33	V II	85	3918.07	Th I	80	3922.75	Co I
500	3914.34	Ti I	620	3918.09	Hf II	140	3922.78	Ta I
40	3914.34	Zr II	120	3918.24	Gd II	550	3922.91	Fe I
150	3914.63	Tb I	50	h 3918.25	Y I	140	3922.92	Ta I
670	3914.70	Nb I	770	3918.28	Ce II	110	3922.96	Pt I
24	3914.74	Ti I	65	3918.32	Mn I	120	3923.05	U II
210	3914.76	Pr II	210	3918.35	Er II	560	3923.11	Ce II
150	3914.85	Ru I	55	3918.50	Th II	450	3923.25	Gd II
540	3914.87	Dy II	210	3918.51	Ta I	100	c 3923.28	Ho II
100	3914.95	Ce II	40	3918.52	Eu I	150	3923.31	Tb II
440	3915.13	Nd II	110	3918.55	Dy II	320	3923.38	Dy II
45	3915.24	Eu II	75	3918.59	W I	1500	3923.47	Ru I
480	3915.38	Ir I	190	3918.62	Sm II	45	3923.51	Sc II
650	3915.43	Tb I	30	3918.65	Fe I	95	3923.55	Pr II
110	3915.44	Mo I	95	3918.78	Tb II	120	3923.75	Mo I
170	3915.46	Pr II	1300	c 3918.85	Pr II	28	3923.80	Th I
390	3915.52	Ce II	50	3918.86	Lu I	200	3923.90	Hf II
540	3915.59	Dy II	85	3918.90	Nd II	130	3924.15	Pr II
50	3915.69	Er II	35	3918.97	Os I	190	3924.27	U II
120	3915.84	Cr I	65	3919.00	Nb I	35	d 3924.36	W I
380	3915.88	U II	75	3919.02	Tb I	65	3924.42	Tb II
310	3915.94	Zr II	110	3919.02	Th I	110	3924.47	Dy II
610	3915.95	Nd II	100	3919.09	Eu II	65	3924.49	Nb I
85	3916.00	Er I	140	3919.12	Dy I	140	3924.49	Nd II
45	3916.00	Eu I				1100	3924.53	Ti I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
100	3924.55	Ho II	140	3929.33	Dy II	150	3934.09	Nd II
65	3924.63	Ru I	1200	3929.53	Zr I	200	3934.12	Zr II
450	3924.64	Ce II	110	3929.54	Hf II	35	3934.14	Nb I
240	3924.66	V I	570	3929.58	Tm II	320	3934.21	Dy II
35	3924.69	W I	590	3929.67	Th II	2000	3934.23	Rh I
70	3924.80	Ce II	65	3929.75	Tb I	70	3934.24	Ti I
110	3924.81	Tb II	550	3929.85	Re I	50	3934.27	Pr II
85	3924.98	Nd I	85	3929.88	Pr II	130	3934.38	Tb I
50	3924.99	Pr I	890	3929.88	Ti I	95	3934.41	Nb I
170	3925.00	Nb I	75	3929.89	Tb I	35	3934.75	Ce II
140	3925.09	Th I	130	ch 3929.93	Ho II	1200	3934.79	Gd I
35	3925.10	Os I	70	3929.96	Ce II		3934.82	Gd II
30	3925.16	Co I	100	3930.00	Os I	200	3934.79	Zr II
290	3925.22	Sm I	260	3930.02	V I	610	3934.82	Nd II
150	3925.24	V I	60	h 3930.11	Y I	400	3934.84	Ir I
760	3925.45	Tb II	540	3930.14	Dy I	45	3934.98	Rh I
960	3925.47	Pr II	65	3930.24	W I	35	3935.02	Mo I
85	3925.63	Nd II	750	3930.30	Fe I	150	3935.03	W I
100	3925.64	Ho II	160	3930.43	U II	150	3935.14	V I
3300	3925.92	Ru I	80	3930.47	W I	110	c 3935.17	Pr II
35	3926.03	W I	32000	cw 3930.48	Eu II	50	3935.18	Sm II
330	3926.22	U I	35	3930.62	Pr II	650	3935.24	Tb II
110	3926.32	Ti I	240	3930.66	Y II	220	3935.38	Gd I
120	3926.42	Hf I	55	3930.76	Tb II	490	3935.38	U II
120	3926.47	Mn I	110	3930.81	Ce II	85	3935.45	Nb I
65	3926.61	Nb I	65	3930.94	Ta I	140	d 3935.48	Th I
35	h 3926.62	Lu I	35	3930.96	W I		3935.63	Th II
70	3926.62	Nd II	430	3930.98	U II	120	3935.65	Hf II
30	3926.65	Cr I	770	3931.09	Ce II	140	3935.72	Ba I
110	3926.68	Gd I	35	3931.16	Sm II	470	3935.76	Sm II
28	3926.71	Th II	60	3931.20	Re I	20	3935.82	Fe I
330	3926.73	U I	190	3931.28	Dy II	370	3935.82	Pr II
35	3926.77	Os I	150	3931.34	V I	50	3935.84	Rh I
75	h 3926.78	Zr I	310	3931.37	Ce II	50	3935.93	Ce II
35	3927.00	Ce II	320	3931.38	Hf I	1500	3935.97	Co I
510	3927.10	Nd II	30	3931.40	Mo I	160	3936.05	Dy II
110	3927.18	Th II	35	3931.46	Nb I	65	3936.06	Zr II
110	3927.39	Ce II	2100	3931.52	Dy II	410	3936.11	Nd II
110	3927.42	Th II	80	3931.52	Os I	180	3936.22	La II
480	3927.46	Pr II	600	3931.76	Ru I	35	3936.22	W I
160	3927.56	La I	230	3931.83	Ce II	100	3936.28	V I
70	3927.57	Ce II	55	3932.00	Th II	85	3936.30	Dy II
150	3927.57	Hf I	35	3932.02	Ti II	320	c 3936.44	Ho II
70	c 3927.59	Re I	2000	3932.03	U II	60	3936.45	Nb I
120	3927.71	Pr II	110	3932.08	Dy II	40	3936.55	Ta I
240	3927.76	U II	29	3932.11	Pr II	29	3936.68	Pr II
420	3927.86	Dy I	150	3932.15	Ce II	420	3936.70	Dy I
700	3927.92	Fe I	320	3932.22	Dy II	140	3936.90	Re I
200	3927.93	V I	85	3932.23	Th II	120	3936.97	W I
1900	3928.28	Sm II	810	3932.25	Er II	140	3937.00	Nd I
150	3928.32	Ce II	220	3932.35	Tb I	3200	3937.01	Er I
45	3928.41	Os I	200	3932.91	Th I	29	3937.02	Pr II
45	3928.54	Os I	130	3932.97	Pr II	140	3937.04	Th II
600	3928.64	Cr I	90	3932.97	Sm II	290	3937.06	Sm II
120	3928.66	Tm II	120	3932.98	Gd II	65	3937.13	Tb I
85	3928.69	Pr II	370	3933.00	Dy II	55	3937.15	Ce II
65	3928.79	Mo I	120	3933.03	U II	140	3937.16	Dy I
120	3928.83	U I	4400	3933.38	Sc I	670	3937.44	Nb I
40	3928.87	Eu II	310	3933.55	Ru I	50	3937.53	V I
65	3928.92	Pr II	290	3933.58	Sm II	70	3937.57	Nd II
2200	3929.22	La II	42000	3933.66	Ca II	160	3937.61	Tb I
28	h 3929.25	Co I	310	3933.73	Ce II	35	3937.61	W I
200	3929.26	Nd II	30	3933.91	Co I	50	3937.63	Ce II
130	3929.29	Nb I	260	3934.01	V I	50	3937.81	Ce II
370	3929.29	Pr II	70	3934.07	Ce I	85	3937.84	Ta I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
35	3937.87	Ba I	180	3942.54	Ho I	95	3947.53	Nb I
120	3937.90	Ru I	190	3942.55	U II	100	3947.61	Nd I
110	3937.92	Th II	150	3942.58	Er I	730 c	3947.63	Pr II
95	3937.96	Nb I	150	3942.62	Nd II	1100	3947.78	Ti I
270	3938.04	Dy II	590	3942.63	Gd I	290	3947.84	Sm II
65	3938.07	Tb I	70	3942.64	Th II	310	3947.97	Ce II
560	3938.09	Ce II	590	3942.72	Rh I	120	3947.98	W I
75	3938.11	Gd II	2700	3942.75	Ce II	50	3948.03	Th I
210	3938.20	Dy I	240	3942.84	U I	550	3948.06	Er I
50	3938.20	V I	50	3942.88	Pr II	740	3948.11	Sm II
250	3938.30	Pr II	110	3942.93	Tb I	20	3948.13	Th I
29	3938.43	Sm II	60	3942.94	Eu II	150	3948.32	Nd II
250	3938.59	Os I	230	3943.04	Mo I	260	3948.35	Tb II
110 d	3938.61	Th I	120	3943.08	Eu II	35	3948.40	Pt I
	3938.78	Th II	150	3943.14	Ce II	300	3948.45	U I
2100	3938.63	Er II	150	3943.18	Er II	4500	3948.67	Ti I
220	3938.85	Ho I	270	3943.24	Gd I	35	3948.78	Fe I
510	3938.86	Nd II	620	3943.24	Sm II	12	3948.90	Ca I
85	3938.92	Er II	150	3943.39	Th II	200 h	3948.96	Th II
110	3938.97	Gd II	55 c	3943.40	Pr II	100	3949.00	Ho I
120	3939.04	Hf I	55	3943.50	Ce II	9000	3949.10	La II
50	3939.33	V I	35	3943.51	Mo I	30	3949.13	Eu II
50	3939.36	Er II	220	3943.62	Gd I	55	3949.25	Gd II
35	3939.43	W I	95	3943.66	Tb I	1500	3949.27	Tm I
55	3939.52	Ce II	150	3943.66	V I	65 d	3949.33	Nb I
140	3939.52	Nd II	520	3943.67	Nb I		3949.46	Nb II
810 d	3939.52	Tb II	85	3943.69	Th II	180	3949.39	Ce II
90	3939.57	Os I	65	3943.75	Pr II	65	3949.42	Ru I
50	3939.64	Sm II	1200	3943.82	U I	900 c	3949.43	Pr II
55	3939.66	Ce II	770	3943.89	Ce II	65	3949.51	Tb II
95 c	3940.16	Pr II	4500	3944.01	Al I	60	3949.60	Eu I
770	3940.34	Ce II	90	3944.13	Pr II	35	3949.78	Ce II
330	3940.49	U II	240	3944.13	U II	100	3949.78	Os I
320 cw	3940.53	Ho II	65	3944.19	Ru I	65	3949.82	Ce I
100	3940.64	Ce II	3200	3944.42	Er I	50	3949.85	Sm I
30 h	3940.80	Sr I	30	3944.59	Eu II	60	3949.94	Nb I
16	3940.88	Fe I	35	3944.61	Pr II	35	3949.96	Fe I
160	3940.89	Co I	10000	3944.68	Dy II	120	3950.04	Ru I
310	3940.97	Ce II	110	3944.72	Re I	210	3950.13	Tb I
260	3941.21	Tb II	70	3944.84	Ce II	460	3950.21	Ru I
110 h	3941.23	Th I	160	3944.88	Tb II	100	3950.23	V I
40	3941.25	V I	65	3944.90	Pr II	4400	3950.36	Y II
170	3941.27	Nb I	85	3944.92	Ce II	540	3950.39	Dy II
29	3941.45	Pr II	75	3945.25	Mo I	200	3950.39	Th I
65	3941.48	Mo II	210	3945.33	Co I	150	3950.41	Ru I
410	3941.49	Cr I	65	3945.41	Pr I	180	3950.42	Ce II
2000	3941.51	Nd II	220	3945.51	Th II	70	3950.42	Nd I
60	3941.54	Re I	1400	3945.54	Gd I	210	3950.43	Tb I
55	3941.56	Eu II	760	3945.57	Ru I	220	3950.56	Ho I
100	3941.62	Zr I	110	3945.60	Pr II	70	3950.64	Re I
65	3941.65	Ru I	30	3945.67	Eu II	45 c	3950.65	Pr II
250	3941.73	Co I	85	3945.82	Th II	45	3950.76	Eu II
450	3941.80	Gd I	180	3945.91	Re I	70	3950.80	Ce II
1300	3941.87	Sm II	220	3946.14	Th II	80	3950.80	Hf I
90	3942.01	V I	120	3946.27	Ir I	110	3950.98	Er I
85	3942.06	Ru I	40	3946.31	Ru I	75	3950.99	Mo I
50	3942.07	Th I	500	3946.51	Sm II	30	3951.10	Cr I
85	3942.12	Nd II	110	3946.68	Ce II	28	3951.11	Th II
2000	3942.15	Ce II	70	3946.81	Nd II	90	3951.14	Ho I
30 h	3942.21	Eu II	180	3946.89	Pr II	2000	3951.16	Nd II
220	3942.21	Tb II	650	3946.89	Tb II	30	3951.17	Fe I
19	3942.24	Ta I	420	3946.93	Dy II	65	3951.18	Pr II
120	3942.27	Pr II	35	3947.17	Mo I	65	3951.21	Ru I
14	3942.44	Fe I	45	3947.25	Tb I	55	3951.33	Eu II
540	3942.53	Dy II	110	3947.33	Th I	40	3951.33	Zr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
250	3951.48	Er I	22	3955.42	Pr II	750	3959.44	Gd II
95	3951.48	U I	65	3955.49	Mo I		3959.52	Gd II
220	3951.52	Th II	45	3955.65	Tb I	190	3959.44	Pr I
95	3951.55	U II	110	3955.68	Nb I	230	c 3959.51	Ho II
150	3951.60	Y II	580	3955.73	Ho I	370		Sm II
110	3951.62	Ce II	60	3955.75	Eu I	180	3959.62	Ce II
410	3951.83	Hf I	50	3955.89	Th I	490	3959.68	Ho I
35	3951.84	Pr I	150	3955.92	Ce II	28	3959.73	Ta I
65	3951.87	Tb I	120	3955.95	Nd II	45	3959.75	Pr II
470	3951.89	Sm I	230	3956.06	Ce II	150	3959.80	Ce II
65	3951.95	Ir I	65	3956.18	Tb II	50	3959.90	Er II
140	3951.97	V II	980	3956.28	Ce II	180	3960.11	Gd I
300	3952.00	Gd II	85	3956.32	Dy I	30	h 3960.12	Tb II
100	3952.11	Ce II	22	3956.34	Pr I	65		Tb I
65	3952.11	Pr II	4500	3956.34	Ti I	70		Th II
65	3952.16	Ta I	320	3956.42	Er I	100	3960.38	Ce II
810	3952.20	Nd II	35	3956.46	Fe I	90	c 3960.49	Pr II
45	3952.27	Sc I	35	3956.55	Pr II	90	3960.51	Os I
45	3952.33	Co I	65	3956.57	Ta I	95	3960.69	Tb I
45	3952.35	Pr II	390	d 3956.59	Th II	770	3960.91	Ce II
65	3952.37	Nb II		3956.69	Th II			
40	3952.40	Cr I	70	3956.68	Fe I	35	3960.98	Nb I
120	3952.52	W I	17	3956.74	Ce I	45	3961.00	Co I
3100	3952.54	Ce II	380	3956.75	Pr II	200	3961.02	Os I
20	3952.61	Fe I	28	3956.78	Ce I	280	3961.04	Re I
30	3952.62	Ir I	40	3956.79	Zr	160	3961.21	Er I
310	3952.68	Ru I	19	3956.82	Ta I	55	3961.28	Pr II
50	3952.76	Th I	140	3956.90	Ce II	9000	3961.52	Al I
55	3952.77	Os I	35	3957.05	Ca I	190	3961.80	Sm II
65	3952.84	Mn I	35	3957.15	Ce II	150	3962.09	Ce II
						55	3962.10	Gd II
320	3952.87	Nd II	55	3957.16	Th II	90	3962.13	Sm I
120	3952.90	W I	35	3957.20	Ce I	510	3962.21	Nd II
370	3952.92	Co I	170	3957.35	Tb I	90	3962.24	Sm II
95	3953.08	Nb I	120	3957.39	Ho I	80	3962.32	W I
160	3953.15	W I	55	3957.42	Tm II	55	3962.42	Th I
35	3953.16	Cr I	240	3957.45	Nd II	470	3962.45	Pr II
85	3953.19	Dy I	40	3957.45	Ru I	350	c 3962.48	Re I
590	3953.37	Gd I	50	3957.52	Sm II	370	3962.59	Dy I
85	3953.40	Nd II	1200	3957.67	Gd II	30	3962.61	Tb I
900	c 3953.51	Pr II	55	3957.68	Pr II	30	3962.78	Ir I
320	3953.52	Nd II	800	3957.79	Dy II	190	3962.79	U II
300	3953.58	U II	40	3957.92	Eu II	950	3962.85	Ti I
340	3953.66	Ce II	210	3957.94	Co I	1500	3963.00	Sm II
40	3953.68	La I	150	3957.97	Ce II	160	c 3963.11	Pr II
120	3953.93	Mo I	280	3957.97	Tb II	1400		Nd II
150	3953.95	Ce II	590	3958.00	Nd II	110	3963.16	Dy I
210	3954.05	Tb I	1500	3958.10	Tm II	50	3963.22	Th II
120	3954.20	Sm II	5200	3958.21	Ti I	60	3963.27	Re I
40	3954.29	Ta I	65	3958.22	Pr II	120	3963.29	Ho II
100	3954.41	Nd II	940	3958.22	Zr II	110	3963.36	Er II
35	3954.43	Re I	95	3958.24	Rh I	100	3963.37	Ce II
420	3954.55	Dy II	230	3958.27	Ce II	28	3963.47	Th II
540	3954.62	U II	350	d 3958.36	Tb II	30	3963.53	Mo I
	3954.67	U II	65	3958.49	Pr II	30	3963.61	Eu I
29	3954.97	Sm	35	3958.60	Mo I	1000	3963.63	Os I
40	3954.99	Pr II	1500	3958.64	Pd I	90	3963.63	V I
90	c 3955.05	Ho II	110	3958.68	Gd I	220	3963.66	Gd II
60	3955.09	Nd II	120	3958.72	Sm II	1900	3963.69	Cr I
60	h 3955.09	Y I	3800	3958.86	Rh I	45	3963.71	Pr II
110		Th I	230	3958.87	Ce II	75	h 3963.80	Zr I
35	3955.24	Pr II	75	3958.87	W I	85	3963.81	Dy II
200	3955.30	W I	120	3959.20	U I	270	3963.90	Nd II
310	3955.36	Ce II	110	3959.30	Th I	30	3963.99	Mo I
45	3955.37	Os I	65	3959.36	Nb I	150	3964.18	Ce II
240	3955.38	U I	85	3959.38	Dy II	350	3964.22	U I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
560	3964.26	Pr II	130	3968.59	W I	660	3973.50	Zr I
950	3964.27	Ti I	75	3968.75	Mo I	110	3973.56	Ni I
390	3964.50	Ce II	170	3968.88	Nd II	3200	3973.58	Er I
85	3964.51	Er I	750	3969.00	Gd I	110	3973.62	Nb I
45	3964.54	Rh II	70	3969.00	Th II	100	3973.64	V II
35	3964.66	Nb I	120	3969.02	U II	740	3973.69	Nd II
240	3964.67	U II	120	3969.06	Cr I	140	3973.71	Ca I
50	d 3964.74	Th II	100	3969.12	Co I	150	3973.77	Mo I
	3964.86	Th II	80	3969.20	W I	90	3973.83	Ho II
1600	c 3964.81	Pr II	550	3969.26	Fe I	160	3973.88	Dy I
30	3964.81	Re I	60	3969.26	Sr I	55	c 3973.90	Pr II
120	3964.90	Eu II	270	3969.29	Gd II	120	3973.93	Mo I
460	3964.90	Ru I	160	3969.44	Er II	590	3973.98	Gd II
80	3964.95	Hf II	120	3969.67	Nd II	85	3974.00	Ce I
100	3964.96	Os I	150	3969.67	Os I	70	3974.19	Ce II
160	3964.96	U II	1600	3969.75	Cr I	55	3974.22	Th II
80	3964.99	W I	35	3969.79	Ru I	170	3974.29	Tb II
75	3965.04	Gd I	55	3969.93	Tb I	90	c 3974.30	Pr II
170	3965.10	Tb I	150	3970.04	Ce II	190	3974.45	Sm II
160	3965.14	W I	30	3970.04	Sr I	85	3974.50	Ru I
1100	c 3965.25	Pr II	150	bl 3970.05	Hf Hf O	110	3974.55	Ho I
45	3965.61	Pr II	55	3970.07	Pr II	620	3974.66	Sm I
250	3965.69	Nb I	210	3970.10	Ta I	170	3974.67	Tb I
35	3965.76	Mo I	65	3970.18	Gd I	1400	3974.72	Er II
170	3965.95	Tb II	170	d 3970.19	Tb II	90	3974.73	Co I
620	3966.04	Sm II	55	3970.42	Ce II	300	3974.81	Gd I
40	3966.07	Fe I	740	3970.53	Sm II	320	3974.85	Pr II
35	3966.09	Ir I	170	3970.64	Ce II	120	d 3974.90	U I
910	d 3966.09	Nb I	65	3970.65	Nb I		3974.98	U II
	3966.25	Nb I	150	h 3970.80	W I	270	3975.07	Ce II
590	3966.28	Gd I	140	3971.06	Gd II	120	3975.11	Gd II
90	3966.34	Sm II	500	3971.16	Pr II	150	3975.20	Nd II
280	3966.35	Er I	160	3971.21	Dy I	160	3975.22	Sm II
110	3966.36	Dy I	85	3971.26	Cr I	200	3975.29	Zr I
100	3966.36	Pt I	25	3971.33	Fe I	380	3975.31	Rh I
240	3966.40	U II	1500	3971.40	Sm II	110	h 3975.44	Os I
600	3966.52	U II	320	3971.67	Pr II	80	3975.47	W I
560	c 3966.57	Pr II	450	3971.68	Ce II	35	3975.65	Re I
150	3966.59	Eu II	450	3971.75	Gd II	220	3975.88	Ho I
30	3966.63	Fe I	220	3971.77	Tb I	55	3975.89	Mn I
490	3966.66	Zr I	210	3971.85	Nb I	45	3975.90	W I
770	3967.05	Ce II		3971.93	Nb I	65	3975.96	Mo I
120	3967.06	Nd II	110	3971.88	Ce II	120	3976.09	Nd II
160	3967.15	Pr II	30000	cw 3971.96	Eu II	960	3976.27	Sm II
150	3967.18	Ce II	170	3972.06	Tb II	55	3976.30	Pr II
45	3967.18	Eu I	270	3972.07	Ce II	590	3976.31	Ir I
95	3967.22	Tb II	620	c 3972.14	Pr II	210	3976.41	Th II
120	3967.33	Ho I	200	3972.15	Th I	1000	3976.43	Sm II
70	3967.39	Re I	85	3972.17	Gd II	80	3976.56	Pr II
390	3967.39	Th I	35	3972.17	Ni I	1600	3976.66	Cr I
30	3967.42	Fe I	40	3972.30	Zr I	130	3976.67	Nb I
120	3967.47	U I	85	3972.41	Dy I	95	3976.68	Tm I
320	3967.51	Dy I	170	3972.52	Nb I	280	3976.73	Er I
110	3967.53	Ce II	80	3972.53	Co I	70	3976.78	Ce II
220	3967.65	Tb I	100	3972.64	Ho II	100	3976.79	Pr II
470	3967.68	Sm II	70	3972.64	Th I	2200	d 3976.84	Tb II
150	3967.75	Nd II	390	3972.71	Gd I	740	3976.85	Nd II
160	3968.01	Hf I	70	3973.03	Ce II	390	c 3976.93	Ho I
50	3968.09	V II	2700	3973.04	Er I	170	3976.97	Ho II
160	3968.14	Pr II	55	3973.09	Pr II	810	3977.02	Er I
590	3968.26	Gd II	90	3973.15	Co I	65	3977.08	Mn I
990	3968.26	Zr I	150	3973.20	Th I	28	3977.18	Co I
14000	3968.39	Dy II	1100	3973.30	Nd II	730	3977.23	Os I
480	3968.46	Lu I	110	3973.39	Zr I	100	3977.29	Nd II
22000	3968.47	Ca II	200	3973.48	Hf I	65	3977.34	Zr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
55	3977.43	Pr II	40	3981.90	Ce II	55	3986.40	Ce II
160	3977.48	Zr I	1400	3981.92	Dy II	55	h 3986.60	Eu I
35	3977.53	Ce II	85	3981.95	Ta I	740	3986.68	Sm II
40	h 3977.73	Pr I	130	3982.04	Ho II	65	3986.80	Zr I
60	3977.74	Fe I	75	3982.05	Mo I	190	3986.83	Mn I
150	3977.77	Ce II	2100	c 3982.05	Pr II	150	3986.90	Sm II
65	3977.90	Mo I	35	3982.06	Nb I	85	3987.07	Dy II
110	3977.94	Nb I	110	3982.16	Ce I	150	3987.10	Mn I
60	3977.99	Nd II	100	3982.16	Zr I	45	3987.12	Co I
40	3978.25	Zr I	1100	3982.33	Er I	450	3987.21	Gd II
60	3978.42	Eu I	320	3982.36	Nd II	85	3987.22	Th I
600	3978.44	Ru I	100	h 3982.45	Pr II	60	3987.25	Nd II
2700	3978.57	Dy II	570	3982.48	Ti I	120	3987.37	Pr II
770	3978.65	Ce II	130	3982.58	Mn I	370	3987.43	Sm II
140	3978.66	Co I	35	3982.60	Mo I	40	3987.50	Y I
85	3978.68	Cr I	3600	3982.60	Y II	280	3987.53	Er I
100	3978.74	Zr I	35	3982.87	W I	810	3987.66	Er I
110	3978.75	Nb I	560	3982.89	Ce II	150	3987.66	Tb I
190	3978.80	U II	90	3982.97	W I	27	3987.80	Ru I
70	3979.03	Nd	150	3983.01	Gd II	50	3987.81	Nd II
55	3979.04	Th II	110	3983.14	Er II	470	3987.84	Gd I
50	3979.13	Er II	740	3983.14	Sm II	32000	3987.99	Yb I
50	3979.14	V I	310	3983.29	Ce II	90	3988.00	Pr II
960	3979.20	Sm II	250	3983.29	W I	200	3988.02	Th II
35	3979.22	Mo I	85	3983.41	Nd II	110	3988.16	Nb I
65	3979.28	Ta I	70	3983.58	Nd II	100	3988.18	Os I
130	3979.29	W I	90	h 3983.59	Pr II	40	3988.24	Eu I
750	3979.33	Gd I	1600	3983.65	Dy II	4400	3988.52	La II
45	3979.36	Os I	19	3983.82	Ta I	55	3988.60	Th II
65	3979.37	Nb I	300	3983.85	Tb II	40	3988.62	Os I
80	3979.40	Hf II	960	3983.91	Cr I	80	3988.64	U II
600	3979.42	Ru I	35	3983.91	Re I	100	3988.68	Zr I
50	3979.42	V I	230	3983.91	U II	85	3988.70	Ta I
270	3979.47	Dy II	40	3983.96	Fe I	70	3988.82	Nd II
740	3979.49	Nd II	260	3984.05	Tb II	90	3988.83	V I
120	3979.52	Co I	95	3984.18	U I	70	3988.84	Th II
30	3979.63	Eu II	800	3984.21	Dy II	60	3988.88	Dy I
40	3979.68	Pr II	90	3984.24	Pr II	190	3988.89	U II
40	3979.80	Cr I	40	3984.25	Re I	60	3988.93	Dy I
150	3980.09	Th I	60	3984.33	Ti I	45	3989.06	Sc II
160	3980.14	Er II	190	3984.34	Cr I	95	3989.25	Gd II
75	3980.20	Mo I	50	3984.34	V I	75	3989.29	Zr I
90	3980.21	Pr II	240	3984.40	Rh I	370	3989.44	Ce II
40	3980.48	Nb I	90	3984.60	V I	75	3989.48	Tb I
50	3980.52	V I	770	3984.68	Ce II	160	3989.50	Zr I
160	3980.60	Er I	85	3984.69	Dy II	1300	c 3989.68	Pr II
130	3980.64	W I	160	3984.75	Zr I	35	3989.76	Ce II
55	3980.75	Th II	29	3984.81	Nb I	5700	3989.76	Ti I
120	h 3980.80	U I	150	3984.84	Tb II	160	3989.99	Cr I
90	3980.84	Pr II	870	3984.86	Ru I	1500	3990.00	Sm II
560	3980.88	Ce II	17	3984.98	Ta I	3990.02	Sm I	Sm I
50	3980.88	Sm II	150	3985.12	Tb II	1400	3990.10	Nd II
60	3980.98	Nd	60	3985.18	Nb I	180	3990.11	Ce II
19	3981.01	Ta II	150	3985.24	Mn I	55	3990.22	Tb I
200	3981.10	Th II	35	3985.25	Ti I	70	3990.30	Co I
65	h 3981.16	Pr II	60	3985.59	Ti I	75	3990.34	Dy II
260	3981.16	Tb II	90	c 3985.64	Pr II	40	3990.40	Ta I
85	3981.23	Cr I	220	cw 3985.71	Ho II	460	3990.42	U II
140	3981.24	Nd II	1200	3985.80	U II	110	3990.49	Th I
110	3981.37	Dy I	150	3986.00	Sm II	540	3990.57	V I
200	h 3981.60	Zr I	65	3986.17	Pr II	220	3990.63	Tb I
4800	3981.76	Ti I	140	3986.20	Mo I	29	3990.67	Nb I
20	3981.77	Fe I	29	3986.23	Sm II	70	3990.69	Ce II
55	3981.83	Th I	470	3986.25	Nd II	930	3990.88	Yb I
1800	3981.87	Tb II	260	3986.35	Tb II	150	3991.02	Sm I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
35	3991.03	Re I	60	3995.26	Er II	2800	3999.24	Ce II
960	3991.12	Cr I	140	3995.26	Nd II	65	3999.24	Tb II
770	3991.13	Zr II	6000	3995.31	Co I	100	3999.28	Ta I
230	3991.15	Er I	35	3995.42	Ce II	70	3999.36	Ti I
22	3991.22	Ce II	440	3995.58	Tm II	350	3999.40	Tb II
45	3991.22	Pr II	90	3995.59	Sm II	380	3999.58	Ho I
80	3991.23	W I	240	3995.61	Rh I	150	4000.01	Tb II
540	3991.32	Dy II	30	3995.66	Ba I	620	c 4000.17	Pr II
55	3991.33	Ce II	3600	3995.75	La II	65	4000.18	Gd I
50	3991.38	Lu I	75	d 3995.80	Tb II	55	4000.28	Th I
35	3991.39	Mo I	270	3995.83	Pr II	65	4000.39	Mo I
40	3991.49	Os I	190	3995.97	U II	8000	4000.45	Dy II
70	3991.54	Co I	55	3995.98	Eu II	110	4000.45	Pr II
75	d 3991.58	Tb I	280	3995.98	Ru I	120	4000.50	Mo I
160	3991.67	Cr I	85	3995.99	Dy I	410	4000.50	Nd II
110	3991.68	Nb I	250	3996.06	Th II	40	4000.60	Nb II
70	3991.69	Co I	380	3996.15	Rh I	17	4000.68	Ce II
110	3991.73	Th I	210	3996.17	Ta I	80	h 4000.70	W I
1000	3991.74	Nd II	700	3996.32	Gd II	17	4000.80	Ce II
35	3991.85	Mo I	14	3996.36	Ce II	90	c 4000.89	Pr II
230	3991.91	Pr II	70	3996.49	Ce II	110	4001.06	Ce II
460	3992.12	Ir I	27	3996.51	Ru I	110	4001.06	Th I
70	3992.13	Ce II	1800	3996.52	Tm II	40	4001.09	Zr I
85	3992.16	Nd II	20	3996.57	Pt I	75	4001.13	Nb I
340	3992.16	Pr II	5500	3996.61	Sc I	470	4001.26	Gd II
85	3992.28	Nd II	1600	3996.69	Dy II	180	4001.26	Tb I
55	3992.28	Th II	40	3996.80	Os I	120	d 4001.28	U I
700	3992.39	Ce II	560	c 3997.04	Pr II	80	c 4001.32	Ho II
380	3992.54	U II	120	3997.09	U I	80	4001.38	W I
170	3992.60	Nd II	50	3997.12	V II	65	4001.43	Pr II
320	3992.69	Gd I	45	3997.14	W I	160	4001.44	Cr I
160	3992.72	Ho I	80	3997.18	Ho II	230	4001.56	Ce II
75	3992.76	W I	80	3997.40	Fe I	140	4001.73	Ce II
260	3992.80	V I	150	3997.43	Tb II	55	4001.73	Th II
190	3992.84	Cr I	70	3997.44	Nd II	65	4001.96	Gd II
65	h 3992.90	Pr II	55	3997.47	Th II	350	d 4002.19	Tb II
370	3992.91	Ce II	50	3997.48	Ce II	29	4002.26	Nb I
45	c 3993.16	Pr II	140	3997.72	Ce II	120	4002.34	U II
220	3993.21	Gd II	320	3997.76	Gd II	70	4002.49	Ti I
740	3993.31	Sm II	70	3997.78	Nd II	75	4002.55	Zr I
180	3993.40	Ba I	150	3997.86	Th II	160	cw 4002.59	Ho II
55	3993.53	Ru I	970	3997.91	Co I	970	4002.59	Tb II
180	d 3993.54	Tb I	170	3997.93	Nd II	180	4002.81	Ce II
170	3993.57	Dy I	230	3997.96	Pr II	110	4002.97	Ce II
220	3993.73	Ho II	110	3998.06	Dy II	110	4003.10	Th II
910	3993.82	Ce II	30	3998.06	Fe I	140	4003.10	Zr I
45	3993.91	W I	85	3998.16	Nd	110	4003.17	Ce II
30	3993.93	Eu II	45	3998.16	W I	120	4003.20	U II
35	3993.93	Mo I	350	3998.24	U II	240	4003.31	Th II
40	3993.97	Cr I	130	3998.29	Ho I	220	4003.39	Ho I
90	3994.01	Pr II	35	3998.29	Mo I	280	4003.46	Sm II
650	3994.16	Gd II	190	3998.35	Sm I	150	4003.48	Os I
120	3994.29	U II	150	3998.40	Tb II	65	4003.70	Ta I
29	3994.43	Nb I	7800	3998.64	Ti I	60	4003.71	Eu II
85	3994.53	Dy I	170	3998.69	Nd	90	4003.72	Sm II
45	3994.54	Co I	430	3998.73	V I	45	4003.73	Pr II
530	3994.55	Th II	75	3998.76	W I	910	4003.77	Ce II
110	3994.57	Ce II	110	3998.87	Tb I	110	4003.78	Tb II
1100	3994.68	Nd II	55	3998.93	Os I	70	4003.81	Ti I
35	3994.70	Ti I	770	3998.97	Zr II	65	4003.85	Gd II
1600	3994.79	Pr II	60	3999.07	Er I	65	4003.91	Tb II
50	3994.85	Er II	320	3999.12	Pr II	540	4004.02	Nd II
45	3994.93	Os I	100	3999.16	Er II	100	4004.02	Os I
230	3994.98	U II	140	3999.18	Nb I	230	4004.05	Er I
85	3995.12	Tb I	120	3999.18	U I	350	4004.06	U II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
55	4004.08	Ce II	150	4009.18	Tb I	29	4014.93	Nb I
100	4004.26	Nd	110	4009.22	Gd II	65	h 4015.04	Os I
50	4004.26	Sm II	90	4009.24	Pr II	210	4015.17	Dy II
75	4004.40	Zr I	120	4009.37	Mo I	150	4015.22	Gd I
75	4004.52	Tb II	150	4009.56	Tb II	540	4015.22	W I
100	4004.58	Ce II	190	4009.66	Ti I	70	4015.38	Ti I
730	4004.70	Pr II	140	4009.71	Nb I	180	4015.39	La I
75	h 4004.87	Zr I	35	4009.72	Fe I	730	4015.39	Pr II
100	4004.93	Re I	28	4009.72	Th I	70	4015.56	Nd II
260	4004.94	Gd II	150	4009.78	Er I	350	4015.57	Er II
55	4005.09	Th I	28	4009.82	Th I	200	4015.58	Gd I
150	4005.16	Os I	65	4009.96	Pr I	60	4015.77	Sm II
430	4005.21	U I	300	4010.04	Tb I	250	4015.88	Ce II
400	4005.25	Fe I	120	4010.07	Dy II	40	4016.08	Nb I
75	4005.40	W I	140	4010.14	Ce II	35	4016.28	Ti I
1900	4005.47	Tb II	45	4010.38	W I	110	4016.36	Er I
140	4005.53	Th II	100	4010.45	Nd II	170	h 4016.52	W I
370	4005.64	Ce II	620	4010.60	Pr II	28	4016.78	Pr II
140	4005.64	Ru I	150	4010.85	Tb I	160	4016.98	Zr I
190	4005.70	U I	150	4011.09	Nd II	300	4017.25	Gd I
170	4005.71	V II	540	4011.29	Dy II	40	4017.38	Mo I
420	4005.84	Dy I	110	4011.45	U II	120	4017.56	Nb I
40	d 4005.93	Nb I	100	4011.56	Ce II	150	4017.58	Eu II
110	4005.97	Tb II	55	4011.59	Th I	140	4017.60	Ce II
35	4005.97	Ti I	180	4011.69	Eu II	430	4017.71	Gd I
75	4006.05	Mo I	90	4011.73	Sm II	570	4017.72	U II
320	4006.07	Dy I	110	4011.74	Th I	120	h 4017.77	Ti I
100	4006.38	Th II	65	4011.97	Mo I	75	4017.85	Tb II
85	4006.60	Ru I	65	4012.06	Nb I	160	c 4018.09	Ho II
190	4006.60	Sm II	65	4012.11	Ta I	1500	4018.10	Mn I
150	4006.67	Pr II	3700	4012.25	Nd II	55	4018.10	Th I
90	4006.82	Sm II	200	4012.25	Zr I	160	4018.26	Os I
190	4006.84	Ta I	60	4012.26	Re I	120	4018.38	Zr II
110	4006.96	Gd I	2700	4012.39	Ce II	35	4018.40	Re I
250	4007.02	Th II	70	4012.39	Ti II	110	4018.45	Tb I
35	4007.23	Ta I	120	4012.47	Cr II	370	4018.81	Nd II
50	4007.36	Yb I	280	4012.50	Th I	300	4018.99	U II
410	4007.43	Nd II	1100	4012.58	Er I	200	4019.04	Ce II
70	4007.45	Ce II	540	4012.70	Nd II	4200	4019.13	Th II
470	4007.48	Sm II	760	4012.75	Tb II	370	4019.14	Tb II
55	4007.54	Ru I	150	4012.86	Tb II	220	4019.23	W I
210	4007.59	Ce II	50	4012.98	Er II	23	4019.30	Co I
200	4007.60	Zr I	65	4013.19	Ta I	400	4019.64	Pb I
100	4007.76	Dy II	140	h 4013.22	Nd II	300	4019.73	Gd I
65	4007.76	Pr II	90	4013.23	Pr II	110	4019.77	Th ThO
14000	4007.96	Er I	330	4013.26	Tb I	120	4019.79	Nd II
30	4008.05	Mo I	190	4013.27	Nb I			
70	4008.06	Ti I	110	4013.38	Pr II			
150	4008.10	Sm II	150	4013.43	Gd I			
230	4008.18	Er II	110	4013.50	Ho I			
220	4008.21	Th I	85	4013.50	Ru I			
85	4008.27	Ru I	180	4013.58	Ti I			
140	4008.28	Nb I	300	4013.80	Gd II			
320	4008.33	Gd I	540	4013.82	Dy I			
150	4008.33	Sm II	70	4013.94	Co I			
40	4008.66	Ce II	85	4013.95	Gd II			
1900	4008.69	Pr II	80	4014.16	U II			
85	4008.75	Nd II	320	4014.20	Ho II			
8600	4008.75	W I	90	4014.32	Pr II			
300	4008.91	Gd II	530	4014.49	Sc II			
950	4008.93	Ti I	55	4014.51	Th II			
55	4009.06	Ce II	40	4014.53	Fe I			
220	4009.06	Th I	30	4014.67	Cr I			
280	4009.16	Er II	540	4014.70	Dy II			
120	4009.17	U II	910	4014.90	Ce II			

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
120	4019.84	Sm II	770	4024.92	Zr I	840	4031.34	Ce II
140	4019.90	Ce II	70	4025.01	Cr I	140	4031.39	Sc I
280	4019.98	Sm II	40	4025.14	Ti II	520	4031.66	Tb II
180	4020.03	Ir I	240	4025.15	Ce II	2800	4031.69	La II
85	4020.05	Nd II	65	4025.18	Pr II	730	c 4031.75	Pr II
29	4020.24	Nb I	110	4025.39	Ho I	180	c 4031.80	Ho I
20000	4020.40	Sc I	360	4025.54	Pr II	1200	4031.82	Nd II
540	4020.47	Tb II	210	4025.65	Th II	120	4031.83	V I
3000	4020.51	Er I	170	4025.73	Tb II	150	4032.20	Ru I
160	4020.87	Dy II	250	4025.88	La II	180	4032.27	Hf I
1000	4020.87	Nd II	80	4026.02	U II	870	4032.28	Tb I
350	4020.90	Co I	170	4026.14	Th II	30	4032.38	Sr I
620	4020.96	Pr II	120	4026.17	Cr I	110	4032.46	Th II
55	4021.00	Ru I	150	4026.44	Mn I	520	4032.47	Dy II
130	4021.02	Mo I	190	h 4026.54	Ti I	230	4032.47	Pr II
1000	4021.34	Nd II	230	4026.83	Pr II	40	4032.50	Mo I
450	4021.55	Er I	190	4026.94	Ta I	1100	4032.52	Nb I
1000	4021.78	Nd II	140	4027.01	Th I	110	4032.60	Th I
140	4021.83	Ti I	70	4027.04	Co I	140	d 4032.62	Tb I
40	4021.87	Fe I	70	4027.05	Ce II	140	d 4032.70	Tb I
110	4022.01	Er II	85	4027.10	Cr I	160	4032.84	Dy I
210	4022.07	Th I	990	4027.20	Zr I	90	4032.92	Os I
	4022.09	Th II	320	4027.21	Ho I	150	4032.96	Pr II
130	4022.12	W I	65	4027.31	Nb I	10000	4032.98	Ga I
1500	4022.16	Ru I	40	4027.48	Ti I	150	4032.98	Sm II
90	4022.18	Pr II	220	4027.61	Gd I	2100	4033.03	Tb II
85	4022.26	Cr I	170	4027.69	Ce II	19000	4033.07	Mn I
240	4022.27	Ce II	420	4027.78	Dy II	85	4033.07	Ta I
300	4022.33	Gd II	65	4027.98	Nb I	29	4033.20	Nb I
29	4022.39	Nb I	1100	4028.15	Gd I	220	4033.31	Re I
20	h 4022.63	Cu I	170	d 4028.31	Tb II	19	4033.38	Ta I
470	4022.71	Pr II	520	d 4028.32	Dy II	160	4033.43	U II
90	4022.73	Sm II		4028.41	Dy I	700	4033.49	Gd I
160	c 4022.76	Ho II	40	4028.34	Ti II	120	4033.50	Nd I
220	4022.88	Tb I	840	4028.41	Ce II	40	4033.55	Sb I
140	4022.96	Re I	60	4028.53	Re I	40	4033.63	Mo I
1200	4023.00	Nd II	85	4028.59	Tb I	17	4033.63	Ta I
1100	4023.14	Gd I	65	4028.65	Mo I	420	4033.65	Dy II
150	4023.14	Nb I	180	4028.79	W I	190	4033.73	U II
120	4023.14	Rh I	270	4028.86	Ho I	350	4033.76	Ir I
50	4023.17	V I	240	4028.95	Zr I	960	4033.83	Pr II
880	4023.23	Sm II	230	4029.00	Pr II	100	4033.90	Nd II
100	4023.31	Re I	29	4029.22	Nb I	40	4033.91	Ti I
810	4023.35	Gd I	55	h 4029.32	Os I	70	4034.01	Nd II
35	4023.37	Ce II	110	c 4029.63	Re I	40	4034.09	Zr II
120	4023.39	V II	400	4029.68	Zr II	100	4034.23	Sc I
23	4023.40	Co I	360	c 4029.72	Pr II	140	4034.25	Th II
90	4023.59	La II	140	4029.94	Ta I	230	4034.33	Pr II
20000	4023.69	Sc I	490	4030.04	Zr I	11000	4034.49	Mn I
370	4023.71	Dy I	55	4030.16	Ce II	220	4034.50	U I
600	4023.83	Ru I	250	4030.34	Ce II	80	4034.76	Tm II
160	c 4023.94	Ho II	40	h 4030.35	Nb I	30	4034.91	Ti I
400	4023.98	Zr I	130	4030.38	Sr I	70	4034.92	Th II
170	4024.09	Mo I	410	4030.47	Nd II	65	4035.10	Nb I
180	d 4024.10	Tb II	65	4030.47	Pr II	740	4035.11	Sm II
220	4024.23	Tm I	190	h 4030.51	Ti I	45	4035.36	W I
110	4024.30	Pr II	220	4030.67	Sc I	340	h 4035.40	Gd I
140	4024.35	Ce II	85	4030.68	Cr I	90	4035.55	Co I
250	4024.43	Dy II	27000	4030.76	Mn I	150	4035.63	V II
120	4024.44	Zr II	250	4030.84	Th I	1500	4035.73	Mn I
840	4024.49	Ce II	860	4030.88	Gd I	110	4035.83	Ti I
1200	4024.57	Ti I	85	4031.00	Ru I	65	4035.89	Ta I
370	4024.77	Tb I	150	4031.07	Pr II	400	4035.89	Zr I
340	4024.78	Nd II	85	4031.08	Dy I	65	4035.93	Nb I
250	4024.90	Dy I	160	4031.31	U II	250	4036.05	Th I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
190	4036.11	Er I	2700	4040.81	Ho I	3000	4045.82	Fe I
350	4036.22	Tb I	120	4040.87	Ta I	12000	4045.97	Dy I
420	4036.32	Dy II	40	4040.94	Au I	440	4046.16	Sm II
45	4036.46	Tb II	200	4041.06	Nd II	620	4046.34	Ce II
65	c 4036.55	Pr II	85	4041.06	Ta I	200	4046.48	Sc I
240	4036.56	Th II	30	4041.12	Mo I	1800	4046.56	Hg I
40	4036.59	La II	240	4041.20	Th II	230	4046.63	Pr II
260	4036.84	Gd I	110	4041.27	Ce II	90	4046.70	W I
180	4036.86	W I	5600	4041.36	Mn I	270	4046.84	Gd II
180	4037.10	Sm II	100	4041.64	Zr I	1000	4046.96	Er I
140	4037.21	La I	590	4041.68	Sm II	340	4047.08	Pr II
65	4037.21	Pr II	65	4041.84	Tb I	270	4047.09	Gd I
40	4037.30	Mo I	280	4041.92	Os I	150	4047.14	Tb I
1400	4037.33	Gd II	320	4041.98	Dy II	740	4047.16	Sm II
55	4037.39	Ce II	55	4042.14	Ce II	160	4047.21	K I
110	4037.49	Re I	240	4042.22	Zr I	130	4047.28	Ce II
220	4037.62	Ho I	95	4042.34	Tb II	100	4047.35	Sm II
340	4037.67	Ce II	85	4042.51	Nd II	220	c 4047.52	Ho I
180	4037.69	Er I	85	4042.57	Nb I	410	4047.62	U I
40	4037.74	Ru I	910	4042.58	Ce II	2400	4047.64	Y I
85	4037.78	Mo I	120	4042.64	V I	85	4047.73	Dy I
100	4037.84	Os I	740	4042.72	Sm II	2700	4047.79	Sc I
700	4037.90	Gd II	65	4042.76	Gd II	160	4047.81	Gd II
130	4038.08	Mo I	1000	4042.76	U I	45	4047.94	W I
150	4038.10	Sm II	130	4042.87	Mo I	100	4047.96	Hf II
270	4038.12	Nd II	880	4042.90	Sm II	160	4048.05	Os I
40	h 4038.18	Nb I	3000	4042.91	La II	180	4048.13	Pr II
230	4038.22	Pr II	230	4043.01	Er II	55	4048.29	Th I
170	4038.25	Ce II	85	4043.05	Nd II	280	4048.34	Er II
730	4038.45	Pr II	70	4043.13	Th II	85	4048.38	Dy II
250	4038.51	Dy II	85	4043.16	Nb I	60	4048.41	Rh I
55	4038.64	Os I	110	4043.39	Th I	55	4048.43	Th I
55	4038.73	Mn I	610	4043.58	Zr I	110	4048.60	Gd II
190	4038.83	Dy I	410	4043.59	Nd II	210	4048.62	Sm II
210	4038.86	Tb I	45	4043.67	Tb II	50	4048.62	V I
220	c 4038.87	Ho II	410	4043.71	Gd I	610	4048.67	Zr II
55	4039.02	Pr II	220	4043.80	Sc I	1100	4048.76	Mn I
190	4039.10	Cr I	45	4043.89	W I	160	4048.78	Cr I
85	4039.10	Nb I	45	4044.02	Gd I	65	4048.80	Tb I
120	4039.19	Eu I	160	4044.10	Nb I	410	4048.81	Nd II
310	4039.21	Ru I	240	4044.11	Sm II	250	4048.93	Dy I
30	4039.21	Tb II	320	4044.14	K I	200	4048.99	Re I
470	4039.34	Pr II	140	h 4044.28	W I	80	4049.00	Mn I
150	4039.48	Tb I	85	4044.35	Nd II	110	4049.03	Ce II
110	4039.49	Gd II	90	4044.39	Hf I	23	4049.04	Rh I
250	4039.53	Nb I	520	4044.42	U II	270	4049.20	Gd I
35	4039.63	Ta I	380	4044.47	Tm I	140	4049.36	Dy I
75	4039.64	Er I	490	4044.56	Zr I	65	4049.41	Ru I
170	4039.67	Gd II	130	4044.71	Nb I	1300	4049.43	Gd II
70	4039.75	U I	1300	4044.81	Pr II	70	4049.45	Hf II
150	4039.80	U I	1600	4045.01	Gd I	200	4049.49	Er II
940	4039.83	Y I	560	4045.05	Sm II	75	4049.58	Sm II
140	4039.85	W I	210	d 4045.13	Mn I	70	4049.74	Hf I
110	4039.86	Th I		4045.21	Mn I	170	4049.76	Nb I
85	4039.89	Ce II	130	4045.15	Gd II	590	4049.81	Sm II
			230	4045.21	Ce II			
130	4040.08	Ir I				2200	4049.86	Gd II
150	4040.10	Tb I	85	4045.32	Ce II	55	4049.87	Tb II
40	4040.24	Zr II	65	4045.35	Tb I	85	d 4049.94	Th I
35	h 4040.32	Ti I	370	4045.39	Co I	120	4049.95	Sc I
130	4040.41	Tb II	5400	c 4045.44	Ho II	1600	4050.04	U II
65	h 4040.47	Nb I	910	4045.59	W I	320	4050.08	La II
35	4040.48	Ru I	400	4045.61	Zr II	30	4050.09	Mo I
45	4040.59	W I	50	4045.63	Th II	200	4050.33	Zr II
2100	4040.76	Ce II	230	4045.70	Pr II	270	4050.37	Gd I
3000	4040.80	Nd II	170	4045.76	Ru I	200	4050.48	Zr I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
1600	4050.56	Dy II	120	4057.44	Dy II	55	4062.85	Ru I
85	4050.81	Ce II	270	4057.55	Ho I	230	4062.94	Ce II
110	4050.89	Th I	40	4057.58	Mo I	120	4062.99	Ru I
360	4050.96	V I	85	4057.62	Ti I	1900	4063.39	Gd II
450	4051.13	Pr II	130	4057.82	V I	250	4063.41	Th I
850	4051.15	Nd II	34000	4057.83	Pb I	730	4063.53	Mn I
360	4051.35	V I	210	4057.95	Mn I	560	4063.54	Sm II
1400	4051.40	Ru I	85	4058.14	Ti I	540	4063.59	Gd II
210	4051.43	Ce II	80	4058.19	Co I	1200	4063.60	Fe I
55	4051.43	Os I	430	4058.19	U II	220	4063.89	Tb II
65	4051.49	Tb II	140	4058.20	Pr II	110	4063.92	Ce II
170	4051.52	Nb I	2600	4058.22	Gd I	230	4063.93	V I
55	4051.73	Mn I	85	4058.24	Ce II	110	4064.10	Ru I
300	4051.86	Tb II	65	4058.46	Ta I	110	4064.16	U I
540	4051.91	U II	80	4058.60	Co I	1500	4064.16	Zr I
210	4051.99	Ce II	120	4058.77	Cr I	200	4064.22	Ti I
170	4052.20	Ru I	50	4058.78	Ce II	280	4064.32	Sm II
70	4052.28	Yb I	450	4058.80	Pr II	55	4064.33	Th I
65	4052.47	Mn I	440	4058.87	Sm II	370	4064.46	Ru I
90	4052.57	Pr II	1100	4058.93	Mn I	1400	4064.58	Sm II
300	4052.87	Tb II	16000	c 4058.94	Nb I		4064.58	Sm II
60	4052.92	Co I	140	4059.25	Th I	210	4064.63	Ta I
180	4053.03	U II	110	4059.37	Gd II	160	4064.79	La I
50	4053.26	V I	110	4059.37	Pr II	180	4064.79	W I
810	4053.29	Gd II	150	4059.39	Mn I	85	4064.81	Nb I
40	4053.44	Rh I	550	4059.51	Er I	85	4064.91	Ce II
700	4053.51	Ce II	210	4059.51	Nb I	70	4065.08	Au I
140	4053.53	Th I	190	4059.61	Mo I	80	4065.08	Mn I
2600	4053.64	Gd I	690	4059.78	Er II	1700	4065.09	Ho II
250	4053.83	Dy I	650	4059.88	Gd I	200	4065.10	Ti I
8100	4053.93	Ho I	850	4059.96	Nd II	85	4065.16	Ce II
90	4053.93	W I	80	4060.10	U II	60	4065.58	La I
150	4053.96	Tb I	410	4060.26	Ti I	55	4065.69	Th II
710	4054.05	Ru I	220	4060.31	Ho I	40	4065.72	Cr I
430	4054.12	Tb I	120	4060.31	Nb I	260	4066.04	Gd I
300	4054.31	U II	220	4060.33	La I	85	4066.12	Nb I
120	4054.43	Zr I	410	4060.37	Tb I	140	4066.21	Hf I
670	4054.45	Lu I	110	4060.47	Ce II	390	4066.22	Tb II
540	4054.48	Ho II	85	4060.57	Dy II	350	4066.37	Co I
5500	4054.55	Sc I	45	4060.70	W I	85	4066.37	Mo I
810	4054.72	Gd I	50	4060.71	Ce I	85	4066.50	Ce II
85	4054.86	Nd II	350	4060.79	Nb I	960	4066.69	Os I
2200	4054.88	Pr II	220	4060.87	Tb II	810	4066.74	Sm II
450	4054.99	Ce II	4700	4061.09	Nd II	110	4066.80	U II
290	4055.02	Ti I	40	4061.26	Nb I	55	4066.91	Ce I
770	4055.03	Zr I	270	4061.30	Gd II	85	4066.94	Cr I
520	4055.14	Dy II	110	h 4061.32	Pr II	170	4067.16	Nb I
85	4055.16	Ce II	80	4061.35	U I	100	4067.24	Ta I
150	4055.21	Mn I	410	4061.40	Ta I	280	4067.28	Ce II
940	4055.47	Er II	330	4061.53	Zr I	850	4067.39	La II
1900	4055.54	Mn I	140	4061.54	Nb I	55	4067.45	Th I
600	4055.71	Zr I	1300	4061.58	Tb I	170	4067.57	Ho I
80	4055.81	Tm I	730	4061.74	Mn I	200	4067.61	Ru I
110	4055.84	Ce I	110	4061.74	U II	85	4067.73	Nd II
270	4056.01	Mo I	28	4061.80	Ce I	520	4067.76	U II
75	4056.32	Mo I	50	4061.86	Re I	310	4067.91	Ta I
23	4056.34	Rh I	1400	4062.08	Mo I	80	4068.00	Mn I
2200	4056.54	Pr II	550	4062.14	Pb I	720	4068.05	Ho I
220	4056.59	Sc I	280	4062.22	Ce II	210	4068.26	Nb I
85	4056.83	Nd II	230	4062.22	Pr II	710	4068.33	Sm II
85	4056.90	Ce II	30	4062.44	Fe I	520	4068.35	Gd I
35	4056.94	Nb I	880	4062.55	U II	760	4068.37	Ru I
280	4057.07	V I	650	4062.59	Gd II	85	4068.44	Ce II
28	4057.20	Co I	3400	4062.81	Pr II	140	4068.54	Co I
29	4057.27	Nb I	230	4062.84	Hf I	75	4068.72	Zr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
260	4068.74	Gd I	35	4074.86	Cr I	6000	4080.60	Ru I
210	4068.80	Pr II	310	4074.93	Zr I	330	4080.61	U II
420	4068.84	Ce II	160	4074.97	Sc I	55	4080.71	Th I
910	4069.20	Th II	710	4075.12	Nd II	500	4080.98	Pr II
1100	4069.28	Nd II	260	4075.22	Tb I	19	4081.13	Ta I
150	4069.79	W I	190	4075.25	Mo I	670	4081.22	Ce II
2300	4069.88	Mo I	470	4075.28	Nd II	90	4081.22	Y I
370	4069.92	Ir I	55	4075.50	Th I	2000	4081.22	Zr I
730	4069.95	W I	50	4075.54	Mo I	550	4081.24	Er II
29	4070.04	Nb I	1500	4075.71	Ce II	390	4081.24	Tb I
55	4070.09	Ce II	810	4075.84	Sm II	110	4081.37	Th I
150	4070.10	Tb I	1500	4075.85	Ce II	240	4081.43	Re I
170	4070.24	Pr II	40	4076.06	Cr I	1300	4081.44	Mo I
290	4070.28	Mn I	60	4076.09	Nb I	790	4081.85	Pr II
750	4070.29	Gd II	190	4076.19	Mo I	130	4081.97	Sm II
	4070.39	Gd II	55	4076.20	Pr II	27	4082.24	Tb II
110	d 4070.54	Tb II	210	4076.24	Ce II	110	4082.26	Th II
340	4070.61	W I	200	4076.53	Zr I	65	4082.30	Zr I
150	4070.68	Ir I	280	4076.65	Sm II	6100	4082.40	Sc I
55	4070.71	Tb I	330	4076.69	U II	290	4082.46	Ti I
70	4070.84	Ce II	110	4076.71	La II	140	4082.55	Nd II
250	4070.86	Os I	980	4076.73	Ru I	410	4082.60	Sm II
140	4070.96	Nb I	90	4076.86	Sm II	560	4082.78	Rh I
85	4071.08	Ce II	40	4077.09	Cr I	75	4082.79	Ru I
410	4071.11	U II	75	4077.09	Nb I	130	4082.79	Tb I
110	4071.21	Tb I	85	4077.28	Yb II	65	4082.93	V I
150	4071.40	Ru I	2800	4077.35	La II	1100	4082.94	Mn I
100	4071.46	Nd II	9400	4077.38	Y I	150	4082.96	W I
230	4071.54	V I	420	4077.47	Ce II	140	4083.05	Er I
190	4071.56	Os I	70	4077.57	Rh I	120	4083.08	Zr I
1000	4071.74	Fe I	240	4077.62	Nd II	85	4083.10	Dy I
55	4071.75	Th I	40	4077.68	Cr I	110	4083.21	Tb I
1100	4071.81	Ce II	46000	4077.71	Sr II	910	4083.23	Ce II
270	4071.83	Ho I	220	4077.79	U I	90	4083.24	Sm II
100	4071.93	W I	120	4077.81	Hg I	500	4083.34	Pr II
40	4072.07	Nb II	420	4077.88	Er I	180	4083.35	Hf I
140	4072.38	Er I	7400	4077.96	Dy II	50	4083.36	Re I
190	4072.50	Pr II	45	4078.24	Eu I	70	4083.47	Th I
100	4072.61	Dy II	240	4078.31	Zr I	110	4083.48	Ce II
130	d 4072.69	Tb I	530	4078.32	Ce II	50	4083.58	Re I
2000	4072.70	Zr I	50	4078.35	Nb I	280	4083.58	Sm II
270	4072.92	Ce II	1300	4078.44	Gd II	1100	4083.63	Mn I
200	4073.00	Ru I	95	4078.47	Tb II	110	4083.64	Ce II
40	4073.00	Ta I	840	4078.47	Ti I	230	4083.67	Ho I
2500	4073.12	Dy II	270	4078.52	Ce II	520	4083.70	Gd I
270	4073.13	Ho I	160	4078.57	Sc I	2000	4083.71	Y I
80	4073.15	W I	40	4078.60	Nb I	40	4083.78	Nb I
650	4073.20	Gd II	2800	4078.70	Gd I	85	4084.18	Nb I
1800	4073.48	Ce II	55	4078.79	Tb I	110	4084.27	Tb I
290	4073.51	Ho I	85	4079.02	Ce II	19	4084.28	Rh I
85	4073.51	Nb I	120	4079.18	La I	160	4084.30	Zr I
	4073.64	Nb I	65	4079.19	Ta I	940	4084.38	Mo I
210	4073.74	Ce II	730	4079.24	Mn I	220	4084.40	Sm II
110	4073.75	Tb II	75	4079.26	Dy I	65	4084.68	Gd II
300	4073.76	Gd II	730	4079.42	Mn I	100	c 4084.71	Pr II
75	4073.94	Tb I	140	4079.67	Ce II	110	4084.82	Tb I
120	4073.98	Dy II	40	4079.72	Ti I	270	4084.86	Nb I
140	4074.00	Er II	12000	4079.73	Nb I	190	h 4084.93	U II
130	4074.16	Tb I	500	c 4079.77	Pr II	700	4085.04	Th II
5000	4074.36	W I	100	4079.83	Sm I	140	4085.09	Ho I
140	4074.42	Nd II	120	c 4080.23	Ho II	100	4085.11	Pr II
300	4074.49	U II	470	4080.23	Nd II	190	4085.13	Dy I
28	4074.65	Ce II	270	4080.44	Ce II	450	4085.23	Ce II
230	4074.68	Os I	190	4080.53	Gd I	55	4085.26	Pr II
90	4074.83	Pr II	240	4080.56	Sm II	370	4085.34	Dy I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
120	4085.38	Eu II	650	4090.41	Gd I	100	4095.69	W I
310	4085.43	Ru I	130	4090.47	Ce II	220	4095.75	U II
85	4085.43	Th I	160	4090.51	Zr II	80	4095.89	Pr II
1500	4085.56	Gd II	1100	4090.58	V I	120	4095.91	Tb I
160	4085.66	Zr I	80	4090.72	Pr II	390	4096.10	Dy I
40	4085.80	Ta I	160	4090.79	Zr I	75	bl 4096.13	Lu LuO
240	4085.82	Nd II	130	4090.95	Ce II	270	4096.13	Nd II
150	4086.02	Mo I	85	4091.00	Nd II	80	4096.32	Pr II
45	4086.16	Sm II	110	4091.06	Ru I	220	4096.35	U I
55	4086.20	Pr II	40	4091.26	Ta I	100	4096.62	Dy I
280	4086.31	Co I	65	d 4091.30	Tb I	65	4096.63	Zr II
85	4086.42	Ce II		4091.42	Tb I	100	4096.71	Nd II
700	4086.52	Th II	50	4091.35	Th II	75	4096.80	Eu II
210	4086.60	Tb I	80	4091.49	Tm II	180	4096.81	Mo I
85	4086.63	Nb I	190	4091.52	Dy II	560	4096.82	Pr II
200	4086.67	Sc I	220	4091.52	U II	110	4097.03	Ru I
5500	4086.72	La II	140	4091.64	Ho I	40	4097.19	Ta I
65	4086.72	Pr II	110	4091.64	U I	55	4097.32	Th I
70	4086.82	Nd II	45	4091.75	Gd I	95	4097.36	Tb II
40	4087.05	Nb I	120	4091.76	Dy II	110	4097.48	Tb II
400	4087.16	Sc I	75	4091.78	Er I	140	4097.52	Rh I
190	4087.20	Dy II	490	4091.82	Os I	40	h 4097.64	Nb I
200	c 4087.21	Pr II	50	4091.94	V I	45	4097.66	W I
50	4087.28	Th I	50	4092.09	Ce II	110	4097.75	Th I
290	4087.34	Pd I	210	4092.19	Tb I	930	4097.79	Ru I
170	4087.35	Ho I	1000	4092.27	Sm II	460	4098.03	U II
250	4087.36	Ce II	830	4092.39	Co I	1100	4098.10	Er I
85	4087.38	Dy I	180	4092.41	V I	55	4098.10	Os I
70	4087.57	Ce II	100	4092.61	Ir I	35	4098.14	Ce I
200	4087.59	Ho I	80	h 4092.61	Pr II	50	4098.18	Mo I
3500	4087.63	Er I	1800	4092.69	V I	220	4098.18	Nd II
260	4087.69	Gd II	1100	4092.71	Gd I	50	4098.22	Nb I
75	4087.69	Zr I	100	4092.72	Ce II	55	h 4098.35	Sc I
45	4087.70	Tb II	40	4092.84	Pr II	380	4098.40	Pr II
45	4087.79	Rh I	210	4092.90	Er I	2600	4098.61	Gd II
35	4087.96	Hf I	50	4093.04	Sm II	55	4098.62	Tb II
270	4088.25	U II	40	h 4093.13	Sc I	55	4098.65	Pr II
130	4088.33	W I	540	4093.16	Hf II	150	4098.74	Mo I
65	4088.44	Os I	55	4093.16	Zr I	520	4098.90	Gd II
60	4088.50	Rh I	50	4093.29	Ce I	100	4098.91	Nd II
85	4088.56	Nd II	85	4093.39	Th II	170	4098.93	Th II
40	4088.58	Ce II	120	4093.50	V I	120	4098.97	Sm II
70	4088.73	Th I	85	4093.64	Dy I	85	4098.98	Ce II
45	4088.77	W I	260	4093.72	Gd I	35	4099.02	W I
230	4088.85	Ce II	150	4093.96	Ce II	170	4099.07	Nb I
40	4088.88	Pr II	130	4094.03	Tb I	45	4099.15	Tb
40	4089.08	Pr II	290	4094.05	Sm II	85	4099.17	Ti I
70	4089.12	Nd II	10000	4094.19	Tm I	110	4099.31	Zr I
55	4089.14	Th I	120	4094.27	Zr I	75	d 4099.48	Tb II
120	4089.34	Tb I	65	4094.28	V I	280	4099.54	La II
55	4089.46	Pr II	260	4094.37	Tb II	40	4099.75	Ce II
29	4089.48	Sm II	260	4094.48	Gd II	2800	4099.80	V I
85	4089.50	Dy I	260	4094.49	Tb I	100	4099.88	Dy I
55	4089.51	Tb II	140	4094.62	Nd II	60	4099.96	Sm I
180	4089.61	La I	80	4094.62	U II	230	4100.22	Ho I
120	4089.68	Nd II	140	4094.64	Er II	160	4100.22	Pr II
440	4089.68	Yb I	700	4094.75	Th II	190	4100.24	Nd II
70	4089.74	Ce II	120	4094.78	Ho I	650	4100.26	Gd I
70	4089.86	Ce II	65	4094.85	Sc I	120	4100.30	Os I
55	4089.88	Pr II	80	4094.89	U II	65	4100.33	Sc I
40	4089.92	Re I	90	c 4094.96	Pr II	150	4100.34	Th I
65	4089.94	Mn I	85	4095.43	Nd II	75	4100.37	Ru I
2200	4090.14	U II	890	4095.49	V I	440	4100.40	Nb I
140	4090.16	Nb I	19	h 4095.55	Ta II	350	4100.56	Er II
80	4090.29	Tm II	50	4095.56	Nb I	2900	c 4100.72	Pr II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
140	4100.82	Th II	60	4106.58	Er II	550	4110.54	Co I
130	d 4100.90	Tb I	140	4106.58	Hf I	55	4110.57	W I
6700	4100.92	Nb I	200	4106.59	Nd II	150	4110.60	Gd II
90	4101.09	Ho I	90	4106.62	Sm II	80	4110.81	Y I
85	4101.45	Nd II	35	4106.78	Nb I	85	4110.83	Th I
130	4101.65	Tb I	70	4106.85	Ce II	70	4110.84	Ce II
350	4101.74	Ru I	60	4106.88	Eu I	55	4110.86	Tb I
17000	4101.76	In I	55	4106.92	Ce II	240	c 4110.89	Re I
450	4101.77	Ce II	200	4106.93	U II	200	4110.90	Mn I
45	4101.84	W I	28	4107.11	Pr II	45	4110.91	Pr II
200	4101.91	U I	810	4107.28	Sm II	1500	4111.34	Dy II
75	4101.93	Dy II		4107.39	Sm II	250	4111.39	Ce II
250	4102.15	Mo I	100	4107.36	Ho I	390	4111.44	Gd II
590	4102.16	V I	55	4107.37	Th II	130	4111.74	Gd II
75	4102.28	Ru I	510	4107.42	Ce II	8900	4111.78	V I
70	4102.36	Ce II	35	h 4107.44	Lu I	100	4111.82	W I
9900	4102.38	Y I	120	4107.44	Nd II	150	c 4111.86	Pr II
85	4102.53	Nd II	730	4107.47	Mo I	35	4111.93	Ce II
85	4102.53	Tb II	40	4107.49	Fe I	300	4112.00	Ho I
55	4102.62	Th I	45	4107.49	Rh I	1200	4112.02	Os I
1000	4102.70	W I	65	4107.49	V I	90	h 4112.04	Eu II
190	4103.12	U I	160	4107.50	Zr I	140	4112.13	Nb I
75	4103.21	Tb I	35	4107.52	Pr II	120	4112.33	V I
3900	4103.30	Dy II	90	4107.70	Pr II	300	4112.50	Tb I
170	4103.36	Tb I	55	4107.79	Tb I	140	4112.62	Er II
85	4103.46	Tb I	50	4107.80	Ce II	95	h 4112.67	Lu I
55	4103.62	Os I	60	4107.80	Sm II	220	4112.71	Ti I
8900	4103.84	Ho I	130	4107.84	Ru I	100	4112.72	Ho I
860	4103.87	Dy I	55	4107.86	Th I	28	h 4112.72	Pr II
260	4103.90	Tb II	70	4107.93	Tm I	1900	4112.74	Ru I
60	4103.98	Er II	120	4107.96	Nd II	240	4112.75	Th I
240	4104.13	Sm II	120	4108.22	V I	130	4112.88	Tb I
110	4104.23	Hf I	25	4108.26	Ce II	65	4112.94	Gd I
150	4104.23	Nd II	130	4108.32	Sm II	120	4113.05	Dy I
140	4104.38	Th II	65	4108.33	Pr II	110	4113.11	U II
230	4104.40	V I	70	4108.36	U I	50	4113.35	Nb I
140	4104.42	Re I	75	4108.40	Gd II	160	4113.38	Ru I
50	4104.43	Ce II	200	4108.40	Zr I	50	4113.40	Re I
50	4104.54	Nd II	840	4108.42	Th II	230	4113.52	V I
30	4104.75	Co I	55	4108.53	W I	110	4113.53	Hf II
260	4104.78	V I	2900	4108.62	Ho I	100	4113.73	Ce II
35	4104.85	Pr II	1400	4109.08	Nd II	45	4113.77	Gd II
40	4104.87	Cr I	35	4109.09	Pr II	300	h 4113.83	Nd II
110	4104.87	La I	55	4109.32	Th I	270	c 4113.89	Pr II
95	4104.99	Gd I	130	4109.33	Er I	410	4113.90	Sm II
250	4105.00	Ce II	35	4109.37	Pr II	170	4113.94	Nb I
120	4105.02	Ta I	410	4109.40	Sm II	35	4114.13	Ru I
200	4105.04	Dy II	2500	4109.46	Nd II	55	h 4114.13	Tb II
120	4105.04	Ho I	40	4109.56	Ce II	50	4114.15	Ce II
150	4105.08	Mo I	40	4109.58	Cr I	65	4114.53	V I
2800	4105.17	V I	27	4109.65	Ru I	19	4114.77	Ta I
270	4105.34	Th II	150	4109.75	W I	55	4114.82	Pr II
55	4105.36	Mn I	2300	4109.79	V I	85	4114.93	Mo I
650	4105.37	Tb I	50	4109.80	La I	4300	4115.18	V I
50	4105.53	Mo I	30	4109.81	Fe I	55	d 4115.36	Tb II
110	4105.71	Pr II	40	4109.88	Nb I	420	4115.37	Ce II
9500	4105.84	Tm I	55	4110.09	Tb I	75	4115.38	Gd II
70	4105.91	Th II	28	h 4110.11	Pr II	55	4115.58	W I
70	4106.13	Ce II	280	4110.19	Sm II	280	4115.76	Th I
75	4106.18	Nb I	200	4110.38	Ce II	140	4115.78	Ir I
380	4106.28	U I	45	4110.43	Gd II	45	4115.82	Pr II
45	4106.35	Tb I	55	4110.46	Pr II	35	4115.90	Hf I
75	4106.38	Dy II	510	4110.48	Nd II	810	4116.10	U II
60	h 4106.39	Y I	110	d 4110.51	Th II	70	4116.33	Rh I
270	4106.50	Ho I		4110.64	Th II	70	4116.34	Nd II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
320	4116.36	Er I	190	4121.64	Re I	980	4127.37	Ce II
190	4116.46	Sm II	1100	4121.68	Rh I	200	4127.41	Th I
1800	4116.47	V I	40	4121.82	Cr I	120	4127.44	Ru I
1100	4116.71	Th II	140	4121.86	Bi I	85	4127.45	Nb I
270	4116.73	Ho I	85	4121.94	Nd II	130	4127.54	Ti I
35	4116.77	Nd II	55	4122.01	W I	20	4127.61	Fe I
55	4116.88	U I	35	4122.16	Cr I	40	4127.64	Cr I
310	4116.90	Nb I	85	4122.17	Ti I	45	4127.72	Gd II
250	4117.01	Ce II	110	4122.47	Tb I	250	4127.74	Ce II
110	4117.23	Tb I	310	4122.49	Lu I	150	4127.80	Hf II
200	4117.29	Ce II	280	4122.51	Sm II	120	4127.87	Ru I
200	4117.59	Ce II	55	4122.70	Th II	85	4127.88	Ta I
50	4117.68	La I	120	4122.81	Nb I	23	4127.92	Ir I
150	4118.05	W I	55	4123.05	W I	75	4127.96	Zr I
19	4118.07	Ta I	160	4123.06	Ru I	200	4128.07	Ce II
770	4118.14	Ce II	140	4123.08	Er II	3100	4128.07	V I
180	4118.18	V I	55	4123.17	Ta I	29	4128.12	Sm II
100	4118.19	W I	180	4123.19	V I	390	4128.24	Dy II
55	4118.36	Tb I	4400	4123.23	La II	150	4128.28	Mo I
1700	c 4118.46	Pr II	510	4123.24	Ce II	8900	4128.31	Y I
50	4118.49	Th I	40	4123.31	Ti I	410	4128.34	U II
65	4118.50	Ru I	40	4123.39	Cr I	180	4128.36	Ce II
320	4118.55	Er I	510	4123.49	Ce II	85	4128.70	Nd II
80	4118.55	Fe I	110	4123.53	Th II	75	4128.83	Mo I
1900	4118.55	Sm II	85	4123.57	Ti I	120	4128.86	V I
110	4118.60	Hf I	2000	4123.57	V I	1500	4128.87	Rh I
180	4118.64	V I	140	4123.65	Mo I	180	4128.96	Os I
110	4118.69	Pt I	5300	4123.81	Nb I	350	4129.12	Dy I
2800	4118.77	Co I	65	4123.81	Ru I	250	4129.15	Pr II
70	4118.91	Hf I	980	4123.87	Ce II	40	4129.17	Ti I
90	4118.94	Ho I	410	4123.88	Nd II	85	4129.18	Ce II
95	4118.96	Mo I	710	4123.96	Sm II	280	4129.23	Sm II
250	4119.02	Ce II	90	4124.03	Pr II	210	4129.38	Ta I
65	4119.21	Gd I	120	4124.07	V I	990	4129.42	Dy II
120	h 4119.25	Yb II	90	4124.32	Pr II	670	4129.43	Nb I
85	4119.28	Nb II	140	4124.54	Mo I	33000	cw 4129.70	Eu II
45	4119.30	Eu II	180	4124.60	Os I	50	4129.87	Nd II
200	4119.31	Dy II	490	4124.63	Dy II	770	4129.93	Nb I
45	4119.33	Pr II	3100	4124.73	Lu I	140	4130.14	Tb I
65	4119.38	Gd II	410	4124.73	U II	55	4130.33	Th I
230	4119.46	V I	140	4124.76	Er I	350	4130.35	Dy I
150	4119.57	Sm II	510	4124.79	Ce II	2200	4130.37	Gd II
120	4119.68	Rh I	320	4124.92	Y II	1500	h 4130.66	Ba II
310	4119.79	Ce II	90	4125.03	Pr II	530	4130.71	Ce II
110	4119.83	Zr I	50	4125.05	Nd II	50	4130.72	Nd II
90	4119.85	Pr II	100	4125.16	W I	340	4130.77	Pr II
310	4119.88	Ce II	60	4125.23	Sm I	110	4131.00	Th I
260	4119.92	Tb I	75	4125.25	Nb I	120	4131.02	Dy II
630	4120.10	Mo I	50	4125.58	Nb I	480	4131.10	Ce II
35	h 4120.11	Pr I	1300	4125.65	Ho I	55	4131.11	Tb I
1500	4120.20	Ho I	50	4125.78	Ce II	150	4131.12	Mn I
110	4120.51	Tb II	55	4125.78	Gd I	40	4131.25	Ti I
180	4120.54	V I	90	4125.85	Sm II	40	4131.36	Cr I
40	4120.61	Cr I	150	4126.08	Dy I	110	4131.42	Th II
85	4120.66	Nd II	55	h 4126.14	Pr II	140	4131.45	Tb I
450	4120.83	Ce II	140	4126.52	Cr I	270	4131.48	Gd II
100	4120.85	W I	50	4126.53	Mo I	600	4131.50	Er I
28	4120.92	Pr II	55	4126.66	Ce II	85	4131.53	Nb I
160	4120.99	Ru I	85	4126.71	Tb I	150	c 4131.79	Lu I
85	4121.03	Tb I	150	4126.80	W I	28	4131.86	Ce II
4400	4121.32	Co I	50	4126.90	Nb I	180	4131.92	Mo I
410	4121.36	Sm II	4300	4127.16	Ho I	140	4132.02	U I
400	4121.46	Zr I	75	4127.28	Eu I	3100	4132.02	V I
140	4121.53	Bi I	140	4127.29	Tb I	320	4132.06	Fe I
120	4121.54	Sm II	35	4127.30	Cr I	170	c 4132.20	Pr II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
55	4132.20	W I	140	4136.81	U II	7500	4142.85	Y I
75	4132.23	Mo I	85	4136.90	Ce II	550	4142.91	Er II
45	4132.23	Tb	40	4137.03	Tb	85	4143.05	Ti I
1100	4132.28	Gd II	110	4137.04	La I	1200	4143.10	Dy II
50	4132.28	Re I	40	4137.07	Eu I	2700	4143.11	Pr II
100	4132.31	Ce II	410	4137.10	Gd II	350	4143.21	Nb I
60	4132.43	Ba I	2300	4137.10	Nb I	55	4143.24	Tb I
140	4132.48	Tb I	35	4137.15	Pr II	80	4143.42	Fe I
85	4132.56	Nd II	100	4137.23	Ru I	280	4143.51	Tb I
55	4132.64	Ce II	140	4137.29	Ti I	2900	4143.55	Mo I
120	4132.69	Tm II	540	4137.46	W I	140	4143.63	Tb I
340	4132.75	Th II	270	4137.47	Ce II	400	4143.87	Fe I
75	4132.83	Dy II	75	4137.59	Nb I	2000	4144.16	Ru I
85	4132.83	Tb I	50	4137.60	Re I	28	4144.21	Pr II
440	h 4133.00	Sc I	2000	4137.65	Ce II	45	4144.25	Gd I
100	4133.19	Sm II	150	4137.84	Os I	700	4144.36	Re I
140	4133.20	U II	150	4138.02	W I	1100	4144.41	Tb II
170	4133.35	Dy II	45	4138.03	Gd I	390	4144.49	Ce II
470	4133.36	Nd II	270	4138.10	Ce II	170	4144.56	Nd II
240	cw 4133.42	Re I	35	4138.20	Pr II	150	4144.70	U II
140	h 4133.46	Th ThO	50	4138.30	Nb I	670	4145.00	Ce II
100	4133.48	W I	90	4138.30	W I	140	4145.16	W I
200	4133.50	U I	1100	4138.33	Tm I	75	4145.24	Sm I
55	4133.51	Tb I	210	4138.35	Ce II	55	4145.39	U II
200	4133.61	Pr II	150	4138.54	Dy I	650	4145.74	Ru I
2700	4133.80	Ce II	95	4138.66	U II	140	4145.76	Hf I
390	4133.85	Dy I	50	4138.97	Sm II	55	4145.84	Th I
200	4134.06	Th I	55	4139.06	Tb I	110	4145.95	W I
	4134.11	Th II	190	4139.14	U II	50	4146.00	Nb I
250	4134.15	Dy I	70	h 4139.19	Th ThO	990	4146.06	Dy I
750	4134.16	Gd I	65	4139.26	V I	140	4146.13	Nd II
75	4134.31	Zr I	55	4139.32	W I	480	4146.23	Ce II
55	d 4134.32	Tb I	130	4139.34	Ho I	270	c 4146.50	Pr II
2300	4134.49	V I	55	4139.43	Ce II	55	4146.61	U I
300	4134.54	Ho I	440	4139.44	Nb I	160	4146.75	Sm II
170	4134.59	Nb I	120	4139.56	Dy I	260	4146.77	Ru I
40	4134.68	Fe I	2700	4139.71	Nb I	110	4146.96	Tb I
100	4134.71	Dy I	140	4139.78	Tb I	28	4147.12	Pr II
85	4134.72	Nd II	40	4140.01	Zr I	160	4147.19	Nb I
120	4135.04	Mn I	220	4140.24	Th II	65	4147.37	Zr I
90	4135.08	Ho I	28	h 4140.28	Pr II	65	h 4147.40	Sc I
70	4135.09	Yb II	530	h 4140.30	Sc I	45	4147.51	Pr II
250	4135.14	Sm II	120	4140.45	Gd II	55	4147.53	Mn I
2100	4135.27	Rh I	55	4140.75	Ce II	20	4147.67	Fe I
510	4135.33	Nd II	30	4141.02	Eu II	320	4147.71	Sm II
130	4135.37	Tb I	45	4141.02	Gd II	230	4147.89	Ta I
40	4135.38	Mo I	80	4141.06	Mn I	75	4147.97	Dy I
75	4135.42	Nb I	1500	c 4141.22	Pr II	85	4148.16	Ce II
270	4135.44	Ce II	460	4141.23	U II	220	4148.18	Th II
45	4135.50	Sm I	470	4141.50	Dy II	45	4148.21	Tb II
160	4135.68	Zr I	140	4141.55	Tb I	85	4148.38	Ru I
95	4135.76	U II	150	4141.63	Th II	270	4148.44	Pr II
2500	4135.78	Os I	60	4141.72	Eu II	50	4148.72	Th I
55	4135.89	Ce II	550	4141.74	La II	85	4148.74	Nb I
65	4136.11	V I	70	4141.86	U I	80	4148.80	Mn I
230	4136.20	Ta I	65	4141.95	Pr II	280	4148.86	Gd I
1500	4136.22	Ho I	230	4142.19	Ho I	280	4148.90	Ce II
140	d 4136.29	Th I	50	4142.24	Nb I	230	4148.94	Mo I
	4136.39	Th II	110	4142.25	W I	290	4148.97	Ho I
55	4136.35	W I	770	4142.40	Ce II	470	4149.07	Yb I
1800	4136.45	Re I	55	4142.43	Tb I	120	4149.14	Tm I
40	4136.47	Tb I	170	4142.48	Th II	110	4149.17	Tb II
30	4136.59	Eu II	75	4142.67	Sm II	1200	4149.20	Zr II
100	4136.76	Nd II	250	4142.70	Th II	40	4149.29	Pr II
55	4136.77	Ce II	150	4142.83	Ce II	55	4149.44	W I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	
55	4149.48	Gd I	70	4155.47	Th	120	cw	4161.35	Tb I
420	4149.79	Ce II	180	4155.53	Ce II	85		4161.42	Cr I
810	4149.83	Sm II	180	4155.58	Mo I	55	d	4161.59	Th II
980	4149.94	Ce II	27	4155.70	Ir I			4161.74	Th I
140	4149.96	Re I	3000	4156.08	Nd II	130		4161.66	Ru I
450	4149.99	Th II	130	4156.24	Th II	200		4161.80	Sr II
80	4150.04	Pr II	290	4156.24	Zr II	90	hd	4161.88	Sc I
55	4150.10	Tm I	130	4156.25	Sm II	45	h	4162.17	Co I
870	4150.12	Nb I	510	4156.26	Nd II	75		4162.25	Dy I
55	4150.30	Ru I	85	4156.28	Tb I	150		4162.36	Hf II
55	4150.54	Tb	200	4156.50	Pr II	240		4162.43	U I
45	4150.61	Gd II	340	4156.51	Th II	55		4162.51	Th I
45	4150.67	V I	380	4156.66	U I	150		4162.63	Ce II
55	4150.87	Tb I	35	4156.68	Nb II	180		4162.68	Mo I
420	4150.91	Ce II	40	4156.79	Mo I	140		4162.68	Th II
40	4150.94	Pr II	40	4156.80	Fe I	110		4162.69	Hf I
170	4150.96	Ti I	35	4156.82	Pr II	540		4162.73	Gd II
160	4150.97	Zr II	28	4157.27	Th I	50		4162.81	Nb I
6900	4151.11	Er I	28	4157.39	Th I	8100		4163.03	Ho I
30	4151.52	Eu II	200	4157.40	Mo I	280		4163.09	Gd II
40	4151.63	Gd II	40	4157.52	La I	160		4163.14	Sm II
45	4151.64	Eu II	70	4157.58	Nd II	870		4163.47	Nb I
170	4151.68	Nd II	100	h	4157.63	Y I	310	4163.52	Ce II
28	4151.74	Pr II	30	4157.72	Eu I	140		4163.62	Cr I
75	4151.88	Mo I	55	4157.73	Pr II	170		4163.64	Th II
1400	4151.97	Ce II	190	4157.78	Gd I	70		4163.65	Ti II
1100	4151.97	La II	170	4158.01	Nb I	4400		4163.66	Nb I
120	4152.04	Nb I	55	4158.28	Tb II	350		4163.68	U II
55	d	4152.20	28	4158.42	Co I	100		4163.72	Sm II
		4152.34	40	4158.48	Gd I	40		4164.08	Mo I
1200		4152.21	350	4158.53	Tb I	35		4164.14	Ti I
85		4152.24	110	4158.54	Th I	1700	c	4164.16	Pr II
70		4152.29	120	4158.60	Tm I	110		4164.25	Th II
720		4152.36	65	4158.78	Os I	60		4164.41	Nd II
150	h	4152.48	80	4158.88	Hf II	80		4164.56	Pt I
4400		4152.58	24	4158.98	Lu I	4000		4164.66	Nb I
980	cw	4152.61	450	4159.03	Ce II	70		4164.79	U II
50		4152.63	35	4159.17	Ru I	190		4164.83	Er I
200		4152.64	120	4159.31	Dy I	60		4164.85	Nd II
45		4152.66	100	4159.40	Sm II	150		4165.04	Nd II
30		4152.78	40	4159.46	Pr II	55		4165.07	Th II
220		4152.78	100	4159.51	Sm II	1100	h	4165.19	Sc I
55		4152.93	70	4159.54	Tm II	70		4165.52	Cr I
100		4153.12	140	4159.57	Nd II	45		4165.54	Sm II
230		4153.13	85	4159.64	Ti I	1300		4165.61	Ce II
530		4153.33	85	4159.66	Th II	270		4165.68	U II
110		4153.51	150	4159.69	V I	140		4165.77	Th I
100		4153.73	28	4159.73	Pr II	85		4165.85	Nb I
75		4153.75	90	4159.92	Re I	200		4166.00	Ba II
120		4153.82	65	4159.96	Os I	15		4166.04	Ir I
50		4153.93	55	4160.03	W I	55		4166.20	Ce II
880		4153.97	70	4160.11	Ce II	40		4166.28	Mo I
90		4154.01	70	4160.18	Ce II	40		4166.32	Ti I
460		4154.08	75	4160.25	Dy I	50		4166.34	Sm II
75		4154.24	100	4160.26	La I	400		4166.36	Zr I
240		4154.37	60	4160.31	Er I	55		4166.51	Tb
40		4154.50	45	4160.34	W I	70		4166.64	U I
160		4154.66	45	4160.47	Pr II	150		4166.65	Ce II
55	h	4154.72	340	4160.57	Nd II	620		4166.88	Ce II
190		4154.86	50	4160.80	Nb I	110		4166.88	Ru I
560		4155.22	70	4160.95	U I	280		4167.16	Gd II
85		4155.28	75	h	4161.00	Ta I		4167.27	Gd I
250		4155.28	110	4161.18	Ce II	870		4167.51	Ru I
110		4155.30	400	4161.21	Zr II	2400		4167.52	Y I
270		4155.41	75	4161.25	Nb I	250		4167.80	Ce II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
5700	4167.97	Dy I	110	4172.80	Eu II	85	4179.76	Nb I
410	4168.00	Nd II	240	4172.82	Tb I	65	4179.79	Tb II
130	4168.03	Pb I	140	4172.97	U II	75	4179.81	Zr II
270	4168.04	Pr II	2500	4173.23	Ho I	150	4179.96	Th II
55	h 4168.05	Th I	1200	4173.23	Os I	55	4180.23	W I
3500	4168.13	Nb I	100	4173.38	Nd II	40	4180.38	Pr II
170	4168.63	Th II	260	4173.47	Tb I	180	4180.40	Tb I
90	4168.65	W I	120	4173.56	Gd II	65	4180.65	Pr II
70	4168.76	Nd II	40	4173.72	Pr II	340	4180.81	Yb II
160	4169.06	U I	120	4173.95	Nb I	55	4180.88	Th I
240	4169.09	Tb I	100	4174.01	V I	85	4181.05	Mo I
75	4169.25	Dy II	2000	4174.14	Y I	340	4181.08	Ce II
240	4169.32	Tb I	220	4174.19	U II	530	4181.10	Sm II
85	4169.35	Ti I	1100	4174.34	Hf I	130	4181.15	Ta I
75	4169.36	Zr I	85	4174.34	Nb I	50	4181.27	Dy I
230	4169.45	Pr II	190	4174.43	Sm II	85	4181.33	Tb II
810	4169.48	Sm II	60	4174.46	Nd II	85	4181.34	Nb I
170	4169.57	Nb I	110	4174.48	Ce II	80	4181.76	Fe I
320	4169.77	Ce II	120	4174.56	Yb I	110	4182.16	Th II
85	4169.82	Mo I	170	4174.80	Cr I	110	4182.22	Eu I
40	4169.84	Cr I	65	4175.05	Tb I	40	4182.30	Pr II
90	4169.84	Pd I	30	4175.16	Eu II	110	4182.46	Ru I
320	4169.88	Ce II	210	4175.21	Ta I	35	4182.47	Ir I
120	4169.91	Tb I	70	4175.24	Ce II	85	4182.52	Nd II
110	4170.05	Ru I	250	4175.32	Pr II	40	4182.58	Pr II
130	4170.11	Gd II	55	4175.43	Ru I	150	4182.59	V I
35	4170.20	Cr I	2400	4175.54	Gd I	65	4182.64	Ru I
160	4170.40	Re I	810	4175.61	Nd II	95	4182.77	Gd I
70	4170.45	Tm I	250	4175.62	Pr II	55	4182.90	Pr II
100	4170.46	Nd II	620	4175.63	Os I	220	4182.90	Re I
220	4170.47	Th II	35	4175.64	Fe I	220	4183.06	Re I
	4170.53	Th I	85	4175.85	Tb I	70	4183.13	Nd I
85	4170.48	Tb I	30	4175.94	Cr I	15	h 4183.21	Ir I
160	4170.53	W I	130	4176.08	Ce II	35	4183.30	Ti I
75	4170.56	Dy I	100	4176.32	Pr II	200	4183.32	Zr I
100	4170.76	Nd II	50	d 4176.33	Th II	210	4183.33	Sm I
55	4170.78	Th II		4176.48	Th I	55	4183.56	Th II
120	4171.03	Ti I	140	d 4176.60	Dy I	250	4183.60	Dy I
240	4171.05	Tb I		4176.78	Dy I	55	4183.66	W I
85	4171.07	Mo I	150	4176.60	Mn I	930	4183.72	Dy I
450	4171.17	W I	340	4176.70	Ce II	530	4183.76	Sm II
65	4171.30	V I	75	4176.90	Ta II	90	4183.82	W I
110	4171.34	Th II		4176.99	Ta I	120	4184.13	Os I
55	4171.39	Ce II	150	4177.26	Mo I	2400	4184.25	Gd II
120	4171.48	Zr I	2400	4177.32	Nd II	1600	4184.25	Lu II
130	4171.54	Er I	50	4177.44	Nb I	110	4184.26	Pr II
65	h 4171.56	Sc I	70	4177.48	La I	180	4184.29	Tb I
410	4171.57	Sm II	8000	4177.54	Y II	40	4184.39	Mo I
1400	4171.59	U II	100	4177.92	Ta I	310	4184.44	Nb I
120	4171.71	Gd I	440	4178.02	Sm II	40	4184.60	Pr II
150	4171.80	Tb I		4178.02	Sm II	50	4184.71	Th II
620	4171.82	Pr II	620	4178.06	Th II	80	h 4184.89	U II
40	4171.90	Ti II	200	4178.27	Mo I	35	4184.90	Cr I
370	4171.93	Dy I	170	d 4178.44	Nd II	30	4184.90	Fe I
	4172.00	Dy I		4178.53	Nd II	250	4184.98	Nd II
20000	4172.06	Ga I	200	4178.63	Pr II	140	4185.12	Pr II
110	4172.16	Ce II	200	4178.64	Nd II	340	4185.33	Ce II
140	4172.22	Er I	150	d 4178.98	Tb II	140	4185.48	Er I
160	4172.23	Ho I	140	4179.00	U II	18	4185.66	Ir I
730	4172.25	Pr II	170	4179.26	Cr I	85	4185.77	Nd II
50	4172.32	La I	70	4179.29	Ce II	480	4185.82	Mo I
90	4172.56	Ir I	5200	4179.39	Pr II	45	4185.88	Pr II
180	4172.57	Os I	230	4179.42	V I	65	4185.91	Tb I
240	4172.60	Tb I	640	4179.59	Nd II	45	4186.00	W I
40	4172.77	Cr I	250	4179.71	Th II	140	4186.04	Nd II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
75	4186.10	Nb I	2200	4191.64	Dy I	50	4197.61	Nb I
360	4186.12	Ti I	120	4191.79	Zr I	180	4197.67	Ce II
240	4186.21	Tb I	55	4191.83	Th II	450	4197.68	Gd II
50	4186.28	Mo I	410	4191.93	Sm II	45	4197.90	Sm II
30	4186.36	Cr I	55	4191.94	U I	280	4198.00	Ce II
55	4186.38	Pr II	870	4192.07	Nb I	800	4198.02	Dy I
45	h 4186.45	Sc I	35	4192.10	Cr I	100	4198.08	Ho I
3500	4186.60	Ce II	40	4192.10	Zr I	85	4198.17	Nd II
100	4186.69	Zr II	160	4192.16	Sm II	140	4198.22	U I
12000	4186.82	Dy I	280	4192.36	La II	110	4198.31	Fe I
190	4186.96	U I	28	4192.36	Th I	180	4198.43	Ce II
130	4187.04	Fe I	40	4192.43	Pt I	85	4198.43	Tb I
70	4187.11	Nd	45	c 4192.47	Pr II	310	4198.51	Nb I
300	4187.16	Tb I	130	4193.02	Th I	85	4198.52	Cr I
28	4187.25	Co I	560	4193.09	Ce II	65	4198.61	V I
530	4187.32	Ce II	55	4193.10	Ta I	280	4198.67	Ce II
280	4187.32	La I	75	4193.15	Gd II	840	4198.72	Ce II
660	4187.56	Zr I	370	4193.28	Ce II	75	4198.85	Nb I
65	h 4187.62	Sc I	55	4193.35	Tb I	550	4198.88	Ru I
8800	4187.62	Tm I	85	4193.66	Cr I	65	4198.98	Tb I
80	4187.66	Hf II	60	4193.83	Nb I	55	4199.02	Th II
65	4187.76	Pr II	370	4193.87	Ce II	65	4199.05	Tb I
130	4187.80	Fe I	75	4194.01	Tb I	610	4199.09	Zr I
190	4188.07	U II	40	4194.01	Zr I	130	4199.10	Fe I
85	4188.10	Gd II	540	4194.35	Ho I	120	4199.11	Nd II
180	4188.11	Tb I	250	4194.56	Mo I	120	4199.28	Y II
1000	4188.13	Sm II	55	4194.57	Pr II	270	4199.45	Sm II
70	4188.26	Nd II	90	4194.67	Re I	45	4199.62	W I
2500	4188.32	Mo I	140	4194.72	Er I	7600	4199.90	Ru I
75	4188.51	Tb II	400	4194.76	Zr I	520	4199.92	Tm II
40	4188.69	Ti I	6800	4194.84	Dy I	55	4200.02	W I
45	4188.82	Gd I	180	4194.91	Ce II	70	4200.04	Nd II
50	4189.18	Ce II	50	4194.94	Th I	55	4200.10	U II
300	4189.28	U II	70	4194.95	Cr I	50	4200.19	V I
35	4189.46	Ru I	35	4195.03	Nd II	50	4200.57	Mo I
2500	4189.48	Pr II	870	4195.09	Nb I	70	4200.75	Ti I
50	4189.56	Th I	55	4195.14	Os I	35	4200.99	Nb I
55	4189.64	Ce II	320	4195.19	Dy II	450	4201.00	Tb II
180	4189.84	V I	40	4195.36	Eu II	95	4201.13	U I
320	4189.91	Os I	55	c 4195.49	Pr II	290	4201.17	Pr II
280	4189.98	Er II	70	4195.56	Th II	26	4201.22	Sm II
120	4189.99	Mn I	1300	4195.66	Nb I	240	4201.24	Ce II
60	4189.99	Nb I	70	4195.82	Ce II	680	4201.30	Dy I
95	4190.00	Mo I	85	4195.83	Th II	100	4201.32	Ce II
35	4190.13	Cr I		4195.95	Th II	50	4201.32	Mo I
65	4190.20	Gd I	55	4195.96	Pr II	180	4201.45	Os I
45	4190.59	Pr II	75	4196.13	Zr I	610	4201.46	Zr I
170	4190.63	Ce II	40	4196.18	Eu II	350	4201.52	Nb I
85	4190.65	Nb I	630	4196.34	Ce II	110	c 4201.55	Pr II
1000	4190.70	Er I	330	4196.50	Rh I	65	4201.76	Mn I
90	4190.71	Co I	1500	4196.55	La II	320	4201.85	Rb I
2200	4190.78	Gd I	390	4196.74	Tb I	170	4201.85	Th II
1200	4190.88	Nb I	110	4196.76	Pr II	340	4202.03	Fe I
320	4190.94	Dy I	150	4196.87	Ru I	250	4202.06	Os I
120	4190.95	Hf I	50	4196.95	Nb I	680	4202.24	Dy I
55	4191.03	Ce II	110	4197.07	Gd II	85	4202.52	Gd II
750	4191.07	Gd II	35	4197.13	Pr II	650	4202.92	Sm II
150	4191.08	Tb I	22	4197.22	Pr II	910	4202.94	Ce II
85	4191.20	Ta I	40	4197.23	Cr I	1100	4203.05	Sm II
85	4191.27	Cr I	60	4197.43	Er I	130	4203.21	Ho I
80	4191.44	Fe I	140	4197.51	Ce II	65	4203.39	Ho II
180	4191.56	V I	180	4197.52	U II	65	4203.41	Nb I
180	4191.59	Tb I	23	4197.54	Ir I	70	h 4203.43	Nd II
560	c 4191.60	Pr II	550	4197.58	Ru I	85	4203.46	Ti I
750	4191.63	Gd I	65	4197.60	V I	55	4203.51	Ce II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
60	4203.59	Cr I	90	4210.94	Ag I	16	4216.19	Fe I
6000	4203.73	Tm I	50 hs	4211.02	Mo I	40	4216.36	Cr I
650	4203.74	Tb I	3300	4211.14	Rh I	95 h	4216.67	Tb I
90	4203.82	W I	440	4211.24	Dy I	80	4217.19	Pr II
14	4203.99	Fe I	470	4211.29	Nd II	650	4217.20	Gd II
240	4204.04	La II	100	4211.30	Ho II	55	4217.22	Th II
65	4204.32	Nb I	75	4211.34	Zr I	930	4217.27	Ru I
180	4204.37	U II	40	4211.35	Cr I	120	4217.28	Nd II
160	4204.40	W I	240	4211.66	U II	300	4217.56	La II
40	4204.47	Cr I	16000	4211.72	Dy I	300	4217.56	Tb I
90	4204.52	Re I	35	4211.73	Ti I	310	4217.59	Ce II
380	4204.70	Y II	65	4211.75	Mn I	85	4217.63	Cr I
70	4204.74	Ce II	1200	4211.86	Os I	27	4217.76	Ir I
50	4204.82	Sm II	320	4211.86	Pr II	160	4217.80	Y I
590	4204.86	Gd II	200	4211.88	Zr II	320	4217.81	Pr II
60000 cw	4205.05	Eu II	1300	4212.00	Gd II	420	4217.94	Nb I
230	4205.06	Dy I	85	4212.04	Nb I	4400	4218.09	Dy I
55	4205.16	Ce II	5400	4212.06	Ru I	55	4218.19	Th II
75	4205.20	Sc I	140	4212.26	U II	110 h	4218.26	Sc I
120	4205.25	Nd II	65	4212.34	Sc I	1400	4218.43	Er I
870	4205.31	Nb I	45	4212.49	Sc I	120	4218.45	Zr I
130	4205.32	Er I	85	4212.53	Nb I	55	4218.54	Th II
470	4205.60	Nd II	75	4212.62	Zr I	70	4218.55	Nd II
160	4205.78	Sm I	70	4212.75	Nd II	55	4218.55	W I
35	4205.79	Ce II	55	4212.79	Tm II	150 d	4218.56	Yb II
95	4205.81	Mo I	2500	4212.95	Pd I		4218.69	Yb I
300	4205.88	Ta I	80	4213.02	Y I	100	4218.63	Sm I
35	4205.89	Ce II	100	4213.04	Ce II	65	4218.71	V I
220	4206.00	Tm II	100	4213.05	Sm II	95	4218.84	Tb I
1500	4206.02	Ru I	85	4213.07	Nd II	90	4219.10	Ho I
85	4206.13	Nb I	55	4213.07	Th I	260	4219.16	Tb I
660	4206.13	Sm II	1800	4213.18	Dy I	50	4219.31	Sm I
120	4206.40	Ta I	85	4213.22	Nd II	70	4219.36	Fe I
600	4206.49	Tb I	85	4213.26	Nb I	250	4219.37	W I
370	4206.54	Dy II	70	4213.27	Re I	40	4219.40	Mo I
160	4206.58	Hf II	45	4213.28	Pr II	70	4219.56	Nd II
70	4206.62	Rh I	40	4213.46	Nb I	160	4219.61	Pr II
270	4206.62	Sm II	300 cw	4213.50	Tb I	110 h	4219.73	Sc I
50	4206.66	Th II	40	4213.54	Y I	70	4219.97	U I
2500 c	4206.72	Pr II	180	4213.56	Pr II	55	4220.06	Th I
65	4206.90	Tb I	120	4213.86	Os I	85	4220.10	Tb II
220	4207.05	W I	400	4213.86	Zr I	180	4220.14	Sm II
120	4207.54	Tb I	140	4213.87	U I	290	4220.25	Nd II
190	4207.64	Ru I	26	4213.94	Sm II	280 h	4220.63	Y I
140	4207.70	Dy I	55	4214.00	Pr II	40	4220.65	Zr I
120	4207.79	Pr II	370	4214.04	Ce II	740	4220.66	Sm II
55	4208.08	Gd I	100	4214.22	Nd II	370	4220.68	Ru I
150	4208.16	Nb I	80	4214.28	U I	13	4220.80	Ir I
500	4208.32	Pr II	85	4214.41	Dy I	200	4220.99	Er I
35	4208.36	Cr I	300	4214.42	Tb II	45	4221.08	Eu II
65	4208.65	Tb I	80	4214.42	U II	650	4221.08	Re I
55	4208.73	Tb I	760	4214.44	Ru I	4400	4221.11	Dy I
620	4208.89	Th II	28	4214.54	Th II	170 h	4221.14	Nd II
610	4208.98	Zr II	100	4214.60	Nd II	55	4221.17	Ce II
110	4209.37	Cr I	350	4214.73	Nb I	55	4221.37	Tb I
270	4209.41	Ce II	28	4214.83	Th I	40	4221.57	Cr I
190	4209.70	Hf I	970	4215.02	Gd II	40	4221.88	Sc I
40	4209.76	Cr I	480	4215.09	Tb I	110	4222.04	W I
230	4209.86	V I	3700	4215.16	Dy I	75	4222.05	Dy II
70	4210.00	Ce II	100	4215.16	Os I	540	4222.21	Dy I
40	4210.35	Fe I	110	4215.38	W I	40	4222.22	Fe I
660	4210.35	Sm II	32000	4215.52	Sr II	290	4222.29	Ho I
80	4210.45	U II	160	4215.56	Rb I	350	4222.36	U I
55	4210.76	Th I	75 h	4216.10	Sc I	35	4222.41	Mo I
130	4210.92	Th I	120 hc	4216.12	Pr II	1500	4222.60	Ce II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
380	4222.67	Tm I	190	4228.20	Nd II	250	4234.19	Nd II
40	4222.68	Nb I	85	4228.30	Ce II	240	4234.21	Ce II
95	4222.70	Tb I	90	c 4228.52	Pr II	65	4234.22	Tb I
40	4222.73	Cr I	95	4228.61	Ta I	150	4234.34	W I
3800	4222.93	Pr II	80	4228.76	U II	50	4234.52	V I
45	4223.02	Gd II	90	c 4229.10	Pr II	620	4234.57	Sm II
35	4223.18	Re I	420	4229.15	Nb I	160	4234.63	Zr I
120	4223.21	Nd II	190	4229.31	Ru I	85	4234.73	Ce II
75	4223.32	Tb II	75	4229.33	Eu II	140	4234.78	Er II
90	4223.46	Pr II	100	4229.45	Th II	75	4234.83	Dy I
290	4223.47	Ho I	100	4229.50	Nd II	35	4235.03	Mo I
60	4223.49	Er I	390	4229.52	Ho II	55	4235.07	Gd II
150	4223.70	Sm II	50	4229.69	V I	370	4235.14	Mn I
60	4223.73	Er II	740	4229.70	Sm II	75	4235.18	Er I
110	4223.88	Ce II	220	4229.80	Gd II	290	h 4235.24	Nd II
40	4223.88	Eu II	65	4229.80	Pr II	510	4235.29	Mn I
65	4224.14	V I	170	4229.83	Nb I	300	4235.35	Tb I
50	4224.23	Sm II	85	h 4230.13	Ce II	85	4235.46	Th I
55	4224.24	Th II	320	4230.20	Er II	600	4235.73	Y II
80	4224.25	Y I	29	4230.20	Rh I	120	4235.76	V I
65	4224.27	Gd I	550	4230.31	Ru I	85	4235.88	Gd II
260	4224.28	Tb I	130	4230.32	Nb I	170	4235.94	Fe I
40	4224.56	Ce II	85	4230.43	Th I	55	4235.94	Ta II
75	4224.67	Dy I	90	4230.60	Pr II	2200	4235.94	Y I
55	4224.76	W I	85	4230.62	Tb I	200	4236.02	Ce II
40	4224.79	Ti I	50	4230.73	Sm I	160	4236.04	U I
140	4224.84	Nd II	200	4230.95	La II	200	4236.06	Zr I
320	4225.03	Gd I	130	h 4231.24	Ho I	320	c 4236.15	Pr II
110	4225.09	Ru I	65	4231.35	Tb I	40	4236.24	Re I
160	4225.15	Gd II	40	4231.63	Zr II	85	4236.36	Ce II
2700	4225.16	Dy I	220	4231.67	U I	65	4236.55	Zr I
1000	4225.33	Sm II	390	4231.74	Ce II	140	4236.60	Pr II
	4225.33	Sm II	260	4231.89	Tb I	110	4236.67	Ru I
3800	4225.35	Pr II	180	4231.93	Sc I	1200	4236.74	Sm II
65	4225.46	Zr I	170	4231.95	Nb I	95	4236.94	Tm II
160	h 4225.59	Pr II	120	4231.97	Yb I	60	4237.03	Er I
90	d 4225.59	Sc I	680	4232.02	Dy I	65	4237.04	Pr II
4800	4225.85	Gd I	70	4232.04	U II	85	4237.16	Mo I
150	4226.18	Sm I	100	4232.06	Ce II	100	4237.43	Zr I
75	4226.22	Nb I	180	4232.19	Tb II	90	4237.51	Eu II
45	4226.34	W I	150	4232.32	Ru I	500	4237.66	Sm II
480	cw 4226.45	Tb II	1300	4232.38	Nd II	75	4237.81	Nb I
55	4226.53	Os I	170	4232.44	Hf II	100	4237.82	Sc I
700	4226.57	Ge I	75	4232.45	Eu II	130	4237.89	Ti I
120	4226.62	V I	60	4232.46	Er I	400	4238.05	Sc I
75	4226.66	Ru I	360	4232.46	V I	65	4238.37	Pr II
11000	4226.73	Ca I	75	4232.47	Gd II	1600	4238.38	La II
55	4226.92	W I	140	4232.56	Ce II	30	4238.59	Re I
70	4226.99	Nd II	1500	4232.59	Mo I	45	4238.69	Eu II
2000	4227.04	Ho I	480	4232.82	Tb I	650	4238.78	Gd II
220	4227.14	Gd II	65	4232.93	Gd I	30	4238.82	Fe I
70	4227.33	U II	35	4232.94	Ta I	40	4238.96	Cr I
55	4227.39	Th I	180	4232.95	V I	95	d 4239.07	Mo I
90	h 4227.40	Eu II	35	4232.96	Re I		4239.19	Mo I
100	4227.42	Ce II	55	4233.00	W I	160	4239.28	Tb I
130	4227.43	Fe I	320	4233.11	Pr II	2000	4239.31	Zr I
3600	c 4227.46	Re I	100	4233.15	Nd II	90	4239.57	Sc I
40	4227.51	Nb I	85	4233.20	Ce II	190	4239.72	Mn I
40	4227.65	Ti I	55	4233.29	Th II	290	4239.84	Nd II
440	4227.73	Nd II	170	4233.46	Os I	680	4239.85	Dy I
50	4227.74	V I	40	4233.49	Mo I	95	4239.91	Tb I
770	4227.75	Ce II	110	4233.61	Fe I	980	4239.92	Ce II
2000	4227.76	Zr I	200	4233.61	Sc I	270	4240.02	Pr II
190	4228.03	Nd II	23	4234.00	Co I	140	4240.08	Mo I
170	4228.08	Hf I	180	4234.00	V I	140	4240.28	Mo I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum		
770	4240.34	Zr I	70	4246.82	Re I	1300	cw	4254.43	Ho I	
50	4240.36	V I	15000	4246.83	Sc II	130		4254.69	Nb I	
45	4240.45	Sm I	120	4246.88	Nd II	70		4254.74	Ce II	
50	4240.59	Th II	45	4247.06	Eu II	140		4254.96	Mo I	
55	4240.59	U II	140	4247.34	Dy II	370		4255.24	Tb I	
60	4240.70	Cr I	2000	4247.38	Nd II	250		4255.44	Nb I	
190	4240.83	Mo I	50	4247.39	Sm II	70		4255.50	Cr I	
960	4241.01	Pr II	30	4247.43	Fe I	40		4255.75	Re I	
760	4241.05	Ru I	70	4247.46	Ce II	620		4255.79	Ce II	
90	4241.16	Re I	28	4247.60	Th II	40		4255.94	Nb I	
770	4241.20	Zr I	840	c	4247.63	Pr II	130		4256.04	Ti I
140	4241.21	Nd II	140		4248.00	Th II	70		4256.09	Th II
95	4241.28	Gd II	70		4248.10	Ce II	95		4256.10	Tb I
170	c	4241.30	Pr II	40	4248.14	Ru I	170		4256.16	Ce II
150		4241.39	Re I	85	4248.15	Nd	70		4256.24	Nd II
290	4241.44	W I	75	4248.45	Dy II	70		4256.25	Th I	
85	4241.45	Nb I	65	4248.57	Tb II	440		4256.33	Dy II	
1000	4241.67	U II	29	4248.66	Nb I	2100		4256.39	Sm II	
1200	4241.69	Zr I	1100	4248.68	Ce II	75		4256.44	Zr I	
85	4242.01	Ce II	90	4249.08	Pr II	100		4256.47	Nd I	
3000	4242.15	Tm II	85	4249.12	Ti I	100		4256.82	Nd II	
95	4242.56	Tb II	55	4249.45	W I	110		4257.12	Ce II	
120	4242.63	Nb I	130	4249.46	Nb I	100		4257.37	V I	
390	4242.72	Ce II	90	4249.48	Pr II	100		4257.50	Th I	
35	4242.80	Mo I	210	4249.55	Sm II	260	c	4257.60	Re I	
760	4243.06	Ru I	55	4249.68	Th II	290		4257.66	Mn I	
75	4243.44	Dy I	140	4249.99	La II	170		4257.79	Nd II	
340	4243.51	Pr II	120	4250.13	Fe I	180		4258.04	Zr II	
55	4243.63	W I	55	4250.26	Tb II	85		4258.15	Dy I	
85	4243.74	Ce II	65	4250.28	Gd I	480		4258.23	Tb II	
290	4243.78	Ho I	190	4250.34	Pr II	55		4258.52	W I	
180	4243.84	Gd II	170	4250.34	Th II	70		4258.54	Ti I	
85	4243.93	Th II	35	4250.66	Ce II	210		4258.58	Sm II	
28	4243.99	Ta I	240	4250.79	Fe I	130	c	4258.61	Ho II	
540	4244.36	W I	300	4251.20	Y I	85		4258.91	Nb I	
520	4244.37	U II	130	4251.33	Tb I	310		4258.99	Ru I	
40	4244.44	Rh I	160	c	4251.45	Pr II	75		4259.11	Ir I
85	4244.56	Nd	55		4251.60	Ce II	120		4259.31	V I
620	4244.70	Sm II	130		4251.72	Tb II	290		4259.35	W I
45	4244.74	Eu I	1700		4251.73	Gd II	50		4259.39	Sm II
110	4244.83	Ru I	250	4251.78	Sm II	70		4259.62	Nd II	
85	4244.96	Nd II	55	4251.86	Ce II	130		4259.75	Ce II	
95	4245.14	Tb I	170	4251.87	Mo I	55		4259.93	W I	
80	4245.16	Hf I	200	4251.94	Er II	75		4260.00	Ru I	
120	4245.18	Sm II	120	bl	4252.08	Hf	810		4260.12	Gd I
150	4245.34	Gd I	60		4252.31	Co I	200		4260.29	W I
130	4245.35	Ta I	160		4252.43	U II	110		4260.33	Th I
90	4245.40	Ho II	850		4252.44	Nd II	95		4260.36	Mo I
65	4245.46	Pr II	95		4252.70	Tb I	360		4260.48	Fe I
40	4245.84	Hf II	120	h	4252.88	Nd II	40		4260.66	Mo I
310	4245.89	Ce II	160		4252.97	Nb I	4900		4260.85	Os I
440	4245.91	Dy I	65		4253.09	Pr II	170		4260.98	Hf I
310	4245.98	Ce II	390		4253.37	Ce II	110		4261.17	Ce II
190	4246.02	Mo I	860		4253.37	Gd II	75		4261.21	Zr I
100	4246.12	Sc I	110		4253.54	Th I	60		4261.35	Cr I
65	4246.16	Pr II	75		4253.57	Zr I	75		4261.42	Zr I
260	4246.26	U I	650		4253.61	Gd II	30		4261.44	Mo I
130	4246.30	Nb I	140		4253.70	Nb I	70		4261.60	Ti I
190	4246.33	Ru I	60		4253.72	Sm II	85		4261.71	Nb I
55	4246.39	Tm II	45		4253.80	Eu II	140	c	4261.78	Pr II
85	4246.40	Ce II	100		4253.87	Nd II	410		4261.84	Nd II
200	4246.57	Gd II	65		4254.04	Tb I	55		4261.84	Tb I
130	4246.59	Tb I	290		4254.29	Nd	770		4262.05	Nb I
390	4246.72	Ce II	20000		4254.35	Cr I	1600		4262.09	Gd I
370	4246.73	Ru I	500		4254.40	Pr II	120		4262.16	V I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
150	4262.24	Nd II	480	4269.50	La II	90	4275.82	Pr II
190	4262.27	Pr II	120	4269.61	Os I	120	4276.18	Pr II
50	4262.34	La I	160	4269.61	U II	120	4276.43	Ti I
28	4262.61	Th I	330	4269.69	Tb I	80	4276.47	U II
1300	4262.68	Sm II	50	4269.76	V I	140	4276.48	Er II
90	4262.80	Pr II	35	4269.77	Sm II	250	4276.69	Dy I
330	4263.13	Ti I	110	4269.77	W I	120	4276.72	Zr I
110	4263.14	Cr I	28	4269.94	Th I	160	4276.74	W I
90	4263.14	Pr II	60	4269.95	Er I	110	d 4276.75	Tb II
200	4263.30	W I	70	4270.14	Ti I	100	d 4276.81	Th II
55	4263.36	Th II	620	4270.19	Ce II	890	4276.91	Mo I
200	4263.39	Hf I	30	4270.24	Eu II	460	4276.96	V I
35	4263.40	Ru I	55	4270.28	Gd I	55	4276.97	Th II
200	4263.43	Ce II	50	4270.32	V I	55	4277.15	Os I
150	4263.44	Nd II	55	4270.33	Th II	1200	4277.24	Mo I
320	4263.59	La II	240	4270.56	Nd II	35	4277.26	Ru I
260	4263.66	Tb I	290	4270.69	Nb I	140	4277.29	Nd II
60	4263.72	Er I	390	4270.72	Ce II	480	4277.31	Th II
270	c 4263.78	Pr II	50	4270.73	Sm II	150	4277.50	Lu I
150	h 4263.91	Nd II	150	4270.84	Sm II	130	4277.50	Nb I
	4264.00	Nd II	30	4271.06	Cr I	70	4277.74	Yb I
70	4263.95	Ce II	50	4271.10	Th II	95	4277.77	Tb I
490	4264.05	Ho I	120	4271.16	Fe I	120	4278.05	Pr II
170	4264.37	Ce II	65	4271.51	Ta I	55	h 4278.22	Gd II
65	4264.72	Tb I	95	4271.53	Tb I	120	4278.23	Ti I
100	4264.75	Os I	460	4271.55	V I	40	4278.25	Ce II
60	4264.87	Er I	270	4271.71	Tm I	70	4278.32	Th I
75	4264.98	Tb I	1000	4271.76	Fe I	760	cw 4278.52	Tb II
500	4265.08	Sm II	160	4271.77	Pr II	60	4278.60	Rh I
50	h 4265.17	V I	50	4271.86	Sm I	40	4278.69	Ru I
27	4265.30	Ir I	50	4272.01	Sm II	30	4278.81	Ti I
75	4265.61	Ru I	30	4272.06	Mo I	200	4278.86	Ce II
35	4265.71	Ti I	95	4272.21	Tb I	90	4279.00	Pr II
290	4265.92	Mn I	790	c 4272.27	Pr II	95	4279.06	Ta I
420	4266.02	Nb I	85	4272.43	Ti I	75	4279.50	Nb I
300	4266.04	Ho I	340	4272.79	Nd II	1200	4279.68	Sm II
95	4266.18	Mo I	170	4272.85	Hf II	40	4279.71	Nb I
40	4266.22	Ti I	55	4272.88	Th I	85	4279.73	Dy I
120	4266.31	Sm I	40	4272.91	Cr I	240	4279.75	Sm II
55	4266.32	U I	35	4272.97	Nb I		4279.94	Sm II
650	4266.34	Tb I	130	4273.07	Mo I	470	c 4280.07	Pr II
55	4266.54	W I	55	h 4273.29	Gd I	140	4280.14	Ce II
650	4266.60	Gd I	29	4273.36	Nb I	70	4280.17	Nd II
340	4266.71	Nd II	280	4273.36	Th II	300	4280.27	La I
470	4267.00	Gd I	60	4273.43	Rh I	90	4280.32	Sm II
100	4267.23	Ce II	130	4273.44	Ce II	85	4280.40	Cr I
140	4267.30	U II	75	4273.52	Zr II	910	4280.49	Gd II
100	4267.74	Pr II	100	4273.63	Ho II	28	4280.57	Th I
75	4267.87	Dy I	55	4273.69	W I	160	4280.60	Nb I
55	4267.94	U I	80	4273.98	U II	2200	4280.79	Sm II
310	4268.02	Zr I	110	4274.02	Th II	110	4281.00	Ce II
75	4268.08	Mo I	300	4274.17	Gd I	190	4281.01	Sm II
260	4268.10	Ir I	220	4274.55	W I	250	4281.03	Lu I
75	4268.26	Dy I	240	4274.58	Ti I	130	4281.07	Th II
130	4268.26	Ta I	75	4274.69	Nb I	270	4281.10	Mn I
55	4268.30	Ce II	90	4274.77	Zr I	85	4281.16	Ce II
70	4268.56	Tm I	16000	4274.80	Cr I	110	4281.38	Ti I
560	4268.64	V I	340	4275.09	Nd II	110	4281.42	Th II
85	4268.67	Nb I	40	4275.11	Cu I	40	4281.83	Mo I
160	4268.73	Gd II	90	c 4275.21	Pr II	45	4281.93	Ru I
80	4268.85	U II	220	4275.21	Tb I	200	4282.03	U II
320	4269.09	Pr II	70	4275.46	Ce II	75	4282.03	Zr I
140	4269.25	Ce II	160	4275.49	W I	700	4282.04	Th II
270	4269.28	Mo I	140	4275.57	Ce II	550	4282.20	Zr I
1400	4269.38	W I	240	4275.64	La II	710	4282.21	Sm I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
75	4282.22	Ru I	820	4288.71	Rh I	110	4295.62	Nb I
110	4282.34	W I	200	4288.84	U I	60	4295.74	Sm II
80	4282.41	Fe I	950	4289.07	Ti I	85	4295.76	Cr I
790	c 4282.42	Pr II	220	4289.36	Ca I	840	4295.76	Ti I
470	4282.44	Nd II	80	4289.41	Pr II	550	4295.93	Ru I
160	4282.45	U II	140	4289.42	Mo I	330	d 4295.97	Lu I
240	4282.57	Nd II	200	4289.44	Ce II		4296.09	Lu I
220	4282.71	Ti I	190	4289.44	Nb I	600	4296.05	La II
45	4282.79	Gd II	300	4289.70	Tb I	200	4296.07	Ce II
470	4282.83	Sm I	10000	4289.72	Cr I	540	4296.08	Gd II
45	4282.91	V I	55	4289.88	Gd II	220	4296.11	V I
240	4283.01	Ca I	120	4289.88	Pr II	40	4296.16	Mo I
200	4283.10	Ba I	2000	4289.94	Ce II	120	4296.16	Nb I
240	4283.50	Sm I	90	4290.18	Ho II	65	4296.22	Os I
110	4283.52	Th II	40	h 4290.18	Mo I	140	4296.30	Gd II
55	4283.56	Sc	120	4290.23	Ti II	85	4296.30	Tb I
430	4284.06	V I	55	4290.40	Pr II	40	4296.37	Ce II
65	4284.08	Mn I	840	4290.94	Ti I	80	4296.41	Hf I
760	4284.33	Ru I	120	4290.96	Nd II	30	4296.62	Mo I
35	4284.50	Sm II	55	4290.99	Pr II	1500	4296.67	Ce II
710	4284.52	Nd II	120	4291.14	Ti I	1600	4296.74	Sm I
80	4284.58	Ho II	120	c 4291.17	Re I	40	4296.74	Zr II
85	h 4284.60	Mo I	140	4291.19	Nb I	70	4296.77	Rh I
45	4284.96	W I	40	4291.20	Mo I	420	4296.78	Ce II
70	4284.98	Th II	110	4291.20	Zr I	150	4297.11	U II
160	4284.99	Ti I	40	4291.30	V I	220	4297.17	Gd II
300	4285.13	Tb II	110	4291.35	Zr I	55	4297.31	Th I
280	4285.37	Ce II	80	h 4291.59	Pr II	70	4297.36	Nd II
45	4285.37	Pr II	35	4291.62	Sm II	170	4297.68	V I
50	4285.50	Sm II	80	4291.65	Re I	3700	4297.71	Ru I
65	4285.75	Tb II	55	4291.81	Th I	70	4297.74	Cr I
23	4285.79	Co I	330	4291.82	V I	1100	4297.76	Pr II
430	4285.82	Gd I	120	4291.95	Dy I	270	4297.80	Nd II
100	4285.90	Os I	40	4291.96	Cr I	170	4298.03	V I
890	4286.01	Ti I	75	4292.04	Nb I	370	4298.36	Tb I
110	4286.01	W I	680	4292.13	Mo I	150	4298.36	Tm I
300	4286.12	Gd I	350	4292.18	Sm II	45	4298.43	Gd II
65	4286.13	Tb II	140	4292.48	Nb I	90	c 4298.47	Ho II
50	4286.19	Th II	110	4292.58	Ce II	2000	4298.66	Ti I
	4286.23	Th I	110	4292.76	Ce II	150	4298.73	Eu I
75	4286.22	Nb I	65	h 4293.13	Tb I	70	h 4298.83	Th II
65	4286.38	Ta I	110	c 4293.14	Pr II	30	4298.90	Mo I
50	4286.42	V I	890	4293.21	Mo I	75	4298.91	Dy I
40	4286.51	Zr II	220	4293.28	Ru I	320	4298.91	Er I
690	4286.56	Er I	140	4293.58	Pr II	450	c 4298.98	Pr II
23	4286.62	Ir I	360	4293.88	Mo I	200	4298.99	Ca I
350	4286.64	Sm II	560	4293.95	Os I	70	4299.09	Ce II
120	4286.91	Tb II	65	h 4294.04	Tb I	90	4299.14	Sm I
600	4286.97	La II	110	4294.10	W I	90	4299.15	Ho I
45	4286.98	Pr II	140	4294.12	Ti II	200	4299.23	Ti I
400	4286.99	Nb I	140	4294.13	Fe I	120	4299.24	Fe I
190	4287.05	Ru I	85	h 4294.19	Nd II	430	4299.29	Gd I
120	4287.08	Mo I	55	4294.36	Ta I	90	4299.34	Sm II
150	4287.11	Tb I	4100	4294.61	W I	590	4299.36	Ce II
840	4287.40	Ti I	160	c 4294.69	Pr II	580	4299.60	Nb I
45	4287.81	V I	70	4294.75	Ce II	200	4299.64	Ti I
200	4287.87	U II	290	4294.77	Sc II	85	4299.71	Nd II
55	4288.05	Th II	320	4294.79	Hf I	85	4299.84	Th I
30	4288.16	Ti I	260	4294.79	Ru I	300	4299.90	Tb I
45	c 4288.47	Pr II	550	4294.79	Zr I	30	4299.92	Re I
28	4288.47	Th I	370	d 4294.93	Dy II	200	4300.05	Ti II
60	4288.51	Er I		4295.04	Dy I	770	4300.33	Ce II
1400	4288.64	Mo I	85	4295.04	Th II	120	4300.44	La II
200	4288.66	Ce II	90	4295.11	Pr II	35	4300.51	Cr I
28	4288.67	Th I	150	4295.34	Tb I	2900	4300.56	Ti I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
40	4300.86	Ce II	180	4307.90	Ti II	110	4314.30	Ru I
580	4300.99	Nb I	1000	4307.91	Fe I	85	4314.35	Ti I
90	4301.09	Ho II	40	4308.12	Nb I	170	4314.38	Nd II
4100	4301.09	Ti I	28	4308.12	Th I	520	4314.40	Gd I
65	4301.15	Tb I	35	4308.50	Ti I	470	4314.52	Nd II
50	4301.18	Cr I	1000	4308.63	Dy II	95	4314.52	Ta I
70	4301.22	Nd I	150	d 4308.68	Tb II	30	4314.58	Re I
60	4301.26	Er I	75	4308.69	Nb I	1200	4314.80	Ti I
30	4301.26	Mo I	55	4308.88	Os I	55	4314.93	Ce II
45	4301.28	Sm I	100	c 4308.90	Pr II	90	4315.03	Ho II
120	4301.47	U II	880	4309.01	Sm II	20	4315.09	Au I
320	4301.60	Er II	40	4309.21	Ru I	60	4315.09	Fe I
75	4301.60	Ir I	260	4309.29	Gd I	55	4315.25	Th I
85	4301.93	Ti II	120	4309.56	Nb I	75	d 4315.35	Sm II
2200	4302.11	W I	150	4309.57	Lu I		4315.38	Sm II
100	c 4302.15	Pr II	110	4309.58	Ce II	100	4315.41	Ce II
360	h 4302.30	Y I	2800	4309.63	Y II	80	4315.51	Pr II
1100	4302.53	Ca I	390	4309.74	Ce II	150	4315.73	Tb I
85	4302.65	Ce II	170	4309.80	V I	50	4315.90	La II
75	4302.71	Dy II	40	4309.82	Zr I	520	4316.05	Gd II
310	4302.89	Zr I	200	4309.99	Th II	80	4316.12	Pr II
240	4302.95	Tb I	85	4310.39	Mo I	65	4316.27	Gd II
160	c 4302.98	Ta I	55	4310.39	U II	50	4316.30	Y I
5400	4303.58	Nd II	450	4310.42	Tb I	40	4316.48	Nb I
290	4303.61	Pr II	100	4310.51	Nd II	75	4316.64	Ru I
140	4303.81	Er II	55	4310.59	Ir I	55	4316.80	W I
29	4303.88	Nb I	150	4310.70	Ce II	70	4316.95	Yb II
120	4304.00	Tb I	75	4310.96	Tb II	45	4317.05	Pr II
65	4304.27	Tb I	85	4310.98	Gd II	75	4317.31	Zr II
110	4304.28	Ce II	200	4311.04	Ho I	140	4317.33	Ce II
200	4304.40	Re I	80	4311.09	Pr II	90	4317.82	Pr II
340	4304.45	Nd II	85	4311.25	Nd I	170	4317.93	Mo I
190	4304.68	Zr I	390	4311.27	Nb I	55	4317.99	Ce II
150	4304.72	Ce II		4311.39	Nb I	40	4318.01	Nb I
130	4304.90	Gd II	85	4311.29	Tb I	120	4318.14	Hf I
40	4304.92	Mo I	560	4311.40	Os I	110	d 4318.29	Th II
320	4304.94	Sm II	220	4311.50	Ir I		4318.42	Th I
420	4305.14	Ce II	300	4311.56	Tb I	95	4318.40	Tm I
30	4305.45	Cr I	28	4311.58	Th I	370	4318.43	Ru I
340	4305.45	Sr II	110	4311.59	Ce II	80	4318.58	Re I
70	4305.48	Nd II	40	4311.65	Ti I	360	4318.64	Ti I
350	4305.71	Sc II	65	4311.70	Nb I	400	4318.65	Ca I
1500	4305.76	Pr II	28	4311.80	Th I	65	4318.81	Ta I
6000	4305.92	Ti I	45	4311.92	Pr II	2200	4318.83	Tb I
120	4305.97	Yb I	110	4312.08	Tb II	1900	4318.94	Sm II
110	4306.04	Pr II	120	4312.45	Nb I	110	4319.00	Pr II
170	4306.21	V I	65	4312.55	Mn I	75	4319.05	Zr I
75	4306.28	Nb I	40	4312.80	Mo I	28	4319.10	Th II
1100	4306.34	Gd I	240	4312.85	Sm I	40	4319.53	Re I
60	4306.36	Er I	85	4312.87	Ti II	470	4319.53	Sm I
55	4306.37	Th II	40	4312.97	Mo I	35	4319.64	Cr I
770	4306.72	Ce II	140	4312.99	Th I	40	4319.78	U II
35	4306.73	U I	35	4313.10	Ce II	550	4319.87	Ru I
120	4306.75	Nd II	150	4313.13	U I	110	4319.94	Er II
27	4306.82	U I	370	4313.25	Tb I	140	4320.13	Th II
160	4306.87	W I	85	4313.36	Nd II	55	h 4320.15	Pr II
240	4307.18	Tb I	120	h 4313.41	Tb I	150	4320.26	Tb I
100	4307.18	Th I		4313.73	Sm II	370	4320.52	Gd I
140	4307.18	V I	180	4313.73	Sm II	40	4320.58	Ru I
930	4307.60	Ru I	1800	4313.84	Gd I	85	4320.59	Th II
45	4307.63	Pr II	40	4313.88	Nb I	80	4320.67	Hf II
110	4307.64	W I	120	4313.88	U II	560	4320.72	Ce II
260	4307.74	Ca I	40	4313.89	V I	3300	4320.74	Sc II
200	4307.78	Nd II	60	4313.93	Dy I	750	4321.11	Gd II
30	4307.87	Gd II	4200	4314.09	Sc II		4321.20	Gd I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
75	4321.17	Zr I	1800	4329.02	Sm II	200	4335.74	Pr II
35	4321.30	Ru I	90	4329.36	Eu I	880	4336.14	Sm I
55	4321.49	Tb I	270	4329.41	Pr II	35	4336.20	Ta I
180	4321.66	Ti I	55	4329.49	Th II	240	4336.23	Ce II
75	4321.97	Mo I	40	4329.56	Zr I	150	4336.28	Ce II
130	4322.20	Gd II	85	4329.57	Ta I	75	4336.42	Ru I
600	4322.23	Tb I	370	4329.58	Gd I	870	4336.43	Tb I
440	4322.51	La II	30	4329.63	Mo I	40	d 4336.63	Gd I
75	4322.53	Dy II	75	4329.73	Nb I		4336.78	Gd I
65	4322.68	Ta I	75	4329.97	Eu I	180	4336.66	Hf II
170	4322.87	Tb I	440	4330.02	Sm I	45	4336.74	Sm II
35	4322.96	Ru I	460	4330.02	V I	40	4337.05	Fe I
590	4323.28	Sm II	50	4330.27	Er II	300	4337.13	Ho II
29	4323.47	Nb I	160	4330.27	Hf I	170	4337.27	Ru I
210	4323.55	Pr II	85	4330.31	Tb I	130	4337.28	Th I
85	d 4323.66	Tb II	55	4330.42	Pr II		4337.38	Th II
110	4324.03	Zr I	310	4330.45	Ce II	30	4337.29	Y I
130	4324.06	Gd II	60	4330.61	Eu II	140	4337.51	Gd I
240	4324.46	Sm I	340	4330.61	Gd II	29	4337.56	Nb I
70	4324.60	Ce I	250	4330.64	Ho II	780	4337.57	Cr I
150	4324.79	Ce II	80	4330.66	W I	600	4337.64	Tb I
2400	4325.01	Sc II	110	4330.78	Y I	90	4337.68	Eu I
170	4325.05	Ru I	28	4330.84	Th I	980	4337.77	Ce II
60	4325.08	Cr I	80	4330.97	W I	160	4337.92	Ti II
140	4325.11	Dy II	100	4331.16	Ru I	50	4338.11	Th I
190	4325.13	Ti I	40	4331.18	Eu I	1700	4338.41	Tb I
180	4325.44	Zr I	23	4331.24	Co I	35	4338.68	Ru I
120	4325.50	Tb I	55	4331.28	Pr II	29	4338.70	Nb I
2600	d 4325.57	Gd II	110	4331.36	Er I	540	4338.70	Nd II
	4325.69	Gd I	390	4331.37	Nb I	360	4338.70	Pr II
950	4325.76	Fe I	240	4331.38	Gd I	40	4338.71	Mo I
1100	4325.76	Nd II	120	4331.45	Sm I	100	4338.75	Os I
600	4325.83	Tb II	150	4331.75	Ce II	90	4338.96	Sm I
320	4325.86	Dy I	55	4331.92	Th II	50	4339.00	Er II
70	4325.90	U II	600	4332.12	Tb I	340	4339.31	Ce II
840	4326.14	Mo I	110	4332.13	W I	1100	4339.45	Cr I
85	4326.14	Tb I	200	4332.25	Re I	45	4339.62	Co I
110	4326.25	Os I	40	4332.50	Ru I	150	4339.62	Tb I
45	4326.32	Gd II	40	4332.51	Mo I	160	4339.65	Dy II
350	4326.33	Nb I	80	c 4332.55	Ho II	65	4339.68	Pr I
160	4326.36	Ti I	310	4332.71	Ce II	380	4339.72	Cr I
100	4326.38	Dy I	75	4332.72	Lu I	40	4339.82	Mo I
3000	4326.43	Tb I	510	4332.82	V I	85	4339.87	Tb I
250	4326.74	Mo I	55	4333.13	Pr II	35	4339.92	Sm I
70	4326.82	Ce II	75	4333.24	Gd I	60	4340.13	Cr I
170	4326.82	Ru I	40	4333.26	Zr II	45	4340.34	Ru I
18	4327.06	Pt I	55	4333.69	Tb I	70	4340.56	Ce II
40	4327.09	Th II	4600	4333.74	La II	40	4340.60	Gd I
1900	4327.12	Gd I	28	4333.93	Th II	700	4340.62	Tb I
40	4327.23	Th II	1300	4333.97	Pr II	40	4340.73	La I
120	4327.38	Nb I	40	4334.09	V I	85	d 4340.75	Mo I
55	4327.40	W I	1300	4334.15	Sm II	55	4340.90	Th I
110	4327.43	Ru I	90	4334.63	Pr II		4341.03	Th II
45	4327.51	Sm II	40	4334.64	Hf II	140	4340.92	Er I
510	4327.93	Nd II	150	4334.65	Tb I	110	4341.00	Tb I
55	4328.21	Pr II	120	4334.81	Mo I	760	4341.01	V I
180	4328.40	Pr II	30	4334.84	Ti I	40	4341.04	Ru I
95	4328.43	Nb I	70	4334.87	Ce II	550	4341.13	Zr I
340	4328.68	Os I	20	4334.96	La II	450	4341.28	Gd II
55	4328.69	Th II	60	4335.03	Er I	130	4341.42	Mo I
130	4328.81	Er I	40	4335.29	Gd II	680	4341.69	U II
120	4328.90	Dy II	28	4335.31	Th II	29	4341.98	Lu II
240	4328.90	Tb I	55	4335.49	Ce II	140	4342.07	Nd II
120	4328.94	Gd I	170	4335.69	Th II	550	4342.97	Ru I
160	4328.98	Pr II	120	4335.73	U I	55	4342.14	Ce II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
910	4342.18	Gd II	55	4348.60	Th I	240	4355.09	Eu II
85	4342.26	Th II	140	4348.65	Nb I	110	4355.14	Ta I
35	4342.38	Sm II	440	4348.79	Y I	150	4355.17	W I
23	4342.44	Rh I	35	4348.93	Zr I	45	4355.18	Pr II
70	4342.44	Th I	110	4349.03	Nb I	110	4355.32	Th II
70	4342.48	Ce II	55	4349.07	Th I	430	4355.75	U I
430	4342.53	Tb I	85	4349.10	Nd II	150	4355.94	V I
80	4342.63	Pr II	110	4349.60	Tb I	150	4356.02	Nd II
	4342.82	Pr II	350	4349.70	Ru I	280	4356.09	Tb I
140	4342.82	Nb I	35	4349.74	Hf I	250	4356.33	Hf I
50	4342.83	V I	700	4349.79	Ce II	290	4356.73	Ho II
40	4343.04	Zr I	70	4350.21	Nd II	35	4356.75	Ce II
70	4343.50	Nd I	40	4350.30	Nb I	870	4356.81	Tb I
55	4343.56	Ce I	70	4350.33	Ba I	29	4356.85	Nb I
55	4343.85	Tb I	230	4350.34	Mo I	55	4356.99	Hf I
45	4343.88	Pr II	340	4350.40	Pr II	40	4357.34	Mo I
100	4343.95	Th II	560	4350.46	Sm II	45	4357.46	Tb I
45	4344.21	Tb II	150	4350.51	Hf II	45	4357.49	Pr II
24	4344.29	Ti II	1300	4350.73	Ho I	55	4357.61	Th II
1000	4344.30	Gd II	55	4350.74	Tb I	120	4357.73	Y I
620	4344.30	Pr II	24	4350.82	Sm I	24	4357.90	Sm I
85	4344.31	Ta I	140	4350.82	Th ThO	55	4357.91	Ce II
130	4344.33	Th II	55	4351.00	Tm II	45	4357.98	Os I
70	4344.48	Tm I	380	4351.05	Cr I	40	4357.98	Re II
1900	4344.51	Cr I	40	4351.15	Hf I	65	4358.14	Os I
170	4344.62	Th ThO	95	4351.18	Tm II	850	4358.17	Nd II
60	4344.65	Y I	680	4351.29	Nd II	55	4358.32	Th I
30	4344.66	Mo I	18	4351.30	Ir I	4000	4358.35	Hg I
95	4345.32	Nb I	100	4351.53	Os I	200	4358.44	Dy II
45	4345.83	W I	30	4351.55	Mo I	110	4358.64	Sc I
70	4345.85	Ce II	290	4351.57	Nb I	380	4358.69	Re I
560	4345.86	Sm II	55	4351.60	Tb II	85	4358.70	Nd II
150	4345.96	Ce II	50	4351.63	Er I	800	4358.73	Y II
70	4346.11	Ti I	55	4351.72	Tb II	65	4358.74	Zr I
40	4346.12	Nb I	2300	4351.77	Cr I	100	4359.07	Ce II
60	4346.37	Dy II	1100	4351.84	Pr II	55	4359.08	Sc I
70	4346.43	Ce II	560	4352.10	Sm II	140	4359.09	Pr II
70	4346.43	Th I	60	4352.33	Y I	55	4359.15	Gd II
2200	4346.46	Gd I	18	4352.56	Ir I	70	4359.25	Nd II
110	4346.48	Ru I	80	4352.57	Hf I	85	4359.37	Th I
70	4346.48	Tm I	85	4352.68	Th II	30	4359.62	Mo I
90	4346.49	Sm II	60	4352.70	Y I	570	4359.63	Cr I
55	4346.49	Tb I	560	4352.71	Ce II	30	4359.64	Gd II
65	4346.52	Zr I	40	4352.74	Fe I	290	4359.74	Zr II
910	4346.62	Gd I	1000	4352.87	V I	410	4359.79	Pr II
70	4346.83	Cr I	430	4353.20	Tb II	65	4359.85	Nb I
100	4346.84	Ho II	60	4353.27	Nb I	2700	4359.93	Tm I
45	4346.87	Pr II	75	4353.31	Mo I	280	4360.16	Tb I
100	4347.00	W I	70	4353.34	Hf I	100	4360.18	Ce II
25	4347.19	Th II	170	4353.37	Ce II	28	4360.41	Ce II
150	4347.19	U II	85	4353.40	Th II	40	4360.44	Ce II
35	4347.22	Zr I	75	4353.79	Gd I	95	4360.49	Ti I
25	4347.24	Th II	30	4354.06	Gd II	560	4360.72	Sm II
220	4347.31	Gd II	35	4354.06	Ti I	310	4360.81	Zr I
40	4347.31	Nb I	710	4354.13	Ru I	45	4360.83	Ta I
470	4347.49	Pr II	29	4354.19	Nb I	70	4360.87	Nd II
45	4347.50	W I	550	4354.40	La II	160	4360.92	Gd II
28	4347.60	Ce II	65	4354.46	Os I	220	4361.07	Sm II
40	4347.70	Ce II	55	4354.48	Th I	870	4361.21	Ru I
160	4347.71	Dy I	140	4354.55	U I	45	4361.24	Pr II
1100	4347.80	Sm II	180	4354.61	Sc II	85	4361.31	Th II
1000	4347.89	Zr I	60	4354.80	La I	60	4361.34	Dy II
55	4348.11	W I	140	4354.80	Ru I	35	4361.36	Ce II
190	4348.34	Er I	450	4354.91	Pr II	50	4361.40	Nd II
28	4348.53	Sc I	130	4354.98	V I	27	4361.57	Eu II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
35	4361.65	Nb I	24	4369.62	Nb I	50	4375.17	Ce II
130	4361.66	Ce II	95	4369.68	Ti I	29	4375.25	Nb I
45	4361.79	Pr II	14	4369.77	Fe I	100	4375.30	V I
100	4361.81	W I	300	4369.77	Gd II	120	4375.31	Dy II
40	4362.02	Mo I	210	4369.92	Sm II	70	4375.33	Cr I
810	4362.04	Sm II	190	4370.18	Gd I	150	h 4375.61	Y I
430	4362.05	U I	60	4370.36	Nb I	110	bl 4375.84	La LaO
190	4362.26	U II	35	4370.42	Ru I	530	4375.92	Ce II
55	w 4362.44	Tb I	45	4370.48	Sm II	60	4375.93	Fe I
40	4362.71	Mo I	110	4370.66	Os I	85	4376.07	Gd I
440	4362.91	Sm I	90	4370.79	Pr II	28	4376.31	Ta I
70	4362.93	U II	130	4370.95	Zr II	55	4376.43	Tb II
100	4362.99	Pr II	180	4370.97	Hf II	50	4376.45	Nd II
70	4363.13	Cr I	23	4371.13	Co I	80	4376.58	Ho II
100	4363.24	Pr II	65	4371.20	Ru I	45	4376.90	Os I
35	4363.39	Ce II	530	4371.28	Cr I	60	4377.40	Nd II
220	4363.45	Sm II	70	4371.43	Ho II	140	4377.96	Nb I
22	4363.47	Ce II	320	4371.62	Pr II	28	4377.98	Ta I
50	4363.52	V I	95	4371.76	U I	110	4378.10	La II
95	4363.66	Tm II	110	bl 4371.97	La LaO	55	4378.18	Th I
140	4363.93	Ho II	220	4372.02	Tb I	880	4378.24	Sm II
24	4364.05	Sm II	60	4372.14	Nd II	60	4378.35	Er II
120	4364.14	Nd II	45	h 4372.20	Eu II	200	4378.48	W I
100	4364.20	Dy II	2400	4372.21	Ru I	190	4378.56	Gd I
50	4364.22	V I	60	4372.28	Nd II	100	4378.82	Ta I
85	4364.47	Mo I	60	4372.38	Ti I	170	4379.14	Ho II
910	4364.66	Ce II	100	4372.40	Ce II	12000	4379.24	V I
110	4364.67	La II	150	4372.52	W I	80	4379.33	Y I
150	4364.78	W I	160	4372.57	U II	40	4379.34	Pr II
45	4364.84	Ta I	60	h 4372.73	Nd II	65	4379.52	Nb I
28	4364.92	Sc I	70	4372.76	U I	60	bl 4379.72	La LaO
70	4365.37	Hf I	45	4373.04	Rh I	240	4379.78	Zr II
210	4365.67	Os I	35	4373.07	Zr I	90	4379.83	Ho II
85	4365.93	Th I	140	d 4373.23	V I	95	4379.92	Rh I
45	4365.95	Sm I	50	4373.24	Ce II	110	4380.06	Ce II
100	d 4365.95	W I	70	4373.25	Cr I	150	4380.29	Mo I
	4366.07	W I	35	4373.32	Mo I	110	4380.30	Pr II
45	4366.00	Tb II	70	4373.33	Ho I	530	4380.42	Sm I
120	4366.03	Y I	110	4373.41	U II	100	4380.55	V I
240	4366.38	Nd II	440	4373.46	Sm II	35	4380.59	Mo I
350	4366.45	Zr I	23	h 4373.63	Co I	140	4380.64	Gd II
75	4366.54	Mo I	80	4373.81	Pr II	60	4380.65	Er I
160	4366.72	Dy I	350	4373.82	Ce II	50	4381.11	Cr I
100	4367.00	Ce II	970	4373.83	Gd I	40	4381.13	Nb I
220	4367.30	Th II	75	4373.83	V I	35	4381.27	Ru I
70	4367.56	Ce II	85	4373.90	Th II	85	4381.29	Tb I
190	4367.58	Re I	85	4374.12	Th I	70	4381.40	Th II
55	4367.89	Tm II	110	4374.16	Cr I	1900	4381.64	Mo I
110	4367.90	Hf II	28	4374.21	Ta I	45	4381.70	Mn I
40	4367.97	Nh II	320	4374.24	Dy II	110	4381.78	Ce II
500	4368.03	Sm II	120	4374.41	Pr II	1300	4381.86	Th II
150	4368.04	V I	55	4374.43	Tb I	23	4381.88	Ta I
85	4368.23	Ce II	2000	4374.46	Sc II	95	4382.06	Gd II
1200	4368.33	Pr II	320	4374.76	Dy II	910	4382.17	Ce II
210	4368.43	Nb I	40	4374.78	Nb I	160	4382.17	Er I
50	4368.60	V I	130	4374.78	Th II	160	4382.39	Pr II
340	4368.64	Nd II	4200	4374.80	Rh I	75	4382.41	Mo I
24	4368.94	Ti I	40	4374.89	Mo I	330	4382.45	Tb I
230	4369.04	Mo I	470	d 4374.93	Nd II	24	4382.49	Nb I
160	4369.15	Gd I		4375.04	Nd II	120	4382.74	Nd II
70	4369.24	Ce II	12000	4374.94	Y II	55	c 4382.77	Pr II
85	4369.32	Th II	45	4374.95	Mn I	35	4382.84	Nb I
55	4369.35	Ta I	320	4374.98	Sm II	140	4383.12	Gd II
110	4369.39	Er II	75	4375.01	Mo I	75	4383.17	Eu II
55	4369.47	Eu II	45	4375.14	Ta I	55	4383.27	U I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
100	4383.36	Ru I	70	4391.10	Nd II	150	4397.29	Mo I
280	4383.44	La II	1100	4391.11	Th II	290	4397.34	Sm I
1700	4383.55	Fe I	140	4391.34	Re I	75	4397.42	Er I
45	4384.06	Tb II	65	4391.44	Gd II	180	4397.51	Gd II
110	c 4384.09	Pr II	45	4391.50	Pr II	170	4397.80	Ru I
290	4384.29	Sm II	75	4391.54	Mo I	85	4397.91	Th II
60	4384.30	Dy II	18	4391.57	Co I	1800	4398.02	Y II
28	4384.66	Th I	1700	4391.66	Ce II	50	4398.03	Nd II
300	4384.70	Er II	70	4391.75	Cr I	55	4398.27	Pr II
7000	4384.72	V I	18	4391.83	Pt I	110	4398.45	Ta I
130	4384.81	Sc II	280	4392.06	Gd I	200	4398.79	Ce II
180	c 4384.83	Ho II	90	4392.07	V I	50	4399.09	Th II
80	4384.85	Pr II	75	4392.12	Mo I	510	4399.20	Ce II
180	4384.85	W I	40	4392.12	Nd II	180	4399.32	Pr II
65	4384.86	Nb I	70	cw 4392.45	Re I	160	4399.47	Ir I
530	4384.98	Cr I	18	4392.59	Ir I	40	4399.58	Nd
100	4385.20	La II	21	4392.60	Sm II	40	4399.59	Ru I
40	d 4385.30	Pr II	160	4392.69	Nb I	55	4399.72	Tm I
	4385.48	Pr I	45	4392.96	Tb I	60	4399.77	Ti II
870	4385.39	Ru I	55	4392.97	Th I	90	4399.88	Sm II
30	4385.48	Y I	45	4393.09	V I	90	4400.02	Pr II
1300	4385.65	Ru I	150	4393.19	Ce II	30	4400.18	Gd II
710	4385.66	Nd II	210	4393.35	Sm I	90	4400.24	Zr I
130	4385.68	Tb I	330	4393.60	U I	80	4400.25	Pr II
26	4385.89	Mo I	60	h 4393.69	Yb I	35	4400.35	Nb I
150	4386.07	Ta I	28	4393.76	Th I	1100	4400.37	Sc II
130	4386.08	Tb II	45	4393.84	V I	70	4400.54	Ce II
45	4386.20	Gd I	170	4393.92	Ti I	150	4400.55	Ho II
120	4386.22	Sm I	30	4394.01	Y I	55	4400.58	Os I
100	4386.27	Ru I	55	4394.03	Tb I	1400	4400.58	V I
70	4386.35	Ce II	80	4394.07	W I	85	4400.76	Gd I
300	4386.40	Er I	40	4394.18	Nd II	60	4400.83	Nb I
1400	4386.43	Tm I	50	4394.32	Mo I	540	4400.83	Nd II
170	4386.70	Ce II	360	cw 4394.38	Re I	70	4400.87	Ce II
700	4386.84	Ce II	200	4394.42	Tm I	410	4401.17	Sm I
30	4387.17	Gd I	50	4394.47	Mo I	120	4401.24	Ho II
60	4387.50	Cr I	35	4394.50	Zr I	45	4401.54	Tb II
180	4387.67	Gd II	30	4394.67	Y I	110	4401.55	Ni I
65	4387.74	Nb I	27	4394.72	Gd II	55	4401.58	Th I
100	4387.74	Y I	85	4394.78	Ce II	1400	4401.86	Gd I
90	4387.88	Eu I	520	4394.86	Os I	35	4402.05	Nb I
310	4388.01	Ce II	85	4394.89	Th II	70	d 4402.30	U II
30	4388.08	Ti I	45	4394.92	Tb II		4402.44	U II
300	4388.23	Tb I	130	4394.94	Zr I	35	4402.49	Mo I
130	4388.36	Nb I	35	4394.96	Ru I	180	4402.50	Ta I
60	4388.38	Er II	140	4394.98	Dy II	100	4402.54	Ba I
70	c 4388.69	Ho II	70	h 4394.98	Ho I	80	4402.60	Re I
27	4388.99	Ru I	180	4394.98	Pr II	50	4402.65	La I
21	4388.99	Sm II	330	4395.04	Ti II	160	4402.74	Os I
45	h 4389.60	Sc I	100	4395.21	Zr I	75	4402.90	Mo I
75	4389.77	Dy I	3600	4395.23	V I	55	4402.93	Th I
55	h 4389.81	Tb I	40	4395.50	Nd II	65	4402.95	Zr I
55	4389.84	W I	180	4395.80	Pr II	810	d 4403.06	Sm II
60	4389.87	La I	40	4395.89	Nd II		4403.13	Sm I
180	4389.88	Gd I	120	4395.96	Tm I	520	4403.14	Gd I
4800	4389.97	V I	270	4396.08	Pr II	100	4403.17	Er II
180	4390.00	Gd I	70	4396.48	Th II	75	4403.18	Tb I
170	4390.28	Ce II	140	4396.50	Tm I	180	4403.27	Ho I
1700	4390.44	Ru I	180	4396.56	Tb I	65	4403.29	Pr II
250	4390.66	Nd II	70	4396.58	Ce II	55	4403.30	Ce II
1600	4390.86	Sm II	140	4396.66	Mo I	65	4403.34	Zr II
260	4390.91	Tb I	60	4396.80	Re I	410	4403.36	Sm II
150	4390.95	Gd II	28	4396.86	Pr II	60	4403.50	Cr I
85	4391.03	Ru I	65	4397.04	Nb I	170	4403.60	Pr II
90	4391.08	Os I	160	4397.26	Os I	75	4403.67	V I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum			
65	4403.78	Ir I	80	h	4412.15	Pr II	120		4419.94	V I	
100	4403.95	W I	24		4412.18	Nb I	50	d	4420.11	Nd I	
55	4404.21	Os I	130		4412.19	W I	140		4420.19	Tb I	
240	4404.28	Ti I	35		4412.25	Cr I	60		4420.45	Nb I	
30	4404.55	Mo I	140		4412.27	Nd II	90		4420.46	W I	
850	4404.75	Fe I	85		4412.56	Th I	240		4420.46	Zr I	
35	4404.82	Ru I	210		4412.74	Th II	4900		4420.47	Os I	
60	4404.90	Ti I	110		4412.77	Mo I	40		4420.52	Nd II	
100	4405.12	Pr II	190		4413.04	Zr I	1500		4420.53	Sm II	
21	h	4405.27	Eu II	110		4413.19	Ce II	200		4420.56	Ho II
75	4405.40	Tb II	27		4413.44	Gd I	95		4420.64	Nb I	
70	4405.47	Ce II	55		4413.63	Tb I	28		4420.66	Sc II	
35	4405.67	Sm II	75		4413.74	Er I	65		4420.84	Ru I	
30	4405.68	Ti I	410		4413.77	Pr II	65	h	4420.96	Lu I	
430	4405.83	Pr II	70		4413.80	Ce II	960		4421.14	Sm II	
90	h	4406.15	V I	50		4413.87	Cr I	160	c	4421.22	Pr II
110	cw	4406.40	Re I	35		4414.14	Zr I	140		4421.24	Gd II
35		4406.55	Nb I	860		4414.16	Gd I	18		4421.34	Co I
2300		4406.64	V I	60		4414.35	Er I	160		4421.46	Ru I
260		4406.67	Gd II	80		4414.39	Pr II	50		4421.54	Th II
65	4406.68	Pr II	70		4414.44	Nd II	640		4421.57	V I	
55	4406.76	Tb I	55		4414.49	Th I	120		4421.76	Ti I	
35	4406.87	Mo I	65		4414.54	Zr II	50		4422.05	Th I	
55	4407.07	Eu II	700		4414.73	Gd I	35		4422.06	Mo I	
120	4407.08	Nd II	350		4414.88	Mn I	35		4422.23	Hf I	
170	4407.28	Ce II	29		4414.88	Nb I	1400		4422.41	Gd I	
60	4407.52	Sm II	45		4415.06	V I	110		4422.51	Er II	
2800	4407.64	V I	45		4415.08	W I	890		4422.59	Y II	
3600	4408.20	V I	480		4415.12	Fe I	120		4422.82	Ti I	
260	4408.25	Gd II	140		4415.24	U II	350		4423.10	Tb I	
200	4408.28	W I	880		4415.56	Sc II	160	bl	4423.17	La La O	
4600	4408.51	V I	130		4415.74	Ta I	90		4423.21	V I	
55	b	4408.81	Hf Hf O	180		4415.82	Re I	75		4423.38	Sm I
1700		4408.82	Pr II	85		4416.24	Th II	50		4423.44	Ce I
65		4408.85	Ce II	200		4416.27	Tb II	210		4423.62	Mo I
85	4408.88	Th I	24		4416.41	Nb I	200		4423.68	Ce II	
35	4408.90	Ce II	640		4416.47	V I	80		4423.77	W I	
220	4409.25	Gd I	60		4416.54	Ti I	29		4423.87	Nb I	
520	4409.33	Sm II	28		4416.84	Th I	160		4423.90	La I	
810	4409.34	Er I	140		4416.89	Nd II	30		4423.91	V I	
540	4409.38	Dy II	310		4416.90	Ce II	45		4424.10	Gd II	
35	d	4409.44	Mo I	220		4417.28	Ti I	22		4424.16	Pr II
95		4409.52	Tb II	120		4417.35	Hf II	60		4424.28	Cr I
75		4409.95	Mo I	23		4417.40	Co I	2900		4424.34	Sm II
1600		4410.03	Ru I	380		4417.58	Sm II	24		4424.39	Ti I
330	4410.21	Nb I	60		4417.72	Ti II	45		4424.56	V I	
24	4410.30	Cr I	160		4417.91	Hf I	320		4424.57	Er I	
28	4410.49	Th II	220	bl	4418.24	La La O	160		4424.58	Pr II	
350	4410.64	Ce II	35		4418.25	Hf I	40		4424.78	Ru I	
350	4410.76	Ce II	45		4418.44	W I	35		4424.96	Ta I	
510	4411.06	Nd II	28		4418.66	Th II	120		4425.01	Gd I	
60	4411.09	Cr I	180		4418.70	Er I	300		4425.44	Ca I	
40	4411.13	Os I	980		4418.78	Ce II	90		4425.71	V I	
55	4411.14	Tb I	340		4419.03	Gd II	30		4425.83	Ti I	
520	4411.16	Gd I	160		4419.04	Pr II	45		4425.91	W I	
50	4411.21	La II	80		4419.16	La II	35		4425.99	Sm II	
95	4411.52	Nb I	70		4419.30	Ce II	460		4426.00	V I	
2500	4411.57	Mo I	470		4419.33	Sm I	120		4426.06	Ti I	
	4411.70	Mo I	190		4419.44	Nb I	55		4426.15	Gd II	
290	4411.58	Sm I	45		4419.55	Ta I	55		4426.20	Ho II	
120	4411.83	Sm II	570		4419.61	Er II	110		4426.27	Ir I	
55	4411.88	Mn I	190		4419.65	Pr II	170		4426.67	Mo I	
55	4411.93	Tb I	18		4419.66	Eu II	95		4426.68	Nb I	
130	4412.02	Ce II	55		4419.78	Mn I	70		4426.68	U II	
140	4412.14	V I	60		4419.83	Nb I	370		4426.77	Er I	

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
35	4426.83	Nd II	24	4433.58	Ti I	140	4440.87	Th II
60	4426.87	Dy I	45	4433.64	Gd II	130	4440.88	Ce II
70	4426.94	U I	50	4433.73	Ce II	55	4441.03	Ta I
310	4427.07	Ce II	1600	4433.88	Sm II	45	4441.27	Tb II
890	4427.10	Ti I	70	4433.89	U II	50	4441.27	Ti I
120	4427.24	Zr I	170	4434.00	Ti I	75	h 4441.45	Tb I
60	4427.31	Fe I	1800	4434.32	Sm II	75	4441.68	Ta I
120	4427.31	V I	95	4434.47	Tb II	830	4441.68	V I
45	4427.34	Tb I	110	4434.53	U II	60	4441.81	Nb I
260	4427.55	La II	90	4434.60	V I	530	4441.81	Sm I
180	4427.58	Sm II	120	4434.81	Eu II	75	4441.81	W I
45	4427.61	Gd II	22	4434.91	Pr II	200	4442.20	Mo I
110	4427.65	U II	990	4434.95	Mo I	440	4442.28	Sm I
55	4427.66	Th II	650	4434.96	Ca I	50	4442.34	Fe I
75	4427.81	Sm II	70	4434.96	Ho I	100	4442.47	Sm II
480	4427.92	Ce II	75	4435.01	Tb I	80	4442.55	Pt I
100	bl 4428.10	La LaO	75	4435.55	Tb II	80	4442.74	Tm I
310	4428.44	Ce II	14000	cw 4435.56	Eu II	50	bl 4443.00	La LaO
330	4428.46	Ru I	180	4435.69	Ca I	140	4443.00	Zr II
24	4428.50	Cr I	50	4435.85	La II	55	h 4443.07	Hf I
310	4428.52	V I	22	4436.05	Th II	110	4443.07	Mo I
55	4429.11	Zr I	240	d 4436.10	Gd I	50	4443.09	Th II
1200	c 4429.13	Pr II		4436.22	Gd II	20	4443.20	Fe I
	4429.25	Pr II	240	4436.12	Tb I	50	4443.27	Sm I
650	4429.27	Ce II	430	4436.14	V I	90	4443.34	V I
95	4429.44	Nb I	28	4436.29	Th II	100	4443.66	Y I
470	4429.66	Sm I	290	4436.32	Os I	150	4443.75	Ce II
230	4429.80	V I	210	4436.35	Mn I	230	4443.80	Ti II
80	4429.81	Ho II	40	4436.55	Th II	55	c 4444.03	Pr II
2000	4429.90	La II	70	4436.59	Ti I	640	4444.21	V I
70	4430.00	Ce II	110	4436.89	Mo I	710	4444.26	Sm II
21	4430.02	Ti I	160	4436.90	W I	24	4444.27	Ti I
45	d 4430.13	Tb II	50	4437.09	Os I	35	4444.29	Nd II
60	h 4430.21	Yb I	230	c 4437.22	Nb I	28	4444.33	Zr I
85	4430.37	Ti I	12	4437.27	Au I	480	4444.39	Ce II
65	4430.41	Ta I	80	4437.34	Y I	85	4444.51	Ru I
190	c 4430.48	Lu I	55	4437.40	Tm II	150	4444.58	Dy I
50	4430.49	Cr I	110	4437.61	Ce II	130	4444.63	Ho I
30	4430.50	V I	110	4437.66	Er I	450	4444.70	Ce II
1100	4430.63	Gd I	640	4437.84	V I	30	4444.98	Gd I
95	4430.66	Tb I	24	bl 4437.90	Nb I	60	4444.99	Nd I
60	4430.99	Dy II	100	4438.01	La LaO	28	4445.03	Th I
35	4431.09	Ta I	200	4438.04	Hf I	70	4445.07	Ho II
50	4431.28	Ti I	35	h 4438.04	Sr I	90	4445.14	W I
45	4431.36	Sc II	90	4438.05	Zr I	710	4445.15	Sm I
160	4431.49	Zr I	90	4438.15	Pr II	14	4445.55	Pt I
16	4431.62	Co I	30	4438.23	Ti I	40	4445.69	Os I
85	4431.76	Gd I	160	4438.27	Gd II	18	4445.72	Co I
22	4431.86	Pr II	45	4438.28	W I	35	4445.84	Sm II
150	4431.89	Ba I	35	4438.79	Lu I	60	4445.85	Nb I
50	4432.18	Cr I	65	4438.96	Mo I	65	4445.85	Pr II
50	4432.23	Er I	95	4438.97	Tb II	28	4445.90	Th I
28	4432.25	Th I	85	4439.00	Nd II	55	4446.15	Ce II
110	4432.28	Pr II	140	4439.12	Th II	75	4446.17	Nb I
60	4432.30	Nd II	440	4439.19	Yb I	580	4446.39	Nd II
100	4432.41	Os I	85	4439.24	Ce II	85	4446.43	Mo I
30	4432.60	Ti I	110	4439.38	Tb I	75	4446.49	Gd II
55	4432.72	Ce II	100	4439.64	Os I	130	4446.63	Y I
110	4432.72	Tb I	460	4439.76	Ru I	45	4446.96	Sm II
70	4432.92	Ce II	130	4440.35	Ti I	90	4446.99	Pr II
250	4432.96	Th II	19	4440.43	Nb I	290	4447.18	Nb I
160	bl 4432.98	La LaO	60	4440.44	Re I	80	4447.23	Ho II
40	4432.98	Ta I	75	4440.46	Zr II	21	4447.23	Mo I
120	4433.08	Sm I	40	4440.57	Th II	230	4447.35	Os I
23	4433.32	Rh I	40	4440.74	U I	50	4447.58	Tm I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
28	4447.67	Ce I	85	4455.66	Ce II	21	4462.09	Ti I
50	4447.72	Fe I	100	4455.80	La II	35	4462.29	Os I
110	4447.83	Th II	110	4455.82	Mn I	610	4462.36	V I
240	4448.04	Tb I	180	4455.89	Ca I	170	4462.42	Nd II
50	4448.62	Er II	35	4456.10	W I	18	4462.46	Ni I
28	4448.95	Zr I	90	4456.11	Sm II	110	4462.83	Gd I
90	4449.00	W I	55	4456.30	Zr I	150	4462.97	U II
27	4449.02	Gd I	300	4456.40	Nd II	740	4462.99	Nd II
840	4449.15	Ti I	40	h 4456.50	V I	55	4463.25	Gd II
770	4449.34	Ce II	10	4456.61	Ca I	70	4463.38	Ti I
440	4449.34	Ru I	140	4456.80	Nb I	65	4463.40	Ho II
27	4449.41	Gd I	55	4457.04	Mn I	420	4463.41	Ce II
65	4449.57	V I	140	4457.34	Hf I	75	4463.50	W I
100	4449.64	Ce II	480	4457.36	Mo I	30	4463.53	Re I
740	4449.70	Dy II	140	4457.42	Nb I	95	4463.54	Ti I
340	4449.74	Mo I	1100	4457.43	Ti I	29	4463.90	Sm I
730	4449.83	Pr II	110	4457.43	Zr I	85	4464.15	Nb I
15	4450.18	Ir I	410	4457.48	V I	55	4464.17	Ce II
80	c 4450.21	Pr II	210	4457.55	Mn I	40	4464.27	V I
90	4450.28	Zr I	120	4457.76	V I	290	4464.68	Mn I
45	4450.34	W I	40	4457.78	Ce II	140	4464.69	Ce II
30	4450.49	Ti II	85	4458.00	Th I	300	4464.74	Gd I
75	4450.72	Ta I	45	4458.09	W I	40	4464.75	V I
620	4450.73	Ce II	60	4458.12	Nb I	65	4464.77	Mo I
190	4450.81	Lu I	270	4458.26	Mn I	75	h 4464.97	Eu II
550	4450.90	Ti I	35	4458.28	W I	100	4465.07	Nd II
65	4450.90	V I	90	h 4458.30	Pr II	70	4465.13	U II
1400	4451.57	Nd II	22	d 4458.32	Gd I	20	4465.27	Y I
800	4451.59	Mn I	1000	4458.41	Gd I	220	4465.34	Th II
85	4451.63	Tb I	1000	4458.52	Sm II	30	4465.36	Cr I
19	h 4451.87	Ta I	110	4458.54	Cr I	40	4465.44	Ce II
140	4451.90	Pr II	30	4458.65	Mo I	40	4465.50	V I
200	4451.99	Nd II	85	4459.04	Ni I	120	4465.60	Nd II
610	4452.01	V I	50	4459.12	Fe I	290	4465.81	Ti I
100	4452.15	La I	100	4459.24	Er II	24	4465.92	Nb I
55	4452.55	Ce II	250	4459.29	Sm I	35	4465.94	Os I
30	4452.56	Mo I	45	h 4459.38	Tb II	100	4465.97	Pr II
25	4452.56	Th I	80	d 4459.53	Os I	140	4466.34	W I
25	4452.70	V I	30	4459.74	Cr I	45	4466.40	Hf II
40	4452.73	Gd I	95	4459.76	Ta I	24	4466.42	Nb I
1300	4452.73	Sm II	1000	4459.76	V I	60	4466.55	Fe I
85	d 4452.82	Tb I	80	4459.99	Tm I	300	4466.55	Gd II
250	4452.95	Sm I	1100	4460.04	Ru I	300	4466.60	Gd I
55	4453.00	Hf I	50	4460.20	Nb I	140	4466.74	W I
160	4453.00	Mn I	2400	4460.21	Ce II	60	4466.89	Co I
55	4453.16	Ce II	2000	4460.29	V I	110	4466.91	Zr I
840	4453.32	Ti I	28	4460.34	Zr I	520	4467.08	Gd I
290	4453.71	Ti I	55	4460.38	Mn I	75	4467.23	Gd II
30	c 4453.92	Re I	85	4460.42	Nb I	22	4467.26	Ru I
40	4453.93	Gd II	140	4460.49	W I	70	4467.28	Ho I
120	4454.03	Tm I	65	4460.62	Mo I	2200	4467.34	Sm II
65	4454.36	Pr II	75	4460.99	V I	280	4467.54	Ce II
25	4454.51	Th II	85	d 4461.06	Th II	30	4467.54	Re I
30	4454.62	Re I	150	4461.24	Th I	110	4467.69	Tb I
1200	4454.63	Sm II	450	4461.08	Mn I	85	4467.85	Nd II
140	4454.68	Pr II	450	4461.14	Ce II	80	4467.92	Re I
1400	4454.78	Ca I	140	4461.18	Hf I	50	4467.98	Tm I
85	4454.99	Ce II	90	4461.22	Zr II	120	4468.01	V I
130	4455.01	Mn I	45	4461.27	Tb I	250	4468.14	Dy II
21	4455.30	Mo I	65	h 4461.29	Pr II	28	4468.22	Zr I
160	4455.32	Mn I	30	4461.36	Gd I	190	4468.28	Mo I
950	4455.33	Ti I	40	4461.53	Th I	240	4468.50	Ti II
55	4455.43	Zr I	30	4461.65	Fe I	960	4468.66	Pr II
35	4455.46	W I	40	4461.70	Th II	40	4468.76	V I
110	4455.60	Dy II	510	4462.02	Mn I	45	4468.79	Zr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
40	4468.97	La I	180	4476.96	Y I	280	4486.90	Gd I
65	4469.12	Tb I	140 c	4477.26	Pr II	25	4486.90	Th I
140	4469.26	Nd II	160	4477.45	Y I	840	4486.91	Ce II
50	4469.32	Nb I	50	4477.46	Nd II	85	4487.05	Mo I
55	4469.32	U I	50	4477.50	Sm I	110	4487.28	Y I
55	4469.53	Th I	300	4477.64	Ho II	300	4487.47	Y I
90	4469.56	Co I	70	4477.71	U II	110	4487.50	Th II
22	4469.65	Pr II	140	4477.88	Nd I	28	4487.79	Pr II
90	4469.66	Sm II	80	4477.99	Re I	40	4488.05	Cr I
140	4469.71	Nb I	21	4478.32	Co I	85	4488.16	Tb I
380	4469.71	V I	120	4478.39	Re I	65	4488.19	Pr II
200	4470.14	Mn I	55	4478.48	Ir I	25	4488.25	Au I
70	4470.23	Ho I	740	4478.66	Sm II	19	4488.32	Ti II
110	4470.31	Zr I	220	4478.80	Gd II	85	4488.39	Ru I
55	4470.48	Ni I	700	4479.36	Ce II	65 h	4488.40	Gd II
190	4470.56	Zr I	40	4479.40	Mn I	40	4488.60	Os I
810	4470.89	Sm I	27	4479.41	Ru I	140	4488.68	Th II
85	4470.97	Nd II	95	4479.70	Ti I	40	4488.81	Ce II
1400	4471.24	Ce II	90	4479.81	Os I	380	4488.89	I
240	4471.24	Ti I	75	4480.04	V I	30	4488.90	Er I
110	4471.29	Gd II	120	4480.32	Sm I	30	4488.97	Ba I
140	4471.29	Nb I	150	4480.45	Ru I	30	4489.00	Mo I
85	4471.41	Nd II	50	4480.59	Ti I	45	4489.01	W I
35	4471.55	Co I	35	4480.77	Zr I	50	4489.05	Er I
50 h	4471.55	Lu I	85	4480.82	Th II	260	4489.09	Ti I
50	4471.66	Mo I	45	4480.93	Ta I	50	4489.47	Cr I
45	4471.72	Tb II	140	4480.97	Nd I	80	4489.70	Tm II
50	4472.04	Mo I	280	4481.06	Gd II	26	4490.02	Sm I
35	4472.28	Th II	530	4481.26	Ti I	170	4490.08	Mn I
600	4472.34	U II	540	4481.26	Tm II	65	4490.19	Mo I
470	4472.43	Sm II	45	4481.27	W I	55	4490.24	Ru I
140	4472.53	Nb I	29	4481.44	Nb I	75	4490.80	V I
450	4472.72	Ce II	70	4481.90	Nd I	110	4490.84	U II
130	4472.79	Mn I	35	4482.03	Ru I	65	4491.01	Tb I
55	4472.92	Pr II	30 d	4482.17	Fe I	230	4491.28	Mo I
620	4473.02	Sm II		4482.26	Fe I	28	4491.56	Zr I
130	4473.18	Mo I	40	4482.17	Th I	30	4491.66	Mo I
65	4473.28	Gd I	85 h	4482.42	Yb I	45	4491.68	Ru I
100	4473.50	Er II	45	4482.50	Zr I	30	4491.75	Y I
95	4473.52	Ta I	95	4482.69	Ti I	40	4492.24	Th II
100	4473.59	Ho II	30	4482.88	Cr I	45	4492.30	W I
180	4473.59	Pd I	220	4483.33	Gd II	60	4492.31	Cr I
55	4473.84	Pr II	35	4483.48	Pr II	55 c	4492.42	Pr II
40	4473.89	Y I	700	4483.90	Ce II	25	4492.42	Y I
190	4473.93	Ru I	18	4483.93	Co I	35	4492.47	Rh I
45	4474.03	W I	640	4484.19	W I	24	4492.55	Ti I
120	4474.04	V I	60	4484.36	Dy I	35 d	4492.91	Pr I
40	4474.07	Th II	85	4484.48	Er I		4493.06	Pr II
700	4474.13	Gd I	120	4484.57	Ho II	40	4492.95	Ce II
630	4474.56	Mo I	220	4484.70	Gd I	19	4492.96	Nb II
	4474.65	Mo I	120	4484.76	Os I	430	4493.07	Tb I
40	4474.69	Ce II	170	4484.82	Ce II	40	4493.11	La I
200	4474.71	V I	150	4484.97	Mo I	170	4493.33	Th I
95	4474.85	Ti I	24	4485.15	Eu II	85	4493.42	Nd II
150	4475.08	Re I	27	4485.48	Gd I	35 h	4493.64	Ba I
75	4475.18	Sm II	85	4485.52	Ce II	35	4493.70	Pr II
29	4475.28	Nb I	45	4485.54	Pr II	75	4493.96	W I
40	4475.57	Nd II	29	4485.57	Sm II	35	4494.18	Pr II
95	4475.62	Mo I	40	4485.68	Tb I	140	4494.22	Ce II
170	4475.72	Y I	40	4485.80	Th II	55	4494.42	Zr II
30	4475.84	Nd I	40	4485.95	Nd II	80	4494.50	W I
25	4475.89	V I	40	4486.06	La I	60	4494.57	Fe I
60	4476.02	Fe I	55	4486.13	Hf II	50	4494.57	Nb I
50 hI	4476.08	Ag I	65	4486.35	Gd II	40	4494.71	La I
860	4476.12	Gd I	25	4486.63	Th II	16	4494.76	Co I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
28	4494.94	Zr I	27	4503.79	Gd I	440	4515.09	Sm II
40	4494.97	Ta I	35	4504.13	W I	40	4515.12	Th I
40	4495.01	Ti I	55 c	4504.61	Pr II	85	4515.16	Yb II
24	4495.14	Sm II	160	4504.84	W I	85	4515.18	Mo I
45	4495.29	W I	120	4504.90	Mo I	240	4515.28	U II
16	4495.35	Ir I	180	4505.05	Sm II	19	4515.62	Ti I
130	4495.39	Ce II	55	4505.22	Th I	110	4515.86	Ce II
11 h	4496.03	Ir I	130	4505.92	Ba I	40	4515.96	Th II
100	4496.06	V I	500	4505.95	Y I	250	4516.36	Nd II
240	4496.15	Ti I	430	4506.21	Gd I	22	4516.45	Pr II
140	4496.23	Ce II	140	4506.33	Gd II	260	4516.64	Re I
40	4496.32	Th II	21	4506.36	Ti I	70	4516.73	U I
130	4496.39	Er I	100	4506.41	Ce I	220	4516.89	Ru I
25	4496.43	Re I	24	4506.47	Th I	60	4516.95	Dy I
1100	4496.46	Pr II	200	4506.59	Nd II	85	4516.98	Gd I
40	4496.50	Ta I	50	4506.67	Mo I	22	4517.04	Th II
65	4496.85	V I	24	4506.85	Cr I	35	4517.11	Co I
660	4496.86	Cr I	55	4506.93	Gd II	230	4517.13	Mo I
200	4496.97	Zr II	120 c	4507.04	Re I	29	4517.27	Sm II
500	4497.13	Gd I	550	4507.12	Zr I	50	4517.41	Mo I
19	4497.25	Nb I	50	4508.01	Re I	200 c	4517.58	Pr II
40	4497.27	Nd II	70	4508.08	Ce II	220	4517.82	Ru I
220	4497.32	Gd I	50	4508.41	Nb I	35	4518.02	Ce I
40	4497.40	Nd I	45 d	4509.04	Tb II	1000	4518.03	Ti I
40	4497.40	V I	55	4509.08	Gd II	45	4518.29	Hf I
24	4497.73	Ti I	35	4509.12	Ce II	21	4518.44	Mo I
250	4497.85	Ce II	28	4509.17	Ce II	60	4518.51	Dy II
24	4497.91	Th I	22	4509.25	Ce II	3300	4518.57	Lu I
85	4497.93	Nd II	120	4510.10	Ru I	22	4518.64	Th II
350	4498.14	Ru I	790	4510.15	Pr II	35	4518.66	Er I
170	4498.28	Gd II	55	4510.17	Ce II	95	4518.70	Ti I
30	4498.45	W I	70	4510.32	U II	35	4518.89	Os I
50	4498.73	Cr I	280	4510.53	Th II	35	4519.15	W I
25	4498.76	Pt I	140	4510.82	Ho I	22	4519.26	Th I
60 h	4498.85	Lu I	50	4510.92	Ce II	75	4519.44	Er II
240	4498.90	Mn I	360 c	4510.98	Ta I	100	4519.59	Ce II
110	4498.95	Th I	75	4511.09	Nb I	150	4519.60	Tm I
370	4499.11	Sm I	50	4511.17	Ti I	880	4519.63	Sm II
50	4499.44	Mo I	85	4511.20	Ru I	1100	4519.66	Gd I
45	4499.47	Tb I	18000	4511.31	In I	45	4519.72	Tb II
370	4499.48	Sm II	120	4511.33	Sm I	22	4519.75	Th II
55	4499.65	Hf I	75	4511.50	Ta I	80	4519.76	Re I
75	4499.80	Nb I	150 h	4511.52	Tb I	65	4520.07	Gd II
70	4499.98	Th I	85	4511.64	Ce II	35	4520.32	Os I
90	4500.22	La I	560	4511.83	Sm II	55	4520.75	Pr II
70	4500.30	Cr I	95	4511.90	Cr I	12	4520.90	Pt I
85	4500.34	Ce II	19	4512.13	Nb I	110	4520.95	Ru I
200	4500.75	Er II	140	4512.15	Mo I	55	4521.09	Ta I
25	4501.10	Ce I	35	4512.21	Er I	24	4521.14	Cr I
50	4501.11	Cr I	40	4512.48	Th II	70 h	4521.20	Th I
200	4501.27	Ti II	90	4512.55	Ho II		4521.24	Th II
50	4501.29	Mo I	780	4512.74	Ti I	55	4521.30	Gd II
60	4501.38	Sm II	130	4512.88	W I	35	4521.71	Ta I
22	4501.79	Cr I	45	4512.96	Tb II	75	4521.94	Gd II
410	4501.82	Nd II	120	4513.25	W I	40	4521.96	Ce I
40	4501.82	Pr II	2600	4513.31	Re I	40 h	4522.05	Y I
120	4501.95	V I	170	4513.34	Nd II	22	4522.08	Ce II
240	4502.22	Mn I	50	4513.58	Y I	50	4522.19	Mo I
150	4503.04	Nb I	55	4513.68	Th I	850	4522.37	La II
60	4503.23	Dy II	80	4514.01	Y I	60	4522.55	Sm I
45	4503.27	Er II	75	4514.19	V I	3000	4522.57	Eu II
240	4503.38	Sm I	75	4514.31	Tb II	260	4522.57	Tm II
24	4503.42	Nb I	12	4514.37	Cr I	500	4522.73	Re I
29	4503.78	Rh I	140	4514.50	Gd II	130	4522.74	Er I
40	4503.78	Ti I	35	4514.53	Cr I	22	4522.78	Th II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
1000	4522.80	Ti I	380	4530.74	Cr I	40	4539.79	Cr I
300	4522.82	Gd II	20	4530.78	Cu I	65	4539.92	Os I
70	4522.84	Nd II	40	4530.79	V I	75	4539.98	Zr I
440	4523.04	Sm II	65	4530.85	Ru I	40	4540.01	V I
	4523.18	Sm I	190	4530.85	Ta I	220	4540.02	Gd II
770	4523.08	Ce II	50	4530.89	Re I	290	4540.19	Sm II
28	4523.13	Zr I	690	4530.96	Co I	55	4540.40	Th II
50	h 4523.24	Ba I	35	4531.08	Er I	240	4540.50	Cr I
530	4523.41	Nb I	55	4531.08	Pr II	240	4540.72	Cr I
40	4523.58	Nd II	20	4531.15	Fe I	140	4540.93	Hf I
120	4523.88	Re I	40	4531.28	Ce I	35	4541.07	Cr I
650	4523.91	Sm II	170	c 4531.28	Ho I	340	4541.27	Nd II
150	4524.12	Gd I	50	4531.33	Ce I	19	4541.51	Cr I
75	4524.12	Nb I	130	c 4531.65	Ho II	40	4541.56	Mo I
140	4524.22	V I	70	4531.71	Th II	100	4541.66	Dy II
230	4524.34	Mo I	45	h 4531.83	Tb II	30	4541.79	La I
400	4524.74	Sn I	40	4532.01	Ce I	40	4541.80	Re I
40	4524.84	Th II	80	4532.15	Tm I	300	4542.03	Gd I
65	4524.87	Os I	85	4532.26	Th II	85	4542.06	Nd I
130	4524.93	Ba II	75	4532.44	Sm I	380	4542.06	Sm II
45	4525.01	Tb II	110	4532.49	Ce II	490	4542.22	Zr I
28	4525.09	Th II	6000	4533.24	Ti I	65	4542.53	Pr II
40	4525.16	V I	170	4533.30	Th II	65	4542.55	Sc I
170	4525.31	La II	290	4533.80	Sm I	340	4542.61	Nd II
80	4526.01	Re I	40	4533.92	V I	24	4542.62	Cr I
24	4526.11	Cr I	240	4533.97	Ti II	40	4542.80	Nb I
420	4526.12	La II	70	4533.99	Co I	35	4542.87	W I
100	c 4526.14	Ho II	70	4534.12	Th II	150	4543.54	W I
85	4526.37	Mo I	45	4534.13	Tb I	620	4543.63	U II
380	4526.47	Cr I	340	c 4534.15	Pr II	27	4543.69	Ru I
35	4526.92	Er II	28	4534.22	Ce II	65	4543.80	Ho I
16	h 4526.94	Ca I	170	4534.58	Ho I	60	4543.81	Co I
120	4527.25	Nd I	65	4534.68	W I	28	4543.94	Pr II
890	4527.25	Y I	3600	4534.78	Ti I	810	4543.95	Sm II
780	4527.31	Ti I	80	4535.03	W I	80	4544.02	Hf I
70	d 4527.34	Cr I	50	4535.15	Cr I	65	4544.23	Gd I
	4527.47	Cr I	40	4535.26	Th I	40	4544.26	Nd II
840	4527.35	Ce II	40	4535.38	Mo I	16	4544.27	Rh I
60	4527.42	Sm I	2400	4535.58	Ti I	100	4544.32	Y I
65	4527.50	Ta I	45	h 4535.59	Eu I	70	4544.51	Th II
100	d 4527.58	Dy I	240	4535.72	Cr I	140	4544.62	Cr I
	4527.76	Dy II	610	4535.75	Zr I	90	4544.68	Sc I
24	4527.65	Nb II	340	4535.92	Pr II	720	4544.69	Ti I
440	4527.80	Y I	1200	4535.92	Ti I	100	4544.83	Sm II
40	4527.99	V I	1200	4536.05	Ti I	210	4544.96	Ce II
840	4528.47	Ce II	270	4536.51	Sm II	100	4545.17	Re I
100	4528.62	Fe I	65	4536.64	W I	35	4545.33	Nd II
30	h 4528.62	Mo I	400	4536.80	Mo I	24	4545.34	Cr I
23	4528.72	Rh I	85	4536.89	Ce II	360	4545.39	V I
70	4528.97	Re I	95	4536.97	Gd I	150	4545.58	U II
40	4529.30	V I	70	4537.07	Th II	55	4545.68	Ir I
180	4529.38	Tm II	45	4537.14	Tb I	29	4545.81	Sm II
120	4529.40	Mo I	45	4537.23	Tb I	35	4545.82	Th II
24	4529.42	Nb I	24	4537.23	Ti I		4545.92	Th I
20	4529.48	Th II	28	4537.62	Os I	35	4545.87	Ce II
75	4529.59	V I	40	4537.66	V I	600	4545.96	Cr I
65	4529.67	Os I	910	4537.81	Gd I	40	4546.06	Ce I
35	4529.74	W I	70	4537.88	Ce II	150	4546.47	W I
45	4529.76	Th I	710	4537.95	Sm II	480	4546.82	Nb I
24	4529.85	Cr I	190	4538.19	U II	28	4547.15	Ta I
70	4529.94	Nd I	150	4538.53	Sm II	170	4547.33	Ru I
120	4529.95	Re I	110	4539.07	Ce II	24	4547.85	Nb I
170	4530.08	Ho II	24	4539.10	Ti I	110	4547.85	Ru I
22	4530.32	Th I	55	h 4539.26	Pr II	240	4548.00	Gd I
35	4530.45	W I	840	4539.75	Ce II	85	4548.24	Nd I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
30	4548.48	Ir I	400	4555.31	Cs I	28	4563.38	Ce II
80	4548.52	Pr II	70	4555.43	Ce II	35	4563.43	Ti I
110	4548.60	Tm I	720	4555.49	Ti I	75	4563.57	W I
110	4548.66	Os I	140	4555.52	Zr I	40	4563.66	Th I
35	4548.73	Rh I	50	4555.70	Er I	110	4563.69	Tb II
950	4548.77	Ti I	70	4555.81	Th I	110	4563.77	Ti II
55	4548.89	Ce I	100	4556.14	Nd II	35	4563.93	Er I
90	4548.94	Ho II	50	4556.17	Cr I	55	4563.95	U I
40	4549.02	Nd II	25	4556.22	Ce II	85	h 4563.95	Yb I
110	4549.07	Tb I	85	4556.35	Ta I	60	h 4564.10	Sm II
27	4549.43	Ru I	110	4556.46	Tb I	19	4564.17	Cr I
80	4549.50	La I	90	d 4556.50	Sm II	21	4564.18	Th II
240	4549.63	Ti II		4556.63	Sm I	30	4564.39	Y I
70	4549.64	Ce II	40	4556.68	Tm II	370	4564.53	Nb I
100	4549.65	V I	85	4556.74	Nd II	27	4564.59	Gd I
90	4549.66	Co I	35	4556.83	W I	80	4564.68	Tm I
45	4549.72	Tb II	40	4556.84	Nb I	40	4564.69	Ru I
40	4549.82	Pr II	120	h 4557.24	Sc I	30	4564.85	Tb II
45	4549.96	Ru I	19	4557.86	Ti I	140	4565.09	Dy I
45	4550.03	Sm I	45	4558.04	Zr I	16	4565.19	Rh I
28	4550.08	Pr II	120	4558.08	Gd II	55	4565.23	Ce I
70	4550.30	Ce II	110	4558.11	Mo I	50	c 4565.30	Re I
540	4550.41	Os I	19	4558.11	Ti I	35	4565.30	W I
110	4550.45	Tb I	45	4558.41	Ho II	45	4565.47	Zr I
13	4550.78	Ir I	400	4558.46	La II	120	4565.51	Cr I
35	4550.83	Pr II	70	4558.60	Ce II	140	4565.59	Co I
65	4550.95	Gd II	22	4558.66	Cr II	420	4565.84	Ce II
250	4551.30	Ce II	26	4558.74	Mo I	170	4565.85	Ta I
140	4551.30	Os I	35	4558.94	W I	250	4565.94	Hf I
22	4551.47	Th I	35	4559.10	W I	470	4566.21	Sm II
40	4551.64	Rh I	50	4559.27	Re I	50	4566.38	Er II
150	4551.82	W I	110	4559.29	La II	30	4566.65	Th II
25	4551.84	V I	100	4559.37	Y I	60	4566.77	Sm I
130	4551.95	Ta I	19	4559.42	Nb I	28	4566.86	Ta I
45	4551.98	U I	45	4559.46	Ta I	60	4567.04	Dy I
35	4551.99	Er I	27	4559.62	Gd I	40	4567.11	Tm II
22	4552.06	Ce I	170	4559.67	Nd I	21	4567.24	Th I
45	4552.11	Ru I	70	4559.68	Re I	85	4567.61	Nd II
75	4552.14	Er II	60	4559.92	Ti I	85	4567.68	Mo I
35	4552.15	Th I	110	4559.98	Ru I	95	4567.69	U II
65	4552.26	Pr I	85	4560.13	Mo I	65	c 4567.82	Ho II
35	4552.42	Pt I	650	4560.28	Ce II	160	4567.91	La I
950	4552.46	Ti I	60	4560.42	Nd I	35	4568.09	Ir I
410	4552.66	Sm II	240	4560.43	Sm II	22	h 4568.55	Pr II
200	4553.01	Zr I	280	4560.71	V I	130	4569.00	Rh I
90	4553.05	V I	19	4560.89	Rh I	21	4569.02	Mo I
22	4553.06	Ce I	24	b 4560.95	Lu LuO	35	4569.29	Er I
50	4553.32	Mo I	310	4560.96	Ce II	35	4569.58	Sm I
35	4553.58	Yb II	45	d 4561.08	Gd I	95	4569.64	Cr I
45	4553.69	Ta I	60	4561.18	Nd II	40	4569.66	Ce II
26	4553.80	Mo I	18	4561.19	Sm II	140	4569.91	U II
85	4553.84	Nb I	70	4561.35	Th I	16	h 4570.02	Co I
40	4553.86	U II	17	4561.48	Ta I	18	4570.02	Ir I
45	4553.97	Zr II	70	4561.86	Nd I	200	4570.02	La I
65000	4554.03	Ba II	40	4561.86	Tm II	50	4570.13	Mo I
270	4554.45	Sm II	22	4562.12	Zr I	65	4570.42	V I
5400	4554.51	Ru I	55	4562.24	Tb II	65	h 4570.54	Pr II
28	4554.56	Ce II	2100	4562.36	Ce II	140	4570.64	W I
35	4554.97	Nd II	200	4562.52	Ho I	35	4570.91	Ti I
45	4554.99	Gd II	22	4562.60	Ru I	24	4570.95	Nb I
24	4555.08	Ti I	50	4562.63	Ti I	65	4570.97	Th I
80	4555.10	U II	200	4563.12	Pr II	30	h 4570.98	Gd II
200	4555.13	Zr I	340	4563.22	Nd II	40	4570.99	U II
50	4555.14	Nd II	160	4563.26	Er II	14	4571.31	Rh I
60	4555.22	Dy I	90	4563.29	Th II	28	4571.61	Pr II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
120	4571.68	Cr I	16	4580.14	Co I	170	4591.22	V I
200	4571.78	V I	640	4580.40	V I	360	4591.39	Cr I
240	4571.98	Ti II	120	4580.68	Re I	65	4591.56	Tb II
22	4572.13	Pr I	28	4580.69	Ta I	25	4591.68	Re I
85	4572.20	Gd I	85	4581.09	Gd II	60	4591.78	Dy II
1100	4572.28	Ce II	35	4581.10	Ce I	290	4591.82	Sm II
55	4572.42	Ho II	21	4581.23	Th II	22	4592.12	Pr II
120	4572.66	Be I	410	4581.29	Gd I	40	4592.21	Mo I
85	4572.79	Ce II	35	4581.32	Y I	45	4592.38	Tb I
720	4573.08	Nb I	50	4581.40	Ca I	75	4592.39	W I
55	4573.19	Tb II	290	4581.58	Sm I	150	4592.52	Ru I
45	4573.29	Ta I	40	4581.58	Th II	35	4592.53	Ni I
60	h 4573.56	Y I	190	4581.60	Co I	55	4592.57	W I
160	4573.69	U II	480	4581.62	Nb I	50	4592.67	Th I
26	4573.70	Th II	440	4581.73	Sm I	75	4592.92	Er I
23	4573.79	Hf II	30	4581.77	Y I	65	h 4592.94	Sc I
130	4573.81	Gd I	75	4582.29	Nb I	200	4593.20	Cs I
80	4573.85	Ba I	100	4582.29	Zr I	380	4593.54	Sm II
60	4573.85	Dy II	26	4582.35	Mo I	19	4593.64	Th I
160	h 4573.99	Sc I	200	4582.36	Yb I	840	4593.93	Ce II
340	4574.31	Ta I	95	4582.38	Gd II	28	4593.93	Pr II
19	4574.33	Nb I	420	4582.50	Ce II	11000	4594.03	Eu I
40	4574.48	Mo I	26	4582.50	Mo I	1300	4594.11	V I
	4574.61	Mo I	130	4582.53	Gd II	85	4594.45	Nd II
20	4574.50	Zr II	410	4583.07	Gd I	35	4594.59	Sm II
75	4574.84	Nb I	22	4583.09	Ce I	35	h 4594.63	Co I
400	4574.88	La II	19	4583.17	Ta I	90	4595.04	Os I
22	4575.12	Cr I	50	4583.78	V I	170	4595.16	Mo I
21	4575.25	Th II	40	4584.04	Nd II	560	4595.29	Sm II
24	b 4575.31	Lu LuO	75	4584.24	Zr I	75	4595.42	Th I
40	4575.37	Nb I	85	4584.26	Gd I	70	4595.59	Cr I
21	4575.42	Th II	30	4584.37	Th II	28	4595.88	Pr II
490	4575.52	Zr I	1700	4584.44	Ru I	130	4596.55	Y I
260	4575.91	Gd I	560	4584.83	Sm II	95	4596.63	Tm I
40	4576.20	Zr I	65	4584.84	Tb II	65	4596.71	Ru I
640	4576.21	Yb I	55	4584.85	U II	45	4596.74	Er I
65	h 4576.33	Pr II	19	4585.84	Ti	240	4596.74	Sm I
55	4576.48	Ce II	80	4585.86	Ca I	35	h 4596.90	Co I
210	4576.50	Mo I	26	4586.06	Mo I	65	4596.93	Pr II
55	4576.64	U I	24	4586.14	Cr I	220	4596.98	Gd II
510	4577.17	V I	830	4586.36	V I	200	4597.02	Nd II
590	4577.69	Sm II	26	4586.57	Mo I	90	4597.16	Os I
420	4577.78	Dy I	100	4586.62	Nd I	55	4597.17	Ce II
26	4577.78	Mo I	21	4586.79	Mo I	30	4597.88	Mo I
90	c 4578.07	Ho I	65	4586.83	W I	45	h 4597.90	Hf I
55	h 4578.17	Pr II	60	4586.96	Nd I	320	4597.91	Gd II
35	4578.32	W I	160	4586.99	Gd I	75	4598.12	Er I
25	4578.55	Ca I	45	4587.10	Ru I	26	4598.25	Mo I
210	4578.69	Tb II	75	4587.91	Dy II	90	4598.35	Sm II
45	4578.72	Sm II	30	4588.23	Th II	40	4598.36	Yb II
140	4578.73	V I	50	4588.43	Th I	65	h 4598.45	Sc I
70	4578.78	Ce II	170	4588.73	W I	500	d 4598.80	Hf I
200	4578.89	Nd II	40	4589.12	Th II		4598.92	Hf I
35	4579.04	Os I	70	4589.21	Yb I	410	4598.90	Gd I
75	4579.09	Sm II	2100	4589.36	Dy I	22	4598.95	Pr I
30	4579.19	V I	45	4589.43	Sm II	22	4599.02	Ce II
85	4579.28	Ce II	30	4589.67	Th II	270	4599.02	Tm I
200	4579.32	Nd II	70	4589.70	Ho II	330	4599.08	Ru I
24	4579.45	Nb II	24	4589.95	Ti II	50	4599.16	Mo I
280	4579.59	Gd I	20	4590.16	Zr I	60	4599.23	Ti I
140	4579.64	Ba I	26	h 4590.38	Mo I	24	4599.48	Nb I
35	4579.69	W I	140	4590.55	Zr I	40	4599.75	Ba I
360	4580.06	Cr I	140	4590.83	Yb I	140	4599.94	W I
200	4580.06	La II	110	4591.10	Ru I	50	4600.10	Cr I
65	4580.07	Ru I	130	4591.12	Ce II	95	4600.21	Nb I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
18	4600.37	Ni I	24	4608.58	Nb I	950	4617.27	Ti I
35	4600.38	Pr II	45	4608.67	Ho II	27	4617.49	Tb I
30	4600.41	W I	30	4608.71	Mo I	22	4617.72	Pr I
480	4600.75	Cr I	55	4608.75	Ce II	30	4617.95	Mo I
50	4601.02	Cr I	22	4609.15	Zr I	22	4618.00	Pr II
340	4601.05	Gd II	22	4609.29	Zr I	100	4618.84	Ho I
55	4601.13	U II	120	4609.32	Ho II	35	4619.06	Tm II
35	4601.29	Tm II		4609.52	Ho II	65	4619.14	Gd I
35	4601.37	Ce II	50	4609.37	Th II	30	4619.36	Tb II
40	4601.42	Ta I	21	4609.37	Ti I	65	4619.48	Th II
55	4601.76	Ru I	45	4609.53	Sc I	260	4619.51	Ta I
35	4602.05	La I	30	4609.65	V I	24	4619.52	Ti I
60	4602.07	Er I	22	4609.83	Zr I	70	4619.55	Cr I
45	4602.19	Ta I	40	4609.86	U II	40	4619.56	Th II
350	4602.57	Zr I	100	4609.87	Nd I	230	4619.77	V I
21	4602.63	Eu I	360	4609.88	Mo I	22	4619.85	Zr Zr O
130	4602.86	Li I	140	4609.89	W I	410	4619.88	La II
19	4602.86	Nb I	45	4609.95	Sc I	14	4619.91	Rh I
45	4602.88	Th II	22	4610.11	Zr I	20	4619.98	Ba I
240	4602.93	Gd I	55	4610.46	Ce I	140	4620.03	Dy II
25	4602.94	Fe I	19	4610.69	Nb I	300	4620.23	U I
60	4603.12	Sm II	55	4611.04	Gd I	15	4620.25	Sm II
55	4603.43	Tm II	50	4611.15	Mo I	30	4620.52	W I
140	4603.66	U II	75	4611.25	Er II	230	4620.86	Hf I
22	4603.81	Pr II	75	4611.25	Sm I	100	4621.38	Mo I
100	4603.82	Nd I	40	4611.44	U II	100	4621.38	Re I
45	4604.10	Tb II	85	4611.56	Ce II	40	4621.72	Tm I
220	4604.18	Sm II	25	4611.74	V I	300	4621.94	Nd I
22	4604.21	Ce II	65	4611.86	Th II	85	4621.96	Cr I
17	4604.28	Ta I	30	4611.96	Tb I	40	4622.43	U II
140	4604.42	Zr I	140	4612.08	Pr II	70	4622.49	Cr I
18	4604.48	Ir I	29	4612.12	Nb I	70	4622.70	Hf II
55	4604.72	Sc I	990	4612.26	Dy I	24	4622.76	Cr I
95	4604.80	Y I	22	4612.32	Ru I	30	4622.96	Ta I
35	4604.85	Ta I	35	4612.47	Nd II	14	4623.04	Co I
40	4604.85	Tm I	26	4612.54	Th II	480	4623.09	Ti I
65	4605.00	Ni I	40	4613.00	Y I	30	4623.46	Mo I
28	4605.04	Os I	70	4613.02	Ce II	27	4623.64	W I
55	4605.15	U II	160	4613.30	W I	30	4623.89	Th II
80	4605.36	Mn I	240	4613.37	Cr I	26	4624.14	Th II
85	4605.39	Lu I	130	4613.37	Ho I	85	4624.21	Nd I
35	4605.48	Ce II	410	4613.39	La II	30	4624.24	Mo I
40	4605.66	Ru I	75	4613.50	Sm II	65	4624.41	V I
120	4605.73	Re I	50	4613.83	Dy I	140	4624.42	Gd I
23	4605.77	Hf II	50	4613.97	Tm I	30	4624.78	Er II
160	4605.78	La II	45	4613.99	Ho II	17	4624.84	Ta I
55	4606.06	Gd I	40	4614.47	Tm II	420	4624.90	Ce II
100	4606.15	V I	520	4614.50	Gd I	24	4624.97	Sm II
18	4606.23	Ni I	25	4614.66	Re I	26	4625.05	Th II
420	4606.40	Ce II	50	4614.82	Dy I	18	4625.78	Co I
40	4606.45	Pr II	23	4614.83	W I	25	4625.96	Re I
26	4606.50	Th II	23	4615.07	La I	550	4626.19	Cr I
290	4606.51	Sm II	70	4615.18	Ce I	75	4626.32	Tb II
1000	4606.61	Er I	290	4615.44	Sm II	80	4626.33	Tm II
1200	4606.77	Nb I	85	4615.6	Gd GdO	210	4626.41	Zr I
45	4606.88	Sm II	470	4615.69	Sm II	460	4626.47	Mo I
6500	4607.33	Sr I	45	4615.92	Tb II	50	4626.48	V I
90	4607.34	Au I	300	4615.94	Tm II	85	4626.50	Nd I
40	4607.38	Nd II	600	4616.14	Cr I	80	4626.54	Mn I
90	4608.00	Ho I	170	4616.17	Nb I	95	4626.56	Tm II
30	4608.03	Gd II	75	4616.39	Ir I	95	4626.94	Tb II
90	4608.09	Hf I	29	4616.49	Sm II	40	4626.97	Tm I
29	4608.12	Rh I	30	4616.62	Mo I	35	4627.07	Pr II
70	4608.49	Ce I	170	4616.78	Os I	240	4627.08	U II
27	4608.58	Gd I	60	4617.26	Dy II	9800	4627.22	Eu I

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
100	4627.48	Mo I	220	4639.67	Ti I	170	d 4648.59	Gd I
19	4627.48	Nb I	65	4639.70	Th II		4648.70	Gd I
22	4627.72	Zr I	190	4639.95	Ti I	80	4648.65	La I
100	4627.98	Nd I	170	4640.04	Gd I	75	4648.66	Ni I
1700	4628.16	Ce II	65	4640.04	Th II	95	h 4648.85	Lu I
100	c 4628.22	Ho I	65	4640.07	V I	24	4648.87	Cr I
270	c 4628.74	Pr II	70	4640.13	Zr I	30	4648.89	V I
40	4629.07	Zr II	80	4640.21	Pr I	450	4648.95	Nb I
290	4629.10	Ho II	110	4640.60	Er II	30	4649.12	Mo I
190	4629.34	Ti I	65	4640.74	V I	110	4649.27	Nb I
120	4629.38	Co I	70	4640.86	Ce I	35	4649.46	Cr I
29	4629.43	Sm I	85	4641.00	Tb II	380	4649.49	Sm I
60	4629.91	Nd II	70	4641.06	Ce I	300	4649.67	Nd I
50	4630.02	Mo I	340	4641.10	Nd I	200	c 4649.77	Ho II
450	4630.11	Nb I	30	4641.24	Th I	70	4649.88	Ce I
150	4630.21	Sm II	60	4641.66	U II	120	4650.02	Ti I
45	h 4630.61	Hf I	35	4641.76	W I	35	4650.33	La I
40	4630.79	Ce I	35	4641.83	Os I	110	4650.51	Ce I
80	c 4630.82	Re I	210	4641.98	Tb II	65	4651.05	Mo I
160	4630.88	Er II	880	4642.24	Sm II	80	4651.12	Cu I
60	4631.29	Nd I	100	4642.53	W I	570	4651.28	Cr I
210	4631.62	U I	30	4642.70	Mo I	45	4651.39	Ho II
140	4631.76	Th II	40	4642.96	Tm II	200	c 4651.50	Pr II
170	4631.83	Os I	95	4643.12	Tm I	140	4651.55	Th II
65	4632.07	Tb I	35	4643.12	W I	30	4651.99	Th II
24	4632.18	Cr I	85	4643.17	Ce I	45	4652.08	La I
140	4632.28	Pr I	23	4643.18	Rh I	840	4652.16	Cr I
170	4632.32	Ce I	26	4643.31	Nb I	90	4652.33	Re I
50	4632.64	Nd II	110	c 4643.49	Pr II	60	4652.39	Nd I
55	h 4632.84	Ho I	65	c 4643.68	Nb I	35	4652.71	Ho II
45	4633.06	Ta I	2000	4643.70	Y I	430	4653.54	Gd I
45	4633.10	Mo I	70	4644.20	Ce II	65	b 4654.03	Lu LuO
35	4633.60	Ce II	35	4644.58	Tm I	130	4654.29	Ce II
45	4633.76	Th I	210	4644.83	Zr I	290	4654.32	Ru I
700	4633.98	Zr I	200	4645.09	Ru I	35	4654.38	Zr I
510	4634.24	Nd I	140	4645.19	Ti I	200	4654.73	Nd I
110	4634.26	Tm II	110	4645.28	La II	35	4654.74	Cr I
23	4634.64	Zr I	260	cw 4645.31	Tb II	85	4654.99	Gd II
35	4634.77	Os I	290	4645.40	Sm I	120	4655.09	Tm I
60	4634.79	W I	95	h 4645.47	Lu I	150	4655.13	Sm II
50	d 4634.87	Ti I	250	4645.77	Nd II	210	4655.19	Hf I
100	4635.18	V I	170	4646.00	Gd I	540	4655.50	La II
140	4635.68	Pr I	140	4646.05	Pr II	24	4656.04	Ti I
170	4635.69	Ru I	35	4646.14	W I	26	4656.18	Ir I
90	4636.26	Sm II	1600	4646.17	Cr I	19	4656.19	Cr I
40	4636.43	La II	45	4646.34	La I	720	4656.47	Ti I
65	h 4636.59	Tb I	200	4646.40	Nd I	35	4656.69	Er II
430	4636.64	Gd I	130	4646.40	V I	130	4657.42	W I
40	h 4636.74	Ce II	220	4646.60	U II	95	4657.64	Zr I
30	4636.99	Tb II	290	4646.68	Sm II	1000	4658.02	Lu I
40	4637.18	Cr I	24	4646.81	Cr I	28	4658.09	Pr II
60	4637.20	Nd I	55	4646.95	Nb I	35	4658.18	Nb I
50	4637.77	Cr I	55	4647.00	Pr I	200	h 4658.32	Y I
23	bl 4637.78	Zr Zr O	80	4647.23	Tb I	60	4658.38	Tb I
60	4637.88	Ti I	40	4647.28	Ce II	20	4658.73	Tb I
65	4638.10	Nb I	40	4647.38	Ce II	35	4658.74	Pr I
45	c 4638.19	Ho II	70	4647.51	La II	70	4658.89	Y I
	4638.29	Ho II	90	4647.53	Sm II	85	h 4659.03	Lu I
85	4638.72	Nd II	720	4647.61	Ru I	55	4659.40	Ce II
110	4639.00	Gd II	170	4647.64	Gd I	35	4659.49	Zr I
85	4639.14	Nd I	70	4647.75	Ho II	640	4659.87	W I
240	4639.37	Ti I	75	4647.81	Mo I	35	4659.94	Ce II
50	d 4639.52	Cr I	24	4648.13	Cr I	35	4660.70	La I
	4639.70	Cr I	240	4648.16	Sm II	55	h 4660.91	Pr I
200	4639.55	Pr I	100	h 4648.21	Lu I	85	4661.12	Ta I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
25	4661.24	W I	160	4670.49	V I	450	4681.88	Ta I
130	4661.33	Ho II	130	4670.56	Nd II	950	4681.92	Ti I
630	4661.75	Lu LuO	85	4670.74	Ce II	160	4681.92	Tm I
8300	4661.88	Eu I	470	4670.75	Sm I	50	4682.03	Dy II
75	4661.93	Mo I		4670.83	Sm I	28	4682.31	Os I
35	4661.98	W I	60	4670.82	Y I	50	4682.32	Re I
40	4662.49	Re I	140	4670.87	Gd I	260	4682.32	Y II
360	4662.51	La II	50	4670.89	Ce I	50	4682.38	Co I
50	4662.72	Dy I	22	4670.91	Ce I	50	4682.52	Tb I
220	4662.76	Mo I	45	4671.10	Nd I	26	4682.66	Nb I
80	4662.79	Tb I	100	4671.41	U II	75	4682.69	Sm II
23	4663.20	Th I	45	4671.59	Er I	25	4682.79	Tb II
40	4663.24	Ce II	35	4671.69	Mn I	65	4683.07	Gd I
40	4663.33	Cr I	160	4671.83	La II	55	4683.08	Ho I
85	4663.41	Co I	130	4671.90	Mo I	430	4683.33	Gd I
290	4663.56	Sm I	35	4671.99	Tm II	260	4683.42	Zr I
50	4663.75	U I	580	4672.09	Nb I	310	4683.45	Nd I
230	4663.76	La II	270	4672.09	Pr II	40	4683.54	W I
140	4663.82	Os I	310	4672.31	Lu LuO	35	4683.81	Yb II
70	4663.83	Cr I	310	4673.16	Er I	30	4683.83	Mo I
450	4663.83	Nb I	35	4673.59	Nb I	190	4684.02	Ru I
80	4664.12	Hf II	85	4673.60	Dy II	110	4684.04	Nd I
45	4664.27	Gd II	30	4673.62	Ba I	420	4684.16	Lu LuO
70	4664.45	Nd II	75	4673.66	Th I	70	4684.25	Zr I
140	4664.65	Pr II	24	4673.97	Nd I	40	4684.27	Yb I
110	4664.66	Dy II	85	4674.49	Ce I	24	4684.45	V I
95	4664.80	Cr I	1100	4674.60	Sm II	270	4684.61	Ce II
75	4665.13	Sm II	140	4674.62	Ho II	45	4684.87	Ta I
35	4665.28	Ce II	95	4674.65	Ru I	55	4684.92	Pr II
26	4665.33	Nb I	2000	4674.84	Y I	70	4685.11	Tm I
110	4665.44	Er II	150	4675.03	Rh I	320	4685.14	Nb I
50	4665.45	Tb I	35	4675.10	Tm I	23	4685.19	Zr II
35	4665.90	Cr I	70	4675.12	Ti I	55	4685.23	Ce II
65	4666.00	Th II	80	4675.31	Tm I	40	4685.27	Ta I
30	4666.14	V I	530	4675.37	Nb I	30	4685.81	Mo I
22	4666.22	Cr I	60	4675.52	Nd I	55	4685.83	Ho II
340	4666.24	Nb I	570	4675.62	Er II	60	4685.84	Ce I
55	4666.45	Gd II	65	4676.06	Th I	26	4686.10	Mo I
70	4666.51	Cr I	50	4676.62	W I	15	4686.20	Th I
35	4666.70	Tm II	80	4676.90	Tb I	23	4686.22	Ni I
35	4666.71	Ce II	680	4676.91	Sm II	65	4686.41	Gd I
50	4666.80	Th I	60	4677.69	W I	23	4686.57	Zr I
140	4666.86	U II	40	4677.86	Tm II	65	4686.77	Ce II
70	4667.14	Zr I	800	4678.16	Cd I	21	4686.92	Ti I
240	4667.22	Nb I	55	4678.20	Pr II	35	4686.92	V I
85	4667.47	Y I	55	4678.25	Gd I	370	4687.18	Sm II
30	4667.59	Er II	60	4678.35	Y I	180	4687.80	Pr I
840	4667.59	Ti I	110	4678.48	Nb I	2300	4687.80	Zr I
90	4668.17	Th I	30	4679.04	W I	25	4687.86	Re I
40	4668.46	W I	150	4679.06	Er II	140	4688.12	Gd I
60	4668.48	Ag I	40	4679.09	Pr II	45	4688.19	Ho II
200	4668.91	La II	170	4679.18	Gd I	130	4688.22	Mo I
17	4668.99	Ir I	260	4680.04	Gd I	510	4688.45	Zr I
24	4669.14	Ru I	150	4680.13	Ce II	14	4688.55	Nd I
130	4669.14	Ta I	400	4680.14	Zn I	80	4688.63	Tb II
26	4669.24	Hf I	40	4680.49	Sc I	35	4688.64	Er II
50	4669.34	Cr I	640	4680.51	W I	370	4688.73	Sm I
740	4669.40	Sm II	40	4680.54	Cr I	19	4688.84	Ta I
40	4669.40	Tb I	30	4680.64	Th II	80	4688.89	Ce I
110	4669.50	Ce II	170	4680.74	Nd II	170	4689.07	U II
620	4669.65	Sm II	19	4680.87	Cr I	100	4689.17	Th II
35	4669.87	Nb I	28	4680.99	Ce II	70	4689.37	Cr I
70	4669.98	Ru I	210	4681.55	Sm I	18	4689.50	Ce II
50	4669.98	Th I	290	4681.79	Ru I	40	4689.57	Sm II
350	4670.40	Sc II	70	4681.87	Tb I	50	4689.75	Dy II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
85	4689.77	Y I	50	4700.14	Th II	22	4710.00	Ce II
290	4690.11	Ru I	35	4700.26	La I	1900	4710.08	Zr I
22	4690.17	Ce II	50	4700.42	W I	120	4710.19	Ti I
110	4690.35	Nd I	30	4700.43	Ba I	25	4710.32	W I
28	4690.50	Ce II	40	4700.44	Re I	80	4710.56	V I
15	4690.68	Th II	50	4700.49	Mo I	60	4710.64	Sm II
45	4690.71	Ce I	35	4700.61	Cr I	25	4711.17	W I
24	4690.80	Ti I	45	4700.98	U II	65	4711.39	Ho I
40	4690.86	Mo I	50	4701.16	Mn I	160	4711.92	Zr I
40	4691.05	Th II	70	4701.17	Ho II	55	4711.98	Gd II
120	4691.11	Tm I	65	4701.32	Ta I	65	4712.39	Th II
85	4691.16	Gd I	65	4701.45	Ce II		4712.48	Th I
90	4691.18	La II	80	4701.69	Ho II	40	4712.49	W I
190	4691.34	Ti I	65	4702.01	Ce II	30	4712.80	Gd II
130	4691.62	Ba I	50	4702.05	U II	70	4712.93	La II
15	4691.63	Th I	35	4702.18	Er II	35	4713.05	Nb I
23	4691.73	Zr I	15	4702.31	Th II	270	4713.06	Sm II
130	4691.90	Ta I	200	4702.41	Tb II	90	4713.11	Pr I
45	4692.06	Ce II	30	4702.47	W I	70	4713.43	Zr I
65	4692.06	Os I	100	4702.52	U II	150	4713.50	Nb I
230	4692.50	La II	35	4702.64	La I	30	4713.59	Eu I
80	4693.11	Tb II	70	4703.02	Mg I	200	4714.00	Ce II
45	4693.21	Co I	170	4703.13	Gd I	65	4714.12	V I
85	4693.35	Ta I	140	4703.28	La II	90	4714.15	Pr I
30	h 4693.39	Tb II	130	4703.57	Nd II	110	4714.42	Ni I
130	4693.63	Sm II	50	4703.99	Th I	30	4714.51	Mo I
40	4693.68	Ti I	530	4704.40	Sm II	75	4714.62	Sm II
100	4693.72	W I	60	4705.04	Re I	100	4714.81	Ce II
40	4693.93	Mo I	130	4705.76	Th II	130	4715.26	Sm II
60	4693.95	Cr I	75	4706.06	Mo I	24	4715.30	Ti I
140	4694.09	Th II	65	4706.09	Ta I	26	4715.43	Th II
700	4694.33	Gd I	130	c 4706.14	Nb I	190	4715.59	Nd II
65	4694.51	Nb I	55	4706.16	V I	45	4715.68	U I
65	4694.88	Ce II	20	4706.16	W I	22	4715.78	Ni I
50	d 4694.92	Th II	40	4706.25	Th II	65	4715.83	Nb I
	4695.04	Th I						
25	c 4694.99	Re I	470	4706.54	Nd II	35	4715.89	V I
23	4695.04	Zr I	80	4706.57	V I	40	w 4716.07	Tb II
24	4695.15	Cr I	140	4706.96	Nd I	730	4716.10	Sm I
270	bl 4695.46	Lu LuO	120	4706.97	Sc I	170	4716.44	La II
			45	4707.00	Ce I	30	4716.70	Lu I
65	4695.47	Nb I	55	4707.24	Ce I	25	4716.86	W I
170	4695.49	Gd I	640	4707.26	Mo I	270	4717.07	Sm I
290	4695.77	Pr I	55	4707.55	Pr II	60	4717.08	Nd II
190	4696.44	Nd I	110	4707.79	Zr I	130	c 4717.52	Ho I
65	4696.50	Ce I	45	4707.94	Ce II	35	4717.59	La II
30	4696.51	Mo I	110	4707.94	Tb II	120	4717.62	Zr I
180	4696.81	Y I	190	bl 4708.00	Lu LuO	55	4717.69	V I
24	4696.94	Ti I	190	4708.04	Cr I	210	4717.72	Sm II
60	4697.06	Cr I	140	cw 4708.07	Pr II	90	4717.88	Ce II
75	4697.17	Er II	15	4708.10	Th II	220	4717.92	Mo I
430	4697.42	Gd I	35	4708.19	La I	65	4718.02	Nb I
90	4697.47	Nb I	150	4708.22	Mo I	190	4718.33	Sm II
50	4698.29	Sc II	260	4708.29	Nb I	240	4718.43	Cr I
11	4698.38	Co I	70	bl 4708.60	Be BeO	65	4718.62	Th II
240	d 4698.46	Cr I	30	4708.71	Er I	25	4718.62	W I
	4698.62	Cr I						
30	4698.62	W I	45	h 4708.84	Hf I	29	4718.64	Sm I
95	4698.68	Dy II	35	4708.85	Y I	35	4718.69	Er I
190	4698.76	Ti I	21	4708.88	Ir I	40	4718.88	Mo I
120	4699.01	Hf I	120	4709.34	Sc I	240	4719.02	Nd I
			1400	4709.48	Ru I	45	h 4719.10	Hf II
120	4699.34	Sm II	140	4709.52	Pr I	210	4719.12	Zr I
90	4699.63	La II	190	4709.71	Nd II	270	4719.84	Sm II
40	4699.72	Hf II	160	4709.72	Mn I	140	4719.94	La II
45	h 4700.11	Zr I	200	4709.78	Gd I	40	4719.98	Th II
	4700.18	Zr I	130	4709.84	Ho II	35	4720.12	Sm II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
25	4720.39	W I	30	4729.13	Th I	40	4738.58	Hf I
65	b 4720.86	Lu LuO	100	4729.14	Mo I	130	4739.11	Mn I
30	4720.92	Ru I	490	4729.23	Sc I	40	4739.12	Ce II
19	4721.00	Rh I	40	4729.53	V I	1400	4739.48	Zr I
85	4721.22	Dy I	80	4729.65	W I	100	4739.53	Ce II
29	4721.39	Sm II	24	4729.72	Cr I	80	4739.93	Tb I
110	4721.46	Gd I	45	4729.88	Th II	150	4740.16	Ta I
40	4721.51	V I	85	4730.12	Ta I	500	4740.28	La II
30	4722.09	Th I	80	4730.13	Ce II	27	4740.50	Eu I
1000	4722.16	Zn I	65	4730.31	Nb I	190	4740.53	Th II
600	c 4722.19	Bi I	27	4730.38	V I	65	4740.61	Nb I
	4722.55	Bi I	180	4730.67	Pr I	790	4741.02	Sc I
	4722.83	Bi I	120	4730.71	Cr I	13	4741.31	Th I
320	4722.28	Sr I	23	4731.14	Zr I	85	4741.40	Y I
35	4722.30	Ce II	55	4731.17	Ti I	28	4741.48	Pr I
65	4722.62	Ti I	140	4731.33	Ru I	45	4741.64	Ce II
230	4722.69	Er I	45	h 4731.37	Hf II	50	4741.72	Sm II
160	4722.73	U II	700	4731.44	Mo I	220	4741.92	Sr I
40	4722.86	V I	85	4731.59	Er II	290	4742.04	Ho II
45	4722.88	Ta I	120	4731.60	U II	22	4742.11	Ti I
26	4723.06	Mo I	140	4731.77	Nd I	26	4742.24	Th II
50	4723.10	Cr I	170	4731.84	Dy II		4742.26	Th II
65	4723.17	Ti I	21	4731.86	Ir I	27	4742.63	V I
35	4723.31	Ce II	40	h 4732.30	Sc I	170	4742.79	Ti I
90	4723.44	Th I	300	4732.33	Zr I	35	4742.94	Zr I
120	4723.78	Th II	60	h 4732.37	Y I	35	4743.02	Ru I
55	4723.80	Nb I	220	4732.60	Gd II	390	4743.09	La II
110	4724.26	Tm I	13	4732.67	Th II	35	4743.53	U I
16	4724.31	Ce I	28	4732.80	Os I	410	4743.65	Gd I
190	4724.35	Nd II	680	4733.34	Tm I	45	4743.69	Th II
50	4724.42	Cr I	45	4733.43	Ti I	1200	4743.81	Sc I
35	4724.43	La II	80	4733.48	Nb I	65	4743.84	Nb I
85	4724.54	Er II	100	4733.52	Ce II	45	4743.89	Os I
50	4724.77	Th II	120	4733.52	Ru I	100	4744.16	Pr I
40	4724.83	Ce I	22	4733.74	Pr I	80	4744.62	Nb I
110	4725.09	Ce II	110	c 4733.89	Nb I	45	4744.80	Ce I
50	4725.12	W I	35	4733.96	Ce I	90	4744.91	Pr II
20	4725.34	Mo I	590	4734.10	Sc I	45	4744.94	Ce II
60	4725.85	Y I	45	c 4734.17	Pr II	70	4745.11	Rh I
25	4725.93	Re I	60	cw 4734.20	Tb I	60	4745.27	Er I
130	4726.02	Sm II	35	4734.36	Zr I	19	4745.31	Cr I
190	4726.08	Yb II	45	4734.43	Gd II	20	4745.59	W I
65	h 4726.20	Lu I	18	4734.68	Ti I	470	4745.68	Sm II
30	d 4726.33	Th II	40	4734.69	Ce I	40	4745.73	Dy II
	4726.46	Th II	7	4734.83	Co I	110	4745.82	Gd I
80	4726.45	Ba I	35	4734.90	Nd I	40	4745.93	Ta I
29	4726.55	Nd I	100	bl 4735.00	Lu LuO	24	4746.63	V I
70	4727.13	Dy II	60	4735.08	Sc I	150	4746.92	Pr II
50	4727.15	Cr I	55	4735.33	Nb I	160	4747.17	Ce II
55	4727.33	Nb I	22	4735.35	Ce II	22	4747.68	Ti I
180	4727.48	Mn I	260	4735.75	Gd I	70	4747.80	Tb I
16	4727.56	Ce I	19	4736.20	Nd II	60	4748.38	Re I
60	4727.60	Re I	65	4736.49	Nb I	40	4748.52	V I
9	4727.94	Co I	250	4736.69	Pr I	320	4748.73	La II
40	4728.16	Tb II	16	4736.78	Fe I	29	4749.03	Nd I
230	4728.42	La II	40	4736.96	Er II	25	4749.03	Re I
770	4728.42	Sm I	310	4737.28	Ce II	35	c 4749.09	Ho II
150	4728.47	Gd II	140	4737.35	Cr I	75	bl 4749.11	Lu LuO
170	4728.53	Y I	690	4737.65	Sc I	30	h 4749.15	Gd I
85	4728.64	Gd I	35	4738.00	Ho II	26	4749.20	Th I
55	4728.64	Pr II	22	4738.04	Os I	16	4749.50	Ce II
35	c 4728.72	Ho II	65	4738.11	Gd I	29	4749.56	Nd II
200	4728.77	Sc I	45	4738.35	Os I	50	4749.68	Co I
50	4728.86	Ir I	27	h 4738.35	Ta I	220	c 4749.70	Nb I
150	4729.05	Er I	30	4738.40	Ru I	70	4749.75	Nd I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
21	4749.97	Th I	70	4759.90	Tm I	75	4773.44	Mo I
100	4750.39	Mo I	16	4759.92	Ce II	80	4773.72	Hf I
45	4750.41	La I	50	4760.04	Dy II	35	4773.89	W I
150	4750.72	Sm I	770	4760.19	Mo I	230	4773.94	Ce II
35	4750.75	Tm II	40	4760.19	Tb II	35	4774.00	Ru I
22	4750.83	Ce I	730	4760.27	Sm I	110	4774.15	Sm II
45	4750.98	V I	21	4760.45	Nd I	40	4774.22	Mo I
35	4751.40	Ho I	110	4760.74	Gd I	65	4774.25	Th II
65	4751.42	Nb I	410	4760.98	Y I	50	4774.80	Dy I
130	4751.52	Er II	65	4761.11	Th II	26	4774.89	Hf I
22	4751.53	Ce II	180	4761.53	Mn I	22	4775.08	Ce I
35	4751.56	V I	30	4762.37	Tb II	16	4775.10	Ce I
40	4751.91	Zr I	750	4762.38	Mn I	20	c 4775.18	Pr I
70	4752.08	Cr I	35	4762.39	Ho II	65	4775.66	Mo I
28	4752.16	Os I	60	4762.64	Er II	120	h 4775.79	Dy I
30	4752.20	W I	100	4762.72	Pr II	35	4776.32	Co I
28	4752.24	Ce II	190	4762.78	Zr I	150	4776.34	Mo I
140	4752.41	Th II	35	4763.10	Os I	130	4776.36	V I
410	cw 4752.53	Tb II	35	4763.57	Ho II		4776.52	V I
22	4752.58	Ce I	45	4763.62	Nd II	26	4777.19	Th I
30	4752.58	W I	20	4763.67	Re I	55	4777.48	Ho II
160	4752.79	Y I	130	4763.82	Gd I	21	4777.62	Nb I
60	4753.05	Zr I	80	4763.87	Nd II	40	4777.72	Nd II
200	4753.16	Sc I	65	4763.90	Ce II	190	4777.85	Sm II
20	4753.39	W I	15	4763.95	Ni I	35	4778.10	U I
40	4753.93	V I	40	bl 4764.22	Lu LuO	65	4778.16	Ir I
1000	4754.04	Mn I	50	4764.29	Cr I	65	4778.26	Ti I
9	4754.36	Co I	40	4764.34	Th II	26	4778.29	Th I
60	4754.99	Dy II	21	4764.40	Ru I	35	4778.36	Tb II
26	4755.32	Nb I	75	4764.42	Mo I	14	4778.40	Nd I
30	d 4755.35	Gd II	25	4764.47	Tb II	35	4778.80	Tb II
	4755.50	Gd II	22	4764.72	Ce I	28	c 4779.23	Pr II
40	4755.37	Sm II	65	c 4765.24	Pr II	220	4779.35	Sc I
55	4755.54	Ce II	300	4765.86	Mn I	30	4779.42	Ho I
12	4755.58	Rh I	45	4766.33	Ti I	120	4779.46	Nd I
100	4755.73	U II	500	4766.43	Mn I	13	4779.59	Th II
45	4755.85	Nd I	90	4766.51	Hf I	50	4779.63	U II
65	c 4756.03	Pr II	13	4766.60	Th I	50	4780.01	Co I
340	4756.11	Cr I	22	4766.63	Cr I	17	4780.18	Y I
70	4756.23	Ru I	55	4766.63	V I	35	4780.19	U I
26	4756.46	Ir I	65	4766.81	Nb I	28	4780.23	Ce II
220	4756.51	Ta I	160	4766.89	La I	16	4780.50	W I
30	4756.52	Ni I	470	4767.24	Gd I	85	4780.94	Ta I
150	4756.80	U I	18	4767.78	W I	65	d 4780.99	Gd I
100	c 4757.01	Ho I	30	4767.86	Cr I		4781.13	Gd I
65	4757.48	V I	11	4768.08	Co I	120	4781.04	Y I
140	4757.54	W I	35	4768.66	U I	70	c 4781.19	Ho I
40	4757.58	Hf I	100	4768.77	Ce II	45	4781.72	Ti I
25	4757.78	W I	120	4768.98	Ta I	70	4781.84	Sm II
110	4757.84	Ce II	75	4769.26	U II	170	h 4781.87	Yb I
500	4757.84	Ru I	95	4769.30	Ru I	180	4781.92	Gd I
80	c 4757.91	Pr II	28	4769.77	Ti I	160	4782.74	Hf I
13	4757.96	Ir I	70	4770.20	Nd I	23	4782.76	Th II
45	4758.03	Ta I	110	4770.20	Sm I	65	4782.92	Ho I
310	4758.12	Ti I	35	4770.43	La I	50	4782.94	Mo I
45	h 4758.14	Th I	35	4771.11	Co I	580	4783.10	Sm I
20	4758.20	W I	24	4771.73	Nd I	110	4783.35	Pr II
45	4758.26	Gd I	35	4771.85	Nb I	940	4783.42	Mn I
40	4758.44	Tb II	60	4771.94	Dy I	40	d 4783.47	Gd I
45	4758.50	Mo I	19	4772.26	Nd I		4783.56	Gd I
320	4758.70	Gd I	870	4772.31	Zr I	70	4783.80	Nd II
40	4758.83	Re I	100	4772.70	U II	40	4783.94	Ce II
24	4759.10	Nd I	40	4772.88	Nd II	15	4784.04	Th I
310	4759.28	Ti I	21	4773.15	Ru I	50	4784.27	Ru I
170	4759.65	Er II	80	4773.25	Nb I	140	4784.32	Sr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
300	4784.62	Gd I	35	4795.92	Ho II	55	4809.37	Nb I
28	4784.78	Ce I	45	4796.22	Ti I	21	4809.47	Ir I
28	4784.78	Ce I	100	4796.52	Mo I	140	4809.47	Zr I
210	4784.92	Zr I	28	4796.69	La II	40	4810.28	Dy I
90	4785.12	Mo I	130	4796.92	V I	23	4810.49	Rh I
150	4785.42	Lu II	120	4797.15	Nd II	1400	4810.53	Zn I
26	4785.70	Nb I	25	4797.55	W I	80	4810.60	Nb I
350	4785.86	Sm I	35	4797.98	Ti I	35	4810.90	U I
35	4785.91	U I	50	4798.44	Ru I	90	4811.06	Mo I
40	4786.06	Nd II	45	4798.87	Ho I	22	4811.08	Ti I
55	c 4786.29	Ho I	180	4799.30	Y I	240	4811.34	Nd II
40	4786.46	Mo I	60	4799.42	Nd II	480	4811.88	Sr I
110	4786.51	V I	19	4799.77	V I	40	4812.25	Ti I
45	4786.54	Ni I	110	4799.80	Ti I	220	4812.75	Ta I
35	4786.57	Ce I	80	4799.91	W I	50	4812.80	Dy I
160	4786.58	Y II	1400	4799.92	Cd I	27	4812.92	Ho II
170	4786.61	Yb II	13	4799.93	Pr II	75	4813.48	Co I
21	4786.64	Ta I	28	4800.00	La I	35	4813.50	Tm I
110	4786.75	Gd I	13	4800.17	Th II	26	d 4813.72	Th I
180	4786.78	Tb I	23	4800.25	La I		4813.89	Th I
170	4786.89	Y I	310	4800.50	Hf I	100	4813.77	Tb I
45	4786.91	Gd II	29	4800.64	Dy I	22	4813.80	Os I
75	4786.92	Dy II	65	4800.90	Ce II	45	4814.32	Pr II
45	4787.14	Ce II	120	4801.03	Cr I	18	4814.47	Mo I
21	4787.40	Nd I	140	4801.05	Gd II	190	4815.04	Zr I
25	4787.92	W I	90	4801.13	Pr II	85	4815.05	Lu I
20	4788.18	Mo I	30	4801.87	Tb II	22	4815.50	Os I
55	h 4788.18	Pd I	26	4802.45	Nb I	260	4815.52	Ru I
16	4788.28	Pr I	30	4802.58	Gd II	700	4815.63	Zr I
20	4788.42	W I	21	4803.48	Th II	430	4815.81	Sm II
55	4788.43	Ce I	40	4803.54	Gd II	45	4815.96	Os I
160	4788.67	Zr I	12	4803.95	Th II	85	4816.01	Sm II
40	4789.11	Zr I	160	4804.04	La II	20	4816.10	W I
190	4789.32	Cr I	50	4804.31	Y I	110	4816.38	Nb I
40	4789.39	Th I	70	4804.81	Y I	35	4816.43	Yb I
170	4789.41	Nd II	60	4804.88	Ru I	55	4816.83	Gd I
35	4789.69	Ce II	15	h 4804.90	Sm II	20	4816.84	W I
40	cw 4789.91	Tb II	18	4804.91	Mo I	28	h 4817.17	La I
27	4789.92	Tm II	28	4805.10	Ti II	35	4817.17	Nd II
65	4789.96	Nb II	110	4805.43	Ti I	35	4817.21	Hf II
160	4789.96	Sm I	30	4805.58	Mo I	19	4817.34	Ru I
45	4790.06	U I	27	4805.82	Gd II	85	bl 4817.38	Y YO
40	4790.72	Hf II	260	4805.87	Zr I	45	h 4817.51	Pd I
45	4791.15	Gd II	45	4805.93	Ce I	26	4817.70	Mo I
95	4791.29	Dy I	19	4806.19	Ru I	140	bl 4818.20	Y YO
190	c 4791.42	Re I	40	4806.62	Nd I	45	4818.64	Th II
35	4791.48	Ho II	35	4806.68	Zr I	65	4818.87	Hf I
90	4791.50	Sc I	22	4807.00	Ni I	24	4818.96	Nd II
230	4791.58	Sm II	40	4807.06	Nb I	75	4819.04	Dy I
110	4792.49	Ti I	10	4807.14	Ir I	410	4819.25	Mo I
95	4792.51	Cr I	50	4807.38	W I	85	4819.53	Ta I
45	4792.59	Eu I	220	4807.45	Gd I	50	4819.54	U II
50	4792.60	Au I	27	4807.48	Tm I	14	4819.64	Nd II
65	4792.74	Mo I	130	4807.53	V I	140	4819.64	Y I
110	4792.86	Co I	28	4807.66	Ce I	45	4820.03	Ce I
45	4793.12	Ce II	28	4807.66	Ce I	40	4820.24	Yb II
35	4793.28	Zr I	50	4807.94	Dy I	140	4820.34	Nd II
65	4793.41	Mo I	45	h 4808.01	Gd I	190	4820.35	Er II
20	4793.82	Mo I	30	4808.09	Mo I	200	4820.42	Ti I
670	4793.99	Os I	45	4808.13	Th I	28	4820.61	Ce I
35	4794.38	Ru I	28	4808.18	Pr I	18	4820.88	Th II
29	4794.96	Zr I	35	4808.50	Ce I	12	4821.27	Th II
95	4795.48	Er II	45	4808.53	Ti I	320	4821.69	Gd I
35	4795.57	Ru I	35	4808.68	Tm I	120	4822.13	Y I
30	4795.67	Ir I	160	4809.01	La II	18	4822.42	Mo I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
110	4822.55	Ce I	75	4834.62	Sm II	55	4845.17	Nb I
26	4822.86	Th I	21	4834.74	Er II	17	4845.38	Ir I
90	4822.98	Pr II	25	4835.01	W I	90	4845.53	Ce I
23	4823.18	Th II	130	4835.26	Gd I	550	4845.68	Y I
190	4823.31	Y II	45	4835.63	Ce II	11	4845.96	Pr I
1000	4823.52	Mn I	29	4835.66	Nd I	19	4846.35	Zr I
30	4823.60	Th I	35	4835.75	Tm I	65	4846.45	Ta I
200	4824.06	La II	70	4835.98	Nd II	55	4846.59	Ce II
14	4824.18	Nd II	40	4836.13	Ti I	75	4847.65	U II
280	4824.29	Zr I	60	4836.62	Nd I	80	4847.68	Sc I
85	4824.96	Dy I	35	4836.67	Sm II	140	4847.76	Sm II
85	4825.43	Ta I	65	4836.71	Ce I	140	4847.77	Ce I
22	4825.46	Ti I	14	4836.86	Cr I	110	4848.10	Gd I
350	4825.48	Nd II	35	4836.96	Yb II	270	4848.32	Sm I
22	4826.66	Os I	45	c 4837.03	Pr II	30	4848.36	Th I
40	4826.70	Th I	80	4837.23	Hf I	110	c 4848.37	Nb I
23	4826.88	La II	40	4837.46	Yb I	65	4848.47	Ti I
27	4826.99	Tm II	28	4837.48	Ce I	40	c 4848.53	Pr II
100	4827.28	Sc I	60	4837.59	Tb II	19	4848.81	V I
35	4827.30	Pr I	26	4837.62	Nb I	85	4848.83	Er I
130	4827.45	V I	40	4837.65	Sm II	40	4849.04	Th II
24	d 4827.57	Nd I	26	4837.99	Nb I	110	4849.06	Nd II
	4827.74	Nd II	15	4838.11	Mo I	60	h 4849.64	Eu I
190	4828.04	Zr I	110	4838.78	Zr I	55	4849.91	Ce I
26	4828.47	Mo I	60	4838.98	Zr I	20	4850.20	Ce II
45	4828.58	Nd II	50	4839.01	Ru I	75	4850.44	Th II
30	4828.67	Er I	60	4839.15	Y I	45	4850.58	La II
75	4828.88	Dy I	170	4839.44	Sc I	21	4850.61	Hf I
27	4828.97	Tm I	40	4839.51	Pr II	70	4850.82	La I
22	h 4829.03	Ni I	70	4839.52	La I	17	4851.15	Yb II
40	h 4829.30	Eu I	18	4839.59	Mo I	210	4851.36	Zr I
55	4829.30	Nb I	50	c 4839.62	Lu II	320	4851.48	V I
110	4829.38	Cr I	19	4839.77	Ru I	60	4851.63	Rh I
21	4829.52	Er I	770	4839.87	Y I	30	4851.64	Er II
130	4829.57	Sm II	45	4840.01	La II	27	d 4851.76	Tm I
50	4829.68	Dy II	100	4840.27	Co I		4851.90	Tm II
45	4829.94	Gd I	25	4840.39	Tb I	30	4852.17	Ta I
60	4830.33	Eu I	40	h 4840.47	Eu I	45	4852.62	Ce I
410	4830.51	Mo I	40	4840.47	Sc I	45	4852.62	Ce I
45	4831.12	Th I	45	4840.47	Th II	80	4852.68	Sc I
85	4831.15	Er II	28	4840.74	Pr I	410	4852.69	Y I
19	4831.18	Ni I	10	4840.77	Ir I	15	4852.87	Th I
80	4831.20	Tm II	50	4840.84	Th I	40	4853.12	Er II
13	4831.60	Th I	470	4840.87	Ti I	80	4853.33	Nd I
150	4831.64	V I	19	4841.45	Zr I	40	4853.59	Ce I
40	c 4832.07	Pr II	970	4841.70	Sm I	35	4853.67	Pr I
360	4832.08	Sr I	75	4841.75	Dy I	40	4854.08	W I
55	4832.18	Ta I	60	4842.03	Er I	120	4854.25	Y I
130	4832.28	Nd II	55	4842.15	Nb I	120	4854.36	Sm II
55	4832.31	Ho II	21	4842.43	Rh I	30	4854.41	Er II
70	4832.38	Dy I	50	4842.48	U I	24	4854.56	Ru I
120	4832.43	V I	30	c 4842.69	Tb II	30	4854.81	Tb I
65	4832.80	Th II	45	4843.06	Ce I	890	4854.87	Y II
40	4832.92	Mo I	11	4843.46	Co I	23	4854.95	La I
70	4833.00	Ru I	790	4843.81	W I	50	4855.04	Sr I
19	4833.02	V I	22	4843.87	Os I	35	4855.31	Nd I
30	4833.32	Ho I	45	4843.99	Rh I	45	4855.41	Ni I
40	4833.32	Sm II	45	4844.16	Th II	30	4855.54	Ho II
65	4833.37	Nb I	310	4844.21	Sm II	290	4856.01	Ti I
100	4833.67	Sc I	28	4844.29	Ce II	45	4856.17	Gd I
35	4833.75	Dy II	25	4844.32	Mn I	40	4856.24	Dy II
26	4833.96	Mo I	120	4844.56	Ru I	20	4856.54	Tb II
40	4834.05	Ce I	18	4844.56	Th II	50	4856.70	Y I
40	4834.19	Hf I	30	4844.89	Tb II	65	4856.72	Gd I
85	4834.23	Gd II	20	4845.17	Mo I	22	4857.36	Pr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
140	4857.44	Er I	50	4869.20	Mo I	11	4881.94	Ta I
140 bId	4857.79	Sc ScO	45	4869.27	Nd I	28	4882.24	Pr I
	4858.09	Sc ScO	22	4869.34	Pr I	45	4882.35	Ti I
85	4858.08	U II	75	4869.98	Sm II	180	4882.46	Ce II
12	4858.10	Th II	85	4870.04	Gd I	14	4882.72	Co I
45	4858.22	Mo I	250	4870.14	Ti I	29	4882.88	Nd II
40	4858.33	Th II	35	4870.56	La I	85	4883.19	Gd I
40	4858.41	Hf I	140	4870.80	Cr I	110	4883.60	Zr I
50	4858.47	Er II	21	4871.26	V I	1900	4883.69	Y II
16	4858.57	Pr II	60	4871.32	Fe I	210	4883.77	Sm I
40	4858.72	Ce II	35	4871.44	Nd I	45	4883.78	U II
30	4858.87	Tb II	120	4871.50	Gd I	350	4883.81	Nd I
28	4859.00	Pr II	19	4871.70	Ta I	75	4883.95	Ta I
280	4859.02	Nd II	150	4872.09	Er II	730	4883.97	Sm I
75	4859.22	Gd I	35	4872.15	Fe I	40 h	4884.05	Eu I
130	4859.24	Hf I	19	4872.28	Tm II	13	4884.47	Pr I
65	4859.50	Ce I	30	4872.48	Er II	40	4884.55	Dy I
85	4859.55	Sm II	300	4872.49	Sr I	45	4885.01	Nd I
29	4859.58	Nd I	40	4872.92	Th I	400	4885.08	Ti I
75	4859.68	U II	21	4872.94	Hf I	45	4885.15	U I
20	4859.75	Fe I	8	4873.20	Sm II	35	4885.78	Cr I
330	4859.84	Y I	30	4873.34	Gd II	19	4885.96	Cr I
26	4860.05	Mo I	17	4873.44	Ni I	28	4886.04	Pr II
45	4860.39	Ho I	65	4874.00	Ce II	20	4886.18	Ce I
320	4860.91	La II	35	4874.35	Ce I	50	4886.28	Y I
100	4861.02	U II	13	4874.36	Th I	30	4886.29	Er II
17	4861.20	Cr I	35	4874.37	Nd I	28	4886.33	U II
13	4861.22	Th I	35	4875.43	Pd I	26	4886.47	Mo I
35	4861.60	Er II	620	4875.48	V I	40	4886.65	Y I
28	4861.74	Ce I	80	4875.57	Tb II	380	4886.90	W I
24	4861.77	Nd I	60 d	4875.73	Nd I	130	4887.01	Cr I
75	4861.78	Gd I		4875.84	Nd II	26	4887.61	La I
70	4861.84	Cr I	40	4875.93	Dy I	95	4888.08	Dy I
85	4861.87	Ru I	60	4876.06	Sr I	16	4888.37	W I
110	4862.59	Gd I	24	4876.12	Nd II	19	4888.53	Cr I
35	4862.61	V I	25	4876.12	Tb II	27	4888.84	Er I
25	4863.06	W I	35	4876.26	Pr II	140	4889.10	Nd II
22	4863.13	Ce I	200	4876.32	Sr I	2200 cw	4889.14	Re I
280	4863.16	Th II	50	4877.00	Th II	27	4889.19	Gd I
65	4863.25	Ce I	80	4877.58	Hf I	20	4889.22	Mo I
80	4863.27	Hf I	90 c	4877.84	Pr II	40	4889.33	Dy II
35	4864.18	Ti I	50 h	4878.13	Ca I	45	4889.59	Ce I
480	4864.74	V I	12	4878.22	Fe I	27 c	4889.67	Ho II
45	4864.78	Nd II	25	4878.28	W I	75	4890.10	Dy II
170	4865.02	Gd II	30	4878.33	Er II	55	4890.26	Pr II
55	4865.23	Pr II	23	4878.37	Mo I	16	4890.27	W I
18	4865.36	Lu II	26	4878.73	Th I	220	4890.70	Nd II
45	4865.48	Th I	65	4878.86	La I	90	4890.75	Nb I
110	4865.60	Os I	11 c	4879.11	Pr II	35	4890.77	Fe I
160	4866.06	Zr I	13	4879.14	Ta I	16	4890.87	W I
30	4866.27	Ni I	27	4879.19	Tm I	240	4891.07	Nd I
190	4866.74	Nd I	12	4879.53	Pt I	80	4891.50	Fe I
110	4867.62	Eu I	50	4879.65	Y I	27	4891.60	V I
45	4867.84	Nd II	45	4879.79	Nd I	27	4891.64	Tm I
150	4867.88	Co I	26	4879.89	Er II	28	4891.88	Ce I
360	4868.00	Mo I	85	4880.16	Dy I	12	4891.94	Sm II
40	4868.05	Dy II	55	4880.56	V I	100	4891.98	Sr I
200	4868.26	Ti I	28	4880.91	Ti I	65 bI	4892.1	Gd CdO
12	4868.27	Th II	85	4881.08	Gd I	30	4892.35	Ho I
35	4868.65	Ce I	80	4881.15	Tb II	30	4892.42	W I
60	4868.70	Sr I	110	4881.24	Zr I	55	4892.50	Nb I
35	4868.86	U I	65	4881.36	Gd I	22	4892.85	Ce I
12	4868.88	Th I	28	4881.54	Ce I	45	4893.12	Zr I
80	4868.99	Nb I	740	4881.56	V I	45	4893.23	Nd I
550	4869.15	Ru I	27	4881.92	Gd II	75	4893.35	Sm II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
95	4893.44	Y I	26	4905.13	La I	35	4921.14	Nd I
50	4893.68	Dy I	100	4906.11	Y I	100	4921.27	Ta I
90	4893.95	Ce II	80	4906.67	Sc I	65	4921.61	Th II
21	4894.21	V I	55	4906.99	Ho II	180	4921.77	Ti I
85	4894.30	Gd II	110	4906.99	Pr I	1000	4921.79	La II
35	4894.30	Sm II	150	4907.18	Eu I	150	4921.87	Y I
29	4894.33	Tb I	29	4907.26	Nd I	22	4921.92	Ce I
40	4894.60	Yb I	26	4907.43	Mo I	50	4922.22	Dy II
90	4894.68	Eu I	40	4907.73	Ta I	260	4922.27	Cr I
45	4894.96	Th I	29	4907.78	Nd I	35	4922.45	Nd I
80	4895.32	Ru I	120	4907.89	Ru I	45	4922.73	Ho I
26	4895.58	Nb I	20	4908.14	Ce I	90	4922.84	Sc I
160	4895.60	Ru I	45	4909.00	Y I	18	4922.95	Th II
45	4896.13	Pr I	20	4909.19	Mo I	65	4923.16	Dy II
35	4896.44	Ho II	24	4909.74	Tm I	20	4923.47	Ta I
280	4896.93	Nd I	90	4909.76	Sc I	65	4923.58	Gd II
27	4896.95	Er II	60	4910.05	Nd I	60	4923.83	Sm II
35	4897.09	Ce I	75	4910.12	Gd I	55	4923.83	Tm I
20	4897.26	Mo I	45	4910.35	U I	220	4923.90	Re I
80	4898.15	Er I	630	4910.40	Sm I	110	4924.04	Sm I
35	4898.20	Ce I	25	4910.74	W I	35	4924.09	Tb I
30	4898.46	Th II	80	4910.95	Nb I	45	4924.25	Ce I
13	4898.80	Th II	18	4911.38	Th I	26	4924.42	Th II
45	4899.22	Os I	180	4911.40	Eu I	470	4924.53	Nd I
24	4899.24	Dy I	27	4912.36	Yb I	200	4924.60	Pr I
26	4899.24	Th I	40	4912.53	Th II	40	4924.64	U II
80	4899.25	Ru I	65	4912.60	Os I	23	4924.78	Mo I
90	4899.29	U II	55	4912.62	Pr II	22	4924.90	Ce I
10	4899.52	Co I	70	4913.16	U II	25	4924.96	Ta I
80	4899.90	Ce I	350	4913.25	Sm II	27	4925.06	Er I
380	4899.91	Ti I	190	4913.41	Nd I	22	4925.32	Pr I
850	4899.92	La II	320	4913.62	Ti I	55	4925.41	Ti I
400	4899.97	Ba II	140	4914.02	Pr I	45	4925.43	Er II
210	4900.08	Er II	15	4914.12	Th II	85	4925.65	V I
1100	4900.12	Y II	14	4914.30	Sm II	28	4925.66	Pr II
55	4900.62	V I	170	4914.37	Nd II	110	4926.00	Ta I
40	4900.73	Sm II	45	4914.94	Ce II	30	4926.16	Ti I
65	4900.79	Nb I	30	4914.96	Ta I	40	4926.19	Mo I
60	4900.86	Eu I	50	4915.02	Re I	40	4926.43	Mo I
28	4901.48	Pr II	55	4915.24	Ti I	35	4926.83	Tb I
120	4901.53	Nd I	22	4915.26	Hf I	18	4927.00	Er II
28	4901.67	Ce I	55	4915.32	Ce I	22	4927.33	Er II
210	4901.84	Nd I	55	4915.32	Ce I	18	4927.78	Th I
65	4901.87	La I	22	4915.41	Pr I	22	4928.09	Ce II
24	4901.90	Sm II	45	4915.66	Ce I	150	4928.34	Ti I
110	4902.03	Nd II	30	4915.83	Gd I	40	4928.44	U I
30	4902.32	W I	95	4915.90	Tb I	70	4928.88	Er I
18	4902.90	Ba I	30	4916.18	W I	50	4928.93	Tb I
16	4902.95	W I	55	4916.41	Dy I	50	4928.98	Nb I
470	4903.05	Ru I	45	4916.60	Gd I	29	4929.56	Sm II
35	4903.24	Cr I	27	4917.08	Er I	85	4929.84	Gd I
10	4903.32	Fe I	22	4918.36	Ni I	18	4929.98	Th II
55	4903.64	Er II	430	4918.99	Sm I	13	4930.54	Ce I
65	4903.81	Mo I	50	4919.00	Fe I	65	4930.69	Gd I
95	4904.29	V I	240	4919.82	Th II	16	4930.70	Ce I
	4904.34	V I						
40	4904.41	Ni I	130	4919.87	Ti I	35	4930.72	Nd II
27	4904.43	Er II	28	4919.88	Ce I	30	4930.87	Zr I
65	4904.53	Nb I	110	4920.11	Ta I	35	4930.93	Y I
65	4904.59	Ta I	75	4920.38	Sm II	40	4931.55	W I
			120	4920.50	Fe I	65	4931.79	Tb I
460	4904.88	Lu I	26	4920.53	Th II	35	4932.03	V I
28	4904.89	Ce I	330	4920.68	Nd II	28	4932.15	Pr I
170	4904.97	Sm I	45	4920.80	Ce I	23	4933.06	U I
40	4905.02	Ru I	1000	4920.98	La II	80	4933.10	Mo I
20	4905.08	Zr I	260	4921.07	Ru I	75	4933.64	Zr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
28	4933.66	U II	21	4948.19	Ti I	55	4960.25	Pr I
18	4933.85	Th II	45	4948.56	Gd I	19	4960.42	Th I
20000	4934.09	Ba II	170	4948.63	Sm II		4960.49	Th II
210	4934.11	Er II	19	4948.68	Ce I	28	4960.85	Ce II
280	4934.12	Gd I	11	4948.72	Ce I	35	4961.03	Ho II
90	4934.25	Sc I	50	4948.76	Zr I	150	4961.39	Nd II
25	4934.45	Hf II	55	4948.94	Hf I	40	4961.47	Gd I
140	4934.83	La II	35	4949.03	Nd II	19	4961.50	Ce II
55	c 4934.89	Ho I	35	4949.53	Ce II	170	4961.94	Sm II
710	4935.50	Yb I	370	4949.77	La I	800	4962.26	Sr I
26	4935.62	La II	65	4950.11	Gd I	19	4962.28	Tb II
45	4935.74	Sc I	28	4950.17	U II	30	4962.30	Zr I
28	4935.81	Os I	35	4950.29	Nd I	25	4962.37	Hf I
16	4935.83	Ni I	110	4950.62	Mo I	55	4962.55	Eu I
140	4936.00	Pr I	50	4950.62	Th II	24	4963.18	Th II
85	4936.01	Gd I	45	4950.66	Y I	80	4963.33	Nd I
45	4936.03	Sm II	27	4950.67	Nd I	60	4963.71	Rh I
110	4936.33	Cr I	380	4951.37	Pr I	35	4963.72	Zr I
85	4936.33	Gd I	30	4951.58	Gd I	50	4964.12	Th II
150	4936.42	Ta I	180	4951.74	Er II	26	4964.19	Mo I
40	4936.77	Th I	9	4951.90	Ce I	40	4964.41	Mo I
24	4937.22	Yb II	11	4951.94	Ce I	45	4964.56	Sm II
50	4937.63	Ta I	65	4952.07	La II	55	4964.75	Ti I
30	4937.74	Ti I	120	4952.37	Sm II	35	4964.93	Cr I
50	4938.09	Ir I	55	4952.46	Nd I	27	4965.05	Gd II
120	4938.10	Sm II	110	4952.47	Gd I	19	4965.16	Ce I
95	4938.29	Ti I	45	4953.03	Sm II	85	c 4965.37	Nb I
180	4938.43	Ru I	35	4953.08	W I	35	4965.88	Mn I
220	4938.61	Gd I	29	4953.13	Nb I	21	4966.04	Ti I
40	4938.89	Pr I	65	4953.15	Gd I	23	4966.12	V I
290	4939.01	Ho I	55	4953.52	Eu I	28	4966.37	Ce I
55	4939.12	Ce I	45	4953.60	Er II	35	4966.62	Er II
40	4939.64	Th I	19	4954.02	Ce I	55	cw 4966.73	Ho II
28	4939.65	Ce I	170	4954.06	Sc I	140	4966.90	Yb I
320	4939.74	Pr I	95	4954.56	Th II	60	4966.97	Er I
160	4940.30	Pr I		4954.66	Th II	250	c 4967.21	Ho II
19	4940.39	Ce I	27	4954.68	Er II	40	4967.33	U I
19	4940.72	Tb II	290	4954.78	Nd I	130	c 4967.78	Nb I
70	4941.33	Sc I	110	4954.81	Cr I	28	4967.87	Pr I
29	4941.52	Nb I	90	4955.26	Ru I	130	4967.94	Sr I
30	4941.58	Ti I	40	4955.78	U I	28	4968.40	Ce II
80	4941.66	Mo I	29	d 4955.95	Sm II	25	4968.53	Ta I
180	4942.34	Lu I		4956.13	Sm II	22	4968.58	Gd II
70	4942.50	Cr I	19	4955.96	Ce I	65	4968.58	Ti I
28	4942.94	Os I	28	4956.06	Pr I	24	4968.75	Th I
35	4942.95	Nd II	80	c 4956.64	Pr II	160	4968.90	Ru I
17	4943.06	Th I	50	4956.76	Re I	95	4969.16	Gd I
110	4943.44	Ce I	40	4956.80	Gd I	45	4969.73	Ta I
28	4943.73	Pr II	140	4957.18	Tm I	35	4969.75	Nd I
28	4943.83	Ce II	65	4957.29	Gd I	55	4969.88	Er I
60	4943.90	Nd II	40	4957.31	Fe I	40	4970.03	Th II
130	4944.36	Er I	480	4957.34	Dy II	340	4970.39	La II
95	4944.61	Ce II	40	4957.37	W I	26	4970.48	Ir I
260	4944.83	Nd I	150	4957.54	Mo I	28	4970.66	Ce I
17	4945.46	Th I	130	4957.61	Fe I	40	4970.87	Tm II
26	4945.85	La I	55	4958.10	Nd II	35	4970.93	Nd II
95	4946.32	Sm I	18	4958.11	Ta I	28	4970.93	Pr I
110	4946.47	La II	21	4958.25	Ti I	29	4970.99	Tb II
17	4946.66	Th II	130	4958.79	Gd I	27	4971.26	Tm I
80	4946.72	Re I	290	4959.13	Nd II	29	4971.42	Tb I
27	c 4946.80	Ho I	65	c 4959.42	Ho II	130	4971.50	Ce II
65	4947.02	Nd II	24	4959.59	Dy I	80	h 4971.70	Li I
30	4947.33	Ba I	45	4959.86	Ru I	28	4971.92	Ce I
60	4947.56	Th II	19	4959.93	Tb II	50	4971.93	Nb I
45	4948.18	Ho II	55	4960.21	Eu I	18	4972.06	Ta I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
40	4972.10	U II	15	4984.57	Ce II	25	4999.74	Ir I
60	4972.16	Sm II	22	4984.70	W I	110	4999.91	Mo I
35	4972.17	Th II	19	4985.30	Gd II	19	4999.94	Th II
45	4972.23	Ce I	24	4985.37	Th I	16	h 5000.34	Ni I
15	4972.56	W I	40	4985.52	Dy I			
55	4972.61	Gd I	26	4985.56	Mo I	90	5000.38	Er II
35	4972.82	Nd	80	4985.98	Re I	70	5000.44	Nd II
29	4973.04	Tb I	45	4986.37	Ce II	85	5000.95	Nb I
75	4973.05	Ti I	45	4986.44	Ce I	230	5001.01	Ti I
110	4973.14	Nb I	370	4986.83	La II	35	5001.02	Tm I
23	4973.36	Mo I	40	4986.90	U II	800	5001.14	Lu I
35	4973.38	Th II	65	4986.92	W I	45	5001.22	Sm II
23	4973.40	Nd I	110	4987.15	Th II	27	5001.59	Tm I
28	4973.57	Dy I	90	4987.17	Nd II	50	5001.79	La I
120	4973.66	Sc I	55	4987.26	Ru I	12	5001.87	Fe I
35	4973.74	Sm II	65	4987.54	Ce I	50	5002.10	Th I
28	4974.09	Ce I	22	4987.82	Zr I	35	5002.13	La II
35	4974.12	Ru I	35	4988.69	Ce I	65	5002.25	Nb I
120	4974.30	Y I	35	c 4988.96	Ho I	70	5002.33	V I
80	4974.92	Pr I	190	4988.97	Nb I	90	5002.44	Pr II
40	4975.12	Tm II	22	4989.08	W I	25	5002.74	Ir I
50	4975.14	Nb I	150	4989.15	Ti I	45	5002.78	Ce II
120	4975.25	Hf I	90	4989.29	Pr II	15	5002.79	W I
120	4975.35	Ti I	19	4989.31	Th I	50	5003.87	Dy I
90	4975.50	Nd I	55	4989.32	Tm II	55	5004.28	Dy II
110	4975.75	Pr I	23	4989.41	Nd II	45	5004.59	Pr II
45	4975.76	Eu I	35	4989.44	Sm II	23	5004.81	Ce I
35	4975.95	Th II	13	4989.51	Nd II	19	5004.84	Tb I
170	4975.98	Sm I	250	4989.94	Nd II	19	5004.91	Mn I
90	4976.20	Ru I	35	4990.31	Er I	90	5005.44	Pb I
25	4976.20	Ta I	55	4991.00	Ce II	10	5005.72	Fe I
80	4976.39	Pr I	4600	4991.07	Ti I	29	5006.10	Tb II
130	4976.42	Er I	140	4991.28	La II	25	5006.13	Fe I
19	4976.59	Th II	140	4991.92	Sc I	330	5006.15	W I
45	4977.20	Ce II	70	4992.02	Sm II	23	5006.42	Ce I
65	4977.74	Ti I	45	4992.36	Er II	23	5006.42	Ce I
60	4977.75	Rh I	45	4992.39	Ce I	100	5006.97	Y I
35	4977.95	La I	120	4992.74	Ru I	3600	5007.21	Ti I
120	4978.20	Ti I	27	4993.79	Tm II	250	5007.25	Er I
50	4978.90	Tm I	85	4993.82	Tb II	19	5008.19	Th II
210	4979.12	Mo I	65	4993.88	La I	110	5008.22	U II
40	4979.18	Rh I	15	4994.08	W I	90	5008.96	Er II
40	4979.32	Os I	800	4994.13	Lu II	210	5009.10	Ce I
55	4979.84	W I	65	4994.30	Nb I	17	5009.17	Ir I
220	4979.97	Ho I	130	4994.63	Ce I	24	5009.52	Yb II
45	4980.16	Ni I	19	4994.72	Tm II	120	5009.65	Ti I
29	4980.16	Tb II	100	4994.76	Zr I	160	5009.77	Tm II
160	4980.35	Ru I	90	4995.05	Ho I	24	5010.60	Dy I
150	4980.37	Sc I	30	4995.08	Ti I	20	5010.81	Mo I
29	4980.56	Tb I	15	4995.29	W I	65	5010.82	Gd II
40	4980.68	Tm II	23	4995.32	Mo I	160	5011.23	Ru I
27	4980.88	Nd I	50	4995.84	Tb II	23	5011.42	U I
19	4980.95	Th II	85	4996.33	Zr I	30	5011.46	Zr I
70	4981.28	Nd II	35	4996.82	La II	55	5011.67	Nd II
45	4981.73	Sm II	140	4997.10	Ti I	55	5011.74	Gd I
5800	4981.73	Ti I	24	4997.80	Th II	100	5011.77	Ce II
120	4982.13	Y II	75	4997.88	Nb I	12	5012.07	Fe I
220	4982.59	W I	55	4997.95	Tb I	35	c 5012.42	Ho I
35	4982.89	Nd I	45	4998.13	Ce I	18	5012.46	Ni I
29	4983.38	Sm II	55	4998.37	Gd II	35	5012.52	Ce I
55	4983.45	Ru I	90	4998.55	Nd II	75	5012.52	Ta I
80	4983.45	Sc I	75	4999.07	Gd I	180	5013.17	Eu I
35	4983.53	W I	720	4999.47	La II	40	5013.27	Nb I
45	4984.13	Ni I	4000	4999.51	Ti I	55	5013.28	Ho II
35	4984.42	Ce II	15	4999.68	Hf II	230	5013.30	Ti I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum.	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
60	5013.32	Cr I	90	5027.15	Nd I	75	5040.62	Ti I
35	5013.74	Ce I	19	5027.34	Ce II	24	5040.68	Th I
23	5013.78	Ce I	170	5027.38	U I	35	5040.74	Ru I
3200	d 5014.19	Ti I	65	5027.85	Nd II	55	5040.82	Hf II
	5014.24	Ti I	40	5027.87	Dy I	120	5040.85	Ce I
19	5014.29	Ce I	65	5028.16	Ru I	27	h 5041.00	Tm II
19	5014.29	Ce I	30	5028.17	Ho I	60	h 5041.62	Ca I
65	5014.55	Nd I	65	5028.33	Ce I	10	5041.76	Fe I
35	5014.56	Tm II	140	5028.33	Er I	210	5042.05	Er II
180	5014.60	Mo I	140	5028.44	Sm II	50	w 5042.06	Tb II
85	5014.62	V I	130	5028.61	Th II	35	5042.08	Ce I
90	5014.95	Ru I	120	5028.91	Er II	15	5042.24	Ce I
30	5014.98	Ir I	80	5029.00	Mo I	130	5042.37	Ho I
750	5015.04	Gd I	90	5029.45	Nd I	160	5042.63	Dy I
220	5015.30	W I	110	5029.54	Eu I	23	5043.20	Ce I
18	5015.40	Nd II	17	5029.63	Th II	90	5043.32	Ta I
28	5015.56	Pr II	35	5029.77	Er II	22	5043.50	Tm I
50	5015.89	Th II	40	5030.13	Nb I	85	5043.59	Ti I
580	5016.17	Ti I	23	h 5030.64	Ce I	110	5043.83	Pr I
19	5016.48	Ce I	65	5030.78	Mo I	130	5043.86	Er I
19	5016.48	Ce I	530	5031.02	Sc II	180	5044.02	Ce II
23	5016.55	Ce I	29	5031.18	Sm II	14	5044.04	Pt I
45	5016.61	Sm II	65	5031.29	Gd II	35	5044.27	Ti I
26	5016.78	Mo I	40	5031.56	Gd II	400	5044.28	Sm I
260	5017.26	Th II	35	5031.77	Ce I	18	5044.42	Ta I
50	5017.59	Ni I	55	5031.83	Os I	50	5044.72	Th I
230	5017.75	Nb I	35	5031.97	Pr II		5044.75	Th I
27	5017.87	Tm II	35	5031.99	Ce II	35	5044.73	Ho I
24	5017.98	Dy II	55	5032.74	Sc I	130	5044.89	Er I
95	5018.20	Hf I	55	5032.95	Ho II	19	5045.25	Th I
80	5018.39	Sc I	50	5033.00	Dy I	55	5045.41	Ti I
120	5018.59	Pr I	50	5033.12	Tb I	35	5045.41	Tm I
40	5019.32	Th II	100	5033.38	Pr I	320	5045.52	Pr I
30	5019.36	Gd II	150	5033.52	Nd II	35	5045.98	Er II
35	h 5019.51	La I	90	5033.55	Eu I	17	5046.06	Ir I
40	5019.51	Nb I	23	5033.81	Ce I	26	5046.52	Mo I
200	5019.76	Pr I	19	5033.85	Ce I	250	5046.58	Zr I
20	5019.85	Mo I	160	5034.22	Tm II	140	5046.88	La I
840	5020.03	Ti I	270	5034.41	Pr II	19	5047.05	Th I
70	5020.14	Sc I	100	5035.37	Ni I	24	5047.25	Dy I
27	5020.37	Gd I	1200	5035.91	Ti I	65	5047.31	Ru I
17	5020.54	Th II	200	5035.94	Er I	23	5047.41	U II
65	5021.44	Ce I	840	5036.47	Ti I	24	5047.43	Th II
80	5021.51	Sc I	45	h 5036.64	Ce I	95	5047.45	Hf I
15	5021.75	Hf I	200	5037.37	Ta I	100	5047.71	Mo I
70	5022.12	Dy I	65	c 5037.46	Pr II	40	5047.96	Nb I
50	5022.16	Tb I	65	c 5037.60	Ho I	26	5048.04	La II
18	5022.67	Nd I	90	5037.66	Ta I	26	5048.21	Ti I
120	5022.87	Ce II	120	5037.78	Ce II	19	5048.78	Gd II
840	5022.87	Ti I	740	5038.40	Ti I	65	5048.83	Ce I
170	5022.91	Eu I	23	5038.91	Mo I	16	5048.85	Ni I
55	5023.13	Gd II	210	5039.04	Nb I	45	5049.51	Sm I
60	5023.50	Sm II	75	5039.09	Gd I	240	5049.80	Th II
30	5024.03	Dy I	45	5039.12	Os I	20	5049.82	Fe I
29	5024.24	Tb II	24	5039.23	Th I	50	h 5050.21	Dy I
45	5024.28	Er II	23	5039.73	Ce I	210	5050.57	La I
24	5024.54	Dy I	35	5039.80	Ce II	24	5050.78	Th I
29	5024.65	Tb I	27	5039.92	Nd I	65	5050.88	Gd II
580	5024.84	Ti I	23	5039.94	Ce I	35	5050.98	Ce I
23	h 5025.15	Ce I	1200	5039.95	Ti I	45	5051.06	Nd I
300	5025.58	Ti I	40	h 5040.15	Th ThO	30	5051.44	Ho II
90	5026.18	Ru I	55	5040.20	Nd I	28	5051.63	V I
150	5026.36	Nb I	35	5040.35	Ru I	10	5051.64	Fe I
65	5026.53	Ho I	55	5040.36	W I	17	5051.90	Cr I
200	5026.96	Pr I	24	5040.56	Th II	22	5052.23	W I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
55	5052.66	Er I	27	5065.88	Tm I	50	5076.74	Yb I
200	5052.76	Sm II	17	5065.91	Cr I	70	5077.16	Nd II
110	5052.87	Ti I	95	5065.93	Ce I	27	5077.18	Tm I
16	5053.19	Dy I	95	5065.99	Ti I	40	5077.40	Nb I
23	5053.26	Ce I	80	5066.67	Tm I	130	5077.59	Er II
820	5053.28	W I	24	5066.78	Th I	120	5077.67	Dy I
30	5053.35	Dy I	35	5066.85	Nd II	23	5077.82	U II
160	5053.40	Pr I	22	5066.86	Sm II	75	5077.85	Ce II
35	5053.54	Ce I	30	5067.06	Gd II	110	5078.25	Tb I
21	5054.08	Ti I	35	5067.16	Ce II	470	5078.25	Zr I
55	5054.18	Ce I	17	5067.30	Yb II	24	5078.92	La I
55	5054.30	Tb I	40	5067.71	Cr I	750	5078.96	Nb I
210	5054.60	W I	30	5067.80	Yb I	55	5079.09	Nd I
30	5054.92	Ho II	100	5067.87	Ta I	35	5079.09	Os I
20	5054.98	Ba I	45	5067.90	La I	35	5079.38	La I
50	5055.00	Mo I	75	5067.95	Eu I	30	5079.65	Hf II
85	5055.34	Th II	110	5067.97	Th I	470	5079.68	Ce II
24	5055.46	Dy I	35	5068.33	Ti I	60	5079.86	Sm I
27	5055.52	W I	10	5068.79	Fe I	35	5079.87	Mo I
35	5055.79	Ce I	80	5068.86	Sc I	100	5080.02	Mo I
170	5056.46	La I	210	5069.12	W I	24	5080.05	Tb II
90	5056.89	Nd I	70	5069.14	Yb I	35	h 5080.21	La II
450	5057.33	Ru I	65	5069.35	Ti I	65	5080.47	Ce I
55	h 5057.60	Lu I	170	5069.46	Sm II	70	5080.52	Er I
65	5057.74	Sm II	28	c 5070.02	Pr II	100	5080.52	Ni I
170	5058.01	Nb I	45	5070.19	Gd I	65	5081.11	Ni I
35	5058.07	Mo I	75	5070.21	Y I	24	5081.11	Tb I
40	5058.56	Re I	530	5070.23	Sc I	35	5081.26	Mo I
70	5058.56	Th II	100	5070.26	Zr I	2100	5081.56	Sc I
25	h 5058.70	Ta I	70	5070.32	Er II	19	5081.80	Tb I
65	5059.35	Nb I	95	5070.68	Dy I	30	5081.89	Nd
30	5059.48	Pt I	45	5071.02	Gd II	30	5082.25	Ta I
60	5059.85	Sm I	540	5071.20	Sm I	55	5082.80	Gd I
24	5059.86	Th I	130	5071.48	Ti I	8	5083.34	Fe I
200	5059.88	Mo I	14	5071.50	Ce I	23	5083.55	Ce I
27	5060.04	Nd I	23	5071.55	Ce I	1200	5083.72	Sc I
85	5060.39	Zr I	120	5071.74	W I	26	h 5084.08	Ni I
27	5060.42	Tm II	120	5071.78	Ce I	23	5084.17	Ce I
35	c 5060.75	Ho I	65	5071.87	Nd I	19	5084.46	Ce I
150	5060.90	Tm I	75	5072.19	Y I	35	5085.09	Tm I
70	5060.93	Sm I	27	5072.42	Tm I	85	5085.26	Zr I
27	5061.06	Gd II	35	5072.88	Os I	40	5085.34	Ti I
40	5061.22	Th II	40	5072.92	Cr I	14	5085.52	Rh I
110	5062.11	Ti I	90	5072.97	Ru I	1100	5085.55	Sc I
27	5062.25	Tm I	30	5072.99	Gd I	2800	5085.82	Cd I
35	5062.52	Mo I	55	5073.74	Gd I	35	5085.86	U II
21	5062.64	Ru I	35	5073.87	Nd I	750	5086.95	Sc I
27	5062.86	Gd II	75	5073.98	Zr I	130	5087.07	Ti I
45	5062.92	La II	65	5074.34	Ho I	29	5087.08	Sm II
40	5063.40	Pr I	220	5074.34	Yb I	180	5087.12	Pr I
110	5063.73	Nd II	35	5074.52	Nd I	390	5087.14	Sc I
35	5063.77	U I	75	5074.72	Ce I	65	5087.37	Ta I
45	5063.96	Ce I	55	b 5074.74	Hf Hf O	1100	5087.42	Y II
35	5064.07	Ti I	35	5074.77	Os I	29	5087.65	Sm II
35	5064.12	V I	30	5074.79	Mn I	30	5088.18	Y I
29	5064.24	Sm II	240	5075.35	Ce II	21	5088.29	U I
250	5064.32	Sc I	24	5075.47	Th II	60	5088.32	Sm I
19	5064.60	Th I	45	c 5075.71	Pr II	22	5088.97	Sm II
29	5064.64	Mo I	250	5075.81	Sc I	75	5089.12	Tb II
1400	5064.66	Ti I	120	5076.32	Ru I	35	5089.62	Ce I
28	c 5064.90	Pr II	27	5076.36	Tm I	24	5089.66	Tb I
360	5064.91	Zr I	45	5076.37	Ta I	150	h 5089.84	Nd II
110	5065.22	Zr I	65	5076.48	Ce II	270	5089.89	Sc I
130	5065.25	Nb I	360	5076.59	Nd II	80	5090.38	Dy II
55	5065.79	Th I	65	5076.69	Sm I	70	5090.63	Rh I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
90	5090.71	Ta I	180	5109.06	Sc I	45	5121.36	Ce I
24	5090.75	Th II	25 c	5109.37	Ta II	19	5121.61	Tb II
35	5090.88	Ce II	55	5109.44	Ti I	85	5121.80	Nb I
40	5090.97	Mo I	130	5109.71	Mo I	350	5122.14	Sm I
35	5091.34	Mo I	20	5109.77	Ta I	22	5122.23	Os I
45	5091.73	Ce I	80	5110.32	Dy I	65	5122.39	Ce I
45	5091.73	Ce I	40	5110.36	W I	28	5122.68	Ce I
35	5092.16	Mo I	360	5110.38	Pr II	17	5122.77	Co I
95	5092.25	Gd II	20	5110.41	Fe I	470	5122.99	La II
45	5092.46	Sc I	30	5110.75	Cr I	450	5123.21	Y II
75 h	5092.69	Eu I	560	5110.76	Pr II	17	5123.46	Cr I
360	5092.80	Nd II	55	5110.81	Os I	30	5123.66	Ir I
80	5093.07	Ho I	55	5110.81	Pd I	30	5123.68	Gd II
35	5093.37	Ce I	50	5110.86	Th II	24	5123.73	Ru I
200	5093.83	Ru I	45	5111.61	Ce I	340	5123.79	Nd II
55 b	5093.88	Hf Hf O	15	5112.13	Hf I	29	5123.83	Mo I
21	5094.13	Th I	50	5112.27	Zr II	40	5124.23	W I
40 c	5094.41	Nb I	130	5112.70	Ce I	120	5124.56	Er I
40	5095.07	Th I	150	5112.86	Sc I	90	5124.77	Eu I
40	5095.27	Ta I	17	5113.13	Cr I	50	5124.86	Sm II
420	5095.30	Nb I	190	5113.44	Ti I	65	5125.01	Ce I
40	5095.89	Mo I	95	5113.97	Tm I	120	5125.56	Gd II
65	5096.06	Gd II	170	5114.37	Eu I	14	5125.69	Co I
90 h	5096.44	Eu I	27	5114.53	Nd I	17	5126.20	Co I
70	5096.50	Re I	50	5114.55	Tm II	55	5127.26	Ru I
65	5096.52	Nd II	470	5114.56	La II	130	5127.41	Er II
100	5096.65	Mo I	80	5114.97	Mo I	85	5127.66	Nb I
390	5096.73	Sc I	30	5115.04	Th I	140	5127.81	Ho I
23 h	5097.26	Ce I	95	5115.24	Ce I	7	5127.93	Ce I
130	5097.52	Mo I	95	5115.24	Ce I	15	5128.02	Ce I
35	5098.03	Mo I	140	5115.24	Zr I	19	5128.53	Hf II
50	5098.04	Th II	21	5115.40	Ni I	110	5128.53	V I
130	5098.38	Gd II	65	5115.65	Ce I	170	5129.10	Eu I
10	5098.71	Fe I	110	5115.84	Ta I	30	5129.15	Ti II
620	5099.23	Sc I	320	5116.69	Sc I	55	5129.27	Ho II
18	5099.32	Ni I	140	5116.70	Sm II	18 h	5129.38	Ni I
23	5099.38	Ce I	35	5116.97	Mo I	410	5129.52	Pr II
26 h	5099.95	Ni I	75	5117.02	Pd I	170	5129.57	Ce I
170	5100.16	Nb I	510	5117.16	Sm I	90	5130.08	Eu I
170	5100.22	Sm II	160	5117.17	Ce II	35	5130.11	W I
	5100.39	Sm I	40	5117.25	Ta I	65	5130.28	Gd II
21	5100.62	Th I	70	5117.25	U II	680	5130.60	Nd II
55	5100.94	Gd II	40	5117.29	Pr I	19	5130.76	Rh I
24	5101.09	Tb I	60	5117.94	Mn I	40	5131.07	Th II
370	5101.12	Sc I	19	5117.95	Ce II	120	5131.53	Er I
180	5102.39	Nd II	22 c	5118.03	Pr II	50 w	5131.69	Tb I
260	5103.09	Sm II	35	5118.39	Tb I	45	5132.12	Ta I
70	5103.11	Nd I	45	5118.88	Ce I	35	5132.21	Sm I
24	5103.13	La I	210	5119.11	Y II	170	5132.33	Nd II
21	5103.15	Ti I	23	5119.46	Ce I	40	5133.34	Nb I
910	5103.45	Gd I	23	5119.46	Ce I	85	5133.40	Zr I
90	5103.50	Os I	23	5119.51	Ce I	270	5133.44	Pr I
140	5104.48	Sm II	35	5119.61	Nd II	17	5133.45	Co I
35	5105.14	V I	60	5119.64	Er II	210	5133.52	Eu I
150 d	5105.21	Nd II	130 h	5120.04	Dy I	25	5133.68	Fe I
	5105.35	Nd I	24	5120.18	Tb I	70 b	5133.68	Sc Sc O
400	5105.54	Cu I	170	5120.30	Nb I	130	5133.83	Er II
200	5106.23	La I	20	5120.32	Re I	65	5133.89	Ru I
80	5107.07	Ru I	270	5120.42	Ti I	140	5134.05	Lu I
24	5107.24	Th II	50	5120.42	Zr I	23	5134.23	Nd
40	5107.53	Tm I	22	5120.67	Tm I	55	5134.45	Ce I
360	5107.59	Nd II	23	5120.69	Rh I	210	5134.75	Nb I
24	5108.56	Tb I	65	5120.78	Ce I	30	5135.02	Dy I
10	5108.89	Co I	45	5120.88	La I	2700	5135.09	Lu I
180	5108.91	Gd II	35	5121.30	Nd II	270	5135.14	Pr II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
180	5135.20	Y I	25	5148.78	Ta I	250	5160.33	Nb I
35 d	5135.32	Ce I	10 I	5148.84	Na I	80	5160.33	U II
21	5135.44	La I	15	5149.38	Gd II	70	5160.72	Th I
65	5135.59	Gd I	40	5149.40	Tm II	45	5160.90	Gd II
35	5135.86	Sm I	160	5149.59	Ho II	75	5160.99	Zr I
20	5135.98	Yb II	65	5149.66	Ce I	40	5161.03	Dy II
75	5136.04	Gd I	140	5149.74	Os I	280	5161.48	Ce I
30	5136.47	Ta I	30	5149.84	Gd II	25	5161.65	Re I
530	5136.55	Ru I	28	5149.88	Pr I	70	5161.71	Nd II
45	5136.83	Nd II	100	5149.99	Ce I	200	5161.74	Pr II
18	5137.05	U II	65	5150.39	Ce I	75	5161.81	Ta I
23	5137.08	Ni I	40	5150.64	Nb I	29	5162.86	Sm II
45	5137.12	Ce I	25	5150.87	Ta I	80	5163.19	Mo I
23	5137.78	Ce I	50	5150.89	Mn I	55	5163.27	Ce II
23	5138.00	Ce I	110	5151.07	Ru I	24	5163.46	Th I
40	5138.40	W I	50	5151.61	Th I	120	5163.62	La II
110	5138.42	V I	24	5151.86	Th II	65	5163.65	Ta I
24	5139.16	La I	28	5152.01	Os I	75	5163.70	Gd I
25	5139.26	Fe I	210	5152.20	Ti I	55	5163.80	Er II
35	5139.48	Fe I	100 c	5152.30	Pr II	160	5163.84	Pd I
25	5139.53	V I	75	5152.63	Nb I	40	5164.12	Dy II
190	5139.60	Dy II	55	5153.20	Ru I	55	5164.14	U I
50	5139.65	Cr I	200	5153.24	Cu I	24	5164.27	Tb I
19	5139.77	Ce I	20 I	5153.40	Na I	75	5164.38	Ce I
100	5139.81	Pr I	75	5153.42	Ta I	250	5164.38	Nb I
22	5140.28	Tm II	17	5153.56	W I	55	5164.54	Gd II
45	5140.50	Ce I	28	5153.91	Ce I	22	5164.62	Sm I
75	5140.58	Nb I	35	5153.99	Ce I	170	5164.77	Er II
24	5140.77	Th I	28	5154.04	U II	50	5164.98	Th I
85	5140.84	Gd II	17	5154.05	Co I	170	5165.14	Nd II
50 w	5141.08	Tb II	60	5154.23	Sm II	50	5165.34	Dy I
75	5141.50	Gd I	50	5154.24	Th I	85	5165.96	Zr I
100	5141.62	Ta I	19	5154.39	Ce I	80	5166.06	Sm II
130	5142.59	Ho II	360	5155.03	Sm II	70	5166.23	Cr I
75	5142.68	Gd I	500	5155.14	Ru I	210	5166.70	Eu I
170	5142.76	Ru I	300	5155.45	Zr I	25	5166.79	Ta I
23 h	5142.77	Ni I	60	5155.54	Rh I	21 bl	5166.86	Ti Ti O
110	5143.22	Ho II	40 h	5155.76	Ni I	750	5167.34	Mg I
95	5143.27	Th II	860	5155.84	Gd I	55	5167.42	Hf I
80	5143.33	Nd II	60	5155.86	Sm I	130	5167.49	Fe I
60	5143.58	Er II	45	5156.01	Nd II	100	5167.76	Mo I
100	5143.69	Ta I	80 h	5156.07	Sr I	80	5167.79	La I
24	5143.92	Th I	17	5156.34	Co I	90 c	5167.88	Ho I
35	5144.09	Er II	80	5156.52	Pr II	90	5167.92	Nd II
14	5144.67	Cr I	330	5156.56	Ta I	28	5168.33	Pr I
24	5145.04	Th II	180	5156.74	La II	50	5168.35	Sm I
23	5145.08	U II	55	5156.76	Gd II	16	5168.66	Ni I
150	5145.38	Mo I	65	5157.07	Sm II	28	5168.98	Os I
450	5145.42	La I		5157.23	Sm I	19	5169.23	Ce I
270	5145.47	Ti I	14	5157.09	Rh I	50	5169.57	Sm II
22	5145.54	Os I	180	5157.43	La II	110	5169.69	Dy II
45	5145.77	W I	30	5157.96	Hf I	35	5169.72	Ce I
40 h	5146.48	Ni I	200	5158.00	Zr I	23	5169.94	V I
35	5146.74	Co I	75	5158.48	Gd I	130 bl	5170.11	Lu LuO
14	5147.02	Yb II	85	5158.60	Th I	29	5170.13	Tb I
250	5147.24	Ru I	35	5158.67	Zr I	75	5170.18	Hf I
110	5147.39	Mo I	290	5158.69	La I	24	5170.22	Th II
28	5147.48	Pr I	40	5158.69	Rh I	24	5170.61	Tb I
230	5147.48	Ti I	40	5159.35	V I	23	5170.91	Nd II
75	5147.54	Nb I	280	5159.69	Ce I	920	5171.03	Ru I
110	5147.57	Ce II	280	5159.69	Ce I	45 b	5171.06	Sc ScO
50	5147.58	Tb I	280	5159.69	Ce I	160 d	5171.08	Mo I
75	5147.62	Ta I	60 h	5159.92	Ba I		5171.25	Mo I
120	5148.21	Th II	55	5160.00	Ru I	60	5171.60	Fe I
70	5148.72	V I	270	5160.07	Eu I	20	5171.63	Ta I

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
45	5171.69	Gd I	50	5184.59	Tb I	150	5195.11	Pr II
2200	5172.70	Mg I	55	5184.59	U II	18	5195.23	Ho I
250	5172.74	Sm I	40	5185.25	Tm I	200	5195.31	Pr II
130	5172.78	Er I	80	5185.30	Dy I	55	5195.36	V I
20	5172.90	Dy II	85	5186.13	Tb I	80	5195.50	Pr I
26	5172.91	La II	40	5186.34	Ti I	55	5195.60	Nd I
230	h 5172.94	Mo I	30	5186.84	Hf I	22	5195.63	W I
1100	5173.75	Ti I	45	5186.92	Gd II	50	h 5195.82	Th I
80	5173.84	La II	110	5186.98	Nb I	150	5195.84	Nb I
620	5173.90	Pr II	30	5187.03	Zr I	60	5196.08	Yb I
160	h 5174.18	Mo I	18	5187.05	Nd I	120	5196.43	Y II
190	5174.55	Ce I	45	5187.09	Sm I	85	5196.44	Cr I
80	5175.27	Pr II	55	5187.24	Gd II	50	5196.59	Mn I
470	5175.42	Sm I	370	5187.46	Ce II	170	5196.61	Lu I
45	c 5175.84	Pr II	14	5187.46	Th I	95	5197.66	Dy II
60	5175.97	Rh I	30	5187.75	Hf II	410	5197.77	Gd I
21	5176.08	Co I	55	5187.85	Ho I	55	5198.07	Nd I
190	5176.28	Gd II	55	5187.88	Gd I	50	5198.80	Th I
50	5176.51	Tb I	260	5188.22	La II	50	5198.86	Tb I
13	5176.56	Ni I	22	5188.22	Pr II	95	5199.16	Th I
70	5176.77	V I	40	5188.45	Dy II	45	5199.21	Gd II
80	5176.79	Nd II	50	5188.48	Tb I	200	5199.85	Eu I
50	5176.96	Th I	19	5188.53	Ce II	80	5199.87	Ru I
12	5177.27	Rh I	75	5188.66	Ce I	35	5200.11	Ce I
580	5177.31	La I	85	5188.70	Ti II	330	5200.12	Nd II
45	5177.36	Pr I	100	h 5188.85	Ca I	110	5200.17	Mo I
35	5177.43	Cr I	160	5188.90	Er II	35	5200.19	Cr I
19	5177.73	Ce I	20	5188.93	Ta I	40	5200.40	Ce I
20	5177.95	Ir I	190	5189.20	Nb I	960	5200.41	Y II
70	h 5178.01	Sm II	35	5189.26	Ce I	13	5200.46	Ce I
40	5178.10	Gd II	30	5189.58	Ti I	27	5200.55	Gd II
28	5178.68	Ce I	21	5189.67	Th II	250	5200.59	Sm I
18	5178.75	Nd I	90	5190.11	Ho II	50	5200.74	Mo I
45	5178.84	Gd II	50	5190.87	Th II	110	5200.96	Eu I
40	c 5178.89	Re I	55	5191.08	Gd II	65	5201.10	Ti I
17	5178.99	Zr I	200	5191.32	Pr II	100	5201.15	Zr I
24	5179.12	La I	40	5191.44	Mo I	55	5201.36	Ce I
27	5179.49	Er II	500	5191.45	Nd II	29	5201.45	Sm I
30	5179.78	Nd II	40	5191.47	Fe I	35	5201.47	Pb I
40	5179.92	Gd II	100	5191.60	Zr II	45	5202.12	Ru I
50	5179.97	Tb I	210	5191.66	Ce II	25	5202.34	Fe I
230	5180.31	Nb I	65	5191.71	Ce I	45	5202.46	Ce I
75	5180.88	Ce I	70	5192.00	Cr I	45	5202.58	Ce I
40	c 5180.98	Ta I	20	5192.01	V I	270	5202.63	Os I
130	5181.17	Nd II	60	5192.36	Fe I	60	5202.73	Sm II
20	5181.74	Re I	630	5192.62	Nd II	35	w 5202.77	Tb I
23	5181.75	Ce I	45	5192.71	W I	65	5203.22	Nb I
230	5181.86	Hf I	290	5192.86	Dy II	35	5203.23	Os I
45	5181.93	Ce I	1300	5192.98	Ti I	45	5203.25	W I
130	c 5182.11	Ho I	110	5192.99	V I	55	5203.27	Ce I
35	5182.53	Th II	170	5193.08	Nb I	170	5204.15	La II
120	5182.60	Nd II	95	5193.14	Rh I	55	5204.27	Ce I
19	5182.68	Tm I	12	5193.49	Cr I	45	5204.32	U II
35	5183.20	Ce I	40	5193.52	Os I	65	5204.38	Nd I
35	5183.20	Ce I	23	5193.62	V I	14	5204.51	Tm II
850	5183.42	La II	60	5193.74	Eu I	5300	5204.52	Cr I
4000	5183.62	Mg I	40	5193.82	Th II	55	5204.52	W I
100	5183.70	Zr I	20	c 5193.99	Ta I	40	5204.55	Tb I
45	5183.84	Pr II	85	h 5194.04	Ti I	35	5204.72	Ce I
90	5183.92	La I	120	5194.43	Pr I	35	5205.13	Ce I
35	5183.97	W I	45	5194.73	Sm I	35	5205.13	Nb I
35	5183.99	Th II	19	5194.76	Ce I	35	5205.51	Ce II
20	5184.15	Yb II	110	5194.83	V I	15	5205.66	Dy I
35	5184.19	Rh I	30	5194.95	Fe I	1500	5205.72	Y II
70	5184.59	Cr I	180	5195.02	Ru I	15	5205.73	Dy I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
24	5205.78	Th II	50	5218.53	Th II	85	5233.22	Th II
8400	5206.04	Cr I	360	5219.05	Pr II	35	5233.52	W I
120	5206.08	Ti I	85	5219.10	Nb I	35	5233.75	V I
55	5206.18	W I	35	5219.11	Th I	19	5233.77	Ce I
20	5206.26	Ta I	280	5219.40	Gd I	130	5233.93	Gd I
120	5206.44	Eu I	80	5219.40	Mo I	55	5234.02	Ce II
90	5206.47	Lu I	280	5219.67	Sc I	110	5234.07	V I
60	5206.49	Th II	150	5219.71	Ti I	45	5234.18	Sm II
	5206.66	Th II	40	5220.07	Cu I	450	5234.20	Nd II
150	5206.52	Er I	560	5220.11	Pr II	100	5234.26	Mo I
360	5206.55	Pr II	75	5220.30	Gd II	520	5234.27	La I
20	5206.61	V I	29	5221.12	Sm I	35	5234.31	Re I
16	5206.95	Rh I	45	5221.54	Ho I	55	5234.86	Pd I
75	5207.87	Ti I	65	5221.57	Nd II	40	5235.11	Tb I
150	5207.90	Pr II	30	5221.75	Cr I	45	5235.21	Co I
40	5207.97	Tb I	45	5221.90	Ce I	30	5235.39	Ta I
65	5208.42	Ti I	40	5221.99	Tb I	23	5235.77	Ce II
11000	5208.44	Cr I	140	5222.20	Sr I	45	5237.07	Ce II
35	5208.70	Ce I	19	5222.66	Rh I	45	5237.16	Rh I
28	5208.91	Ce I	95	5222.69	Ti I	85	5237.43	Nb I
1000	5209.07	Ag I	45	5222.94	Ce I	30	5237.53	Ta II
85	5209.30	Zr I	260	5223.46	Ce I	29	5237.58	Sm I
19	5209.34	Tb II	300	5223.49	Eu I	9	5237.80	Rh I
60	5209.92	Sm I	65	5223.55	Ru I	40	5237.91	Th II
28	5210.34	Ce II	85	5223.64	Ti I	460	5238.20	Mo I
1400	5210.39	Ti I	250	5224.32	Ti I	13	5238.47	Ce I
26	5210.44	Mo I	95	5224.56	Ti I	40	5238.50	Ce I
55	5210.49	Gd II	770	5224.66	W I	280	5238.55	Sr I
390	5210.52	Sc I	85	5224.93	Zr I	120	5238.58	Ti I
35	5211.04	Ce I	85	5224.94	Cr I	18	5238.61	U II
50	5211.23	Th I	190	5224.95	Ti I	19	5238.90	Ce I
45	5211.28	Sc I	130	5225.05	Nd II	22	5238.92	Ir I
16	5211.52	Rh I	200	5225.11	Sr I	19	5238.97	Cr I
85	5211.60	Yb I	23	5225.12	U II	120	5239.24	Eu I
720	5211.86	La I	65	5225.16	Nb I	35	5239.55	La I
50	5211.86	Mo I	35	5225.77	V I	250	5239.79	Nd II
190	5211.92	Ce I	35	5226.21	La II	350	5239.82	Sc II
65	5212.29	Ti I	19	5226.24	Ce I	17	5239.83	Ce II
310	5212.37	Nd II	19	5226.38	Ce II	19	5240.12	Ce I
50	5212.71	Co I	65	5226.56	Ti II	40	5240.20	Th II
19	5212.73	Rh I	30	5226.88	Fe I	20	5240.20	V I
110	5212.74	Ta I	12	5226.89	Cr I	29	5240.39	Nb I
45	5212.81	W I	120	5227.19	Fe I	35	5240.51	Yb II
60	5212.91	Er II	35	5227.66	Pt I	180	5240.81	Y I
150	5213.23	Nd I	110	5227.97	Pr I	26	5240.83	La I
24	5213.35	Th I	120	5228.12	Tb I	110	5240.87	V I
80	5213.38	Tm I	22	5228.23	Tm II	230	5240.88	Mo I
45	5213.43	Ru I	130	5228.43	Nd II	40	5242.38	Ru I
19	5214.13	Cr I	60	5228.80	Sm II	22	5242.71	Pr II
40	5214.28	Tb I	200	5229.27	Sr I	110	5242.81	Mo I
16	5214.79	Rh I	45	5229.34	Er II	75	5242.98	W I
750	5215.10	Eu I	180	5229.75	Ce I	65	5243.07	Ce I
30	5215.13	Er II	45	5230.16	Ce I	30	5243.40	Cr I
90	5215.65	Nd II	22	5230.21	Pr I	30	5243.47	Zr I
25	5216.28	Fe I	50	5230.22	Co I	20	5243.69	Pr II
35	5216.38	Ce I	19	5230.62	Rh I	110	5243.99	Hf I
95	5216.59	Th II	40	5230.80	Ta I	100	5244.11	Yb I
40	5216.59	V I	55	5230.84	Ce I	22	5244.38	Gd I
45	5216.73	Pr II	65	5231.06	Mo I	35	5244.47	Ho I
85	5217.48	Gd I	110	5231.16	Th I	95	5244.50	Ce I
240	5218.20	Cu I	24	5232.04	Th II	18	5244.78	Ta I
30	5218.26	Er II	26	5232.36	Mo I	19	5245.28	Ce I
60	5218.40	Sm I	150	5232.81	Nb I	100	5245.51	Mo I
110	d 5218.45	Ta I	140	5232.92	Ce II	260	5245.92	Ce I
	5218.66	Ta I	110	5232.94	Fe I	21	5246.15	Ti I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
55	5246.57	Ti I	35	5258.36	Th I	55	5270.09	Nd I
65	5246.87	Gd I	16	5258.37	Dy II	480	5270.27	Ca I
50	5246.94	Dy II	28	5258.40	Ce II	80	5270.36	Fe I
55	5247.10	Hf II	150	5259.04	Mo I	55	5270.69	Nd II
75	5247.31	Ti I	65	5259.34	W I	1300	5270.95	Re I
18	5247.35	U II	110	5259.39	La II	35	5271.04	Ce I
290	5247.56	Cr I	680	5259.73	Pr II	370	5271.19	La I
95	5247.65	Th II	70	5259.88	Dy I	400	5271.40	Sm I
45	5247.75	U II	28	5259.92	Ce I	270	5271.53	Nb I
50	5247.93	Co I	55	5259.99	Ti I	22	5271.79	Gd I
16	5248.14	Dy II	16	5260.17	Mo I	35	5271.80	Mo I
75	5248.71	Tb I	25	5260.44	Hf II	35	5271.81	Ce I
50	5248.86	Re I	130	5260.56	Dy I	45	5271.86	Ce I
19	5249.16	Ce I	22	5260.81	Gd I	35	5271.92	Ce I
720	5249.59	Nd II	14	5260.93	Tm II	390	5271.96	Eu I
35	5249.61	Ce I	17	5260.98	V I	27	5272.00	Nd II
22	5249.86	Pr I	65	5261.14	Mo I	16	5272.00	U I
10	5250.00	Co I	85	5261.70	Ce I	35	5272.01	Cr I
20	5250.46	Os I	110	5261.71	Ca I	19	w 5272.07	Tb II
200	5250.82	Nd II	19	5261.75	Cr I	50	5272.25	Dy II
21	5250.95	Ti I	75	w 5262.11	Tb II	30	5272.37	Gd I
35	5251.06	Ce I	130	w 5262.24	Ca I	110	5272.48	Eu I
320	5251.18	Gd I	13	5263.22	W I	25	5272.48	Nb I
150	d 5251.62	Nb I	55	bl 5263.3	Dy I	16	5272.72	Pr II
		Nb I	55		Ti I	25	5272.82	Sm II
55	5251.67	Ru I						
65	c 5251.71	Pr II	30	5263.81	Gd I	80	5272.91	Er I
65	5251.82	Ho I	180	5263.88	Pr II	55	5272.91	Gd I
260	5251.92	Sm I	530	5264.15	Cr I	590	5273.43	Nd II
55	5251.99	Ce I	85	5264.18	Ce I	30	5273.44	Cr I
			35	5264.22	Nd I	340	5274.23	Ce II
19	5252.02	Ce I	110	5264.24	Ca I	30	5275.02	Ta I
110	5252.11	Ti I	35	5264.77	Er II	24	5275.03	Tb I
120	5252.14	Gd II	13	5264.92	Tb I	55	5275.04	Hf I
75	5252.67	Ce II	30	5264.95	Hf II	95	h 5275.17	Cr I
35	5252.77	Sm II	55	5265.15	Os I	50	5275.29	Dy II
75	5253.03	Nb I	30	5265.16	Cr I	55	5275.48	Ho I
19	5253.41	Ce I	280	5265.56	Ca I	45	5275.53	W I
19	5253.44	Th II	25	5265.67	Sm I	1600	cw 5275.56	Re I
340	5253.46	La I	130	5265.71	Ce II	35	h 5275.69	Cr I
22	5253.80	Sm I	180	5265.72	Cr I	35	5275.79	Ce II
85	5253.93	Nb I	27	h 5265.74	Nd I	70	h 5276.03	Cr I
35	5254.54	W I	9	5265.82	Co I	17	h 5276.19	Co I
9	5254.65	Co I	150	5265.98	Ti I	130	c 5276.20	Nb I
85	5254.75	Gd I	26	5266.30	Co I	28	5276.24	Ce I
55	5254.82	Ce I	200	5266.40	Eu I	35	5276.28	Mo I
60	5254.92	Cr I	40	5266.47	Ru I	50	5276.42	La I
60	5255.13	Cr I	45	5266.49	Co I	150	5276.88	Nd II
85	5255.32	Mn I	50	5266.58	Fe I	150	h 5277.04	Yb I
45	5255.40	W I	23	h 5266.64	Nd I	22	c 5277.39	Pr II
360	5255.51	Nd II	12	5266.71	Th I	120	5277.41	Zr I
140	5255.80	Gd I	40	h 5266.83	Ru I	70	5277.50	Th II
45	5255.82	Os I	20	5267.03	Ba I	17	5277.52	Ce I
75	5255.83	Ti I	65	5267.11	Dy I	55	5277.71	Er I
140	5255.93	Er II	24	5267.34	Tm II	23	5278.18	U II
28	5255.98	Ce I	22	5268.01	Gd I	100	5278.24	Re I
22	5256.47	Er II	26	5268.52	Co I	15	5278.43	Ce I
480	5256.90	Sr I	65	5268.78	Gd I	26	5279.13	La II
27	5257.02	Er II	20	5268.95	Mo I	27	5279.34	Er II
45	5257.04	U II	14	5269.27	Rh I	29	c 5279.43	Nb I
40	5257.07	Ru I	120	5269.48	Nd II	35	5279.53	Yb II
23	5257.35	Nd I	35	5269.51	Ce I	65	5279.65	Mo I
40	5257.49	Yb II	15	5269.54	Ce I	50	5279.70	Dy II
17	5257.62	Co I	220	5269.54	Fe I	18	5279.82	Ta I
35	5257.85	La I	90	5269.78	Nd II	75	5280.05	Zr I
280	5258.33	Sc I	50	5269.92	Nb I	12	5280.10	Th II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum						
11	h	5280.12	Rh	I	120	5294.87	Hf	I	110	5306.47	Nd	II		
19		5280.29	Cr	I	17	5294.95	Ce	I	55	5306.70	Gd	I		
70		5280.38	U	I	90	5295.01	Ta	I	650	5307.12	Tm	I		
45	h	5280.65	Co	I	55	5295.47	Mo	I	280	5307.30	Gd	I		
40		5280.82	Ru	I	120	5295.63	Pd	I	30	5307.47	Th	II		
210		5280.86	Mo	I	20	5295.65	Os	I	24	5307.53	La	I		
18		5281.02	Ta	I	65	5295.79	Ti	I	30	5307.82	Hf	I		
75		5281.05	Tb	I	35	5296.34	Nb	I	29	5308.19	Tb	I		
17		5281.35	Ce	I	130	5296.56	Ce	I	27	5308.28	Nd	I		
20		5281.80	Fe	I	340	5296.69	Cr	I	23	5308.30	Ce	I		
55		5282.07	Dy	I	120	5296.79	Zr	I	23	5308.30	Ce	I		
40		5282.39	Ti	I	120	5297.26	Ti	I	27	5308.42	Nd	II		
55		5282.48	Gd	I	70	h	5297.36	Cr	I	65	5308.53	Ce	I	
150		5282.82	Eu	I	30		5297.75	Th	I	40	5308.54	U	I	
250		5282.91	Sm	I	40		5297.82	Dy	II	22	5308.96	Pr	II	
280		5283.08	Gd	I	45		5298.06	Hf	II	40	5309.02	Dy	II	
140		5283.45	Ti	I	230		5298.09	Pr	II	260	5309.27	Ru	I	
9		5283.49	Co	I	35		5298.26	Ce	I	29	5309.46	Tb	I	
40		5283.63	Fe	I	660		5298.27	Cr	I	22	5309.50	Sm	I	
20		5283.84	Mo	I	65		5298.44	Ti	I	45	5309.68	Hf	I	
20		5283.89	Os	I	30		5298.58	Gd	I	13	5309.89	Ce	I	
130		5284.08	Ru	I	40		5298.78	Os	I	13	5309.89	Ce	I	
35		5284.39	Ti	I	23		5298.88	Nd	I	45	5310.01	Nd	II	
35		5284.97	Sc	I	17		5299.16	Ce	I	21	5310.04	U	II	
28		5284.99	Dy	II	35		5300.21	Tm	I	4	5310.20	Co	I	
50		5285.26	Nb	I	27		5300.58	Nd	I	40	5310.26	Th	II	
90		5285.65	Pr	II	85		5300.75	Cr	I	90	5311.11	Pr	II	
210		5285.76	Sc	I	17		5300.94	Yb	II	110	5311.40	Zr	I	
22		5286.09	Hf	I	40		5301.02	Pt	I	220	5311.46	Nd	II	
55		5286.68	Nd	II	26		5301.06	Co	I	55	5311.60	Hf	II	
35		5286.81	Ce	I	90		5301.25	Ho	I	45	5311.84	Gd	I	
35		5287.13	Nd	II	35		5301.40	Th	II	40	5311.88	U	II	
10		5287.19	Cr	I	160		5301.58	Dy	I	35	5312.00	Th	I	
55		5287.25	Eu	I	280		5301.67	Gd	I	35	5312.23	Sm	II	
13		5287.30	Tb	I	35		5301.94	Sc	I	65	cw	5312.37	Pr	II
7		5287.57	Co	I	60		5301.97	Zr	I	35		5312.53	Th	I
8		5287.81	Co	I	370		5301.98	La	II	18	h	5312.57	Pd	I
18		5288.40	U	II	15		5302.11	Ce	I	17		5312.66	Co	I
26		5288.81	Ti	I	160		5302.28	Nd	II	16		5312.73	U	II
60		5289.25	Eu	I	45		5302.30	Er	II	24		5312.88	Cr	I
45		5289.34	Pr	I	25		5302.31	Fe	I	28		5313.41	Pr	II
60		5289.82	Y	II	16		5302.35	Mo	I	22		5313.76	Sm	I
25	h	5289.94	Sm	I	13		5302.58	Os	I	55		5313.89	Mo	I
140		5290.84	La	II	27		5302.61	Nd	I	35		5313.93	Ce	I
45		5290.92	Ce	I	140		5302.62	La	II	35		5314.38	Ce	I
40		5291.14	Tm	I	35		5302.69	Tm	I	35		5314.55	Nd	II
40		5291.16	Ru	I	220		5302.76	Gd	I	14		5314.79	Rh	I
120		5291.26	Eu	I	12		5303.05	Th	II	23		5314.84	Ce	I
17		5291.29	Ce	I	15		5303.08	Ce	I	35		5315.04	Mo	I
17		5291.29	Ce	I	65		5303.21	Nd	II	23		5315.05	Ce	I
110		5291.67	Nd	I	35		5303.23	Sm	I	18		5315.27	U	I
340	c	5292.02	Pr	II	23		5303.32	Ce	I	13		5315.33	Ru	I
55		5292.08	Mo	I	11		5303.33	Ce	I	50		5315.55	Nb	I
14		5292.14	Rh	I	180		5303.55	La	II	22	h	5315.79	Gd	II
17		5292.45	Ce	I	90		5303.85	Eu	I	16		5316.56	Pr	I
40	h	5292.52	Cu	I	45		5304.02	La	I	55		5316.60	Nd	II
340		5292.62	Pr	II	17		5304.21	Cr	I	10		5316.78	Co	I
680		5293.17	Nd	II	40		5304.40	Lu	I	30		5316.80	Gd	II
35		5293.46	Mo	I	12		5304.62	Th	II	17		5317.01	Nb	I
60		5293.68	Eu	I	65		5304.72	Tb	I	20		5317.28	Re	I
65		5294.05	Ce	I	80		5304.86	Ru	I	19		5317.59	Ce	I
40		5294.32	Tm	I	30		5305.56	Re	I	22		5318.35	Sc	II
120		5294.64	Eu	I	17		5305.58	Th	II	250		5318.60	Nb	I
35		5294.65	Sm	I	55		5305.87	Tm	II	40	c	5318.67	Ta	I
60		5294.82	Zr	I	20		5306.26	Mo	I	24		5318.78	Cr	I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
27	5318.86	W I	35	5331.04	Tb I	16	5341.55	Pr I
45	5319.11	Nd	14 h	5331.08	Rh I	30 cw	5341.81	Gd I
110	5319.23	Tb I	21	5331.47	Co I	25	5342.25	Ta I
35	5319.24	Ho I	65	5331.48	Pr II	20	5342.58	Pr II
21	5319.38	U I	70	5331.77	Sc I	50	5342.71	Co I
50	5319.49	Nb I	20	5331.90	Re I	95	5342.96	Sc I
35	5319.65	Ho I	45	5331.92	Gd I	300	5343.00	Gd I
500	5319.82	Nd II	18	5332.09	Sm I	26	5343.39	Co I
20	5319.89	Mo I	28	5332.34	Ce I	25	5343.58	Nb I
16	5320.16	La I	27	5332.43	Nd I	60	5343.58	Th I
190	5320.60	Sm I	11	5332.58	Tb I	16	5343.65	Nd I
45	5320.78	Y II	8	5332.67	Co I	55	5343.89	Pr II
27	5320.79	Nd I	20	5332.76	Re I	22	5343.94	Er II
90	5321.07	Pr II	40	5332.93	Ru I	460	5344.17	Nb I
45	5321.25	Gd I	55	5333.06	Er I	30	5344.50	Er II
25	5321.26	Zr I	170	5333.30	Gd I	10	5344.76	Cr I
35	5321.28	Re I	27	5333.33	Er II	15	5345.10	Pd I
130	5321.50	Gd I	8	5333.65	Co I	17	5345.12	Ce I
16	5321.60	U II	20	5333.85	Re I	85	5345.13	Gd I
3	5321.72	Co I	17	5334.02	Ce I	30	5345.31	Th II
280	5321.78	Gd I	27	5334.23	Er II	30 d	5345.66	Yb II
40	5321.81	Pr II	14	5334.23	Sc II		5345.83	Yb II
18 h	5321.82	Sm I	27	5334.33	Nd I	75	5345.68	Gd I
15	5322.11	Tb II	45 h	5334.70	Ru I	80	5345.71	Nd II
30	5322.37	Gd I	17	5334.71	Ce I	780	5345.81	Cr I
45	5322.69	Gd I	16	5334.79	Mo I	11	5346.03	Os I
430	5322.76	Pr II	8	5334.84	Co I	15	5346.04	Tb I
16	5322.99	Tm II	75	5334.87	Nb I	9	5346.30	Hf II
35	5323.28	Ce I	170	5335.15	Yb II	80	5346.49	Tm II
35	5323.57	La I	75	5335.76	Ce I	23	5346.55	Ce I
15	5323.92	Tb I	110	5335.93	Ru I	23	5346.55	Ce I
70	5324.18	Fe I	30	5336.13	Ta I	14	5347.04	Th II
12	5324.26	Hf II	65	5336.22	Ce I	60	5347.22	Yb II
20	5324.47	Mo I	18	5336.23	Os I	7	5347.49	Co I
35	5324.59	Nd I	90	5336.55	Nd II	24	5347.83	Tb II
50	5324.69	Dy I	25	5336.81	Nb I	35	5347.84	Ce II
22 hd	5324.99	Sm I	26	5336.81	Ti II	90	5348.06	Er I
60	5325.14	Th II	16	5337.20	Mo I	29	5348.08	Sm I
15 h	5325.28	Co I	27	5337.35	W I	380	5348.32	Cr I
5	5325.95	Co I	24	5337.43	Dy II	200	5348.67	Gd I
50	5326.98	Th I	55	5337.53	Gd I	45	5348.74	Sm I
35	5327.06	Mo I	17	5337.79	Ce I	45	5348.93	W I
110	5327.32	Gd I	65 w	5337.90	Tb I	7	5349.09	Co I
50	5327.46	Re I	45	5338.01	Nd II	50	5349.09	Ta I
35	5327.76	U II	12	5338.43	Zr I	80	5349.12	Lu I
180	5328.05	Fe I	35 d	5338.59	Tb I	35	5349.14	Sm I
130	5328.08	Ce I	35	5338.90	Tm I	23	5349.26	Nd I
65	5328.30	Gd I		5339.03	Tm I	15	5349.27	Ce I
340 h	5328.34	Cr I	95	5339.41	Sc I	350	5349.30	Sc I
75	5328.38	Ta I	14	5339.94	Fe I	9	5349.31	Rh I
25	5328.53	Fe I	65	5340.30	Dy I	160	5349.47	Ca I
15	5329.05	Tb I	14	5340.44	Cr I	50	5349.57	Ta I
27	5329.11	Nd II	15	5340.66	Ce I	35	5349.58	Nd I
70 h	5329.17	Cr I	110	5340.67	La II	120	5349.71	Sc I
40	5329.26	U I	12	5340.74	Ir I	16	5349.79	Mo I
24	5329.37	Th II	7	5340.77	Ce I	19	5349.88	Mn I
	5329.48	Th II	50	5340.80	Nb I	21	5349.92	U II
35	5329.56	Ce I	18	5341.03	Fe I	30	5350.09	Zr II
17 h	5329.72	Cr I	120	5341.05	Sc I	60	5350.30	Sc I
40 h	5329.74	Rh I	140	5341.05	Ta I	30	5350.35	Zr II
35 h	5329.82	Sr I	160	5341.06	Mn I	300	5350.38	Gd I
18	5329.88	Nd I	30	5341.17	Gd I	30 h	5350.41	Eu I
80	5330.11	Ho I	110	5341.29	Sm I	35	5350.43	W I
190	5330.54	Ce II	12 h	5341.33	Co I	18000	5350.46	Tl I
22	5330.84	Zr I	17	5341.50	Ti I	45	5350.47	Er I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
35	5350.53	Ce I	45	5361.17	Nd II	11	5373.45	U II
45	5350.62	Sm I	290	5361.47	Nd II	110	5373.86	Hf I
23	5350.65	Ce I	120	5361.61	Eu I	22	5374.14	W I
14	5350.72	Ce I	55	5361.66	Gd I	18	5374.24	Pr I
340	5350.74	Nb I	130	5361.77	Ru I	40	5375.27	Nb I
25	5350.90	Zr I	17	5362.01	Nb I	270	5375.35	Sc I
75	5351.08	Ti I	18	5362.40	U II	40	5375.35	Th II
14	5351.13	Th I	75	5362.56	Zr I	24	5375.77	Th II
30	h 5351.29	Yb I	6	5362.64	Ce I	75	5375.98	Tb I
19	h 5351.37	Ce I	9	5362.73	Ce I	110	5376.79	Os I
75	h 5351.69	Eu I	21	h 5362.77	Co I	110	5376.94	Eu I
22	h 5351.89	W I	75	h 5363.33	Ce I	130	5377.09	La II
25	5351.92	Zr I	75	5363.33	Ce I	100	c 5377.10	Re I
50	5352.05	Co I	12	5363.35	Zr I	13	5377.45	Pr II
30	5352.11	Dy I	10	5363.62	Tb I	95	5377.63	Mn I
13	5352.22	Ce I	30	5363.66	Yb I	35	5377.79	Nd I
13	5352.25	Os I	18	5363.82	U II	65	5377.84	Ru I
23	5352.28	Ce I	110	hl 5364.28	Mo I	19	w 5377.88	Tb II
20	5352.35	Mo I	35	5364.32	Ir I	14	h 5378.09	Sm I
200	5352.40	Pr II	22	5364.39	Sm II	23	h 5378.23	Nd I
40	5352.84	Eu I	12	5364.88	Fe I	23	5378.32	Ce II
150	5352.95	Yb II	35	5365.12	Nd II	12	5378.84	Th I
240	5353.26	Gd I	95	5365.38	Gd I	45	5379.10	Rh I
40	5353.28	Nb I	21	5365.89	La I	28	5379.92	Ce I
40	5353.41	V I	15	5365.95	Ta I	21	5380.01	La I
26	5353.48	Co I	26	5366.65	Ti I	11	5380.11	Ce I
450	5353.53	Ce II	15	d 5366.92	Ce I	75	5380.62	Y I
130	5354.40	Rh I	35	hl 5367.11	Mo I	140	5380.99	La II
22	5354.45	W I	14	h 5367.46	Fe I	6	5381.10	Co I
65	5354.68	Ta I	23	5367.54	Ce I	18	5381.26	Pr II
110	5354.73	Hf I	30	5367.70	Gd I	40	5381.34	Nb I
80	5354.88	Mo I	15	5368.05	Ce I	55	5381.40	Ho I
160	5354.88	Tb I	30	5368.20	Dy II	18	5381.70	Pr II
90	5355.10	Eu I	140	5368.36	Sm I	9	h 5381.75	Co I
55	5355.18	Ce I	28	5368.43	U II	80	5381.92	La II
13	5355.25	W I	13	5368.68	W I	20	5382.37	Zr I
25	5355.31	Nb I	30	5368.79	Gd I	35	5382.58	Ce I
35	5355.51	Mo I	35	5368.85	Er I	35	5382.92	Th II
23	5355.59	Ce I	12	5368.99	Pt I	11	5382.94	U I
40	5355.70	Nb I	23	5369.07	Ce I	30	5383.37	Fe I
210	5355.75	Sc I	15	5369.17	Ce I	35	5383.43	V I
35	h 5355.88	Sm I	14	5369.18	Sm II	30	5383.85	Nd II
15	5355.96	Ce I	16	5369.24	Dy II	12	5384.03	Th I
530	5356.10	Sc I	17	5369.39	Zr I	15	5384.12	Ce I
23	5356.47	Rh I	35	5369.48	Re I	45	5384.15	Gd I
65	5356.48	Mo I	35	5369.58	Co I	30	5384.56	Ho I
180	5356.98	Nd II	30	5369.61	Gd I	30	5384.97	Ho I
13	5357.09	W I	55	5369.64	Ti I	40	5385.14	V I
14	5357.19	Sc II	75	5369.72	Tb I	270	5385.14	Zr I
45	5357.20	Ce I	50	c 5369.80	Re I	45	5385.39	Gd I
45	5357.20	Ce I	95	5369.92	Gd I	11	5385.54	U I
540	5357.61	Eu I	20	5369.96	Fe I	20	5385.63	Dy II
45	5357.79	Gd II	22	5370.06	Sm I	65	5385.88	Ru I
110	5357.86	La I	14	5370.16	Nd II	110	5385.90	Nd II
30	5358.64	Yb II	23	5370.31	Ce I	55	5386.19	U II
35	5358.99	Pr I	150	5370.63	Gd I	75	5386.32	Ce I
14	5359.18	Co I		5370.74	Gd I	35	5386.61	Th I
45	5359.18	Gd I	120	5371.49	Fe I	30	5386.65	Zr I
29	5359.19	Nb I	19	5371.56	Ce I	55	5386.78	Ce II
19	5359.26	Ce I	150	5371.94	Nd II	30	5386.98	Cr I
23	5359.50	Ce II	40	5372.22	Gd II	22	5387.57	Cr I
28	5359.97	Ce I	18	5372.37	Pr I	35	5387.97	Sm I
90	5359.99	Ho I	35	5372.40	Mo I	22	5388.00	W I
560	hl 5360.56	Mo I	27	5372.98	Tm II	23	5388.23	Nd II
60	5360.83	Eu I	20	5373.01	Ta I	17	5388.30	Nb I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
14	5388.30	V I	40	5400.61	Cr I	15	5411.54	Ce I
25 c	5388.51	Ta I	35	5400.90	U I	55	5411.54	Pr II
26	5388.69	Mo I		5400.94	U II	19	5411.76	Ce I
40	5389.18	Ti I	13	5400.95	Pr I	45	5411.86	Eu I
90	5389.30	Ta I	110 h	5401.04	Ru I	18	5411.93	Nd I
40	5389.34	Hf I	28	5401.21	Ce I	13	5412.14	Os I
85	5389.50	Gd I	28	5401.21	Ce I	22	5412.64	Gd II
85	5389.58	Dy II	40	5401.39	Ru I	85	5413.20	Gd I
18 d	5389.83	U I	100	5401.93	V I	80 cw	5413.22	Pr II
17	5389.84	Yb II	29 d	5402.06	Tb II	45	5413.39	Gd I
22	5389.85	Sm I	27	5402.23	Tm I	25 c	5413.48	Ta I
55	5389.99	Ti I	200	5402.51	Ta I	14	5413.62	Ho II
10	5390.39	Cr I	15	5402.56	Ce I	29	5413.65	Tb I
95	5390.44	Rh I	500	5402.57	Lu I	35	5413.69	Mn I
70	5390.46	Th II	28	5402.59	Pr I	17	5413.93	Zr I
12	5390.79	Pt I	450	5402.77	Eu I	28	5414.11	Ce I
17	5391.18	Zr I	220	5402.78	Y II	60	5414.63	Er II
19	5391.36	Hf II	27	5402.90	Nd I	16	5414.67	Mo I
19	5391.82	Ce I	70	5403.17	Ho I	30	5414.80	Nd II
23	5391.88	Ce I	23	5403.20	U II	30 h	5415.21	Fe I
14	5391.96	Tm II	16	5403.43	Os I	140	5415.26	V I
370	5392.08	Sc I	13	5403.54	Ta I	18	5415.31	Nd I
50	5392.57	Th II	95	5403.70	Sm I	70	5415.46	Th II
22	5392.69	Sm I	15	5403.82	Tb II	26	5415.68	La I
120	5392.94	Eu I	35	5404.02	Ti I	85	5415.69	Gd I
20	5393.18	Fe I	35 h	5404.15	Fe I	35	5415.98	Sm II
300	5393.40	Ce II	50	5404.19	Dy I	45	5416.12	Sc I
18 h	5393.85	Ho I	35	5404.36	Ce I	29	5416.20	Tb I
29	5394.48	Sm II	19	5404.47	Hf I	21	5416.30	Nb I
65	5394.52	Mo I	23 h	5404.73	Rh I	120	5416.34	Os I
95	5394.67	Mn I	18	5404.80	Pr II	70	5416.38	Nd II
12	5394.76	Th I	45	5404.96	Ta I	45	5416.69	Os I
55	5394.87	Ce I	22	5405.00	Cr I	24	5417.03	Y I
35	5395.24	Ce I	25	5405.13	Zr I	40	5417.38	Mo I
35	5395.24	Pd I	130	5405.23	Sm I	24	5417.49	Th I
40	5395.57	Dy I	45	5405.33	Eu I	28	5417.51	Os I
28	5395.70	Ce I	21 bl	5405.66	La LaO	15	5417.83	Ce II
28 c	5395.83	Pr I	70	5405.78	Fe I	28	5418.09	V I
21	5395.86	Nb I	35	5405.79	Mo I	35	5418.70	Ce I
35	5395.87	Er II	13	5405.80	Ta I	40	5418.86	Ru I
17	5395.88	Zr I	14	5405.98	Tm II	9	5419.07	Sm I
40	5395.99	Ta I	23	5405.98	U II	80	5419.13	Dy I
29	5396.33	Nb I	45	5406.17	Nd II	130	5419.19	Ta I
17	5396.60	Ti I	35	5406.39	Mo I	11	5419.39	W I
18	5396.72	Nd II	15	5406.65	Ce II	27	5419.88	Gd II
85	5397.09	Ti I	100	5407.08	Ho I	85	5420.36	Mn I
70	5397.13	Fe I	95	5407.42	Mn I	110	5420.38	Ce I
35	5397.38	Mo I	14 h	5407.51	Co I	18	5420.66	Nd I
25	5397.56	Ta I	85	5407.62	Zr I	16	5420.77	Dy I
150	5397.64	Ce I	24	5407.65	Th I	55	5421.07	Eu I
11	5397.87	V I	19	5407.67	Ce I	45	5421.19	Gd I
15	5397.90	Th I	24 bl	5407.69	La LaO	11	5421.29	Ce I
15	5397.95	W I	15	5408.36	Ce I	7	5421.38	Ce I
15	5397.99	Ce I	30	5408.78	Ta I	80	5421.56	Nd II
20 h	5398.26	Dy DyO	280	5409.23	Ce II	45	5421.57	Sm I
24	5398.92	Th I	110	5409.61	Ti I	19	5421.84	Th II
23	5399.06	Ce I	1400	5409.79	Cr I	20	5421.86	Zr I
23	5399.12	Nd II	14	5410.24	U I	140 c	5421.90	Lu I
50	5399.49	Mn I	45 cwd	5410.54	Pr II	6	5422.16	Ce I
14	5399.56	Ce I	18	5410.55	Ta I	6	5422.23	Ce I
23	5399.60	Ce I	21	5410.77	Th I	11	5422.26	Ce I
24	5399.93	Dy II	18	5410.91	Fe I	28	5422.36	Pr I
30	5400.20	Nd I	27	5411.20	Gd I	65	5422.44	Nb I
27	5400.46	Tm II	29	5411.24	Nb I	18	5422.81	Er II
50	5400.47	Mo I	60	5411.39	Sm I	7	5422.88	W I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
70	5423.32	Dy I	18	5433.82	Sm I	28	5446.45	Ce I
11	5423.35	U I	40	5434.18	V I	40	5446.64	Ti I
23	5423.43	Ce I	16	5434.39	Ho II	60	5446.92	Fe I
7	5423.93	W I	50	5434.53	Fe I	22	5446.93	Os I
21	5424.01	Th I	55	5435.03	W I	27	5447.28	Nd I
28	5424.02	Hf I	12	5435.13	Th II	18	5447.39	Sc I
18	5424.07	Nd I	65	5435.27	Ta I	35	5447.56	Nd II
60	h 5424.07	Rh I	11	5435.59	W I	22	5447.74	Gd II
35	h 5424.08	Fe I	55	5435.68	Mo I	11	5447.76	Os I
50	5424.08	V I	12	5435.78	Hf I	14	5447.92	Re I
50	5424.10	Tb II	18	5435.87	Ho I	19	5448.31	Nb I
30	5424.27	Dy I	8	5435.87	Ni I	11	bl 5448.34	Ti Ti O
90	5424.37	Y I	50	5435.89	Th II	35	5448.57	Zr I
220	hI 5424.55	Ba I	6	5436.04	Ce I	30	5448.90	Ti I
19	5424.72	Rh I	9	5436.11	Ce I	21	5449.16	Ti I
19	5425.00	Tb I	45	5436.30	Gd I	55	5449.21	Nd II
19	h 5425.45	Rh I	29	5436.33	Sm I	140	5449.24	Ce I
45	5425.57	Sc I	26	5436.73	Ti I	40	5449.27	Yb II
18	5425.63	Sm I	7	h 5436.99	Co I	20	5449.37	Os I
60	5425.68	Th II	14	5437.03	Re I	40	5449.48	Th II
40	5426.26	Ti I	13	5437.10	Tb I	75	5449.50	Ir I
15	5426.36	Zr I	110	5437.27	Nb I	18	5449.8	Ho II
15	5426.37	Ce I	28	c 5437.36	Pr I	18	5449.86	U II
29	c 5426.43	Tb I	24	5437.38	Th II	18	5449.93	U II
15	5426.60	Ce I	21	5437.54	La I	23	5450.03	Ce I
40	5426.70	Dy II	11	5437.66	V I	40	5450.51	Mo I
23	5426.89	Mo I	65	5437.75	Mo I	150	5450.84	Sr I
90	5426.94	Eu I	25	5437.76	Zr I	95	5451.11	Dy I
18	5427.24	Pr I	28	5437.86	Ce I	110	5451.12	Nd II
23	5427.26	Ce I	100	5437.88	Lu I	18	h 5451.30	Er I
13	5427.47	Tb I	13	5438.12	Tb I	120	5451.34	Sc I
11	5427.55	Mo I	45	5438.22	Sc I	380	5451.51	Eu I
55	5427.59	Ru I	190	5438.24	Y I	35	5451.74	Ce I
18	5427.96	Pr II	17	5438.32	Ti I	30	h 5451.90	Ho I
13	5428.26	Ce I	19	5438.44	Ce I	30	5452.22	Th I
25	5428.42	Zr I	40	5438.74	Hf I	7	5452.30	Co I
75	5429.15	Ti I	55	5439.03	Sc I	13	5452.71	Ru I
18	5429.30	Nd I	26	I 5439.21	Ru I	75	5452.92	Hf I
45	5429.41	Sc I	12	5439.58	Rh I	260	5452.94	Eu I
11	5429.42	Ce I	15	5439.71	Mo I	220	5453.00	Sm I
8	5429.52	Ce I	9	5440.05	W I	15	5453.03	Mo I
80	5429.70	Fe I	15	5440.41	Zr I	20	5453.40	Os I
40	5429.86	La I	35	5441.26	Nd II	65	5453.46	Gd I
35	5430.25	Ce I	12	h 5441.36	Rh I	35	5453.57	Lu I
19	5430.53	Ce I	27	5441.58	Gd I	35	5453.65	Ti I
70	5430.79	Nd II	16	5441.82	Os I	35	5453.96	Ce I
16	5431.02	Mo I	90	5442.27	Nd II	14	5454.0	Ho II
12	5431.11	Th I	12	5442.41	Cr I	35	5454.27	Er II
21	5431.26	Nb I	55	h 5442.60	Sc I	30	5454.50	Ir I
28	5431.41	Ce I	35	5443.11	Th II	17	h 5454.56	Co I
160	5431.53	Nd II	55	5443.31	Os I	80	h 5454.82	Ru I
23	5431.66	Ta I	30	5443.34	Dy II	500	5455.15	La I
25	5431.90	Re I	35	5443.38	Tb I	30	5455.21	Sc I
28	5432.05	Pr II	40	5443.56	Eu I	30	5455.31	Gd I
35	5432.36	Nd II	14	5444.07	Hf II	30	5455.47	Dy II
13	5432.45	Tb II	9	h 5444.32	Rh I	40	5455.61	Fe I
35	5432.55	Mn I	35	5444.48	U II	70	5455.82	Nd II
18	5432.58	Pr II	21	h 5444.57	Co I	90	5456.13	Ru I
14	5432.71	Yb II	10	h 5445.04	Fe I	19	5456.19	Nb I
18	5432.90	Pr I	35	h 5445.23	Rh I	45	5456.39	Ce I
35	5432.94	Sc I	30	5445.39	Ho I	35	5456.46	Mo I
55	5433.23	Sc I	16	h 5445.41	Pr I	30	5456.56	Nd II
23	5433.34	Ce I	23	5445.43	Ce I	22	5456.58	W I
18	5433.55	Sm I	23	5446.18	Ce I	180	5456.62	Er I
10	5433.70	Th II	270	5446.20	Sc I	29	5457.00	Tb I

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
18	5457.06	Pr I	16	5471.91	Dy II	24	5481.45	Tb I
35	5457.20	Ce I	60	5472.19	Sc I	16	5481.77	Pr I
22	5457.30	Os I	140	5472.29	Ce II	16	5481.85	Os I
12	5457.47	Mn I	90	5472.32	Eu I	75	5481.87	Ti I
40	5457.62	Eu I	35	5472.70	Ti I	60	5481.92	Yb I
15	5457.86	Ce I	28	5472.87	Ce I	55	5481.97	Ce I
7	5457.92	W I	35	5473.08	Nd II	750	5481.99	Sc I
40	5458.04	Nb I	13	5473.37	Mo I	22	5482.01	Gd I
17	5458.12	V I	28	5473.39	Ce I	65	5482.27	La II
25	5458.41	Ta I	90	5473.39	Y II	45	5482.54	U II
18	5458.60	Nd	28	5473.53	Ce I	13	5483.09	Nb I
35	5458.69	La II	40	h 5473.55	Ti I	18	5483.12	Nd II
28	5458.83	Ce I	14	h 5473.69	Ba I	45	5483.34	Co I
55	5459.20	Ce II	85	5474.23	Ti I	11	5483.39	Ce I
18	5459.27	U I	30	5474.46	Ti I	20	5483.43	Ta I
55	5459.81	Tb I	13	5474.58	Os I	19	5483.49	Nb I
45	5460.06	Ce I	18	5474.64	Sc I	17	5483.50	Ce I
9	5460.09	Ce I	45	5474.73	Nd II	9	5483.96	Co I
28	5460.26	Pr I	19	5474.86	Th II	24	5484.14	Th II
55	5460.51	Ti I	10	5474.92	Zr I	16	5484.23	Rh I
26	5460.53	Mo I	11	5475.11	W I	80	5484.32	Ru I
25	5460.64	Re I	13	5475.13	Os I	11	5484.55	U II
3200	5460.74	Hg I	40	5475.17	La I	530	5484.62	Sc I
90	5461.29	Ta I	13	h 5475.18	Ru I	18	5484.64	Ru I
18	5461.55	Sm I	30	5475.57	Ta I	45	h 5485.10	Nd II
24	5461.74	Th II	35	c 5475.67	Pr II	65	5485.42	Sm I
14	5461.95	Tm II	22	5475.72	Gd I	16	5485.54	Pr I
35	5462.43	Er II	80	5475.72	U II	170	5485.70	Nd II
30	5462.61	Th II	14	5475.77	Pt I	80	5485.97	Er II
30	5463.38	Hf II	35	5475.90	Mo I	15	5486.01	W I
19	5463.97	Cr I	12	5476.12	Rh I	30	5486.09	Zr I
14	5464.14	Tm I	2100	5476.69	Lu II	110	5486.12	Sr I
55	5464.21	Ce II	180	5476.91	Ni I	16	5486.61	Pr I
45	5464.38	La II	11	5476.96	Tb I	35	5487.00	U II
19	5464.39	Tb I	9	5477.08	Co I	23	5487.03	Nd II
18	5465.20	Sc I	9	5477.27	Os I	25	5487.22	V I
95	5465.34	Ce I	10	5477.40	Zr I	45	c 5487.58	Pr I
1000	5465.49	Ag I	15	5477.41	Ce I	10	5487.77	W I
14	5465.54	Tm II	18	5477.47	Er II	85	5487.92	V I
23	5465.57	Mo I	120	h 5477.71	Ti I	85	h 5488.20	Ti I
35	5465.68	U II	40	5477.78	W I	11	5488.26	Tb II
710	5466.46	Y I	25	5478.29	Sm II	24	5488.62	Th II
140	5466.72	Sm I	35	5478.33	Zr I	120	5488.65	Eu I
13	5466.92	La I	14	5478.50	Pt I	13	5488.67	Mo I
19	h 5468.10	Nb I	14	5478.50	Yb II	28	5488.91	U I
23	h 5468.11	Rh I	27	5478.61	Nd I	16	5488.94	Pr I
90	5468.32	Er I	28	5478.62	Ce I	8	h 5489.65	Co I
140	5468.37	Ce II	55	5479.40	Ru I	25	5489.94	V I
55	5468.40	Sc I	40	5479.75	Pr I	40	5490.11	Ta I
100	5468.47	Y I	22	5480.23	Gd I	150	5490.15	Ti I
24	5469.10	Dy II	70	5480.27	U II	35	5490.28	Mo I
7	5469.30	Co I	26	5480.30	Ru I	16	5490.57	Pr I
7	5469.40	Ir I	19	5480.50	Cr I	26	5490.84	Ti I
11	5469.71	Pr I	26	5480.73	La II	13	5491.06	Nb I
45	5469.72	Gd I	90	5480.74	Y II	26	5491.07	La I
22	5469.93	Pr I	35	5480.83	Zr I	28	5491.15	Ce I
28	5470.00	Os I	700	5480.84	Sr I	35	5491.22	U II
29	w 5470.34	Tb II	40	5481.00	Nb I	20	5492.17	Mo I
9	5470.46	Co I	19	5481.15	Ce I	35	5492.30	Nd I
60	5470.64	Mn I	15	5481.16	Ta I	65	5492.31	W I
35	h 5470.85	Rh I	10	5481.16	Zr I	28	5492.37	Pr II
75	5471.21	Ti I	70	5481.21	U II	160	5492.97	U II
13	5471.33	V I	40	5481.40	Mn I	60	5493.17	Y I
100	5471.55	Ag I	12	5481.42	Rh I	14	5493.34	Nd I
13	5471.56	Ta I	110	5481.43	Ti I	22	5493.42	Gd I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
40	5493.45	La II	40	5505.49	Yb I	50	5516.77	Mn I
230	5493.72	Sm I	20	5505.66	Ta I	30	5517.11	Zr I
26	5493.80	Mo I	30	5505.87	Mn I	65	5517.34	La I
65	5494.01	Nd II	50	5506.00	La I	19	5517.39	Ce I
28	5494.66	U II	9	5506.10	Ce I	17	5517.39	Nb I
20	5494.78	Ta I	13	5506.46	Ce I	9	5517.84	Ce I
45	5495.20	Eu I	7800	5506.49	Mo I	8	5517.86	Ru I
35	5495.59	Y I	28	5506.52	Dy I	10	5518.05	Zr I
4	5495.67	Co I	20	5506.78	Fe I	55	5518.47	Ce II
7	5495.81	Th II	18	5507.66	Nd II	90	5518.91	Ta I
10	5496.14	Th I	70	5507.75	V I	19	5518.99	Th I
10	5496.23	W I	25	5507.87	Zr I	320	5519.05	Ba I
18	5496.42	Nd I	35	5508.40	Nd II	13	5519.38	Pr II
35	5496.43	U I	10	5508.61	W I	23	5520.04	Mo I
26	5496.69	Ru I	40	5508.79	Pr II	14	5520.05	Re I
28	5496.83	Dy I	17	5509.12	Nb I	20	5520.31	Pr II
13	5496.94	Mo I	65	5509.15	Pr II	660	5520.50	Sc I
16	5497.25	Pr I	22	5509.33	Os I	27	5520.60	Nd II
15	5497.30	Hf I	55	5509.61	Tb I	26	5520.64	Mo I
240	5497.41	Y II	250	5509.90	Y II	9	5521.00	W I
27	5497.44	Er II	35	5509.99	Th I	25	5521.10	Re I
16	5497.52	Fe I	6	5510.00	Ni I	9	5521.15	Ta I
45	5498.16	Ce I	15	5510.12	Hf I	13	5521.17	Mo I
80	5498.21	Sm I	35	5510.41	U I	120	5521.63	Y I
26	5498.49	Mo I	15	5510.45	Hf I		5521.70	Y II
30	5498.57	Ho I	120	5510.52	Eu I	27	5521.75	Gd I
27	5498.75	Gd I	28	5510.68	Ce I	12	5521.75	Th I
13	5498.86	Nd I	12	5510.68	Th II	12	5521.78	Ru I
30	5499.26	Th I	130	5510.71	Ru I	260	5521.83	Sr I
50	5499.44	Ta I	29	5511.09	Sm I	13	5522.17	Nd I
17	5499.53	Nb I	14	5511.18	V I	35	5522.46	Ce I
40	5499.97	Gd I	11	5511.49	Mo I	45	5522.79	Pr II
11	5500.10	Tb I	45	5511.49	U I	12	5523.29	Co I
16	5500.30	Tm II	16	5511.63	Pr II	270	5523.53	Os I
40	5500.43	Gd II	40	5511.78	Ti I	50	5523.57	Nb I
27	5500.49	W I	260	5512.08	Ce II	18	5523.82	Nd I
18	5500.68	Ta I	80	5512.10	Sm I	10	5523.98	Ta I
16	5500.69	U I	20	5512.37	Ru I	65	5524.12	Tb I
15	5500.83	Eu I	340	5512.53	Ti I	28	5524.15	Pr I
13	5501.02	Ru I	35	5512.82	Nb I	24	5524.22	Th II
470	5501.34	La I	25	5512.98	Ca I	19	5524.35	Hf II
10	5501.47	Fe I	13	5513.12	Ce II	17	5524.54	Yb I
35	5501.47	Nd I	16	5513.39	U I	12	5524.58	Th I
16	5501.49	U II	55	5513.58	Pr II	19	5524.60	Gd II
16	5501.50	Pr I	60	5513.64	Y I	7	5524.98	Co I
50	5501.54	Mo I	19	5514.21	Ce I	10	5525.61	Sm I
23	5501.87	Mo I	570	5514.22	Sc I	24	5525.62	Tb I
12	5501.94	Th II	270	5514.35	Ti I	45	5525.72	Nd I
140	5502.12	Zr I	50	5514.54	Tb I	28	5525.91	Pr II
26	5502.25	La I	320	5514.54	Ti I	45	5526.06	Sc I
18	5502.67	La I	220	5514.68	W I	13	5526.08	Ce I
24	5502.79	Dy I	19	5514.87	Th I	40	5526.52	Mo I
27	5503.44	W I	28	5515.12	Pr II	30	5526.63	Eu I
300	5503.45	Y I	40	5515.28	La I	24	5526.76	Y I
26	5503.54	Mo I	16	5515.39	Sc I	660	5526.82	Sc II
90	5503.81	La I	24	5515.41	Dy II	14	5526.82	Tm II
110	5503.90	Ti I	27	5515.56	Ho II	35	5526.85	Ce II
40	5504.13	U II	22	5515.61	Gd I	40	5526.97	Mo I
350	5504.17	Sr I	9	5516.01	Os I	23	5527.18	Ce I
19	5504.30	Th I	27	5516.02	Er I	740	5527.54	Y I
30	5504.51	Ho I	28	5516.08	Ce II	70	5527.83	U II
40	5504.58	Nb I	230	5516.09	Sm I	16	5527.93	Pr I
9	5504.65	Rh I	15	5516.27	Ta I	12	5528.00	Th II
28	5504.87	V I	18	5516.29	Nd I	30	5528.01	Dy I
27	5505.11	Gd I	18	5516.45	Ho II	35	5528.33	Nd II

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
24	5528.34	Tm I	50	5543.12	Mo I	12	5556.52	Ru I
13	5528.36	Ta I	55	5543.24	Nd I	26	5556.72	Mo I
75	5528.41	Zr I	25	h 5543.36	Sr I	55	5556.95	Ce II
60	h 5528.46	Mg I	40	5544.49	Mo I	24	5557.04	Th I
18	5529.07	Nd I	21	I 5544.58	Rh I	12	5557.31	Th II
18	5529.87	La I	120	5544.61	Y I	35	5557.62	Nd II
13	5530.21	Pr I	19	5544.62	Ce I	23	5557.87	U I
26	5530.49	Ti	28	5544.81	U II	50	5558.34	Th I
17	5530.77	Co I	24	5544.91	La I	13	5558.65	Ce I
12	5530.99	Ru I	22	5545.01	Gd II	35	5558.75	V I
45	5531.16	Pr I	55	5545.01	Pr II	3	5558.82	Co I
16	5531.26	U I	10	I 5545.20	Ta I	55	5559.20	Ce I
15	5531.38	W I	50	5545.32	Zr I	22	5559.73	Gd I
13	5532.06	La I	45	5545.91	Nd II	90	5559.75	Ru I
20	5532.30	Zr I	23	5545.93	V I	7	5559.89	Th I
50	c 5532.68	Re I	90	5546.02	Y II	6	5560.01	Ce I
5200	5533.05	Mo I	10	5546.12	Th I	7	5560.10	Ce I
30	5533.25	Eu I	30	5546.40	Sc I	11	5560.62	Os I
22	5533.37	Gd I	19	5546.51	Ce I	30	5560.69	Gd II
90	5533.82	Nd I	22	5546.82	Os I	35	c 5560.94	Ho I
30	5534.33	Ho I	35	5547.02	Pd I	16	5561.10	Sc I
200	5534.81	Sr I	70	5547.07	V I	55	5561.17	Nd I
29	5535.04	Rh I	65	5547.27	Dy I	14	5561.37	Sm I
150	5535.17	Pr II	200	5547.44	Eu I	15	h 5561.45	Ce II
95	5535.23	Ce I	13	h 5547.50	Ce I	22	5561.46	Pr II
55	5535.27	Nd II	16	5548.05	U II	28	5561.66	V I
6500	5535.48	Ba I	35	5548.18	Th I	45	c 5562.06	Pr I
90	5535.67	La II	27	d 5548.20	Gd I	35	5562.09	Yb I
16	5535.78	U II	20	5548.32	Ta I	6	5562.13	Ce I
11	5536.26	Tb II	20	5548.33	Pr II	7	5562.20	Ce I
29	5537.07	Sm II	55	5548.47	Nd II	16	5562.48	Dy I
12	5537.13	Th II	27	5548.68	Nd II	11	5562.49	Mo I
45	5537.46	Zr I	65	5548.80	Ce I	29	5563.00	Nb I
35	5537.54	Ce I	50	5548.95	Sm I	45	5563.02	Ce I
15	5537.72	W I	9	5549.79	Os I	50	c 5563.24	Re I
40	5537.76	Mn I	35	5550.04	Ce II	35	b 5563.6	Ho HoO
23	5537.77	Nd II	27	5550.09	Nd II	20	5564.05	Mo I
45	5538.02	Hf I	19	5550.21	Gd I	70	5564.17	U I
28	5538.26	Hf I	18	5550.40	Sc I	60	5564.20	Th II
27	5538.32	Gd II	140	5550.40	Sm I	35	5564.24	Ce I
28	5538.37	Pr I	230	5550.60	Hf I	70	5564.86	Sc I
23	5538.53	U II	19	5550.66	Ce I	170	5564.97	Ce I
20	5538.78	Pr II	85	5551.35	Nb I	28	5565.28	Ce I
14	5539.03	Tm II	24	5551.37	Th II	50	5565.44	La I
85	h 5539.05	Yb I	13	5551.41	Ce I	110	5565.49	Ti I
27	5539.21	Nd II	28	5551.42	U II	13	5565.52	Pr I
50	5539.26	Th I	22	bl 5551.75	Zr Zr O	40	5565.72	La I
40	5539.41	Mo I	21	5551.98	Mn I	35	5565.93	Tb I
9	5539.48	W I	230	5552.12	Hf I	130	5565.97	Ce I
27	5539.81	Gd II	10	5552.19	Mo I	27	5566.00	Tm I
70	5539.91	Th II	5	5552.25	Sc II	19	5566.48	Ce I
200	5540.05	Sr I	9	5552.27	Ce I	70	5566.52	Ho I
28	5540.54	Ce I	10	c 5552.35	Bi I	13	5566.91	Pr II
24	5540.66	Ru I	18	5552.60	U II	24	5566.94	La II
55	5541.04	Sc I	13	5552.88	Os I	60	5567.75	Y I
65	5541.26	La I	27	5553.14	Ho I	8	5567.76	Mn I
25	5541.47	Nb I	25	bl 5553.17	Zr Zr O	45	5567.82	Ce I
35	5541.63	Y I	11	5553.42	Pr II	35	5568.00	Th II
13	5541.65	Mo I	35	5553.59	Sc I	13	5568.09	W I
13	5542.20	Dy I	16	h 5555.77	U II	20	5568.11	Yb I
30	5542.54	Eu I	110	5556.25	Ce I	80	5568.46	La I
15	5542.71	Ce I	55	5556.28	Mo I	40	5568.62	Mo I
55	5542.80	Pd I	11	5556.30	Tb II	11	5569.03	Ru I
13	5542.87	Ce I	75	5556.43	Y I	13	h 5569.29	Ce I
19	5542.89	Th I	2400	5556.47	Yb I	26	5569.48	Mo I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum			
20	5569.62	Fe I	21	h	5582.98	Ti	360	5594.47	Ca I		
35	5569.96	Nd II	55		5583.68	Gd II	13	5594.89	Nb I		
150	5570.33	Eu I	21		5583.76	Th II	22	5594.92	Pr I		
16	5570.38	La I	11		5584.02	Pr II	65	5594.96	Ce I		
2500	5570.45	Mo I	30		5584.02	Ta I	24	5595.06	Th I		
40	5570.66	U II	80		5584.44	Os I	18	5595.81	Nd II		
35	5571.19	Th I	140		5584.50	V I	100	5595.88	Ce I		
18	5571.24	Sc I	15		5584.61	Ce I	10	5596.32	Mo I		
17	c	5571.44	Nb I	19		5584.66	Ce I	19	5597.21	Gd II	
45		5571.83	Pr II	35	bl	5584.7	Ho Ho O	22	5597.29	Pr II	
19	5572.19	Ce I	25		5584.72	Re I	28	5597.37	U II		
17	5572.47	Th I	30	h	5585.68	Ti	65	bl	5597.85	Ti Ti O	
27	5572.53	Gd I	23		5586.00	V I	35		5597.96	Ce I	
11	5572.82	Tb I	13		5586.16	Gd II	8		5598.47	Mo I	
30	5572.85	Fe I	90		5586.24	Eu I	240		5598.49	Ca I	
7	5573.01	Mn I	22		5586.32	Gd I	15		5598.75	Ta I	
14	5573.07	U I	20		5586.36	Yb I	23		5598.86	Ce I	
40	5573.36	Th I	7		5586.62	Ce I	160		5599.42	Rh I	
45	5573.42	Sm I	14		5586.65	Tm II	30		5599.52	Ta I	
25	5573.47	Re I	11		5586.74	Ce I	17	c	5599.59	Nb I	
11	5573.59	U I	40		5586.76	Fe I	18		5599.80	Eu I	
8	5573.68	Mn I	75		5586.83	Eu I	80	bl	5600.02	La La O	
18	5573.96	Ho II	19		5586.96	Tb I	8		5600.50	Os I	
11	5574.61	Pr II	50		5586.97	Nb I	40	d	5600.65	Dy II	
29	5574.89	Sm I	60		5587.03	Th I	14		5600.77	Hf I	
6	5575.00	Ce I	11		5587.17	U II	50		5600.86	Sm II	
7	5575.11	Ce I	27		5587.61	Nd I	15		5601.05	Mo I	
35	5575.19	Mo I	24		5587.73	Th II	45	d	5601.14	Er I	
27	5575.50	Nd I	9		5587.86	Ni I			5601.32	Er I	
55	5575.86	Hf I	18		5587.96	Nd II	120		5601.28	Ca I	
24	d	5576.00	Th I	13		5588.10	Ce I	240		5601.28	Ce I
		5576.20	Th I	35		5588.20	Sm I	13		5601.30	Pr II
7		5576.11	Fe I	28		5588.33	Ce I	28		5601.38	V I
40		5576.13	Gd I	80		5588.34	La I	55		5601.43	Nd I
35	c	5576.16	Nb I	40		5588.45	Yb II	7		5601.60	Th I
7	5576.32	W I	700		5588.76	Ca I	45		5601.92	Nd I	
27	5576.70	Nd I	24		5588.87	Th II	110	bl	5602.50	La La O	
200	5577.14	Eu I	30		5588.91	Nd II	35		5602.68	Nd II	
19	5577.28	Ce I	9		5589.24	Ce I	40		5602.76	Mo I	
180	5577.42	Y I	19		5589.56	Tb I	120		5602.85	Ca I	
27	5577.70	Nd I	14		5589.94	Tm II	23		5602.90	U II	
35	5578.28	Ce I	9		5590.10	Ce I	8		5602.96	Fe I	
35	5578.29	Nb I	100		5590.12	Ca I	21		5603.14	Ru I	
21	5578.40	Ru I	13		5590.53	Ce I	40		5603.52	Nb I	
23	5578.66	Nd II	15		5590.73	Co I	8		5603.55	Ru I	
6	5578.73	Ni I	17	c	5590.95	Nb I	27		5603.65	Nd II	
11	5578.81	Pr I	21		5590.96	Y I	13		5603.93	Nb I	
28	5578.90	Ce I	55	b	5591.1	Ho Ho O	14		5603.97	U II	
13	5579.16	Ti	110		5591.33	Sc I	22		5604.19	Sc I	
35	5579.36	Th I	20		5591.58	Mo I	13		5604.31	W I	
75	5579.63	Eu I	11		5591.62	Tb II	50		5604.51	Th II	
14	5579.76	Sc I	55	d	5591.85	Gd I	70		5604.94	V I	
120	5580.03	Eu I	18		5592.25	Eu I	7		5605.30	Th I	
16	5580.66	Os I	13		5592.28	Ni I	9	c	5605.50	Ta I	
21	5580.81	U II	55	bl	5592.3	Ho Ho O	24		5605.53	Dy I	
24	5581.08	Y I	100		5592.42	V I	90		5605.65	Pr II	
28	5581.23	U II	18		5592.67	Nd II	18		5605.86	Eu I	
22	5581.37	Tm I	35	h	5593.38	Sc I	120		5606.33	Y I	
30	5581.60	Nd II	80		5593.46	Er I	19		5606.42	Ce I	
45	5581.61	U II	24		5593.61	Th II	19		5606.53	Ce I	
620	5581.87	Y I	15		5593.68	Ce I	14		5606.64	Tm I	
120	5581.97	Ca I	13		5593.75	Ce I	13		5606.68	Pr I	
13	5582.35	Pr II	21		5594.12	Y I	13		5606.73	Ru I	
19	5582.69	Ce I	40		5594.13	Gd I	30	b	5607.1	Ho Ho O	
45	5582.73	Ce I	240		5594.43	Nd II	10	h	5607.21	Re I	

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
7	5607.71	Rh I	13	5623.00	Ce II	11	5634.44	Ce I
16	5608.35	Rh I	110	5623.05	Pr II	7	5634.52	Ce I
23	5608.62	Mo I	35	5623.53	Zr I	50	5634.86	Mo I
14	5608.86	U I	11	5623.62	Nd I	35	5635.42	Nb I
28	5608.93	Pr II	11	5623.74	Ce I	5	5635.50	W I
23	5609.23	Mo I	15	5623.91	Y I	13	5635.51	V I
11	5609.45	Ce I	13	5624.20	V I	20	5635.71	Ta I
45	h 5609.94	Er I	90	5624.45	Pr II	65	5635.76	Nd I
55	5610.22	Pr II	10	5624.55	Fe I	17	5635.84	Ti I
75	5610.24	Ce II	5	5624.58	W I	6	h 5636.12	Co I
12	5610.24	Th I	200	5624.60	V I	30	5636.20	Er I
19	5610.68	Th I	70	5624.89	V I	290	5636.24	Ru I
55	5610.89	U I	11	5625.25	Ce I	22	5636.46	Pr II
45	5610.93	Ce I	5	h 5625.33	Ni I	19	5636.56	Tb I
100	5610.93	Mo I	45	5625.55	Ir I	9	5636.78	U I
60	5611.82	Er I	35	5625.72	Nd II	14	5637.30	Sm II
12	5612.07	Th I	70	5626.01	Sm I	45	5637.35	Ce II
12	5612.11	Zr I	55	5626.01	V I	9	5637.41	Os I
12	h 5612.27	Re I	35	bl 5626.03	La LaO	14	h 5638.00	U II
23	5613.07	Mo I	45	b 5626.4	Ho HoO	35	5638.20	Ce I
30	5613.23	Dy I	80	5626.53	Er II	11	5638.42	Ce I
95	5613.27	Hf I	7	5626.73	Th II	11	5638.63	Ce I
27	5613.64	Ho I	20	5627.49	Dy I	55	c 5638.79	Pr II
35	5613.69	Ce II	65	5627.60	Ho I	29	c 5638.80	Tb I
25	5614.01	Hf I	400	5627.64	V I	40	5639.31	La I
35	5614.30	Nd II	14	5628.02	U II	100	5639.50	Dy I
22	5614.45	Gd I	13	5628.20	Ta I	45	5639.54	Nd I
75	5614.72	Ce I	11	5628.21	Ce I	70	5639.75	Th II
9	5614.79	Ni I	30	5628.24	Ho II	19	5640.10	Ce I
35	5615.32	Th I	25	5628.26	Nb I	40	5640.18	Ta I
18	5615.35	Nd I	8	5628.27	Hf I	14	5640.30	U I
50	5615.65	Fe I	45	bl 5628.60	La LaO	90	5640.36	Er I
24	5615.73	Th II	24	5628.64	Cr I	16	5640.37	Pr II
17	5615.98	Ce I	25	bl 5629.02	Zr ZrO	55	5640.62	Ho I
9	5616.15	W I	65	5629.17	Nb I	11	5640.79	Ce I
27	5616.21	Gd II	55	bl 5629.28	Ti TiO	80	5640.98	Sc II
9	5616.53	Ce I	14	5629.46	U I	22	5641.42	Er I
14	5616.58	U I	65	5629.55	Gd I	16	5641.50	Dy II
9	5617.05	W I	25	bl 5629.58	Zr ZrO	11	5641.66	Ru I
35	5617.71	Nd II	9	5629.67	W I	8	5642.03	W I
9	c 5617.71	Ta I	11	5629.79	Ru I	170	5642.11	Nb I
190	5617.91	Gd I	560	5630.13	Y I	7	5642.36	Cr I
20	5618.45	Mo I	7	5630.30	Th I	22	5642.56	Os I
10	5618.77	Mo I	22	5631.02	Sc I	40	5642.60	Tm I
40	5618.81	Eu I	160	5631.22	La I	15	5642.69	Pd I
27	5619.00	Nd II	11	5631.27	W I	16	cw 5643.16	Pr I
23	5619.38	Mo I	270	5631.41	Tm I	260	5643.24	Gd I
27	5619.44	Pd I	40	5631.71	Sn I	85	5644.10	Sm I
10	5620.04	Ir I	27	5631.94	W I	250	5644.14	Ti I
11	5620.06	Pr II	65	5632.03	La I	9	5644.21	U II
35	5620.08	Os I	110	5632.25	Gd I	4	5644.47	W I
120	5620.14	Zr I	24	5632.25	Y I	120	5644.69	Y I
20	5620.26	Pr I	13	5632.46	V I	27	5644.84	Gd II
17	5620.38	Ce I	330	5632.47	Mo I	28	5645.25	Os I
220	5620.54	Nd I	14	5632.47	U I	35	5645.30	Nb I
40	5620.68	Ta I	28	5632.49	Ce I	27	5645.40	Tm I
55	5620.78	U I	75	5632.54	Eu I	22	5645.41	Pr II
17	5621.43	Gd II	5	5632.77	Rh I	19	c 5645.75	Tb I
28	5621.51	U I	21	5632.89	Y I	210	5645.80	Eu I
11	5621.55	Tb II	11	h 5633.03	Pr I	50	5645.89	Th II
50	5621.79	Sm I	17	5633.04	Ce I	150	5645.91	Ta I
45	c 5621.89	Pr II	28	5633.10	Ce I	55	h 5645.99	Dy I
70	5622.01	Er I	30	5633.49	Gd I	85	5646.11	V I
60	5622.44	Eu I	10	5633.90	V I	45	5646.36	Sc I
9	5622.68	Ce I	28	5634.38	U I	35	5646.58	Ce I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
17	5647.22	Co I	740	5662.94	Y II	23	5675.12	Ce I
16	5647.60	Sc I	11	5663.20	Ce I	90	5675.27	Y I
18	5647.98	Nd I	13	5663.46	Ce I	7	5675.37	W I
12	h 5648.10	Rb I	22	5663.91	Sm I	130	5675.44	Ti I
240	5648.25	La I	55	5663.98	Ce I	55	5675.48	Er I
65	5648.37	W I	30	hs 5664.02	Cs I	520	5675.84	Tm I
9	5648.38	U I	5	5664.02	Ni I	140	d 5675.97	Nd I
120	5648.47	Y I	24	5664.04	Cr I	55	5676.33	Nd I
75	5648.58	Ti I	8	5664.33	W I	13	5676.60	W I
7	5648.98	Os I	11	5664.34	Mo I	55	5676.87	Ce I
12	h 5649.37	Cr I		5664.38	Mo I	15	5676.90	W I
7	5649.56	Ru I	40	bl 5664.42	Gd GdO	16	5677.03	Pr II
55	5649.56	Sc I	160	5664.51	Zr I	11	5677.22	Ce I
4	5649.70	Ni I	19	5664.69	Ce I	30	5677.45	Gd I
230	5650.13	Mo I	130	5664.71	Nb I	25	5677.47	Nb I
45	5650.59	Ce I	14	h 5664.86	U II	14	5677.68	Dy I
19	5650.83	Hf I	9	5664.89	Lu II	120	5677.75	Ce I
15	5651.11	Eu I	130	5664.90	Ta I	40	5677.89	Mo I
11	5651.87	Mo I	70	5664.95	Er I	7	5678.92	Th II
60	5651.98	Yb II	17	5665.18	Th I	11	5679.03	Ce II
80	5652.01	Dy I	11	5665.20	Ru I	16	5679.63	Ru I
12	5652.90	Th II	11	5665.26	Nd I	30	h 5679.94	Ti I
11	5652.98	Ce I	9	5665.41	Ce I	20	5680.18	Ba I
7	5653.30	Ru I	45	5665.44	Er II	17	5680.26	Ce II
13	h 5653.33	Gd I	30	5665.62	Th II	14	5680.37	U I
35	5653.57	Nd I	170	5665.63	Nb I	28	5680.88	Os I
23	5653.77	U II	20	5666.28	Zr I	55	bl 5680.89	Gd GdO
12	5654.02	Th II	11	5666.43	Dy I	120	5680.90	Zr I
17	5654.14	Nb I	17	5666.86	Nb I	27	5681.10	Eu I
35	5654.23	Pr II	55	5667.16	Sc II	11	5681.16	Nd I
23	5654.39	U II	13	5667.30	Mo I	7	h 5681.20	Cr I
35	b 5654.82	La LaO	100	5667.88	Re I	55	5681.89	Pr II
190	5655.14	Ce I	110	5668.36	V I	12	5682.20	Ni I
14	5655.42	Pd I	65	c 5668.46	Pr I	7	h 5682.48	Cr I
70	bs 5655.9	Ho HoO	70	5668.87	Nd II	70	l 5682.63	Na I
11	5656.18	Ce I	95	5668.92	Ce II	11	5682.76	Ce I
22	5656.34	Sm I	70	5669.04	Sc II	35	5682.89	Mo I
16	5656.54	La I	28	5669.42	U I	13	5683.11	Ce II
110	5657.44	V I	45	5669.55	Pr II	20	5683.22	V I
130	5657.72	La I	65	5669.77	Nd I	40	5683.33	Gd I
250	5657.88	Sc II	240	5669.96	Ce I	18	5683.33	U II
12	5657.93	Th I	35	5669.99	Pr II	14	5683.59	Tm I
18	5658.26	U I	75	5670.07	Pd I	28	5683.76	Ce II
70	5658.30	Tm I	310	5670.85	V I	27	5684.11	Gd GdO
60	5658.34	Sc II	65	cw 5671.02	Nb I	95	5684.20	Sc II
22	h 5658.63	Er II	14	5671.25	Dy I	27	5684.24	Eu I
12	5658.83	Fe I	11	5671.42	Ce I	40	5684.76	Tm II
65	b 5658.9	Ho HoO	50	5671.55	La II	14	5685.19	U I
3	5659.11	Co I	1500	5671.81	Sc I	15	5685.42	Zr I
140	5659.58	Ho I	70	c 5671.84	Ho	24	5685.58	Dy I
9	5659.62	Rh I	19	5671.84	Tb I	13	5685.60	Pr II
35	5659.78	Nd II	35	5671.89	Ce I	29	c 5685.74	Tb II
11	5659.79	Ce I	85	5671.91	Nb I	45	5685.84	Ce II
55	5659.84	Pr II	10	5672.07	Mo I	40	5686.38	Rh I
140	5659.86	Sm I	21	5673.42	Ti I	40	c 5686.48	Tb I
8	5660.07	W I	8	5673.53	W I	16	5686.52	Pr I
9	5660.21	Os I	23	5673.63	Mo I	7	5686.53	Yb II
35	5660.72	W I	60	5673.85	Eu I	22	5686.66	Gd I
9	5661.54	Sm II	16	5674.14	Pr II	29	5686.75	Sm II
26	bl 5661.55	Ti Ti O	7	5674.38	Os I	1200	5686.84	Sc I
35	h 5661.57	Pr I	27	5674.39	W I	14	5686.98	Sm I
190	5662.16	Ti I	55	5674.47	Mo I	22	h 5687.17	Pr II
16	5662.19	Pr II	65	5674.70	Ho I	10	5687.64	Mo I
18	5662.46	Nd I	9	5674.88	U II	11	5687.82	Ce I
75	5662.91	Ti I	14	5674.99	Th I	140	l 5688.20	Na I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum			
30	5688.25	Ta I	9	h	5702.47	Rh I	22	5715.79	Tm I		
65	5688.44	Pr II	75		5702.68	Ti I	16	5716.08	Pr II		
23	5688.49	Ce I	24		5702.91	Dy I	11	h	5716.21	V I	
220	5688.53	Nd II	35		5703.22	Ce II	65		5716.35	Nb I	
460	5689.14	Mo I	45		5703.33	La II	35		5716.46	Ce I	
22	5689.21	Pr II	920		5703.56	V I	55		5716.48	Ti I	
95	5689.47	Ti I	23		5704.07	U II	8		5716.53	Ta I	
23	5689.51	Nd I	15		5704.31	Ta I	21		5716.87	U I	
11	5690.14	Pd I	22		5704.38	Pr I	18		5716.95	Re I	
55	h	5690.97	Pr II	11		5705.66	U I	230		5717.28	Sc I
40	5691.40	U II	80		5705.72	Mo I	55		5717.48	Er I	
11	5691.47	Ce II	11		5705.95	Dy Dy O	29		5717.92	Sm I	
140	c	5691.47	Ho I	40		5706.16	Nb I	80		5718.12	Nd II
9	5692.05	Sm I	85		5706.20	Sm I	75	bj	5718.21	Zr Zr O	
23	5692.12	Ce I	80		5706.21	Nd II	11		5718.36	Ce I	
40	5692.13	Gd I	25		5706.28	Ta I	70	h	5718.46	Dy I	
120	5692.94	Ce I	85		5706.48	Nb I	11		5718.58	Ce II	
25	5693.09	Nb I	160		5706.73	Y I	240		5719.03	Ce I	
18	5693.63	Y I	22		5706.75	Sm I	45		5719.08	Pr II	
28	h	5693.67	Dy Dy O	570		5706.98	V I	30		5719.09	Nd II
24	h	5694.10	Dy Dy O	21		5706.99	U II	14		5719.12	Sm II
10		5694.39	Mo I	95		5707.10	Th II	160		5719.18	Hf I
28	cw	5694.54	Dy Dy O	65		5707.61	Pr I	9		5719.54	Ce I
24		5694.73	Cr I	35		5708.23	Ti I	70		5719.55	Er I
8		5695.00	Ni I	160		5708.28	Nd II	19		5719.62	Th I
55	h	5695.09	Pd I	190		5708.61	Sc I	45	d	5719.63	Pr II
11		5695.23	Nd I	30		5708.89	Zr I			5719.80	Pr II
14		5695.53	Er II	11		5708.95	V I	7		5719.82	Cr I
23		5695.66	Ce I	17		5709.06	Ce I	220		5719.99	Yb I
75		5695.84	Ce II	29		5709.33	Nb I	45		5720.02	La I
22		5695.90	Pr II	11		5709.37	Os I	25	bl	5720.16	Hf Hf O
13		5696.03	Mo I	65		5709.42	Gd I	50		5720.18	Th I
90		5696.19	La I	11		5709.49	U I	29		5720.19	Sm I
390		5696.22	Gd I	23		5709.56	Ni I	35		5720.48	Ti I
22		5696.24	Sm II	22		5709.73	Sm I	24		5720.61	Y I
70	bs	5696.3	Ho Ho O	35		5709.97	Tm II	22		5721.38	Sm I
14		5696.42	Tm II	9		5710.04	Ce I	170		5721.93	Os I
140	c	5696.57	Ho I	40		5710.32	Gd I	35		5721.96	Ce I
120		5696.73	Sm I	10		5710.85	La I	22		5721.99	Gd II
300		5696.99	Ce I	27		5710.87	Er II	11		5722.23	U I
15		5697.79	W I	35		5710.93	Sm I	210		5722.74	Mo I
35	d	5697.90	Nb I	45		5711.43	Ce II	7		5723.05	W I
		5698.03	Nb I	25		5711.43	Re I	11		5723.11	Mo I
40	bl	5698.03	Hf Hf O	14		5711.45	Sm I	40		5723.63	U II
11		5698.27	Mo I	40		5711.63	Pr II	180		5724.08	Sc I
40		5698.33	Cr I	880		5711.75	Sc I	20	I	5724.45	Rb I
1200		5698.52	V I	23		5711.80	Mo I	12		5724.45	Sm I
28		5698.72	Dy II	65		5711.88	Ti I	45		5724.75	Gd I
45		5698.93	Nd II	10		5711.90	Ni I	13		5724.82	Ru I
180		5699.05	Ru I	17		5712.29	Ce I	30		5725.39	Th I
370		5699.23	Ce I	65		5712.40	La II	70		5725.64	V I
40		5699.24	Ta I	17		5712.45	Tb II	25		5725.66	Nb I
23		5699.28	Mo I	12		5712.64	Cr I	13		5725.73	Ru I
13		5699.39	La I	24		5712.78	Cr I	95		5725.83	Ce I
1100		5700.21	Sc I	25		5713.28	Hf I	28	h	5725.84	Dy Dy O
100		5700.24	Cu I	14		5713.49	Lu II	17		5726.13	Ce I
24		5700.45	Th II	22		5713.83	Pr II	65		5726.83	Nd II
95		5700.70	Th II	40	h	5713.92	Ti I	55		5726.97	Er I
		5700.91	Th II	40		5714.02	La I	850		5727.03	V I
95		5701.35	Gd I	13		5714.55	La I	19		5727.25	Ce II
30		5701.57	Nd I	10		5715.09	Ni I	26		5727.29	La II
11		5702.11	Mo I	95		5715.13	Ti I	6		5727.30	Rh I
130		5702.24	Nd II	30		5715.24	Ta I	170		5727.66	V I
24		5702.31	Cr I	35	h	5715.25	Ce II	11		5728.38	Pr I
55		5702.39	Ce I	17		5715.59	Nb I	55	h	5728.64	Dy Dy O

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
23	5728.77	Mo I	70	5740.86	Nd II	17	5752.74	V I
75	5728.89	Y II	22	5740.89	Sm I	21	5752.84	Ti I
130	5729.19	Nb I	19	5741.17	Th II	110 c	5752.93	Re I
100	5729.29	Nd I	10	5741.19	Sm I	22	5753.02	Pr II
14	5729.30	Sm I	19	5741.22	Ti I	10	5753.03	Th I
9	5729.34	Ce I	27	5741.28	Nd II	27	5753.53	Nd II
7	5729.42	Ce I	15	5741.71	Mo I	7	5753.69	Cr I
26 d	5729.45	Mo I	45	5742.08	Nd II	85 d	5754.17	Gd I
	5729.59	Mo I	24	5742.08	Th II	5	5754.57	W I
15	5729.87	Mo I	27	5742.76	Nd II	16	5754.68	Ni I
150 bl	5730.12	Y YO	18	5742.94	La I	30	5755.81	Ta I
10	5730.13	Sm I	30	5743.20	Nd II	10 h	5755.89	Yb I
60	5730.87	Eu I	50	5743.35	Sm II	11	5756.10	W I
16	5731.05	Nd I	110	5743.45	V I	90	5756.17	Pr II
230	5731.25	V I	95	5743.53	Ce I	11	5756.83	Ru I
40	5731.88	Pr II	90	5743.85	Y I	19	5756.86	Ti I
21	5732.09	Y I	11	5744.14	Nd II	70	5757.63	Er II
50	5732.95	Sm I	160	5744.41	La I	22	5757.97	Sm I
30	5732.98	Th II	45	5744.66	Gd I	27	5758.02	Tm I
23	5733.21	U II	19	5744.68	Ce I	35	5758.11	Ce I
22	5733.43	Er II	45	5744.77	Nd II	23	5758.14	U I
14	5733.81	Tm II	9	5745.50	Sm I	35	5758.29	Ce I
120	5733.86	Gd II	55	5745.53	Dy I	11	5758.35	U I
17	5733.94	Ce I	10	5745.68	Th II	24	5758.79	Dy I
40	5734.01	V I	16	5745.99	Ru I	16	5759.40	Pr II
27	5734.02	Ho I	85	5746.36	Gd I	45	5759.52	Sm II
16	5734.06	Mo I	7	5746.43	Cr I	7	5759.65	W I
23	5734.55	Nd I	11	5746.46	Ce I	18	5760.00	Nd II
40	5734.95	La I	23	5746.71	Ta I	22	5760.20	Pr I
55	5735.09	W I	18 bl	5746.93	Y YO	55	5760.20	Tm I
19	5735.69	Ce I	20	5747.13	Pr II	110	5760.34	Nb I
120	5735.70	Zr I	7	5747.27	W I	70	5760.55	Th I
45	5735.98	Gd I	16	5747.47	Ru I	9	5760.59	Ce I
23	5736.38	U I	85 c	5747.58	Tb I	8	5760.85	Ni I
45	5736.4	Ho HoO	16	5747.67	Mo I	17	5761.41	V I
550	5736.55	Lu I	17	5747.70	V I	15 h	5761.61	Ta I
22	5736.56	Er I	11	5747.74	Pr I	9	5761.62	Tb II
18	5736.61	Pd I	11	5747.95	Pr II	30	5761.70	Nd II
22	5736.84	Sm I	29	5748.09	Sm I	160	5761.84	La I
55 bl	5736.85	Sc ScO	21	5748.10	U II	9	5761.88	U I
22	5736.94	Er I	30	5748.15	Nd II	14	5762.08	Nd I
230	5737.06	V I	35 bl	5748.17	Zr ZrO	40 h	5762.27	Ti I
11 d	5737.20	Tm II	9	5748.26	Ce I	24	5762.66	Tb I
	5737.25	Tm II	11	5748.44	U II	290	5762.80	Er I
23	5737.27	U I	60	5748.65	Er I	11	5763.00	Ce II
21	5737.36	Nb I	12	5748.72	Hf I	7	5763.01	Fe I
8	5737.89	Os I	10	5748.74	Th I	10	5763.53	Th I
29	5738.01	Sm II	40	5748.87	V I	6	5763.57	Pt I
13	5738.20	Nb I	17	5748.94	Ce I		5763.63	U I
7	5738.29	Mn I	27	5749.06	Nd II	11 h	5763.63	U I
7	5738.31	Th II	55	5749.19	Nd I	29	5763.91	Sm I
24 h	5738.73	Dy DyO	13	5749.24	W I	24 bl	5764.22	Y YO
14 h	5738.92	Tm II	30	5749.38	Th II	11	5764.23	Nd II
60	5739.00	Eu I	40	5749.41	Gd II	190	5764.29	Tm I
100	5739.19	Er I	22	5749.58	Ho I	55 bl	5764.45	Sc ScO
55	5739.24	Ho I	27	5749.66	Nd I	23	5764.77	Ce I
85	5739.51	Ti I	10	5749.91	Yb II	65	5764.99	Nb I
5	5739.60	W I	24	5750.48	Dy I	22	5765.05	Os I
11	5739.66	Mo I	21	5750.54	U I	330	5765.20	Eu I
8	5739.72	Os I	620	5751.40	Mo I	23	5765.33	Ce I
45	5739.96	Nd II	85	5751.44	Nb I	11 h	5765.41	U I
40	5740.02	Ti I	40	5751.88	Gd I	75	5765.64	Y I
50	5740.20	Dy I	11	5752.02	Ru I	55 h	5766.35	Ti I
35	5740.61	Er I	11	5752.50	Ce I	25	5766.56	Ta I
180	5740.66	La I	55	5752.53	Er I	30	5766.64	Ho

TABLE 2. All observed line in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
14	5767.18	Hf II	30	5780.78	Ti I	13	5793.06	W I
23	5767.33	Nd I	170	5780.82	Os I	50	5794.24	Nb I
11	5767.43	U I	12	h 5781.20	Cr I	9	5794.79	Ce I
30	c 5767.91	Ta I	100	5781.69	Y II	27	5795.17	Nd II
11	5767.92	Ru I	6	h 5781.81	Cr I	75	5795.64	Tb I
75	5768.90	Ce II	45	5781.93	Sm II	23	h 5795.77	Mo I
160	5769.07	La II	400	5782.13	Cu I	9	5795.79	Rh I
22	5769.16	Pr II	19	5782.36	Tm II	35	5796.09	Ce I
370	5769.34	La I	10	I 5782.38	K I	21	5796.42	Th II
240	hs 5769.59	Hg I	35	5782.42	Ce I	13	5796.49	W I
10	5769.75	Mo I	11	5782.61	V I	11	5796.51	U I
16	5769.79	Pr II	13	5782.78	Ce I	65	h 5796.80	Gd I
35	5769.87	Nd II	45	5782.82	Er I	220	5797.58	La II
70	5769.92	Er I	24	h 5783.11	Cr I	160	5797.74	Zr I
23	5769.93	Ce I	23	h 5783.33	Mo I	70	5798.54	U II
80	5769.99	La I	11	5783.50	V I	4	5799.51	W I
35	5770.40	Ce I	180	5783.69	Eu I	19	5799.79	Ce II
45	5770.50	Nd II	30	h 5783.93	Cr I	11	5799.97	Tm II
10	5771.05	Mo I	13	5783.99	Ce II	15	bl 5800.00	Y YO
11	5771.05	U I	40	h 5784.38	V I	45	5800.09	Nd I
29	5771.08	Nb I	22	5784.46	Tm II	90	I 5800.23	Ba I
22	5771.20	Gd GdO	70	5784.66	Er I	60	5800.27	Eu I
27	5771.66	Yb II	45	5784.86	Ce I	26	5800.46	Mo I
10	5771.93	Ta I	10	5784.87	Th II	60	5800.52	Sm I
13	5771.98	Ce II	45	5784.96	Nd I	80	5800.59	Lu I
35	5772.22	Ce I	24	h 5785.00	Cr I	40	5800.60	Os I
70	5772.42	V I	24	5785.18	Tb II	70	5800.79	Er I
95	bl 5772.74	Sc ScO	65	c 5785.28	Pr II	14	5801.24	Sm I
45	5772.88	Ce I	10	5785.69	Mo I	9	h 5801.66	Sm II
140	5773.12	Ce I	19	h 5785.82	Cr I	14	I 5801.75	K I
45	5773.16	Pr II	75	h 5785.98	Ti I	40	5802.11	U I
23	5773.59	Ce I	55	h 5786.16	V I	35	5802.67	Mo I
70	5773.77	Sm I	65	5786.17	Pr II	65	5802.84	Sm I
35	5773.95	Y I	11	5786.87	Ce I	55	5802.92	Gd I
75	h 5774.05	Ti I	70	d 5786.98	Sm II	75	5803.13	Tb II
23	5774.55	Mo I		5787.15	Sm I	9	5803.34	Rh I
17	5774.56	Gd II	13	5787.20	Ce I	10	5803.44	Yb I
19	5774.99	Ce I	14	5787.53	Sm I	27	b 5803.8	Ho HoO
55	bl 5775.32	Sc ScO	85	5787.54	Nb I	8	5803.98	Mo I
55	5775.40	Lu I	60	h 5787.99	Cr I	160	5804.02	Nd II
13	5775.80	Ce II	120	5788.15	Ce I	50	5804.03	Nb I
11	5775.91	Pr II	45	5788.22	Nd I	35	5804.14	Th I
75	5776.02	Gd I	16	h 5788.29	Pr II	65	hI 5804.26	Ti I
50	c 5776.07	Nb I	60	5788.38	Sm I	16	5804.39	Ru I
45	5776.12	Nd I	23	5788.56	V I	95	5804.43	Ce I
35	5776.64	V I	23	5788.59	U II	45	5804.85	W I
130	5776.77	Ta I		5788.59	U II	11	5805.20	U I
110	cw 5776.83	Re I	16	5788.92	Pr II	70	5805.68	Ba I
11	5776.87	U II	320	5789.24	La I	160	5805.78	La II
16	5777.29	Pr II	17	5789.79	Nb I	13	d 5806.05	W I
500	hl 5777.62	Ba I	280	h 5790.65	Hg I	22	5806.24	W I
11	5777.77	U I	16	5790.86	Pr II		5806.10	Er I
10	5778.19	Mo I	180	h 5791.00	Cr I	10	5806.19	Mo I
60	5778.33	Sm I	22	5791.15	Er II	17	5806.28	Th II
17	bl 5778.57	Zr ZrO	11	5791.34	Ce I	16	5806.69	Mo I
5	5778.82	Tm II	450	5791.34	La I	14	5806.77	Sm I
45	5779.24	Sm I	45	5791.36	Pr II	40	5806.91	Rh I
90	5779.28	Pr I	240	5791.38	Gd I	27	5807.05	Gd II
40	5779.36	Mo I	18	5791.60	Re I	35	h 5807.14	V I
25	5780.02	Ta I	17	5791.66	Ce I	55	hs 5807.72	Gd I
10	5780.11	Mo I	23	5791.74	U II	10	5808.06	La I
7	5780.19	Mn I	520	5791.85	Mo I	10	5808.23	Mo I
17	5780.34	Nb I	29	5792.66	Rh I	50	5808.32	La II
70	5780.59	U I	15	5792.72	Eu I	8	5809.03	Mo I
90	5780.71	Ta I	22	5792.95	Pr I	55	h 5809.22	Gd I
						45	5809.25	Nd II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
12	5809.50	Hf II	14	5823.18	Nd II	20	5839.99	Mo I
70 bl	5809.84	Sc ScO	30	5823.35	Nd II	20	5840.12	Pt I
40	5810.58	Pr II	11	5823.46	Ce II	55	5840.47	Gd II
55	5810.73	Ce I	40	5823.71	Ti I	18	5841.16	Er I
130	5811.10	Ta I	14	5823.72	Nd I	21 h	5841.18	Ti I
14	5811.19	Tm II	90	5823.72	Pr II	18	5841.82	U II
21	5811.27	U II	50	5823.83	La I	25	5842.23	Hf II
80	5811.57	Nd II	14	5823.91	Nd II	80	5842.39	Nd II
70 bl	5811.60	Sc ScO	45 h	5823.97	Gd I	50	5842.47	Nb I
11	5811.84	Ce I	23	5825.20	Mo I	8	5842.49	Os I
120	5812.92	Ce I	70	5825.87	Nd II	22	5842.60	Sm II
16	5813.55	Pr II	300	5826.28	Ba I	29	5842.97	Tb I
11	5813.83	U I	30	5826.74	Nd I	11	5843.10	Ce I
10	5813.86	Mo I	430	5826.79	Er I	16	5843.23	Nd II
45	5813.89	Nd I	24	5827.56	La I	23	5843.29	U II
13	5814.23	Er I	18	5827.99	U II	35	5843.73	Ce I
13	5814.34	Er I	8	5828.06	Ru I	22	5843.76	Sm I
9	5814.41	U I	10	5828.55	Ir I	11	5843.82	U II
45	5814.89	Sm I	80	5829.72	La I	45 c	5843.94	Ta I
21 bl	5814.96	Ti Ti O	13	5829.96	Ce I	28 h	5844.41	Dy Dy O
65	5814.98	Ru I	4	5830.08	Co I	35 c	5844.65	Pr II
160 d	5815.17	Pr II	19	5830.13	Ce I	30	5844.66	Nd I
	5815.33	Pr II	29	5830.51	Sm I	8	5844.84	Pt I
29 h	5815.33	Nb I	16	5830.72	Nd I	40	5844.98	Pr II
65	5815.36	Tb I	55 h	5830.72	V I	24	5845.03	La I
19	5815.42	Th II	45	5830.94	Pr II	25 hs	5845.14	Cs I
16	5815.44	Nd I	600 cw	5830.98	Eu I	35	5845.25	U II
11	5815.47	Ce I	45	5831.02	Sm II	17	5845.27	W I
16	5815.52	Mo I	19	5831.38	Ce I	24	5845.65	Dy Dy O
10	5815.74	Mo I	35	5831.58	Rh I	22	5845.71	Gd II
55	5815.85	Gd II	22 h	5831.74	Sm II	27	5845.77	Eu I
10 c	5815.92	Re I	95	5831.91	Ce I	25	5845.87	Hf I
12	5816.34	Sm I	80 h	5832.01	Dy Dy O	23	5845.95	Nd I
14 h	5816.46	Tm I	21	5832.27	Y I	6	5845.96	Ce I
25	5816.51	Ta I	18	5832.37	U II	14	5846.08	Ce I
11	5816.79	U I	16 h	5833.21	Ru I	17	5846.09	Nb I
7	5816.84	Mn I	13	5833.61	W I	85 h	5846.30	V I
23	5817.06	V I	55 h	5833.85	Dy Dy O	16	5846.36	Nd II
19	5817.47	Hf I	11	5833.88	Er II	65	5847.13	Pr II
35 h	5817.53	V I	35	5833.99	Yb II	30	5847.32	Zr I
28	5817.78	Ce II	19	5834.24	Ce I	13	5847.59	Nd I
13	5818.32	Sm I	550	5834.31	Re I	95 bl	5847.73	Sc Sc O
55	5818.57	Pr II	40 h	5834.86	Dy Dy O	19	5847.77	Hf I
15 bl	5818.58	Y YO	75	5834.90	Nb I	40 h	5848.05	Dy Dy O
170	5818.74	Eu II	40	5835.13	Pr I	35	5848.32	Ce I
9	5819.01	U I	23	5835.59	Mo I	65	5848.38	La I
45 b	5819.2	Ho Ho O	95	5835.84	Ce I	22	5848.67	Sm II
10	5819.41	Yb II	45	5835.84	Er I	11	5848.84	Ce II
110	5819.43	Nb I	45	5836.03	U I	20 h	5848.86	Mo I
65 hs	5819.51	Gd Gd O	45	5836.37	Sm II	13	5848.95	La II
45	5820.37	Ce I	35	5837.14	Yb II	70 bl	5849.07	Sc Sc O
27	5820.37	Nd I	25	5837.40	Au I	45 b	5849.4	Ho Ho O
35	5820.62	Nb I	55	5837.70	U II	13	5849.68	Ta I
40	5820.62	Pr II	9 b	5838.07	Y YO	55 h	5849.73	Mo I
18	5820.68	Sm II	75	5838.15	Ce I	100	5850.07	Er I
10	5820.69	Mo I	25	5838.15	Nb I	11	5850.32	V I
45	5820.99	Gd II	130 d	5838.64	Nb I	65 c	5850.64	Pr II
16 h	5821.36	Pr I	35	5838.76	Tm II	28	5851.02	Ce I
6	5821.84	Rh I	10	5838.94	Th II	65	5851.07	Tb I
30	5821.87	Y I	13	5838.97	W I	23	5851.10	Ce I
27 h	5821.90	Ho I	11	5839.04	U II	50 h	5851.52	Mo I
140	5821.99	La I	35	5839.36	Ce I	28	5851.58	W I
55	5822.59	Pr II	22	5839.47	Ho I	220	5851.63	Gd I
7	5822.60	W I	16	5839.79	La I	11	5852.01	U I
55	5822.98	Ce I	14	5839.95	Er I	35 h	5852.27	La I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum			
21	5852.34	Ti	16	5869.95	La I	70	b	5887.38	Sc ScO		
45	5852.63	Pr II	17	5870.55	Th II	30		5887.91	Nd I		
7	5852.68	Th I	65	5870.62	Tb I	820		5888.33	Mo I		
35	5853.06	Ce I	11	5870.85	Ce I	19		5888.52	Ce I		
23	5853.34	Ce I	45	5870.85	Ho I	21	h	5888.68	Ti		
35	5853.67	Ce I	35	5870.93	U II	20000		5889.95	Na I		
2800	5853.68	Ba II	27	5871.04	Nd I	12		5890.48	Co I		
28	5853.91	U II	35	5871.06	Sm I	25		5891.41	Sm I		
11	c	5854.44	Pr I	75	5871.59	Ce I	8		5891.45	Th I	
27		5854.51	Yb I	14	5871.63	Er I	35		5891.53	Nd II	
55	5855.24	Gd II	15	5871.83	Y I	11	h	5891.56	Mo I		
120	5855.31	Er I	140	5872.35	Er I	13		5891.61	W I		
40	5855.56	Dy DyO	90	5872.98	Eu II	55		5892.23	Pr II		
80	5855.58	La I	18	5873.53	Er I	23		5892.29	Mo I		
45	5856.07	Pr II	22	5873.83	Pr II	13		5892.47	Ce I		
280	5856.22	Gd I	13	5873.90	Ce I	35	c	5892.56	Ho I		
11	5856.61	W I	21	5874.00	La II	10		5892.88	Ni I		
55	5856.90	Pr II	50	5874.21	Sm I	35		5893.19	Ce I		
45	5856.96	Gd II	11	5874.22	W I	50	h	5893.38	Mo I		
45	5857.11	Ce I	35	5874.70	Nb I	40		5893.44	Nb I		
220	5857.45	Ca I	35	5874.72	Pr I	16	bh	5893.57	La LaO		
30	5857.52	Nd II	45	5874.73	La I	24	b	5893.94	Y YO		
10	5857.76	Ni I	9	5875.10	Sm I	35		5894.06	Ir I		
110	5857.76	Os I	9	5875.69	W I	22		5894.22	Pr II		
23	5858.14	Ce I	13	5875.92	Sm I	65		5894.85	La I		
520	5858.27	Mo I	24	5876.14	Y YO	22		5895.16	Sm I		
19	h	5858.56	Ce II	26	5876.59	Mo I	15		5895.31	Eu I	
15		5858.83	Y YO	65	5877.26	Gd II	23		5895.32	U II	
55		5858.91	Nd I	240	5877.36	Ta I	240		5895.63	Tm I	
11		5859.16	U II	21	5877.63	La I	10000		5895.92	Na I	
45	5859.37	Ce I	17	5877.79	Nb I	16	bh	5896.67	La LaO		
17	5859.67	Th II	27	5877.83	Nd II	8		5897.21	Yb II		
90	5859.68	Pr II	16	5877.99	La I	45		5897.39	Sm II		
14		5860.27	Sm II	11	5878.03	Ce I	45		5897.62	Gd II	
140	c	5860.28	Ho I	35	5878.10	Pr I	11		5897.75	Ce I	
28	5860.64	Os I	13	5878.11	Sm II	13		5898.08	Ce II		
12	5860.69	Er II	11	5878.14	Ce II	20		5898.78	Mo I		
55	5860.73	Gd II	23	5878.90	Ce I			5898.82	Mo I		
35	5860.78	Sm I	13	5879.03	Ce II	21		5898.78	U I		
40	h	5860.79	Lu I	35	5879.04	Pr I	35		5898.84	Tb I	
27	5860.97	Eu I	80	5879.25	Pr II	50		5898.96	Sm I		
20	5861.38	Mo I	27	b	5879.6	Ho HoO	230		5899.32	Ti I	
95	5862.49	Ce I	340		5879.80	Zr I	35		5899.47	Tm I	
7	5863.41	U I	24	5879.96	Y I	18		5899.49	Nd I		
80	5863.71	La II	13	5880.21	W I	11		5899.71	Ce I		
27	h	5864.42	Ho I	65	5880.31	Ti I	23		5900.43	Nd II	
22		5864.63	W I	65	5880.64	La II	190	cw	5900.62	Nb I	
15	5864.77	Eu I	120	5881.14	Er I	11		5900.68	Ce I		
35	5865.06	Nd II	10	5881.53	Mo I	10		5900.75	La I		
9	5866.30	Lu I	10	5882.30	Ir I	50		5901.09	Zr I		
16	bI	5866.42	La LaO	130	5882.30	Ta I	13		5901.20	W I	
400		5866.46	Ti I	10	5882.72	Mo I	23		5901.29	Ce I	
65		5866.47	Nb I	27	5882.78	Nd II	13		5901.39	Ce I	
15		5866.61	Ta I	11	5882.92	Os I	40		5901.47	Mo I	
35		5867.08	Nd I	70	c	5882.99	Ho I	24		5901.57	Tm I
65		5867.79	Sm I	30		5883.29	Nd I	90		5901.91	Ta I
55	h	5868.11	Dy II	22		5883.66	Hf I	16		5901.96	La II
50		5868.27	Zr I	35	c	5884.72	Pr I	27		5902.08	Er II
45		5868.61	Sm I	85		5885.62	Zr I	24		5902.40	Tb I
13		5868.76	Mo I	14		5885.70	Th I	23		5902.50	U I
80	5868.83	Pr II	23	5886.24	Nd I	29		5902.60	Sm I		
30	5868.90	Nd I	27	5886.30	Er II	40		5902.64	W J		
50		5869.33	Mo I	55	5886.46	Gd I	35		5902.96	Y I	
16	bI	5869.50	La LaO	11	5886.93	U II	27		5902.97	Eu I	
110		5869.50	Zr I	7	5887.36	Ir I	40		5903.11	Pr II	

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum						
55	5903.33	Ti I	16	bh	5920.84	La	LaO	16	5936.33	Pr	II			
29	5903.50	Sm I	22		5921.01	Sm	I	8	5936.65	Ru	I			
40	c	5903.80	Nb	I	27	5921.22	Nd	I	85	5936.84	Gd	I		
11	5903.98	Os I	80		5921.45	Ru	I	15	5937.09	Tb	I			
55	5904.07	Gd II	70		5921.76	Ho	I	14	5937.16	Er	II			
22	5904.29	Ho I	150		5922.12	Ti	I	65	5937.71	Gd	I			
16	5904.30	La I	9		5922.79	Nd	I	95	5937.72	Ce	I			
45	5904.45	Pr II	22		5923.34	Sm	I	75	5937.82	Ti	I			
110	5904.56	Gd I	10	h	5923.79	Mo	I	16	5937.91	Mo	I			
35	5904.71	Tb I	16	bh	5923.97	La	LaO	19	5938.44	Ce	I			
23	5905.99	Ce I	23		5924.04	Ce	I	17	5938.83	Th	I			
18	5906.05	Sm I	20		5924.56	Dy	II	35	5938.90	Sm	II			
55	5906.06	Er I	40		5924.57	V	I	90	bl	5939.08	Y	YO		
27	5906.65	Nd II	22		5924.66	Sm	I	50	c	5939.38	Tb	I		
11	5906.84	Os I	19		5924.90	Ce	II	130		5939.76	Ta	I		
7	5907.31	Rh I	140		5925.13	Zr	I	160		5939.90	Pr	II		
11	5907.49	Ce I	12		5925.30	Eu	I	35		5940.17	Tb	I		
50	5907.64	Ba I	23	h	5925.47	U	I	65		5940.72	Pr	II		
20	5908.36	Yb II	19		5925.87	Th	II	13		5940.83	La	I		
30	bl	5908.61	Zr	ZrO	15	5925.90	Ta	I	230		5940.86	Ce	I	
40	5908.67	Pr II	55		5926.31	Ce	I	55	h	5940.95	Gd	GdO		
7	5908.95	Os I	40	h	5926.36	Mo	I	7		5941.46	Rh	I		
22	5909.04	Sm I	15		5926.47	Hf	I	28		5941.54	Ce	II		
45	5909.24	Er I	27		5926.52	Eu	I	22		5941.65	Pr	I		
55	5909.86	Ce I	21		5926.87	Ru	I	120		5941.76	Ti	I		
35	5909.87	Nd II	29		5927.41	Nb	I	22		5942.33	Sm	I		
12	5909.94	Eu I	16		5927.71	La	II	28		5942.67	Ce	I		
15	5910.10	Tb I	60	bl	5928.10	Sc	ScO	45		5942.72	Eu	I		
55	5910.12	Ce I	85		5928.35	Ce	I	10		5942.77	U	I		
9	5910.83	Sm I	21		5928.49	La	I	55	h	5942.78	Gd	GdO		
170	5911.45	Gd II	13		5928.58	W	I	30		5943.22	Nd	II		
8	5912.12	Mo I	160	h	5928.88	Mo	I	60		5943.24	Re	I		
24	b	5912.19	Y	YO	21	5929.33	U	I	240		5944.02	Ta	I	
8	5912.58	Tm I	19		5929.50	Ce	I	10		5944.65	Th	I		
29	5912.61	Sm I	28		5929.82	Ce	I	28		5944.86	Ce	I		
45	5912.92	Ce I	85		5930.29	Gd	I	45		5945.72	Y	I		
65	5913.55	Gd II	320		5930.62	La	I	70		5945.80	Dy	I		
22	5913.56	Sm I			5930.68	La	I	22		5946.37	Er	I		
40	5914.39	Th II	15		5930.62	Ta	I	25		5946.37	Sm	I		
9	5914.40	Nd I	40		5930.66	Pr	II	5		5946.49	Co	I		
17	5914.65	Th I	23		5931.05	Ta	I	35		5947.16	Pr	II		
11	5914.82	Ce I	24	b	5931.10	Y	YO	55		5947.57	W	I		
40	5915.16	Dy II	20		5931.68	Ta	I	23		5947.64	Ce	I		
11	5915.31	Pr I	11		5931.70	Tm	I	70	cw	5948.03	Ho	I		
230	5915.40	U I	23		5932.16	Ce	I	18	h	5948.30	La	II		
12	5915.54	Co I	25		5932.18	Sm	I	14		5948.57	U	I		
14	5915.56	Sm I	26		5932.38	Ru	I	14		5949.64	Nd	I		
75	5915.74	Eu I	16		5932.44	U	II	22	c	5949.76	Pr	I		
11	5915.97	Pr I	25		5932.90	Sm	II	24		5950.02	Y	I		
14	5916.36	Sm I	35		5933.50	Er	I	10		5950.21	Re	I		
18	5916.46	Er I	17		5933.58	Ce	II	23		5950.61	Ce	I		
30	5916.51	Ta I	60		5933.69	Hf	I	8		5951.15	Ru	I		
55	5916.77	Gd I	30	c	5933.71	Ho	I	24		5951.17	Tb	I		
45	5917.63	La I	16		5933.82	U	I	11		5951.21	Ce	I		
35	bl	5918.04	Sc	ScO	40	c	5934.16	Nb	I	55		5951.27	Pr	II
9	5918.54	Rh I	55		5934.32	Ce	I	55		5951.60	Gd	II		
120	5918.55	Ti I	40		5934.45	Ce	I	20		5951.76	Pr	II		
90	5918.95	Ta I	10		5934.46	U	II	25		5951.78	Ta	I		
30	5919.11	Sc I	27		5934.75	Nd	II	15		5951.78	Tb	I		
22	5919.33	Sm II	100		5935.20	Zr	I	21		5952.05	U	II		
55	5919.34	Ru I	65		5935.24	La	I	300		5953.17	Ti	I		
10	5919.86	Re I	6		5935.39	Co	I	27		5953.49	Eu	I		
45	5920.42	Ce I	18		5935.54	Ta	I	27		5953.84	Eu	II		
40	5920.76	Pr I	27		5935.90	Tm	I	13		5953.96	W	I		
65	c	5920.78	Tb	I	50	5936.22	La	II	30		5954.28	Eu	I	

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
110	5955.35	Zr I	11	5972.79	Ce I	45	5989.38	Ce I
25 h	5955.82	Sm II	21 h	5973.38	Ru I	16	5989.47	Mo I
27	5955.87	Nd I	90	5973.52	Ho I	10	5989.99	Re I
45	5955.98	Ho I	45	5973.53	La II	10	5990.01	Mo I
13	5956.19	W I	30	5973.66	Th I	14	5991.00	Th I
75 b	5956.41	Y YO	8	5974.17	Ru I	9	5991.19	Rh I
55	5956.48	Gd II	15	5974.26	Mo I	13	5991.27	Pr I
90	5956.60	Pr II	75	5974.28	Hf I	10	5991.35	Mo I
	5956.70	Pr I	120	5974.49	Dy I	40	5991.51	Yb II
9	5956.68	Ce I	25	5974.72	Hf I	17	5991.88	Co I
25	5956.76	Sm I	27	5975.02	Tm I	16	5992.36	La I
14	5956.84	Ce I	30	5975.07	Th I	45	5992.67	Ce I
21	5956.86	U I	27	5975.49	Er I	240	5992.83	Eu I
22	5957.52	Sm II	18 h	5975.75	La I	25	5992.96	Hf I
40	5957.70	Nb I	75	5975.87	Ce II	35	5993.65	Ru I
13	5959.25	Pr I	35	5975.98	Ce I	13 h	5993.85	Sm II
35	5959.69	Ce II	100	5976.32	U I	24	5994.13	Th I
25	5960.09	Sm I	13 c	5976.95	Pr I	25	5994.64	Sm II
18	5960.13	Ta I	85	5977.25	Gd I	30	5994.76	Nd I
26	5960.59	La I	30 bl	5977.80	Zr Zr O	13 c	5994.89	Pr I
9	5960.70	Ce II	270	5978.56	Ti I	29	5995.09	Sm I
27	5960.83	W I	60	5978.66	Hf I	35	5995.26	Ce II
13	5960.87	Ce I	20	5978.86	W I	17	5995.37	Zr I
19	5961.00	Tb II	13	5978.88	Pr I	35	5995.45	Ce II
14	5961.16	Nd I	28	5978.91	V I	18 h	5995.73	Re I
35	5961.49	Sc I	19	5979.37	Ce I	65	5996.00	Os I
20	5962.18	Pr I	25	5979.38	Sm I	11	5996.06	Pr I
16	5962.60	La I	15 c	5979.83	Tb I	27	5996.47	Nd I
28	5963.00	Pr I	15	5980.47	Eu I	19	5997.03	Ce II
25	5963.22	Sm II	20	5980.78	V I	500	5997.09	Ba I
11	5963.33	Ce I	65	5981.19	Pr II	140	5997.13	Lu I
90	5963.76	Eu I	11	5981.20	Ce I	190 c	5997.23	Ta I
50 l	5964.46	Dy I	7	5981.36	Os I	45	5997.31	U I
8	5964.62	Ce I	22	5981.43	Ho I	85 cw	5997.93	Nb I
8	5964.64	Ce I	50	5981.86	Y I	16	5997.96	U I
16	5965.30	La I	26	5982.35	La I	340	5999.04	Ti I
10	5965.57	Mo I	230 c	5982.90	Ho I	85	5999.08	Gd I
65	5965.71	Sm II	16	5982.93	Mo I	23	5999.41	U I
200	5965.84	Ti I	27	5983.14	Eu I	65	5999.68	Ti I
55	5965.86	W I	150	5983.22	Nb I	11	6000.18	Ce I
330	5966.07	Eu II	11	5983.22	Os I	21	6000.19	U I
28	5966.18	Ce I	130	5983.60	Rh I	9	6000.67	Co I
45	5966.33	Ce I	27	5983.78	Eu I	14	6000.84	Dy I
480 cw	5967.10	Eu I	20	5983.82	W I	65	6000.96	Gd CdO
75	5967.34	Th II	690 cw	5983.9	Lu II	50	6001.05	Zr I
110	5967.82	Pr II	7 h	5984.08	Co I	7	6001.21	Th I
60 bl	5968.25	Sc Sc O	100	5984.23	Zr I	75 h	6001.87	Gd CdO
15 h	5968.43	Eu I	35	5984.29	Sm I	55	6001.90	Ce I
8	5968.48	Mo I	24	5984.86	Dy I	8 hl	6001.93	Pb I
55	5968.68	Er I	11	5984.87	Tm I	22	6001.94	Sm I
35 h	5968.82	Sm II	10	5985.99	Dy I	55	6002.04	Ho I
35	5969.19	Sc I	65	5986.08	Nb I	28	6002.31	V I
13	5969.49	Sm I	28	5986.10	U I	29	6002.44	Pr II
18 h	5969.77	Re I	40	5986.14	Pr I	55	6002.63	V I
20 h	5970.10	Sr I	45 c	5987.14	Pr I	14	6003.26	Dy I
				5987.29	Pr II			
13	5971.09	La II				740 bl	6003.60	Y YO
140	5971.26	Tm I	1000 bl	5987.64	Y YO	4	6003.62	Ce I
55	5971.50	U I	110 h	5988.02	Gd I	7	6003.68	Ce I
30	5971.69	Eu I	40	5988.17	Mo I	22	6004.18	Sm I
500	5971.70	Ba I	90	5988.42	Sc I	60	6004.36	Eu I
1300 bl	5972.04	Y YO	140	5988.56	Dy I	1400	6004.52	Lu I
28	5972.09	Ce I	16	5988.67	Ru I	55	6004.57	Gd II
27	5972.51	W I	85	5989.04	Th II	120	6004.65	Y
170	5972.75	Eu I	17	5989.33	Yb I	21	6004.83	U II
70	5972.76	Ho I	30	5989.34	Nd II	27	6005.33	Ho I



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum						
15	h	6005.61	Eu	I	28	c	6019.85	Pr	I	24		6044.43	Th	II
24	h	6005.75	Dy	Dy O	620	bl	6019.87	Y	YO	60		6044.66	Eu	I
55		6005.86	Ce	I	9		6020.60	Ce	I	50		6045.00	Sm	I
15		6006.20	Ce	I	100		6020.72	Ta	I	45		6045.39	Sm	I
90		6006.33	Pr	II	17		6021.04	Th	I	250		6045.39	Ta	I
6	h	6006.36	Co	I	28	b	6021.12	Hf	Hf O	28		6045.42	Ce	I
24	h	6006.54	Dy	Dy O	55		6021.13	Gd	I	50		6045.50	Nb	I
35		6006.79	Er	II	35		6021.43	Ho	I	22		6045.63	Er	II
55		6006.82	Ce	I	40		6021.52	W	I	170		6045.85	Zr	I
24	h	6006.97	Dy	Dy O	290		6021.80	Mn	I	55		6046.66	Pr	II
21		6007.07	Th	I	70		6022.56	Er	I	100		6047.25	Ta	I
65		6007.36	La	I	60		6023.15	Eu	I	55		6047.40	Ce	I
19		6007.37	Ce	I	120		6023.41	Y	I	20		6047.83	Mo	I
6	h	6007.67	Co	I	8		6024.06	Fe	I	22		6048.14	Er	II
45		6007.67	Nd	I	110		6024.20	Ce	I	25		6048.72	Nb	I
14	h	6007.90	Er	I	30		6025.36	Zr	I	6	h	6049.10	Co	I
13		6008.54	Pr	I	20		6025.41	V	I	100		6049.24	Zr	I
55		6008.71	Gd	I	19		6025.44	Tm	I	35		6049.26	Pr	I
22		6008.75	Er	II	35		6025.49	Mo	I	420		6049.51	Eu	II
21		6008.87	U	I	9		6025.54	Nd	I	13		6049.92	W	I
30		6008.94	Dy	I	150		6025.72	Pr	II	28		6050.04	Pr	II
13		6009.01	W	I	6		6026.04	Pt	I	9		6050.48	U	I
120		6009.19	Y	I	7		6026.10	Ir	I	9		6050.67	U	I
14		6009.30	Nd	II	60		6026.18	Sc	I	27		6050.71	Ho	I
25	h	6009.89	Ta	I	15		6027.16	Ce	I	11		6050.88	Pr	I
11		6010.16	Th	I	25		6027.16	Sm	I	55		6051.74	U	II
80	hs	6010.49	Cs	I	16		6027.27	Mo	I	19		6051.80	Ce	II
11		6010.65	Tb	II	23		6028.13	U	I	10		6052.88	Yb	II
65		6010.82	Dy	I	20		6028.32	W	I	25		6053.70	Ta	I
21		6010.86	U	I	170		6029.00	Eu	I	420	bl	6053.81	Y	YO
25		6011.22	Sm	II	50		6029.75	Nb	I	9	h	6053.88	Sm	I
60	h	6012.20	Eu	I	1300		6030.66	Mo	I	25		6054.17	Hf	I
110		6012.56	Eu	I	24		6030.98	Dy	I	10		6054.57	Yb	I
21		6012.73	Ti		11		6031.26	Ce	I	7		6054.63	Os	I
55		6012.78	W	I	35		6031.27	Nd	II	20		6054.81	Mo	I
75		6013.42	Ce	I	50		6031.84	Nb	I	45		6054.85	Er	I
140		6013.50	Mn	I	22		6032.12	Er	II	440		6055.03	Lu	I
21		6014.07	U	I	85		6032.61	Zr	I	140		6055.13	Pr	I
55		6014.83	Er	I	18		6033.23	Sm	II	29		6056.65	Nb	I
30		6015.42	Th	II	27		6033.29	Nd	I	16		6056.80	U	I
60		6015.58	Eu	I	23		6033.58	Ce	II	16		6057.07	U	I
35		6015.74	Er	II	14	h	6034.09	Cs	I	140		6057.36	Eu	I
20		6015.79	Os	I	35		6034.20	Ce	II	23		6057.50	Ce	I
25		6015.90	Ta	I	45		6034.24	Nd	II	35		6058.00	Ce	I
28		6016.12	V	I	23		6034.41	Ce	I	100		6058.14	V	I
55		6016.48	Pr	II	35		6035.49	Ce	II	24		6058.18	Dy	I
23		6016.59	Ce	I	7		6035.54	U	I	18		6059.73	U	II
200		6016.64	Mn	I	620	bl	6036.17	Sc	Sc O	45		6060.31	Ho	I
10		6016.73	U	I	500	bl	6036.60	Y	YO	70		6061.25	Er	I
45	c	6016.79	Hf	I	17		6037.70	Th	I	15		6061.83	Tb	I
12		6016.80	Sm	I	50		6038.59	La	I	18		6062.30	U	I
160	bl	6017.07	Sc	Sc O	16		6038.97	Ho	I	140		6062.84	Zr	I
16		6017.16	La	I	29		6038.97	Tb	I	1100		6063.12	Ba	I
24		6017.26	Dy	I	29		6039.38	Tb	I	490	bl	6064.31	Sc	Sc O
18		6017.39	Sm	II	21		6039.60	U	I	110		6064.63	Ti	I
28		6017.39	U	II	450		6039.73	V	I	13		6065.08	W	I
21		6017.57	U	I	29		6041.40	Sm	I	12		6065.49	Fe	I
150		6017.80	Pr	II	13		6041.55	La	I	55		6066.03	Nd	I
420		6018.15	Eu	I	35	h	6041.66	Lu	I	12		6066.50	Th	II
4		6018.78	Ce	I	24	bl	6042.49	Dy	Dy O	23		6066.75	Ce	I
6		6018.82	Ce	I	18		6042.84	Sm	I	13		6067.14	La	II
12		6019.00	Th	II	35		6042.87	Pr	II	45		6067.23	U	II
16		6019.19	U	I	25	b	6043.19	Hf	Hf O	20		6067.26	V	I
15		6019.24	Tb	I	20		6043.31	W	I	13		6067.27	Pr	II
500		6019.47	Ba	I	110		6043.39	Ce	II	12		6067.78	Sm	II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum			
11	6067.78	Tm II	160	bl	6096.78	Y YO	30	6120.56	Th II		
12	6067.83	Ir I	45		6098.34	Ce II	50	6120.83	Zr I		
9	6068.64	Ce I	95		6098.67	Hf I	35	h	6121.01	Ti I	
45	6068.68	La I	40	h	6098.67	Ti I	170		6121.91	Zr I	
19	6069.46	Ce I	24		6099.08	Th II	22	c	6122.15	Pr I	
35	6069.48	Ce I	240		6099.35	Eu I	950		6122.22	Ca I	
50	6070.06	Sm I	11		6099.80	Ce I	9		6122.65	Co I	
27	6071.70	Nd I	14	h	6099.90	Sm I	18		6122.75	Sm I	
35	6072.00	Ce I	40		6100.38	La II	22		6123.60	Sm II	
13	6072.05	La I	100		6101.58	Ta I	45		6123.67	Ce I	
440	bl	6072.65	Sc ScO	14		6101.75	Nd I	9		6124.25	Ce I
130	bl	6072.78	Y YO	18		6101.77	U I	60		6124.67	Eu I
30		6073.10	Th II	40		6101.87	Mo I	85		6124.84	Zr I
30		6073.97	Nd I	320	bl	6101.87	Sc ScO	14		6124.88	Sm II
90		6075.58	Eu I	18		6101.96	Sm I	35		6125.32	Er I
12	h	6075.72	Sm I	11		6102.60	Th I	80		6126.09	La II
60		6076.45	Er II	340		6102.72	Ca I	120		6126.22	Ti I
35		6076.61	Ce I	35		6102.72	Rh I	14		6126.33	Sm I
17		6077.16	Ce I	22		6103.37	Sm I	26		6127.05	La I
90		6077.29	U I	3200		6103.62	Li I	24		6127.15	Dy I
30		6077.38	Eu I	24		6104.29	Tb II	75	bl	6127.38	Y YO
15		6077.84	Tb II	30		6104.57	Th I	680		6127.44	Zr I
620	bl	6079.30	Sc ScO	14		6105.18	Er II	16		6127.77	U I
20		6079.58	Mo I	13		6106.03	Tb I	8		6128.06	Rh I
17		6080.37	Ce I	22		6106.72	Pr II	22		6128.25	W I
55		6080.65	Gd II	28		6106.98	V I	20		6128.34	V I
10		6081.27	Mo I	16		6107.27	La I	80		6129.56	La II
17		6081.28	Ce I	29		6107.71	Nb I	28		6129.72	U I
480		6081.44	V I	130	bl	6107.82	Y YO	9		6130.15	Ce I
22		6081.44	W I	10		6108.12	Ni I	12		6130.62	Sm I
120		6081.79	Ho I	60		6108.15	Eu I	10		6130.63	Mo I
17		6082.44	Co I	14		6108.41	Nd II	16		6131.53	Tm I
240		6083.84	Eu I	80		6108.48	La I	19		6132.00	Ce II
45		6084.12	Sm I	28		6108.74	Ce II	1400	bl	6132.06	Y YO
15		6084.34	Tb I	18		6109.08	Pr I	19		6132.18	Ce I
16	h	6084.89	La I	370	bl	6109.93	Sc ScO	21		6132.61	U I
30		6085.06	Dy I	45		6110.66	Sm II	23	d	6133.47	Nd II
120		6085.23	Ti I	20		6110.67	Ir I			6133.58	Nd II
12		6085.26	Th II	1700		6110.78	Ba I	70	cw	6133.60	Ho I
13		6085.81	Pr I	9		6110.91	U II	24		6133.64	Dy I
28		6086.16	Pr II	13		6111.66	W I	50		6134.39	La I
7		6086.65	Co I	280		6111.67	V I	13		6134.39	Tb I
30		6087.26	Th II	45		6111.72	La I	340		6134.55	Zr I
28		6087.34	U II	9		6111.82	Ce I	120		6135.04	Y I
65		6087.52	Pr II	7		6111.92	Ce I	280		6135.38	V I
50		6088.00	Y I	40		6112.84	Th II	11		6135.45	Ce I
140		6088.26	Dy I	12	h	6112.98	Sm I	7		6135.55	Ce I
12		6088.62	Sm I	430		6114.07	Gd I	22		6135.85	Sm I
19		6088.86	Ce I	30		6114.22	Re I	30		6136.62	Fe I
19		6088.96	Ce I	65		6114.38	Pr II	13		6137.00	Tb II
16		6089.19	U I	18		6114.58	Sm II	9		6137.23	Ce I
210	bl	6089.35	Y YO	22		6114.73	Sm I	20		6137.70	Fe I
1300		6090.22	V I	130	bl	6114.73	Y YO	18		6138.05	Sm I
20		6090.38	Pr II	13		6115.52	W I	19		6138.38	Ti I
30		6090.82	Ta I	370	bl	6115.97	Sc ScO	150		6138.43	Y I
120		6091.17	Ti I	35		6116.01	Er I	9		6138.54	U I
35	h	6091.40	Sm I	6		6116.15	Rh I	23		6139.03	Ce I
18		6092.06	Ta I	18		6116.77	Ru I	18		6139.33	Sm I
40		6092.81	Ti I	9		6116.98	Co I	25		6140.07	Ta I
28		6093.09	Pr II	22	c	6118.02	Pr I	100		6140.46	Zr I
12		6093.13	Co I	15		6118.56	Ce I	22		6140.60	Sm I
35		6093.19	Ce I	120		6118.78	Eu I	11		6140.71	Lu I
15		6093.99	Tb II	17		6118.90	Ce I	35		6141.51	Pr II
18		6096.28	Pr I	600		6119.52	V I	20000		6141.72	Ba II
14		6096.78	Sm I	9		6119.81	Ce I	40		6142.51	Nb I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
15	6142.92	Ce I	50	6164.32	Nb I	15	6189.66	Ta I
24	6142.98	La I	8	6164.50	U I	10	6191.18	Ni I
18	6143.09	Sm I	12	6164.51	Sm II	20	6191.56	Fe I
440	6143.20	Zr I	16	6164.77	U II	55	6191.68	Ho I
35	6143.36	Ce II	820	6165.08	Y YO	1200	6191.73	Y I
12	6143.59	Sm I	18	6165.38	Pr I	12	6191.91	Th I
13	6143.94	W I	19	6165.45	Ce I	29	6192.64	Sm II
20	6144.53	Os I	80	6165.70	La I	150	6192.90	Sc ScO
65	6144.56	Ta I	18	6165.84	Sm I	60	6192.96	Zr I
13	6145.30	La I	270	6165.94	Pr II	15	6193.11	Ta I
35	6145.81	Re I	60	6166.44	Ca I	11	6193.64	Tb I
30	6146.22	Ti I	23	6166.67	Nd II	24	6193.86	Th II
23	6146.43	Ce I	12	6168.33	Sm II	18	6194.39	Sm I
18	6146.53	La II	100	6168.43	Dy I	11	6194.52	Tb II
50	6146.82	Re I	70	6169.05	Ca I	140	6195.07	Eu I
19	6147.84	Ce I	140	6169.56	Ca I	11	6195.14	Tb I
50	6148.13	Nb I	60	6169.82	Th I	15	6195.23	Ce I
65	6148.23	Pr I	30	6170.06	Er II	19	6195.53	Ce I
	6148.24	Pr II	85	6170.36	V I	20	6196.23	Dy II
1100	6148.36	Y YO	15	6170.46	Ta I	35	6197.45	Pr II
180	6148.70	Sc ScO	35	6170.49	Nd II	10	6197.66	Mo I
29	6149.10	Sm II	40	6171.85	U I	19	6198.05	Ce I
27	6149.28	Nd I	11	6171.88	Tb II	10	6198.14	Sm II
12	6149.32	Er II	35	6172.73	La II	10	6198.22	Th I
9	6149.56	Ce I	7	6172.84	Ce I	450	6199.19	V I
21	6149.74	Ti I	7	6172.86	Ce I	26	6199.42	Ru I
180	6150.15	V I	330	6173.05	Eu II	160	6199.66	Lu II
23	6151.72	Ce I	18	6173.95	Sm I	590	6199.82	Y YO
120	6151.72	Y YO	18	6174.45	Sm I	14	6199.99	Rh I
14	6151.99	Th I	18	6174.96	Sm II	12	6200.43	Th II
9	6152.25	U I	19	6175.28	Ce I	35	6200.81	Pr II
30	6152.54	Ta I	14	6175.29	Tm I	110	6200.86	Gd GdO
60	6152.57	Yb II	35	6175.38	U I	18	6201.13	Sm I
20	6153.72	W I	10	6176.81	Ni I	18	6201.74	Nd II
150	6153.93	Sc ScO	45	6178.59	Nd I	18	6203.24	Re I
30	6154.23	Na I	110	6178.76	Eu I	12	6203.49	Th I
130	6154.50	Ta I	18	6179.41	Sm I	16	6203.51	La II
20	6154.87	W I	22	6179.82	Sm II	20	6203.51	W I
27	6155.06	Nd I	55	6180.42	Gd II	25	6203.86	Sm I
30	6155.61	Zr I	18	6181.05	Sm II	13	6205.63	Pr II
14	6156.16	Nd I	8	6181.37	U II	25	6206.31	Rh I
13	6156.29	Tb I	14	6181.41	Tm II	22	6206.87	Sm I
35	6156.38	Ho I	560	6182.23	Y YO	10	6207.13	Sm I
27	6156.58	Ho I	55	6182.34	Pr II	19	6207.22	Th I
14	6156.90	Sm II	50	6182.62	Th I	15	6207.60	Eu I
14	6157.55	Sm II	110	6182.68	Gd GdO	13	6208.01	Nd II
75	6157.71	Zr I	29	6182.89	Sm II	27	6208.24	Nd I
22	6157.82	Pr II	27	6183.21	Er II	25	6208.37	Ta I
35	6157.83	Nd II	27	6183.91	Nd II	70	6208.65	Ho I
11	6158.03	Os I	12	6184.79	Th I	35	6208.98	Ce I
24	6158.28	Dy I	95	6185.13	Hf I	9	6209.56	Ce I
40	6158.84	Ta I	35	6186.15	Ti I	13	6210.59	Pr I
13	6159.10	Pr II	35	6186.17	Ce I	9	6210.68	Nd II
45	6159.56	Sm I	8	6186.89	Rh I	620	6210.68	Sc I
19	6159.82	Ce I	9	6186.93	Ce I	55	6210.70	Hf I
150	6159.94	Lu II	13	6187.96	Pr I	9	6211.05	Ce I
25	6160.20	Zr I	15	6187.97	Ce I	110	6211.71	Gd GdO
22	6160.42	Sm II	22	6188.00	Sm II	3	6212.29	Ce I
60	6160.75	Na I	26	6188.09	La II	7	6212.49	Ce I
190	6161.18	Pr II	150	6188.09	Sc ScO	22	6212.73	Pr I
30	6161.29	Ca I	260	6188.13	Eu I	85	6213.05	Zr I
19	6162.14	Ce I	19	6188.13	Th I	29	6213.06	Nb I
1400	6162.17	Ca I	12	6189.00	Co I	120	6213.10	Cs I
30	6162.23	Ti TiO	23	6189.35	V I	130	6213.87	V I
30	6163.76	Ca I	35	6189.40	Zr I	100	6214.69	Zr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
95	h	6215.28 Ti I	13	6238.71 Ce I	21	6261.06 Th II		
16		6215.37 U I	90	6239.41 Sc I	300	6261.10 Ti I		
450		6216.37 V I	320	6239.78 Sc I	55	6261.22 V I		
13		6216.69 Nd I	55	6240.13 V I	21	6261.42 Th I		
11		6216.82 Ce I	20	h 6241.05 Pr I	240	6262.25 Eu I		
28		6216.82 Hf I	75	bl 6241.66 Cd CdO	60	6262.25 Sc I		
18		6217.17 Sm I	7	6241.70 Os I	260	d 6262.30 La II		
8		6217.60 Cs I	11	6241.87 Ce I	40	6262.55 Pr II		
20		6217.89 Mo I	3	6241.95 Ce I	55	6262.56 Er I		
450	bl	6217.96 Y YO	160	6242.34 Lu II	55	bl 6262.64 Gd GdO		
25		6217.97 Re I	170	6242.81 V I	18	6263.23 Nd II		
18		6218.06 Pr I	13	6242.91 Ce I	15	6264.27 Ce I		
13		6218.20 La I	710	6243.10 V I	10	6264.27 Mo I		
28	h	6218.31 V I	35	cw 6243.24 Re I	18	6264.54 Pr II		
10		6218.4 Tb II	35	6244.08 Nd I	5	6265.14 Fe I		
75	h	6220.49 Ti I	25	h 6244.21 Sm II	16	6265.88 Mo I		
110	bl	6220.93 Cd CdO	45	6244.35 Pr II	90	6266.02 La I		
360		6221.02 Er I	120	6245.63 Sc II	11	6266.17 Th II		
65	h	6221.41 Ti I	7	6246.34 Fe I	85	6266.32 V I		
2100		6221.87 Lu II	16	6246.53 U I	55	6266.95 Eu I		
75		6221.96 Nb I	45	6246.76 Sm II	35	6267.06 Zr I		
13		6222.25 Tb I	30	6246.97 Yb II	100	6267.28 Sm II		
300		6222.59 Y I	14	6248.11 Sm I	45	6267.93 Er I		
9		6223.25 Ce I	13	6248.28 Nd II	14	6268.66 U I		
45		6223.39 Nd I	16	h 6248.80 Lu I	150	6268.70 Ta I		
130		6224.50 V I	60	6248.95 Hf II	130	6268.82 V I		
12		6224.53 Th I	9	6249.51 Co I	60	6268.87 Er I		
26		6225.20 Ru I	40	6249.79 Ta I	22	6269.41 Os I		
10		6225.48 Sm I	720	6249.93 La I	18	6269.42 Nd I		
10		6225.95 Tb II	110	6249.96 Sc I	13	6270.27 Nd I		
27		6226.50 Nd I	9	6250.43 Nd II	9	6270.28 Ce I		
170	bl	6226.51 Zr Zr O	55	6250.47 Eu I	18	c 6271.37 Re I		
18		6226.70 Sm I	45	6251.05 Y I	45	6272.05 Ce II		
35		6227.70 Os I	40	c 6251.76 Nb I	11	h 6272.36 Tb I		
35		6228.14 Lu II	280	6251.82 V I	45	b 6273.00 Gd GdO		
9		6228.23 Ce I	55	b 6252.12 Gd CdO	5	6273.03 Co I		
35		6228.94 Ce I	12	6252.56 Fe I	13	6273.76 La II		
19		6229.13 Ce I	15	6253.65 Ce I	50	6274.12 Th II		
30	cw	6229.42 Re I	16	6253.72 Rh I	170	6274.65 V I		
15		6230.51 Eu I	16	6254.22 U II	22	c 6274.66 Pr II		
20		6230.73 Fe I	20	6254.28 W I	60	6274.81 Pr II		
430		6230.74 V I	35	6254.10 Pr II	60	6274.78 Yb II		
35		6230.90 Er I	45	c 6255.75 Ho I	35	6274.94 Er I		
7		6230.97 Co I	9	6256.36 Ce I	11	6274.94 Os I		
55	bl	6231.62 Gd GdO	13	6256.36 Ni I	120	bl 6275.01 Y YO		
23		6232.45 Ce II	45	6256.54 Sm I	55	6276.31 Sc I		
12		6232.97 Th II	45	6256.66 Sm II	15	6276.47 Ce I		
100		6233.20 V I	150	6256.68 Ta I	5	6276.66 Rh I		
35		6233.51 La I	85	6256.90 V I	11	6277.23 Th II		
90	h	6233.73 Eu I	100	6257.26 Zr I	23	6277.29 Nd II		
18		6234.17 Ho I	23	6257.49 Nd I	8	6277.46 Rh I		
16		6234.30 U I	6	h 6257.58 Co I	60	6278.18 Au I		
35	h	6234.86 La I	13	6257.99 Ce I	50	6278.34 Ta I		
24	h	6234.86 Th I	380	6258.10 Ti I	40	6278.68 Pr II		
80		6235.36 Lu II	85	6258.57 V I	18	6278.76 Re I		
18	h	6236.17 La I	12	h 6258.60 Th II	30	6279.16 Th II		
270	bl	6236.72 Y YO	380	6258.70 Ti I	10	6279.49 Sm II		
13	h	6236.74 La I	27	6258.73 Nd II	11	6279.64 U II		
20	h	6236.80 Pr I	250	6258.96 Sc I	45	6279.76 Sc II		
28		6237.45 Ce I	270	6259.09 Dy I	28	6280.20 U II		
29		6237.66 Sm II	35	d 6260.02 Re I	110	6281.28 Pr II		
18		6238.30 Sm I		6260.24 Re I	65	6281.33 Ta I		
23		6238.50 Nd II	30	6260.36 Dy I	18	6282.00 Nd I		
45		6238.58 Hf I	21	6260.77 Nb I	17	h 6282.33 V I		
18	h	6238.59 La I	50	b 6261.05 Zr Zr O	17	6282.63 Co I		

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
9	6284.49	Ru I	20	6303.21	W I	11	6323.54	Mo I
200	6285.16	V I	230	6303.41	Eu II	14	6324.66	V I
17	6285.28	Th II	10	6303.42	Re I	75	6325.08	Ta I
27	6285.79	Nd I	65	6303.75	Ti I	18	6325.54	Sm II
27	6285.88	W I	19	6303.78	Tb II	110	6325.91	La I
15	h 6285.95	Eu I	16	6304.05	Pr I	55	6326.13	Er I
7	6286.39	Ce I	11	h 6304.24	Th II	7	6326.36	Th I
10	6286.41	Re I	15	6304.34	Zr I	8	6326.58	Pt I
7	6286.43	Ce I	75	6305.15	Gd II	70	6326.84	V I
11	6286.83	Os I	13	6305.19	Sm II	21	6327.28	Th I
30	6286.86	Er I	35	6305.23	Pr II	70	6327.47	Sm II
15	6287.36	Ta I	70	c 6305.36	Ho I	13	6328.01	Sm I
18	6287.74	La I	21	6305.46	La II	35	6330.10	Cr I
40	6287.91	Ta I	750	6305.67	Sc I	18	6330.17	Nd II
12	6288.28	Ir I	13	6306.64	Ce I	13	6330.62	Ru I
16	6288.56	La I	22	6306.68	Ho I	9	6330.77	U II
18	6288.59	Er I	35	6307.06	Sm II	40	6331.35	Gd I
18	c 6289.02	Pr I	200	6307.70	Re I	35	6331.68	Tb II
40	6289.34	Ta I	14	6308.15	Yb II	8	6331.97	Ce I
11	h 6289.48	Th II	11	6308.26	Nd I	50	6332.91	Ta I
85	6289.73	Gd II	130	6308.77	Er I	17	6333.75	Gd I
25	6289.90	Sm II	50	6309.06	Ta I	7	6334.44	Ir I
15	6290.74	Mo I	30	6309.11	Gd II	24	6334.91	Tb II
60	6291.34	Eu I	150	6309.58	Ta I	9	6335.36	Ce I
7	6291.48	U II	26	6309.90	Sc II	15	6335.40	Ce I
50	6291.82	Sm II	35	6310.01	Ce I	75	6335.82	Eu I
45	6292.02	W I	16	6310.14	La I	30	6336.10	Ti I
14	6292.03	U I	55	6310.49	Nd I	9	6336.12	Ru I
24	c 6292.43	Tb I	35	6310.92	La II	17	6336.34	Gd I
200	6292.83	V I	28	h 6311.50	V I	7	6336.55	U II
23	6292.84	Nd II	25	h 6311.85	Hf I	10	6336.83	Tb I
45	bl 6292.84	Zr Zr O	25	c 6312.22	Ta I	11	6337.21	Ce I
30	6292.87	Gd I	55	6312.24	Ti I	11	6337.85	Tb II
14	6292.94	Sm I	300	6313.02	Zr I	30	6338.10	Hf I
21	6293.32	U I	24	h 6313.78	Eu I	24	b 6338.10	Y YO
6	6293.38	Rh I	10	6314.66	Ni I	55	6339.09	V I
65	6293.57	La I	30	6314.71	Zr I	25	6340.10	Sm I
29	6294.68	Sm II	13	6315.78	Sm II	22	6340.36	Zr I
18	6295.22	Ru I	24	b 6316.20	Y YO	13	6340.70	Ce I
60	b 6295.46	Y YO	27	6317.19	Gd I	65	6341.17	Ta I
35	6295.58	Ce I	10	6317.82	Tb I	27	6341.51	Nd II
180	6296.09	La II	5	6317.95	Ce I	500	6341.68	Ba I
170	6296.49	V I	4	6317.99	Ce I	35	6342.86	Th I
23	6297.07	Nd I	5	6318.02	Fe I	14	6343.32	Dy I
11	c 6298.01	Pr I	26	6318.03	Ti I	22	h 6343.88	Pr I
40	h 6298.33	Rb I	11	h 6318.13	Pr II	35	6343.95	Ce II
16	6298.42	Nd II	16	6318.26	La I	26	6344.83	Sc I
18	6298.53	U I	19	6318.33	Hf I	50	bl 6345.10	Zr Zr O
45	6299.42	Er I	7	6318.37	Pt I	75	6345.22	Zr I
14	6299.46	Tm II	15	6318.58	Eu I	70	h 6345.35	Lu I
28	6299.51	Ce II	29	6319.53	Rh I	25	h 6345.75	Sr I
22	h 6299.54	Hf I	18	6319.69	Nd II	30	6346.02	Ta I
120	6299.66	Zr I	160	6320.39	La II	7	6346.27	U II
170	6299.77	Eu I	6	6320.41	Co I	27	6346.65	Gd II
23	6300.21	Ce I	16	6320.85	Sc II	28	6347.11	Pr II
18	6300.70	Sc II	11	6321.22	Nd I	22	6347.16	Er II
22	6301.12	Sm II	50	6321.35	Zr I	6	h 6347.83	Co I
11	6301.42	Th I	19	6321.59	Tb II	11	h 6348.56	Th II
6	6301.52	Fe I	25	6321.75	Sm II	50	6349.48	V I
13	6301.75	Mo I	200	6321.90	Re I	120	cw 6350.04	Eu I
18	h 6301.97	Nd I	30	6321.94	Ho	80	d 6350.75	Re I
11	6302.05	Pr I	19	6322.33	Tb II	18	c 6350.98	Pr I
35	6302.35	Pr II	45	c 6322.36	Pr I	11	6351.56	Er II
18	6302.40	Sm II	14	6322.37	U II	27	h 6351.72	Gd I
29	6303.15	Sm II	13	6322.51	Sm I	27	6352.66	Tm I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum			
6	6353.48	Ce I	5	6380.05	Sm I	9	h	6403.98	Sm II		
22	6353.54	Sm II	19	h	6380.19	Hf I	35	h	6404.21	W I	
30	c	6354.35	Ho I	100	6380.75	Sr I	17	c	6405.97	Tb II	
25	h	6354.55	Cs I	40	6380.95	Gd II	40	h	6406.11	Eu I	
18	h	6354.85	Lu I	23	6382.07	Nd II	40	bl	6406.2	Th ThO	
13	6355.35	Sm I	17	6382.19	Gd II	12	h	6406.24	Sm II		
14	6355.58	V I	55	6382.73	Eu I	35	h	6407.00	Zr I		
60	6355.89	Eu I	16	h	6382.94	Re I	55	bl	6408.41	Sc ScO	
9	6355.95	Nd I	8	6383.59	U I	900	h	6408.47	Sr I		
75	6356.16	Ta I	75	6383.86	Eu I	22	h	6408.55	Gd I		
9	6356.40	Tb II	7	6384.67	Mn I	19	h	6408.63	Th II		
29	6357.18	Sm II	65	6385.20	Nd II	26	h	6409.11	Mo I		
22	c	6357.20	Pr I	4	6386.10	Ce I	19	h	6409.52	Hf I	
40	6357.22	Mo I	60	6386.23	Hf I	180	h	6410.04	Eu I		
50	6357.30	V I	5	6386.26	Ce I	10	h	6410.69	Pr I		
35	6358.13	La II	13	6386.47	W I	210	h	6410.99	La I		
7	6358.62	Th II	90	h	6386.50	Sr I	55	h	6411.23	Pr I	
25	6358.82	V I	14	h	6386.77	Sm I	140	h	6411.32	Eu I	
55	c	6359.03	Pr I	40	6386.80	Dy I	14	h	6411.47	Re I	
28	6359.28	U I	28	6386.84	Ce I	9	h	6411.59	U I		
15	b	6359.48	Y YO	11	6386.84	U II	10	h	6411.66	Fe I	
9	6359.88	Tb II	45	6388.19	Er I	30	h	6411.90	Th I		
6	6360.22	Ce I	60	h	6388.24	Sr I	10	h	6412.39	Mo I	
35	6360.22	La I	16	6389.11	Mo I	50	b	6412.39	Zr ZrO		
65	6360.84	Ta I	90	6389.45	Ta I	90	h	6413.35	Sc I		
35	6361.27	V I	11	6389.57	Pr I	22	h	6413.41	Ho I		
18	6361.43	Nd II	23	6389.77	U I	11	h	6413.59	Er I		
18	6362.09	Nd II	29	6389.85	Sm II	24	h	6413.62	Th I		
120	hl	6362.35	Zn I	18	6390.00	Nd II	40	h	6413.68	Pr II	
22	6362.87	Cr I	16	6390.23	Ru I	12	h	6414.72	Rh I		
17	6363.23	Gd I	7	6390.32	Ce I	10	h	6415.43	Pr I		
9	h	6363.41	Ru I	170	6390.48	La II	17	h	6416.10	Th II	
11	h	6363.62	Pr II	25	6390.81	Sm II	29	h	6417.50	Sm II	
25	h	6363.94	Sr I	11	6391.12	Mo I	8	h	6417.57	Ru I	
18	6365.55	Nd II	6	6391.32	U II	9	h	6417.82	Co I		
9	6365.79	Lu I	18	h	6391.99	Pr I	35	h	6417.91	Yb I	
16	6366.00	Lu I	23	6392.21	Ta I	11	h	6419.10	Ti I		
35	6366.35	Ti I	28	6392.74	U I	8	h	6421.36	Fe I		
14	6367.41	Sm I	23	6393.02	Ce II	50	h	6421.92	Dy I		
22	6368.28	Sm II	40	6393.18	Pr I	22	h	6422.42	Gd II		
14	6369.14	Th I	14	6393.28	V I	9	h	6423.05	Er I		
60	6369.25	Eu I	10	6393.60	Fe I	9	h	6423.17	Er I		
15	6369.87	Y YO	450	6394.23	La I	100	h	6424.37	Mo I		
35	h	6369.96	Sr I	11	6395.16	Ce I	13	h	6424.43	Tb II	
6	6371.01	Sm I	5	6395.20	Co I	17	h	6424.52	Gd I		
35	6371.11	Ce II	90	6395.42	U I	14	h	6424.81	Th II		
55	6372.43	U I	7	6396.22	Ce I	11	h	6424.89	U II		
30	c	6372.59	Ho I	4	6396.27	Ce I	11	h	6425.29	Ce II	
6	6372.97	U I	24	6396.60	Dy II	18	h	6425.79	Nd II		
6	6372.99	Ce I	18	6397.14	U I	12	h	6426.17	Zr I		
40	6373.06	Ta I	45	6397.96	Pr II	45	h	6426.64	Sm II		
14	h	6373.86	Ho I	14	6398.13	Er I	55	h	6428.29	Eu I	
11	6374.78	U II	9	6398.86	Os I	22	h	6428.32	Sm II		
11	6375.97	Nd I	50	6399.05	La II	65	h	6428.60	Ta I		
6	6375.98	U II	6	6399.90	Ce I	18	h	6428.65	Nd II		
9	6376.45	Ru I	3	6399.94	Ce I	10	h	6428.94	Sm I		
40	6376.93	Th I	16	6400.02	Fe I	45	h	6429.63	Pr II		
16	6377.61	Pr I	35	h	6400.35	Yb I	6	h	6429.84	Nd I	
28	6378.52	U II	8	6400.36	U II	5	h	6429.91	Co I		
75	bl	6378.56	Zr ZrO	120	cw	6400.93	Eu I	35	h	6430.07	Ce I
16	6378.59	Pr I	35	6401.07	Mo I	85	c	6430.46	Nb I		
60	6378.82	Sc I	22	6401.44	Tm I	35	c	6430.47	V I		
15	6379.07	Ta I	75	6402.01	Y I	250	c	6430.79	Ta I		
23	6379.36	V I	22	6403.15	Os I	10	h	6430.85	Fe I		
23	6379.64	U II	13	6403.20	Nd I	8	h	6430.93	U I		

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
8	6430.94	Tm II	9	6454.84	Pr II	11	6484.35	Zr I
22	6431.00	Sm II	21	6455.00	Co I	35	6484.52	Sm II
23	6431.63	V I	35	6455.60	Ca I	380	6485.37	Ta I
45	6431.84	Pr II	14	6455.60	Sm II	5	6485.38	U II
10	6431.96	Sm II	20	6455.83	Ta I	35 b	6485.40	Sc Sc O
22	6432.53	Er I	250	6455.99	La I	24 h	6485.55	La I
16	6432.65	Nd I	9	6456.18	Pr I	35	6485.69	Nd I
20	6432.73	Yb II	10	6456.25	Sm II	27	6485.87	Er I
14	6433.18	V I	13	6457.13	Nd I	45	6486.55	Pr I
50 c	6433.22	Nb I	60	6457.28	Th I	28	6486.59	Dy I
35	6434.33	Zr I	10	6457.55	Sm I	9 h	6486.97	Pr II
19	6434.39	Ce I	20	6457.63	Zr I	29	6487.62	Sm II
1000	6435.00	Y I	26 b	6457.78	Sc Sc O	11	6488.05	V I
11	6435.16	V I	120	6457.96	Eu I	9	6488.35	U I
10	6435.34	Sm I	35	6458.03	Ce I	340	6489.06	Yb I
23	6436.40	Ce I	4	6459.36	Sm I	110	6489.64	Zr I
13 h	6436.55	Dy I	30	6459.92	Ta I	6 h	6490.34	Co I
26 b	6437.08	Sc Sc O	9 h	6460.19	Pr I	14	6490.70	Tm I
24	6437.18	Y I	200	6460.26	Tm I	14	6490.74	Th I
13	6437.36	Ta I	8	6460.83	Dy I	29	6490.82	Sm II
830	6437.64	Eu II	10 c	6461.74	Tb II	17	6490.97	Ce I
260 h	6438.47	Cd I	8	6461.88	Ce I	24	6491.71	Mn I
700	6439.07	Ca I	700	6462.57	Ca I	40 h	6491.75	Pr I
18	6439.93	Eu I	50	6462.62	Th I	55	6492.35	Er I
8	6439.97	Ce I	1100	6463.12	Lu II	16	6492.35	Nd II
14	6440.54	Tm I	17 h	6463.15	Yb II	22	6493.10	Zr I
17	6440.97	Mn I	14	6463.58	Nd I	10	6493.13	Mo I
10 c	6441.03	Tb I	35	6465.00	U I	9	6493.49	Pr I
22	6441.14	Lu I	11	6465.24	Nd II	320	6493.78	Ca I
16	6441.32	Er II	25 h	6465.79	Sr I	11	6494.89	Pr I
7 h	6442.78	Pr II	19	6466.88	Ce II	6	6494.94	Ce I
9 h	6443.91	Pr II	28	6467.39	Ce I	30	6494.98	Fe I
40	6444.61	Ta I	18	6467.72	Pr II	5	6495.23	U II
26 h	6444.84	Ru I	13 h	6468.44	La I	7	6495.59	Nd II
11	6444.89	Lu II	10	6468.58	Dy II	26 b	6495.90	Sc Sc O
40	6445.12	W I	6	6468.97	Ce II	8	6496.44	Ru I
60	6445.74	Zr I	110	6470.21	Zr I	12000	6496.90	Ba II
9	6445.79	Nd II	19 h	6470.29	Gd I	22 c	6497.11	Pr I
30	6445.87	Ta I	18 h	6470.46	Sm II	17	6497.69	Ti I
19	6446.12	Ce I	5	6470.55	U II	17	6497.84	Nb I
55 bl	6446.24	Sc Sc O	12	6470.70	Eu I	40	6498.19	La II
20	6446.34	Mo I	13	6470.86	Tb II	35	6498.67	Sm II
35	6446.61	La II	20	6471.20	Mo I	1600	6498.76	Ba I
25	6446.68	Sr I	8	6471.20	Th II	18	6498.94	Pr II
24	6446.87	Tb II	10	6471.59	Sm I	80	6499.65	Ca I
7	6447.56	Sm II	80	6471.66	Ca I	16	6500.16	Nd I
5	6448.04	U II	27 c	6471.77	Ho I	22	6500.72	Pr I
21	6448.11	La I	45	6472.34	Sm II	18 h	6501.23	Y YO
9	6448.13	Os I	35	6473.72	Ce I	8 c	6501.33	Tb I
110	6449.17	U I	60 bl	6473.79	Zr Zr O	45	6501.55	Eu I
180	6449.81	Ca I	20	6473.99	Mo I	9	6502.00	Sm II
45	6450.24	Co I	11	6474.91	Dy I	18 h	6502.43	Ta I
13	6450.34	La I	9 h	6475.26	Pr II	50	6503.26	Zr I
200	6450.36	Ta I	29	6477.67	Lu I	11	6503.27	Ce II
360	6450.85	Ba I	8 h	6477.88	Co I	12	6503.51	Th II
14	6451.23	Nd I	35 cw	6478.02	Pr II	16	6503.62	U I
7	6451.56	Er I	13	6479.17	Ho I	4	6503.98	Ce I
20	6451.62	Zr I	15	6480.11	Gd II	550	6504.00	Sr I
6	6451.99	Ce I	13	6480.21	Nd II	9	6504.09	Pr I
12	6452.08	Sm I	5	6481.72	U I	4	6504.12	Ce I
70	6452.34	V I	14	6481.74	Er I	55	6504.17	V I
16 c	6453.44	Pr I	5	6482.28	Nd II	8	6504.46	Nd II
7	6454.02	Er II	600	6482.91	Ba I	65	6505.52	Ta I
90 c	6454.52	La I	18	6483.02	Eu I	10	6506.23	La I
7	6454.80	Nd I	20	6483.59	Dy II	5	6506.32	U II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum			
50	6506.36	Zr I	13	6538.11	W I	19	h	6565.62	Ti I		
11	6507.16	Ce II	40	h	6538.15	Gd I	7		6565.67	Ce I	
13	h	6507.70	Sm	11	6538.30	Os I	11		6565.88	V I	
11	6508.05	W I	90		6538.60	Y I	45		6566.77	Pr II	
19	6508.14	Ti I	11	h	6538.99	Ho I	35	b	6566.88	Sc ScO	
50	bl	6508.15	Zr	13		6539.94	Nd	75		6567.87	Eu I
7		6509.01	Ce	16		6540.47	Pr	10		6568.00	Gd II
29	hl	6509.44	Sm	22		6541.57	Er	7		6568.47	Nd II
16		6510.41	Rh	50		6542.76	Sm	140		6569.31	Sm II
7	h	6511.36	Th	30	bl	6542.90	Zr	30		6569.43	Zr I
							Zr O				
50		6511.47	Re	9		6542.98	U	10		6569.63	Th II
9		6512.19	Tb	130		6543.16	La	35	h	6570.67	Sm II
23		6513.59	Ce	28		6543.51	V	8		6570.96	La II
100		6514.39	Ta	18		6544.57	Sm	7		6571.03	Pr I
16		6514.96	Nd	65		6544.61	Nb	12	h	6572.58	Y
14		6515.25	Re	12		6544.91	Re	13		6572.65	Nd II
11		6515.30	Ho	6		6546.24	Fe	20		6572.78	Ca I
100		6516.10	Ta	55		6546.28	Ti	5		6572.88	Th II
8		6517.14	Pr	100		6546.79	Sr	9		6573.60	Ce I
19		6517.31	Ce	8		6548.26	Dy	10		6573.80	Gd I
18	h	6518.33	Y	8	h	6549.12	Eu	20		6573.93	W I
35	cw	6518.68	Tb	22		6549.25	Gd	24	c	6574.04	Tb II
16		6518.79	Pr	14		6549.54	Nd	27		6574.38	Sm II
16		6518.94	U	18	h	6549.77	Sm	15		6574.73	Nb I
6		6519.12	Ce	16	h	6549.77	Ti	100		6574.84	Ta I
60		6519.59	Eu	7		6549.88	U	14	h	6575.18	Ti I
19		6519.70	Rh	14		6550.19	Nd	8		6575.54	Tm I
14		6519.78	Tm	170		6550.26	Sr	18	b	6575.85	Sc ScO
23		6519.84	Mo	35		6550.54	Zr	20		6576.56	Zr I
13		6519.86	Nd	70		6550.97	Ho	11		6576.83	Os I
12		6520.52	Er	3		6551.44	Co	35		6576.85	Y I
21	h	6520.74	La	19		6551.70	Ce	35	c	6577.11	Re I
6		6520.85	Os	13	h	6551.80	Sm	5		6577.45	Ce I
5		6520.98	U	3		6552.75	U	19		6577.65	Th II
15		6522.72	Eu	13		6553.07	Nd	6		6578.00	Pr I
7		6523.15	Nd	7	h	6553.30	Pr	30	b	6578.06	Zr ZrO
55	c	6523.18	Lu	12	h	6553.84	Y	140		6578.51	La I
9		6523.45	Pt	6		6554.16	Th	23		6579.10	Ce I
55	b	6525.62	Sc	65		6554.23	Ti	160		6579.37	Dy I
7		6526.08	U	11	h	6554.83	Ti	18	h	6580.94	Nd II
13	h	6526.64	Sm	14		6555.01	U	35		6581.82	Tb I
110		6526.99	La	45		6555.65	Ce	10		6582.19	La I
5		6527.04	U	75		6556.07	Ti	3		6582.78	U I
700		6527.31	Ba	11		6556.33	Er	60		6583.48	Er I
17		6527.63	Tb	15	h	6556.50	Hf	24		6583.91	Th I
18	h	6528.02	Sm	70		6557.39	Y	6		6584.56	Pr II
11		6528.74	Ru	7		6557.58	U	23		6584.87	Y I
7		6528.87	Os	18		6557.82	Er	10		6585.13	Ta I
18	h	6529.70	Sm	45	b	6557.84	Sc	40	h	6585.21	Sm II
10	h	6529.73	La	20		6558.02	Dy	18		6585.71	Nd II
6		6530.68	Ce	17		6558.02	V	30	h	6586.51	Cs I
50	h	6531.34	Th	13		6558.97	Nd	15	c	6587.16	Ta I
110		6531.43	V	14		6560.06	Th	28		6587.23	Hf I
18	h	6532.25	Sm	15		6560.08	Ho	7	h	6587.54	Sm I
		6533.96	Sm	4		6560.45	Ru	7		6587.83	U II
15		6532.39	W								
7		6533.14	Os	6		6560.79	Ce	16		6588.03	Nd II
6		6534.51	Ce	25	h	6561.60	Ta	24		6588.54	Th I
8		6534.52	Pr	9		6562.50	Tb	27		6588.91	Sm I
5		6534.60	U	13		6563.20	W	110		6589.72	Sm II
22	b	6535.30	Sc	15		6563.42	Co	6		6590.05	U II
			ScO								
11		6535.46	U	7		6563.46	Ce	7		6590.90	Mo I
18	h	6535.84	Y	25	cw	6564.26	Ta	19	cw	6591.00	Nb I
			YO								
7		6536.58	U	22		6564.62	Pr	11		6591.43	Nd II
			II								
7		6537.49	Ce	55		6564.78	Gd	12		6591.48	Th I
			II								
				26		6565.44	La	12		6591.50	Sm II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
30	6591.60	Gd I	8	6614.56	Os I	10	6642.76	Gd I
50	6591.99	Zr I	4	6615.43	Os I	26	6642.79	La II
40 cw	6592.52	Re I	11	6615.88	Nd I	15	6643.37	Dy I
9	6592.92	Fe I	50	6616.59	La I	80	6643.54	Sr I
15	6593.42	Gd I	55	6616.67	Pr I	20	6643.55	Yb I
45	6593.46	La I	12	6616.74	Er II	16	6643.64	Ni I
16	6593.51	Er I	10	6617.05	Th II	13	6643.79	V I
14	6593.66	Tb I	300	6617.26	Sr I	30	6643.98	Gd I
9 h	6593.74	Pr II	11	6617.61	Sm II	35	6644.41	La I
4	6593.74	Ru I	18 bl	6617.94	Sc ScO	45	6644.60	Hf II
45	6593.79	Eu I	9	6618.20	Ru I	21	6644.66	Th II
24	6593.94	Th I	11	6618.34	Pr II	18 bl	6645.08	Sc ScO
14	6594.14	Dy II	16 c	6618.53	Nd I	1400	6645.11	Eu II
650	6595.32	Ba I	230	6619.13	Mo I	18	6645.16	La I
11	6595.48	Pr I	11	6619.15	Lu II	18	6645.41	Tb II
7	6595.90	Co I	18	6619.35	Nd I	12 h	6646.22	Sm I
10	6596.71	Zr I	24	6619.94	Th II	8	6646.54	Th II
10	6598.84	Zr I	16	6620.52	U I	10	6646.85	Gd I
35	6599.11	Ti I	15	6620.56	Zr I	19	6647.06	Hf II
7	6599.63	Ce I	75	6621.30	Ta I	14	6647.12	Pr I
35	6600.17	La I	11	6621.74	W I	5	6647.79	U I
35 d	6600.58	Ho I	16	6621.77	U II	6	6648.50	Th II
70	6601.11	Er I	14	6622.49	Y I	4	6648.96	Th II
3	6601.39	U I	7	6622.82	U II	6	6648.97	Er I
16	6601.76	Nd I	10	6623.00	Ce I	20 h	6649.02	Sm II
40	6601.83	Sm II	10	6623.54	V I	4	6649.06	Er I
1	6602.68	U I	30 c	6623.91	Re I	50	6650.38	Mo I
50	6603.27	Zr I	10	6624.57	Mo I	45	6650.57	Nd II
3	6603.34	U II	5	6624.73	Ir I	40	6650.61	Y I
18 h	6603.55	Eu I	50	6624.85	V I	70	6650.81	La I
6	6603.98	U I	6	6625.28	Sm II	13	6650.89	Ce I
95	6604.56	Sm II	7	6625.29	U I	4	6651.43	Ce I
60	6604.60	Sc II	19	6626.98	Nb I	18 bl	6651.46	Ti TiO
260	6604.94	Ho I	8	6627.25	Tm I	3	6651.51	Ce I
95	6604.96	Tm I	9	6627.80	Rh I	20	6651.61	Sm II
100 cw	6605.19	Re I	13	6628.35	Ho I	27 cw	6652.39	Re I
7	6605.35	Ce I	9	6628.43	Gd I	22	6652.72	Ce II
24	6605.42	Th II	4	6628.65	U I	9 h	6652.98	Ho I
50	6605.97	V I	20	6628.88	Sm II	10	6653.55	Gd I
19	6606.16	Nb I	30	6628.93	Ce I	7	6654.23	Dy II
15	6606.35	Ce I	120	6628.99	Ho I	22 bl	6654.42	Sc ScO
15	6606.86	Ce II	45	6630.14	Nd I	30	6655.67	Nd I
11	6607.13	W I	19	6630.16	Rh I	27	6656.19	Sm II
30	6607.17	Tb II	14	6630.61	Sm II	5	6656.81	U I
19	6607.28	Nb I	7 h	6631.00	Pr I	75	6656.83	Pr II
55	6607.47	Ho I	10	6631.21	La I	35	6657.72	Tm I
15	6607.83	V I	13 h	6632.06	Pr I	22	6658.36	Dy I
45	6608.26	La I	15	6632.24	Ho I	11	6658.64	Tm I
11	6609.05	W I	40 h	6632.28	Sm II	6 h	6658.68	Th I
15	6609.86	Pr I	15	6632.44	Co I	11	6659.40	Hf I
26 bl	6609.99	Sc ScO	13	6633.26	V I	13	6659.68	Mo I
10	6610.04	Gd II	50	6634.36	Gd II	210 cw	6660.84	Nb I
15 h	6611.20	Mo I	9	6636.15	Nd II	26 bl	6661.01	Sc ScO
35 cw	6611.28	Lu II	19 h	6636.49	Y I	19	6661.08	Cr I
	6611.58	Lu II	10	6636.53	La II	80	6661.40	La I
	6611.80	Lu II						
	6611.95	Lu II	5	6637.16	Mo I	10	6661.41	Ce I
			18	6637.19	Nd II	29	6661.64	Dy I
17	6611.62	W I	10 c	6637.25	Re I	7	6661.81	Os I
6 h	6611.73	Dy II	14	6637.65	Er I	15 cw	6662.24	Ta I
110	6611.95	Ta I	35	6637.96	Nd II	30	6662.27	Th I
18	6611.99	Nd I	7	6639.21	Dy I	15	6662.52	Ho I
	6612.04	Lu II	35	6640.08	Gd I	21	6663.14	Ru I
22	6612.06	Ce I	16	6640.14	Tb II	11	6663.52	Er I
95	6613.75	Y II	3	6640.50	U II	21	6664.40	Y I
35	6614.15	Nb I	8 c	6642.27	Tb II	13	6665.59	Ce I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
6	6665.94	Tb I	10	6692.86	Gd I	6	6716.00	Hf I
18 h	6666.55	Ti I	40	6692.87	La I	26	6716.68	Ti I
17 h	6667.22	Sm II	11	6692.93	Tm I	8	6717.45	U II
22 h	6667.74	Ti I	15	6693.08	W I	40 h	6717.68	Ca I
180	6667.82	Yb I	18	6693.38	Tb II	27	6717.88	Zr I
75	6667.86	Dy I	70	6693.55	Sm II	14	6718.14	Gd II
9	6668.39	Ti I	15	6693.61	Ta I	15	6718.30	Ru I
11	6669.26	Cr I	8	6693.66	V I	7	6718.68	La II
10	6669.65	Nd II	320	6693.84	Ba I	8	6719.20	Th I
9	6670.16	Dy I	95	6693.96	Eu I	9	6720.28	Ce II
10	6670.37	Nd I	55 cw	6694.32	Ho I	5	6720.76	U II
3	6671.21	U II	11 h	6694.69	Sm II	11	6721.00	Er I
35 c	6671.40	La II	7	6694.75	Y I	30	6721.36	Tm I
50	6671.51	Sm I	6	6694.92	Gd II	27	6721.91	Er I
55	6673.41	Pr II	6	6698.65	Nd II	15 cw	6722.34	Ho I
100	6673.73	Ta I	8	6699.25	La I	13	6722.76	Er I
75	6673.78	Pr II	4 h	6699.25	Pr I	40 d	6723.07	Sm I
320	6675.27	Ba I	16 h	6699.26	Y I		6723.26	Sm I
180	6675.53	Ta I	9	6699.85	La I	200 hs	6723.29	Cs I
10	6675.54	Ce II	18 b	6700.48	Sc ScO	15 h	6723.61	Ta I
9	6676.92	U II	10	6700.64	Dy II	130 c	6723.62	Nb I
23 c	6677.14	Lu I	26	6700.66	Ce I	16 bl	6723.95	Ti Ti O
18	6677.18	Ti I	70	6700.71	Y I	6 h	6724.70	Dy I
150 cw	6677.33	Nb I	3	6700.83	U I	27	6724.73	Sm I
90	6677.94	Tb II	7 h	6701.06	Eu I	20	6725.88	Sm I
18	6677.99	Fe I	65	6701.20	Nb I	9	6726.34	Tm I
11	6678.01	Zr II	4	6701.68	U II	3	6726.54	Ce I
15	6678.17	Yb I	7	6701.75	Er I	5	6726.89	U II
13	6678.42	W I	9	6702.12	Gd II	7	6727.21	Tb I
11	6678.52	Nd II	11	6702.12	Zr I	16	6727.46	Th I
4	6678.71	Th I	40 cw	6702.61	Tb I	25	6727.61	Yb II
3	6678.81	Co I	14	6703.61	Sm I	19	6727.74	Nd II
4 h	6678.89	Mo I	8	6704.05	Th II	17	6727.83	Gd II
70	6679.21	Sm II	10	6704.18	Gd II	9	6727.94	Tm II
10	6679.56	Gd II	35	6704.27	Ce I	3	6727.96	U I
7	6679.80	Ce I	13	6704.52	Ce II	9	6728.04	Mo I
7	6679.88	Ce I	18 b	6705.93	Sc ScO	15	6728.71	Ce I
19	6680.14	Nd II	10	6706.04	Ce II	27	6729.56	Os I
19 c	6680.46	Ho I	15	6706.46	Ta I	15	6729.57	Ce I
3	6681.15	U II	20 c	6706.79	Tb II	15	6730.45	Ru I
35	6681.23	Gd II	20 h	6707.45	Sm II	85	6730.73	Gd I
17 h	6681.53	Sm II	11	6707.52	Ru I	120 d	6731.84	Sm II
24 c	6681.62	Ho I	5	6707.59	U II	7	6732.78	La II
15 h	6682.02	Ho I	36000	6707.84	Li I	4	6733.21	Ce II
15 h	6683.28	Re I	8	6708.07	V I	8	6733.75	Th I
12	6683.38	U I	25	6709.39	Ta I	110	6733.98	Mo I
30	6684.00	Ta I	180	6709.50	La I	70 d	6734.06	Sm II
26	6685.21	Eu I	17	6709.61	Zr I	40 d	6734.81	Sm II
10	6686.08	Ir I	3	6710.09	Ce I	7 c	6734.86	Tb II
15	6686.60	Ce I	10	6710.42	Pt I	9 h	6735.76	Lu I
13	6687.14	Er I	12 h	6710.45	Eu I	40	6735.99	Y I
5 h	6687.51	Pr II	5	6710.57	U II	6 h	6736.07	Dy I
150	6687.58	Y I	9 c	6711.30	Re I	13	6736.79	Pr I
17 h	6687.79	Sm II	10	6712.27	Nd I	9	6736.80	U I
5	6687.87	Mo I	14	6712.62	Sm II	25	6737.79	Nd II
22	6688.18	Zr I	7 h	6713.05	Dy I	65	6737.87	Sc I
8	6689.51	Tb II	35	6713.20	Y I	18	6739.22	Tm I
55	6690.00	Ru I	7	6713.47	Ce I	35	6739.40	Sc I
7	6690.02	Er II	30	6713.48	Hf I	75	6739.88	Nb I
18	6690.47	Mo I	6 h	6713.69	Tl I	40	6740.11	Nd II
4	6691.08	Mo I	8	6713.97	Th I	75 c	6740.73	Ta I
22 b	6691.21	Ti Ti O	19	6714.09	La II	55	6741.47	Sm II
3	6691.21	U I	6	6714.15	Nd II	3	6742.47	U II
14 h	6691.83	Y I	10	6714.44	Ta I	25	6742.54	Nd I
8	6692.72	Th II	12 c	6714.98	Tb II	6	6742.88	Th I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
80	6743.12	Ti I	25	6768.70	Yb I	40	6788.99	Ta I
7 h	6743.68	Dy I	18	6768.94	Er II	85	6789.27	Hf I
15	6744.70	Ce II	85	6769.16	Zr I	60	6790.00	Sm II
30	6744.88	Eu I	14	6769.81	Tb II	13	6790.06	Ta I
40	6745.05	Ho I	11	6769.95	Hf I	7	6790.30	Dy I
22	6745.52	Ti I	10	6770.10	Th II	13	6790.30	U I
21	6746.08	Mo I	4	6770.15	Ce I	30	6790.37	Nd II
50	6746.27	Mo I	13	6770.37	Ta I	35	6790.85	Zr I
5	6746.56	W I	4	6771.03	U II	35	6790.92	Er I
10	6746.90	Ce I	11	6771.06	Co I	180	6791.05	Sr I
35 c	6747.09	Pr I	75	6771.74	Ta I	6	6791.23	Th I
29	6747.93	Dy I	16 h	6771.85	Ba I	18	6791.53	Os I
35	6748.13	La I	9	6772.03	Gd I	13	6792.48	Tb II
19 c	6749.19	Pr I	8	6772.18	Th I	14	6792.55	Sm II
4	6749.38	Ce I	9	6772.32	Ni I	13	6793.7	Ho I
7	6749.49	Ce I	27	6772.89	Zr I	190	6793.71	Y I
7 h	6750.21	Dy I	27	6773.37	Er I	30 c	6793.77	Lu I
30	6751.22	Re I	40 cw	6774.25	Ta I	6	6793.84	Ce I
40	6752.35	Rh I	120	6774.26	La II	95	6794.20	Sm II
50	6752.67	Gd II	30	6774.28	Ce II	8	6794.23	Dy I
40	6752.73	Zr I	23	6774.54	Pd I	130	6794.58	Tb II
65 c	6753.00	V I	28 c	6774.68	Ho I	25	6795.31	Nb I
60	6753.04	La I	30	6775.02	Ru I	70 h	6795.41	Y II
14	6753.91	Gd II	35	6775.59	Ce I	3	6796.43	U II
35	6753.97	Mo I	16	6776.14	Er II	9	6796.65	Rh I
7	6754.29	Tb I	5	6776.89	U II	8	6796.68	Zr I
17	6754.61	Hf II	9	6777.93	Tm I	7	6796.73	La I
17 h	6754.68	Sm II	20	6778.19	Sm II	14	6796.96	Er II
40	6754.85	Sm I	10	6778.28	Ce I	55 cw	6798.60	Pr I
40	6754.91	Ta I	6	6778.31	Th I	13	6799.27	Ta I
4	6754.93	U I	40 h	6778.61	Sm II	690	6799.60	Yb I
14	6755.01	Tb II	110	6779.77	Tm I	10 h	6799.88	Mo I
4	6755.08	Ce II	14	6780.03	Er I	11	6801.34	Nd I
13 c	6755.85	Ta I	14 h	6780.03	Sm II	5	6801.72	Ce I
20	6756.45	Th I	7	6780.13	Th I	10	6802.62	Mo I
7	6756.54	Ru I	9	6780.21	Ce II	140	6802.72	Eu I
10	6757.62	Dy I	11	6780.42	Th I	20 h	6802.96	Sm I
17	6759.25	Sm I	3	6780.62	U I		6803.1	Sm I
70	6759.87	Er I	9	6780.71	Ce I	16	6803.06	Nd I
20	6760.02	Pt I	18	6780.76	Er I	12 h	6803.15	Y I
10	6760.12	V I	17 h	6781.17	Sm II	8 h	6803.20	Dy I
5 c	6761.19	Re I	14 h	6782.00	Tm I	5	6803.28	Ce I
12	6761.68	Er II	30 h	6782.54	Eu I	18	6803.85	Er II
75	6762.38	Zr I	3	6782.70	U I	30	6804.00	Nd II
22	6762.92	Er I	3	6782.85	U I	6	6804.73	Th II
10	6763.01	Nd I	20	6782.95	Sm II	7	6805.31	W I
13	6763.50	Mo I	14	6783.39	Gd I	8	6805.54	Dy I
9	6763.78	Nd I	65	6784.52	Pd I	14	6806.61	Os I
6	6764.45	Ce I	40	6784.98	V I	9	6807.31	Dy II
5	6764.45	W I	7 c	6784.99	Pr II	10	6807.50	Sm I
11	6764.55	Er I	30	6785.12	Tb II	18	6807.81	Ce I
9	6764.61	Nd II	55 c	6785.43	Ho I	20 h	6808.31	Sm I
4	6764.92	Mo I	15	6786.32	V I	3	6808.76	U II
6	6765.68	Th I	26	6786.33	Gd II	10	6808.82	Ce I
45	6765.89	Dy I	15	6787.15	Zr II	29 h	6808.86	La II
50 c	6766.49	V I	10	6787.18	Gd I	40 c	6810.46	Ta I
14	6766.52	Sm II	13	6787.23	Ru I	8	6810.54	Th II
11	6766.62	Er I	6	6787.37	Dy I	13 cw	6811.04	Ho I
13	6766.74	Ho I	14 h	6787.48	Eu I	6 h	6811.62	Ce I
21	6766.95	Ru I	6	6787.73	Th I	11	6811.76	Pr II
9 h	6767.48	Tm I	8	6787.92	Er I	10	6812.03	Mo I
6	6767.68	Ce I	8	6787.98	Mo I	13 h	6812.30	Nd II
22	6767.77	Ni I	18	6788.52	Tm I	26	6812.40	V I
9	6768.42	Er II	6	6788.84	Th I	6	6812.76	Th II
3	6768.64	U I	8	6788.94	Mo I	17 cw	6812.87	Pr II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
1	6812.98	U I	260	6829.90	Re I	9	6849.89	Gd I
160 c	6813.25	Ta I	9	6829.94	V I	13	6850.07	Hf I
180 c	6813.41	Re I	5	6830.01	Ir I	17 c	6850.46	Pr II
8	6813.48	Sm II	19	6830.50	Pr II	15	6850.83	Ta I
8	6813.51	Ru I	17	6830.54	Sm I	4 h	6851.99	Dy I
14	6813.66	La II	23	6831.09	Tm I	11	6852.23	Nd I
3 d	6813.75	U I	7	6831.52	Ru I	13	6852.56	Zr I
	6813.81	U I	13	6832.00	Ta I	11	6852.77	Pr I
13	6814.04	Pr II	15	6832.44	V I	80	6852.96	Dy I
12	6814.56	Gd I	14	6832.49	Y II	8 h	6852.97	Ho
9	6814.92	W I	4	6832.71	U I	10 h	6853.54	Sm I
14	6814.94	Co I	45	6832.89	Zr I	9	6853.59	Ce I
21	6815.16	Y I	4 h	6833.42	Pd I	4	6853.74	W I
9	6815.29	Ce I	7	6833.67	Zr I	7	6854.11	Th I
13	6816.02	Nd II	35	6834.05	La II	18	6854.12	Tm I
35	6816.06	Eu I	6	6834.24	Ce II	14 h	6854.50	Sm II
26	6816.49	Gd I	11 h	6834.30	Eu I	9	6854.63	Zr I
35	6817.08	Sc I	14	6834.92	Th I	75	6856.03	Sm II
9	6817.61	Pr I	50	6835.03	Sc I	22	6856.46	Dy I
12	6818.20	Dy I	180	6835.42	Dy I	12	6856.55	Ce I
15	6818.23	Ce I	12	6835.90	Er I	10	6857.00	Nd I
7	6818.29	U I	12 h	6837.20	Sm I	30	6857.13	Gd II
160	6818.94	Hf I	23	6837.90	La II	9	6857.24	Er I
20	6819.36	Ta I	17	6838.33	Sm I	11	6857.68	Rh I
50	6819.52	Sc I	40	6838.88	Mo I	4	6857.90	Zr I
13 h	6820.27	Tm I	12	6839.58	V I	10 h	6858.12	Sm I
9	6820.27	W I	10 h	6839.64	Sm II	14	6858.24	Y II
15 cw	6820.38	Ho I	2	6839.92	Ce I	35	6858.70	Hf I
23	6820.76	U I	3	6839.97	Ce I	8 h	6859.03	La II
17	6820.90	Gd I	17	6840.93	Eu I	18	6860.39	Ti
14 h	6820.91	Sm I	20 h	6841.75	Sm I	120	6860.93	Sm I
24	6821.64	Ho I	12	6841.90	V I		6861.10	Sm II
45	6823.78	La I	60	6842.60	Pt I	35	6861.47	Ti I
15	6823.88	Ru I	16	6842.66	Nd II	40	6862.82	Sm II
21	6824.17	Ru I	4 h	6843.75	Dy I	15	6864.25	Gd I
8	6824.45	U I	4	6844.26	Ce I	360	6864.54	Eu I
8	6824.68	Th I	120	6844.26	Tm I	55	6865.13	Er I
18 c	6824.96	Ta I	9	6844.39	Pr I	15	6865.13	Ta I
9	6825.35	Nd I	4	6844.48	Ce II	60	6865.69	Ba I
22	6825.44	Er I	18	6844.64	Ti	17 cw	6865.85	Ho I
13	6825.63	Mo I	55	6844.71	Sm II	210	6866.23	Ta I
17 c	6825.72	Ho I	17 h	6844.83	Eu I	8	6867.11	Sm I
22	6825.98	Er I	45	6845.24	Y I	12 h	6867.85	Ba I
7	6826.44	Ce I	13	6845.33	Zr I	6	6868.46	Th I
15	6826.56	Hf I	9 h	6845.47	Pr II	16 h	6869.07	U I
11	6826.59	Lu II	7	6845.76	Dy I	11 c	6870.44	Pr I
8 h	6826.62	Ho I	80	6845.76	Tm I	10 c	6870.88	V I
90	6826.93	U I	7	6846.25	U I	19	6870.92	Nb I
14	6826.95	Tm I	17	6846.34	Zr I	8	6871.56	V I
9	6827.07	Dy I	27 d	6846.54	Sm II	14	6872.40	Co I
13	6827.33	Rh I	9	6846.59	Pr II	27 h	6872.43	Sm II
35 cw	6827.60	Pr II	35	6846.60	Gd II	10	6873.05	Nd II
85	6828.11	Nb I	25	6846.72	Nd II	11	6873.09	Er I
100	6828.25	Gd I	7	6846.78	Ce II	18	6873.66	Er I
4	6828.35	Dy II	11	6846.94	Nd II	9	6873.92	Ti I
8	6828.43	W I	100	6846.97	Zr I	40	6874.18	Tb II
45	6828.78	Zr I	14 h	6847.04	Eu I	14	6874.66	Nd II
18 d	6828.87	Mo I	13	6847.25	Ce I	8	6874.75	Th I
11	6829.04	Th I	8 h	6847.44	In I	16	6874.77	Er I
	6829.05	Mo I	70	6848.10	Er I	10 h	6875.27	Sm II
14	6829.12	Tm II	14	6848.16	Sm II	180	6875.27	Ta I
7	6829.38	Ce II		6848.31	Sm I	8	6876.00	Nd II
29	6829.54	Sc I	16	6848.92	Mo I	4	6876.01	W I
10	6829.73	Ce II	27	6849.26	Zr I	40	6876.36	Nb I
27	6829.86	Sm II	25 c	6849.35	Nb I	35	6876.75	U II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
12 h	6877.10	Sm II	5	6902.55	U I	5	6929.88	Ir I
40	6877.49	Ta I	25 c	6902.89	Nb I	16	6930.41	Sm II
480	6878.38	Sr I	60 h	6903.67	Eu I	9	6931.40	Mo I
5	6878.70	Os I	15 h	6903.80	Ho I	7	6932.16	Nd I
14	6879.50	Sm I	20	6904.36	Zr I	16	6932.38	Zr I
20	6879.94	Rh I	10	6904.51	Sm II	7	6932.45	Dy II
27	6879.98	Er I	6	6904.58	Ce I	14 h	6933.15	Ti I
5 h	6881.62	Cr I	10	6906.03	Nd I	14	6933.52	Y I
10 h	6882.38	Cr I	17	6906.22	Sm I	18	6934.05	Yb II
21 h	6883.03	Cr I	22	6906.53	Dy II	13	6934.10	Mo I
6	6883.23	Zr I	29	6907.37	Zr I	9	6934.23	W I
9	6883.36	Ho I	35	6908.07	Nb I	45	6935.01	La I
11	6884.09	Er I	13	6908.20	Mo I	9	6936.44	Nd II
7	6884.66	Pr I	9	6908.23	Er I	10	6937.37	Tm I
27 h	6885.16	Sm II	9	6908.26	Y I	3	6937.81	Co I
3	6885.49	Ce I	5	6908.29	W I	18	6938.36	Er I
2	6885.71	Ce I	4	6909.35	Ce I	12	6938.67	Nd II
21	6886.28	Mo I	14	6909.81	Sm II	50 hl	6938.77	K I
4 h	6886.40	Dy I	15	6909.84	Th II	8 h	6939.33	Ta I
10	6886.78	Nd I	14 h	6910.17	Eu I	10	6939.45	Ce I
29	6887.22	Y I	25 hl	6911.08	K I	40 cw	6939.49	Ho I
17 h	6887.42	Sm II	24	6911.23	Th I	4	6939.65	Dy I
21	6887.63	Gd II	45	6911.40	Hf I	17	6940.14	Nd II
8	6887.74	U I	26	6911.48	Ru I	24	6941.39	Nd II
120	6888.29	Zr I	7	6912.20	Dy II	16	6941.56	Sm II
13	6888.50	Ho I	12	6913.19	Ti I	6	6942.11	Dy I
22	6888.83	Dy I	15 cw	6913.47	Ho I	14 h	6942.52	Mn I
20	6889.30	Th II	35	6914.01	Mo I	35	6943.61	Th I
16	6892.36	Mo I	10	6914.56	Ni I	14 h	6943.70	Ti I
7	6892.39	Er I	30 h	6914.82	Eu I	8	6943.96	Lu II
120	6892.59	Sr I	5	6915.31	U I	6	6944.94	Er II
8	6892.71	Pr I	6	6915.86	Tm I	4	6945.21	Fe I
15 c	6892.96	Ho I	100	6916.57	Gd I	4 h	6945.26	Dy I
10	6893.66	Ce I	13	6916.69	Tb I	17	6945.98	Gd II
7	6894.00	V I	9	6916.70	Ho I	17	6946.07	Nb I
11 bl	6894.4	Th ThO	20	6916.87	Zr I	5	6946.75	Mo I
4	6894.51	Dy I	11	6917.05	U I	20 c	6946.87	Ta I
7	6894.56	Ce I	21	6917.24	La I	10	6947.39	Mo I
4	6895.51	Dy I	45	6917.31	Lu I	29	6948.46	Zr I
21	6896.00	Y II	12	6918.30	La I	11	6948.58	U II
55	6896.37	Tb II	40	6918.32	Nb I	12	6949.23	Sm II
14	6896.65	Nd I	13 d	6918.78	Sm I	5	6949.54	Tm I
15	6896.77	Ta I	9	6919.03	Sm I	29	6950.28	Dy II
13	6897.29	Nd II	21	6919.27	Ce II	24 h	6950.31	Y I
14	6897.48	Er II	6	6920.62	Gd II	45 cw	6950.39	Ho I
17	6897.95	Ho I	13 h	6922.23	Zr I	30	6950.51	Sm II
15	6897.97	Dy II	110	6923.09	Tb II	65	6951.26	Ta I
10	6898.01	Mo I	17	6923.23	Ru I	11	6951.42	Dy I
21	6898.21	Eu I	27 h	6923.86	Nd I	10	6951.68	Y II
10	6898.45	Ce II	30	6924.13	Cr I	18	6951.88	Er I
6	6898.56	Tm I	15	6924.81	Ce I	8 h	6952.51	La II
10	6898.98	Mo I	17 h	6924.99	Gd II	6	6952.93	Dy II
9	6899.06	Ce I	70	6925.20	Cr I	6	6952.96	Th II
65	6899.32	Dy II	7	6925.24	La I	8	6953.78	Mo I
45 h	6899.95	Tb I	12	6925.49	Dy I	150	6953.84	Zr I
4 h	6900.13	In I	12	6925.93	Er I	45	6953.88	Ta I
10	6900.28	Sm II	10	6926.19	Hf I	21 h	6954.52	La II
40	6900.43	Nd II	6	6926.25	Er I	120	6955.29	Sm II
40	6900.55	Ta I	21	6926.49	Gd I	13 hl	6955.3	Ho I
29	6900.59	Zr I	12	6926.87	Nd II	11	6956.02	Os I
14	6900.73	Gd II	16	6927.03	Sm II	4	6957.63	Dy I
11	6901.42	Nd II	140	6927.38	Ta I	15	6957.74	Gd II
4	6901.58	Os I	140	6928.54	Ta I	10	6958.04	Y I
40	6901.98	Tb I	15	6929.55	Dy I	40	6958.08	Dy I
150	6902.10	Ta I	12	6929.60	Sm II	35	6958.10	La II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
9	6958.97	Sm II	7	6989.30	Er I	7	7018.43	Mo I
15	6959.24	Gd II	11	6989.60	Tb II	10	7018.56	Th I
10	6960.64	Mo I	55	6989.66	Th I	4	7018.72	Ce I
8	6961.48	Mo I	12	6989.96	Mn I	4	7018.79	Ce I
5	b 6963.12	Sc ScO	85	6990.32	Nb I	8	7018.85	Nd II
8	6964.12	W I	5	bI 6990.68	Sc ScO	7	7019.25	Hf I
14	6964.33	Gd I	150	6990.84	Zr I	90	7020.44	Sm II
5	6964.50	Nd I	13	6991.30	Dy I	14	7020.71	U II
8	6964.71	Nd I	9	6991.69	Mo I	17	7020.92	Nd II
65	6965.67	Rh I	75	6991.92	Gd I	5	7021.28	Th I
180	6966.13	Ta I	24	6993.03	Th II	40	7021.51	Pr II
60	6966.44	Zr I	21	6993.18	Gd I	21	7023.48	Nb I
16	6968.65	Sm II	8	6993.27	W I	75	7023.67	La I
8	6969.49	Ta I	13	6993.40	Sm II	65	cw 7024.15	Re I
8	h 6970.38	Pr	4	6994.06	W I	10	7024.53	Pr I
2	6970.40	Ce I	80	6994.32	Zr I	17	7024.58	Nd II
6	6970.43	Dy I	9	6994.38	Ho	50	7025.03	Ta I
2	6970.53	Ce I	9	h 6995.19	Nd I	7	7025.32	Mo I
8	c 6971.31	Ta I	110	d 6995.22	Ta I	5	bI 7025.72	Sc ScO
85	6971.53	Re I		6995.49	Ta I	21	7026.07	V I
9	6971.53	Ta I	17	c 6996.11	Nb I	100	7027.40	Zr I
15	6971.66	Gd II	23	6996.63	Ti I	4	7027.81	Co I
17	6972.49	Nb I	60	6996.76	Gd II	26	7027.98	Ru I
8	6972.91	Rh I	13	b 6996.89	La LaO	3	7028.68	W I
9	6973.01	Er I	45	6998.10	Dy I	6	h 7029.40	Tm I
200	hs 6973.30	Cs I	12	6999.13	Mo I	7	7030.33	Hf II
19	6973.50	Ce II	8	6999.88	Mo I	5	7030.69	U I
12	6974.50	V I	20	6999.88	Yb II	6	7031.00	Ce I
10	6975.91	Zr I	9	6999.89	Ce I	6	7031.05	Ce I
12	6976.35	Gd II	9	6999.93	Ce I	23	7031.24	Lu I
5	h 6976.69	Tm II	20	7000.21	Ta I	13	7031.51	Ta I
19	6976.7	Ho II	14	h 7000.71	Ho	26	7032.05	La I
10	6976.86	La I	17	7000.75	Gd II	10	7033.21	Nd
10	6978.27	Gd II	18	7000.81	Th I	11	7033.84	U I
30	h 6978.48	Cr I	22	7001.40	Er I	12	7034.34	Tm I
16	6978.71	Mo I	16	7001.58	Rh I	7	7035.13	Hf I
3	6978.86	Fe I	16	7001.60	Mo I	19	h 7035.18	Y I
16	6979.15	Rh I	15	7004.66	Ti I	8	b 7035.77	Sc ScO
19	6979.59	Hf I	40	7005.07	Ta I	14	h 7035.86	Ti I
11	h 6979.82	Cr I	10	7005.46	Zr I	7	7036.28	Th I
24	6979.88	Y I	9	7005.99	Tb II	3	h 7036.37	Dy I
8	c 6980.12	Pr I	45	7006.16	Gd II	13	7036.73	Sm II
8	6980.37	Mo I	35	cw 7006.63	Re I	21	7037.26	Gd II
26	h 6980.86	Gd I	75	7006.96	Ta I	35	7037.30	Nd II
21	6980.91	Hf II	14	7008.35	Ti I	7	7037.53	Dy I
26	6982.01	Ru I	13	h 7008.97	Y I	22	7037.98	Mo I
13	h 6982.44	Dy I	10	7009.93	Y I	17	7038.04	Nb I
9	6982.65	Nd I	5	7010.79	Tm I	11	7038.76	Rh I
35	6983.49	Cs I	17	h 7010.80	Nd II	40	7038.80	Ti I
23	6983.52	Ta I	14	7010.94	Ti I	40	7039.07	Ta I
8	h 6983.53	Gd I	13	b 7011.22	La LaO	90	7039.22	Sm II
10	6983.82	Ce II	6	7013.35	Ce I	120	7040.20	Eu I
13	6984.16	Sm II	6	h 7014.31	Tm II	26	b 7040.84	La LaO
13	6984.27	W I	3	h 7014.64	Dy II	90	7042.24	Sm II
7	6984.67	Mo I	6	7014.81	Ce I	13	7042.40	Pr I
6	6984.95	Os I	5	7015.70	U I	10	7043.78	Yb II
10	6985.11	Ho	9	7016.44	Mo I	8	7044.45	Pr II
7	h 6985.25	Nd I	11	7016.44	Pd I	7	7045.02	Gd II
50	6985.89	Gd II	10	7016.60	Gd I	9	h 7045.29	Mo I
30	6986.02	Ce I	11	7016.61	Co I	30	7045.80	Th II
25	6986.09	Nb I	7	7017.24	Ce I	110	7045.96	La I
5	6987.72	U II	20	7017.42	Dy I	190	c 7046.81	Nb I
13	6988.36	Sm I	7	7017.73	Gd II	13	7049.15	Sm II
10	6988.75	Gd II	8	7017.88	W I	6	7049.61	Ce I
26	6988.94	Mo I	10	7017.90	Tm I	6	7049.73	Ce I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
14	7050.65	Ti I	13	7076.38	La I	280	7102.91	Zr I
14	7051.00	Gd II	330	7077.10	Eu II	170	7103.72	Zr I
7	7051.07	Pr I	10	7079.07	Ho I	15	7104.45	Rh I
90	7051.52	Sm II	6	7079.78	Tm II	30	7104.54	Sm I
7	7052.14	Nd II	10	7079.99	Pr I	11	7105.04	Ce II
7	7052.79	Gd I	13	7081.22	Mo I	10	7106.14	Tm I
21	7052.89	Co I	15	h 7081.30	Ta I	19	7106.23	Sm I
29	7052.94	Y I	11	7082.11	U II	100	7106.48	Eu I
15	7053.61	Th II	90	7082.37	Sm II	8	7108.05	Ta I
5	7054.04	Co I	17	7082.85	Tb II	17	7109.26	Dy II
13	h 7054.28	Y I	8	7082.93	Nd II	8	7109.67	Er I
12	7054.51	Ce I	30	7084.16	Th I	110	7109.87	Mo I
40	bl 7054.51	Ti Ti O	5	7084.18	Gd I	5	7110.90	Ni I
13	7054.62	Gd II	45	7084.99	Co I	4	h 7111.18	W I
7	7054.74	Nd II	21	bl 7085.40	La La O	140	7111.68	Zr I
13	b 7054.80	La La O	20	7085.40	Ta I	11	7112.69	Tb I
16	7054.97	Sm II	7	7085.52	Gd II	40	7112.82	Zr I
35	7055.95	Dy II	40	d 7085.52	Sm II	7	7113.17	Ce I
10	7056.43	Tm II	9	7086.06	Ru I	18	7113.52	Zr I
25	7057.36	Zr I	35	7086.35	Ce II	4	7113.56	Co I
14	7057.96	Zr I	140	7087.30	Zr I	20	7113.73	Pt I
10	7058.02	Gd II	12	7087.35	Ru I	20	7114.55	Pr I
12	7058.55	Er I	45	bl 7087.89	Ti Ti O	11	7115.08	Ce II
11	7058.68	Ce II	26	7088.30	Sm I	26	7115.96	Sm I
1400	7059.94	Ba I	11	7089.22	Tb II	10	h 7116.77	Gd II
11	7060.00	Ce I	24	7089.33	Th II	10	h 7116.8	La II
22	7060.21	Mo I	25	7089.43	Zr I	10	h 7116.90	Pr I
6	7060.65	Th I	12	h 7089.71	Nd II	23	7117.51	Sm II
15	7060.67	Os I	16	7091.16	Sm I	15	c 7117.52	Ta I
5	7060.97	Tm I	11	h 7092.08	V I	11	7118.24	Pr II
7	7061.47	Nd II	12	h 7092.09	Nd II	21	h 7118.86	Gd II
35	7061.75	Ce II	12	h 7092.74	Nd II	19	7119.31	Nb I
11	7061.90	Hf I	12	h 7092.94	Nd II	55	7119.52	Hf I
9	h 7062.30	Dy I	23	7093.02	Ta I	26	h 7119.81	Sm II
15	7062.87	Hf I	5	7093.90	Gd I	190	7120.33	Ba I
13	7063.34	Mo I	17	h 7093.98	Nd I	11	7120.81	Dy II
7	7063.69	V I	5	b 7094.38	Sc Sc O	7	7120.86	Ce II
160	7063.83	Hf I	11	h 7094.40	Hf I	9	7121.23	Dy I
6	7064.45	Th I	35	7094.46	Zr I	20	7121.27	Ta I
11	7064.49	Ce I	11	c 7095.18	Pr I	26	7122.20	Ni I
12	h 7065.04	Er I	20	h 7095.42	Nd I	12	7122.40	Sm II
160	7066.23	La II	30	7095.50	Sm I	35	7122.57	Gd I
8	7066.41	Nb I	50	7095.59	Zr I	8	7122.65	Mo I
40	7066.89	Nd II	16	7096.33	Sm I	15	7122.95	Nb I
10	7068.09	Gd II	14	c 7096.34	Lu I	6	7123.44	Ce I
65	7068.37	La I	540	7097.70	Zr I	11	7124.56	Th I
23	7069.11	Ti I	14	7098.11	Gd I	10	7124.73	Ce I
14	7069.84	Mn I	3	7098.22	W I	30	b 7124.9	Ti Ti O
7	7069.93	Gd II	12	7098.58	Ho I	23	h 7125.11	Sm II
550	7070.10	Sr I	14	7098.73	Gd I	40	bl 7125.61	Ti Ti O
21	bl 7070.79	La La O	40	c 7098.94	Nb I	40	7125.72	Ta I
11	7070.99	Er II	6	7099.44	Gd I	45	7125.84	Lu II
18	7071.00	Gd I	10	7100.51	Th II	35	7126.17	Nb I
23	7072.05	Ti I	3	h 7100.54	Dy II	11	7127.92	Y I
5	b 7072.37	Sc Sc O	15	7100.54	Hf I	30	7128.89	U I
6	7072.39	Th I	7	7100.71	Gd I	29	7129.35	Nd II
5	7073.61	U II	26	bl 7101.02	La La O	5	h 7130.05	U I
18	7073.63	Gd I	18	7101.27	Er I	17	7130.06	Nb I
12	7074.54	Eu I	27	7101.61	U I	4	7130.29	Th I
19	7074.67	Sm I	18	7101.64	Rh I	6	7130.94	Fe I
23	7074.78	U I	5	7101.66	Dy II	5	7131.35	Th I
9	7075.13	Y I	4	7101.73	Gd II	19	bl 7131.58	La La O
24	7075.14	Dy II	17	cw 7102.01	Nb I	13	7131.80	Sm I
8	7075.23	Nb I	6	7102.58	V I	570	7131.81	Hf I
24	7075.33	Th II	9	7102.65	Mo I	7	7132.07	Ce II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
12	7132.95	Zr I	5	7161.91	Er I	13	7197.08	Gd II
8	7133.16	Gd II	10	7162.60	La LaO	5	7198.62	W I
27	7134.08	Mo I	9	7162.64	W I	6	7198.63	Gd I
3	7134.32	Co I	6	7164.30	Gd II	3	7198.65	Dy I
13	7135.73	Gd II	8	7164.47	Fe I	10	7199.00	Nd II
10	7136.01	Sm I	6	7164.66	Eu I	7	7200.04	Th I
7	7136.08	Ce I	9	7164.87	U I	11	7200.16	W I
7	7137.33	Pr II	7	7164.88	Th ThO	13	7201.41	Gd II
12	7138.14	Sc I	8	7165.94	Lu II	11	7201.56	Ce II
8	7138.28	Zr I	26	7167.13	Ti	50	7201.62	Zr I
26	7138.91	Ti I	25	7167.24	Sr I	16	7201.89	Ce I
12	7139.39	Sm II	7	7167.77	Pr II	90	7202.19	Ca I
5	7140.45	Th II	170	7168.37	Gd I	10	7203.55	Ce I
15	7140.52	W I	30	7168.90	Th I	26	7203.64	Ti Ti O
16	7140.74	Zr I	590	7169.09	Zr I	65	7204.28	Tb I
6	7141.17	Gd II	14	7169.13	Sc I	5	7205.42	U I
16	7141.42	Ce I	23	7171.53	Ti	10	7206.33	Os I
3	7141.52	Dy II	5	7172.10	U I	5	7206.48	Th I
7	7141.68	Ce I	21	7172.26	Gd II	3	7206.77	Dy I
4	7141.72	Ru I	10	7172.67	Sm I	12	7207.41	Fe I
12	7142.04	Nd II	110	7172.90	Ta I	35	7208.00	Th I
6	7142.55	Rh I	7	7173.37	Th I	10	7208.85	Pr II
9	7142.79	Lu I	4	7173.40	Gd II	19	7208.94	Nb I
7	7143.10	Lu I	13	7174.91	Ta I	260	7209.44	Ti I
10	7143.72	Nd	7	7175.00	Ce II	5	7209.96	Os I
40	7143.98	Sm II	13	7175.11	Dy II	7	7210.28	U I
12	7144.47	Zr I	30	7175.55	Eu I	12	7210.67	Ce I
22	7145.54	Os I	5	7176.72	Th II	9	7210.95	Sm I
6	7146.13	Gd II	7	7177.44	Ce I	11	7212.69	Th I
18	7147.31	Gd II	6	7182.00	Ni I	11	7213.27	Dy I
16	7147.87	U I	7	7182.08	V I	23	7213.82	Sm I
190	7148.15	Ca I	7	7182.30	Ce I	6	7213.92	Ce I
24	7148.15	V I	9	7183.47	U II	60	7216.20	Ti I
5	7148.56	Th I	4	7183.71	Ir I	5	7216.35	W I
150	7148.63	Ta I	4	7184.10	Os I	19	7217.36	Ce I
5	7149.30	Dy II	12	7184.25	Mn I	570	7217.55	Eu II
85	7149.60	Sm II	6	7185.01	Nd	10	7217.76	Th II
10	7149.77	La I	7	7185.52	Cr I	7	7218.04	U II
10	7149.89	Os I	6	7186.20	Ce II	11	7218.06	Th I
19	7150.23	Ce II	20	7187.34	Fe I	26	7218.09	Sm II
5	7150.28	Th I	10	7187.48	Tb I	9	7219.06	Rh I
6	7150.77	Gd I	10	7189.09	Nd II	4	7219.16	Th I
8	7151.03	Nd II	16	7189.40	Ce II	6	7219.26	Ru I
7	7151.36	V I	24	7189.42	Nd II	21	7219.91	La I
10	7151.67	Ce I	28	7189.57	Gd II	13	7220.07	Sm I
6	7153.09	Nd I	10	7189.57	Sm II	3	7222.52	Dy I
6	7153.09	Sr I	55	7189.89	Ti I	3	7222.90	Dy I
6	7153.58	Ba I	7	7189.95	Pr I	11	7224.68	Eu I
4	7154.71	Co I	40	7191.13	Th II	4	7226.06	W I
10	7154.95	Th I	5	7191.33	W I	8	7227.01	Nd I
16	7155.25	Ce I	13	7191.35	Ta I	24	7227.70	Pr II
11	7155.40	Er II	17	7191.37	Nb I	10	7228.02	Gd I
15	7155.5	Th ThO	6	7191.49	Gd II	20	7228.84	Ba I
6	7156.48	Dy I	35	7191.66	Y I	140	7229.00	Pb I
5	7156.94	Th I	10	7191.72	Ce I	17	7230.04	Dy I
16	7156.99	Ce II	20	7192.01	Nd II	5	7230.87	Th I
40	7158.08	La I	2	7193.60	Co I	5	7231.33	Tm I
13	7158.28	Gd I	9	7194.63	U I	13	7231.53	Pr I
8	7158.56	Th ThO	570	7194.81	Eu II	20	7232.27	Sr I
18	7159.10	Th ThO	60	7195.24	Ba I	25	7233.45	Gd I
4	7159.18	Co I	10	7195.89	Tb II	8	7233.45	Ta I
130	7159.43	Nb I	10	7195.93	Y I	5	7233.74	Tm II
10	7159.88	Pr I	5	7196.66	U I	4	7234.68	Dy II
5	7159.94	Th I	14	7197.00	Er I	19	7234.98	Tb I
50	7161.25	La I	5	7197.02	Ni I	16	7235.71	Ce II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
6 h	7236.20	Cr I	5	7273.03	Rh I	13 h	7310.06	Pd I
15	7236.54	Nd II	8	7273.57	Dy II	11	7310.46	Eu I
13	7237.02	Sm II	5	7274.47	W I	14	7310.51	Tm I
650	7237.10	Hf I	15	7274.81	Nb I	17	7311.57	Tb I
8	7237.12	W I	8	7275.57	Sc I	25	7311.62	Zr I
14 ch	7237.98	Lu I	30	7276.96	Ta I	10 h	7313.05	Yb I
22	7238.36	Ce II	5	7277.54	Ta I	21	7313.28	Gd I
35	7238.92	Ru I	11 h	7277.90	Ce I	19	7313.45	Ce II
8	7240.46	Mo I	10	7278.24	W I	12	7313.63	Eu I
410	7240.87	Hf I	13	7279.25	Sm I	35	7313.72	Zr I
60	7240.90	Sm II	3	7279.90	Dy I	2 h	7314.71	Dy II
12	7241.73	Ce I	6	7279.94	Ce I	15	7315.56	Ti I
9	7242.08	Ho I	35 hl	7280.00	Rb I	12	7316.81	Nd II
6	7242.24	Gd II	950	7280.30	Ba I	13	7317.03	Nb I
150	7242.50	Mo I	26	7281.47	Sm II	90	7318.08	Zr I
7 c	7243.26	Pr I	11 h	7281.53	Eu I	26	7318.39	Ti I
9 h	7244.41	Yb I	7	7281.53	Mo I	20	7319.84	Ta I
5	7244.69	Th I	8	7282.21	Sm I	75	7320.05	Hf I
130	7244.86	Ti I	110 cw	7282.34	La II	10	7320.91	La I
40	7245.85	Mo I	19	7283.33	Sm II	7 h	7321.43	Nd I
65 cw	7246.67	Re I	24 h	7283.82	Mn I	8	7321.44	V I
10	7247.82	Mn I	7 h	7283.95	Er I	16	7321.76	Hf I
13	7250.01	Dy I	8	7284.30	Tm I	8	7322.25	Mo I
30 h	7250.27	Ta I	8	7284.69	Zr I	11 c	7322.72	Ta I
9	7250.60	Ho I	7	7284.90	Th I	8	7322.79	Mo I
9	7251.16	Os I	3	7285.28	Co I	7	7323.12	Nd II
130	7251.72	Ti I	9	7285.29	Nd II	8	7323.56	Ru I
50	7252.35	Nb I	5 hs	7285.62	Th ThO	17	7323.92	Nb I
14	7252.70	Gd II	15	7285.81	W I	7 cw	7324.42	Pr I
25	7252.75	Ce I	11 h	7286.16	Tm I	7	7324.81	Th I
6	7253.49	Os I	9	7286.36	Ta I	18	7324.89	Gd II
16	7254.44	U I	7 hs	7287.05	Th ThO	13	7325.95	Ta I
9	7257.11	Sm II	7 c	7287.61	Pr I	60 h	7326.15	Ca I
10 b	7257.16	La LaO	9	7288.24	Dy II	50	7326.51	Mn I
12	7257.57	Sc I	9	7288.56	Nd II	8	7327.07	Gd I
4	7257.72	Tm I	16	7288.92	Sm II	13	7327.08	Sm II
40	7257.73	Tb I	11 hs	7288.98	Th ThO	10	7327.82	Zr I
12	7258.17	Zr I	7 h	7289.19	Pr I	7	7328.28	Th I
15	7258.72	Eu I	13	7290.23	Sm I	29 cw	7328.38	Nb I
7 c	7259.21	Pr I	14	7291.35	Gd I	7	7328.47	Pr I
9 d	7261.52	Sm II	6	7291.38	Nd II	14	7329.73	Er II
7 h	7261.64	Nd II	5	7291.45	Ni I	25	7329.91	Ce I
7	7261.74	Dy I	13 cw	7292.72	Re I	9 h	7330.62	Y I
5	7261.93	Ni I	9 h	7293.08	Y I	13	7332.65	Sm I
6	7262.62	Hf I	11	7296.17	Ce I	5	7332.96	Y II
12	7262.64	Ce I	13 c	7296.32	Ta I	8	7333.71	Mo I
28	7262.66	Gd I	15	7296.55	W I	110 cw	7334.18	La I
30	7262.77	Eu I	6 h	7297.56	Eu I	6	7334.54	Nd I
19	7263.40	Ti I	3	7298.25	W I	16	7334.68	Ce II
35	7264.17	Y II	7	7298.72	Nd II	7	7335.57	Th I
14	7264.29	V I	17	7300.19	Mo I	50	7335.97	Zr I
35	7264.76	Zr I	3 h	7300.28	Dy I	55 cw	7336.18	Eu I
7 h	7264.82	Er II	3 h	7300.62	Sc I	11	7336.63	Tm II
11 h	7264.82	Ta I	26 h	7300.72	Sm II	8	7338.04	Sm I
19	7266.29	Ti I	540	7301.17	Eu II	40	7338.92	V I
7	7266.96	Ru I	4	7301.22	Gd II	11 cw	7340.19	Ta I
22	7267.62	Mo I	19	7301.42	Ce II	8	7341.15	Th I
18	7268.18	Rh I	140	7301.74	Ta I	25	7341.43	Ho I
19 b	7269.05	Ti TiO	35 h	7302.89	Mn I	5	7342.57	Th I
26	7270.09	La I	8 h	7305.22	Yb I	12	7343.44	Ce I
10	7270.30	La I	11	7305.40	Th II	50	7343.96	Zr I
35	7270.82	Rh I	20	7306.21	Zr I	120	7344.72	Ti I
12	7271.94	Rh I	6 h	7307.32	Zr I	7	7344.86	Pr I
6	7272.29	Ta I	14	7308.55	Ho I	17	7345.13	Dy II
17	7272.62	Tm I	250	7309.41	Sr I	65	7345.34	La I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
6	7345.62	Ce I	9	7381.57	Dy I	10	7418.18	Nd II
4	7346.25	Eu I	7	7381.79	Nd II	13	7419.83	Nb I
5	7346.34	Th II	35	7382.73	La I	6	7421.00	Ce I
160	7346.41	Ta I	25	7383.63	Zr I	23	7422.28	Ni I
50	7346.46	Y I	7	7383.71	Th I	10	7422.75	Zr I
26	7347.30	Sm I	6	7383.74	Ce I	6	7423.69	Hf I
13	7348.49	Mo I	7	7385.08	W I	15 h	7424.24	Tb II
45	7348.88	Tb II	4	7385.24	Ni I	11	7424.70	Ce Ce O
3	7349.64	Dy II	18	7385.50	Th I	23	7425.50	U I
16 h	7350.04	Yb I	9	7385.95	V I	300	7426.57	Eu II
11	7352.16	Ti I	8	7385.97	Gd II	55	7426.86	Dy II
140 c	7352.86	Ta I	5 h	7386.64	Rh I	9	7427.41	Nd II
65 c	7353.16	Nb I	4	7387.36	Eu I	5 h	7428.54	Dy I
3 h	7354.39	Dy II	5	7388.70	Co I	18	7428.67	Er I
3	7354.59	Co I	12	7389.16	Eu I	21	7428.94	Th I
18	7355.37	Er I	18	7389.40	Ho	10 h	7429.62	Tb II
85	7355.90	Cr I	6	7389.42	Fe I	13	7430.19	Gd I
6	7356.10	Hf I	9	7390.46	Ce II	10	7430.26	Th I
11	7356.34	Er I	20	7390.70	Hf I	9	7430.80	Rh I
35	7356.54	V I	5	7390.99	U I	14	7432.18	Tm I
4	7356.65	Eu I	40	7391.36	Mo I	4	7432.57	Gd II
100	7356.96	Ta I	27	7391.92	Pd I	12	7433.08	Ce I
6	7357.10	Nd I	5	7392.11	U I	10	7433.10	Zr I
90	7357.74	Ti I	110	7392.41	Ba I	10	7434.10	Mo I
6 h	7358.35	Th II	6	7393.40	Ce I	65 bl	7434.28	La La O
11	7358.66	V I	3	7393.43	Th II	110 bl	7434.36	La La O
5	7360.38	Mo I	6 h	7393.49	V I	5	7434.46	Gd I
24	7361.39	V I	16	7393.60	Ni I	5	7434.51	Tm II
5	7361.58	Dy II	16	7393.93	Ru I	11 c	7435.19	Ta I
13	7361.65	Mo I	13	7393.98	Sm II	15	7436.02	Nb I
6 h	7361.89	Ce I	13	7394.90	Gd II	21 h	7436.59	Eu I
11	7362.25	Eu I	14	7396.98	U I	25	7437.56	Hf I
6	7362.40	Ce I	25	7397.77	Ce I	11	7438.56	Ce I
12	7362.49	V I	10	7398.27	Tb II	110	7439.86	Zr I
4	7363.09	Ce I	11 h	7398.77	Y I	5	7439.95	Tm II
24	7363.16	V I	8 h	7399.30	Zr I	23	7440.17	Ta I
2	7363.19	Ce I	130	7400.21	Cr I	6	7440.49	Ce I
60	7364.11	Ti I	14	7400.90	Zr I	26	7440.60	Ti I
10 h	7364.41	Mo I	11	7401.27	Ce I	11 c	7441.52	Lu I
8	7365.25	Mo I	9	7401.31	Nd I	35	7441.85	Gd I
6	7365.28	Hf I	5	7402.25	Th I	18 h	7442.39	Rh I
75	7368.12	Pd I	9 h	7403.10	Dy I	30 b	7442.92	La La O
90 cw	7369.09	Ta I	110 bl	7403.52	La La O	12	7444.44	Ce I
55 cw	7369.60	Eu I	210 bl	7403.75	La La O	30	7444.56	Sm I
720	7370.22	Eu II	3	7404.02	Dy I	26	7445.41	Sm I
11	7370.23	Dy II	11 h	7404.41	Eu I	14	7445.78	Fe I
5	7371.95	U I	10	7406.62	Nd II	7	7446.77	Rh I
190 cw	7372.50	Nb I	16	7407.56	Pr II	13	7447.34	Mo I
6	7372.54	Ce I	11	7407.59	Dy I	4	7447.85	Th I
20	7373.50	Zr I	160	7407.89	Ta I	25	7448.28	Yb I
14	7373.81	Gd I	9	7407.95	Os I	9	7448.71	Nd II
6	7374.04	Nd II	50	7408.17	Rb I	29	7450.30	Y II
8	7374.80	Zr I	16	7409.35	Ni I	9	7451.11	Dy II
6	7375.07	Os I	5	7409.70	Lu II	4	7451.39	W I
9	7375.57	Rh I	7	7411.18	Fe I	20 c	7451.74	Pr II
20	7376.04	Dy I	6	7411.20	Nd II	13 h	7452.85	Mo I
14	7376.41	Gd I	50 b	7411.34	La La O	26 d	7453.03	Sm II
26	7376.69	Sm II	10	7411.39	Zr I	11	7454.03	U II
8	7376.88	Th I	24	7412.37	Dy I	3	7456.37	W I
13	7377.27	Gd II	5	7414.51	Ni I	8	7456.96	Lu II
6	7377.77	Gd I	5	7416.57	U I	20	7457.05	Dy II
14	7379.63	U II	8	7417.38	Co I	5	7457.36	Co I
50 bl	7379.71	La La O	20	7417.53	Ba I	6 h	7458.42	Ce II
85 bl	7380.08	La La O	8 h	7417.89	Zr I	55	7459.55	Er I
13	7380.28	Gd I	12	7417.94	Ce II	30 hl	7459.78	Ba I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
3 h	7459.99	Dy I	13	7504.47	Mo I	8	7542.02	Rh I
9	7460.42	Er I	6	7505.35	Gd II	55	7543.73	Dy I
150	7462.31	Cr I	9	7506.51	Zr I	20	7544.59	Zr I
9	7462.32	Ce I	30 b	7506.79	La La O	9	7544.74	Sm I
50 h	7463.08	La I	10 h	7507.28	Tm I	14	7545.78	Tm I
13	7463.86	Hf I	6	7508.13	Ce I	10	7546.57	Sm I
40	7464.36	Gd I	10	7509.00	W I	7	7547.00	Nd II
50 bl	7465.25	La La O	9 h	7509.49	Ce I	6	7547.32	Eu I
95 bl	7465.48	La La O	3	7509.60	Dy I	7	7549.32	Th I
18	7467.57	Zr I	5	7510.08	U II	11	7550.23	U I
30	7467.75	Ta I	10 h	7510.74	Ho I	9	7550.48	W I
18	7468.91	Ru I	60	7510.75	Au I	10	7551.25	Ce I
120	7469.51	Er I	30	7511.04	Fe I	29	7551.46	Zr I
8	7470.53	Eu I	12	7511.16	Nd II	17 h	7553.00	Dy I
13	7470.76	Sm I	7	7511.35	Th II	7 h	7553.00	Zr I
9	7472.15	Tb I	27	7511.40	Tb I	14 h	7553.96	Sc I
10	7472.41	Ce I	17	7513.73	Nd II	4	7553.99	Co I
9	7474.94	Ti I	7 h	7514.44	Nd II	40	7554.70	Zr I
12	7475.40	Ru I	14 h	7515.70	Zr I	140	7555.09	Ho I
7	7475.43	Mo I	65	7515.93	Nb I	19	7555.60	Ni I
12	7475.74	Rh I	7	7516.02	Nd II	27	7556.26	Er I
19	7478.20	Nb I	17	7516.61	Dy II	15	7556.37	Hf I
6	7478.71	Ce I	10 h	7517.00	Sm II	6	7557.59	Tb II
16	7479.58	Zr I	5	7517.39	U I	11	7557.67	Rh I
75	7481.08	Tm I	12	7517.95	Zr I	5 h	7557.85	Dy I
5	7481.28	Nd II	29 c	7519.77	Nb I	140	7558.33	Tm I
10	7481.35	Th I	9	7519.77	Tb II	25	7558.45	Zr I
26	7481.99	Sm II	30	7520.56	Ta I	26	7559.61	Ru I
7	7483.03	Dy I	3	7520.66	W I	27	7559.78	Dy I
8	7483.35	W I	9 h	7521.03	Zr I	12 h	7560.03	Sm II
75 cw	7483.50	La II	13	7522.76	Ni I	35 bl	7560.09	La La O
22	7484.54	Tb I	12 h	7524.13	Sc I	12	7560.09	Zr I
7	7484.56	Hf I	9	7525.12	Ni I	7	7560.31	Zr I
140	7485.74	Mo I	50	7525.51	Th II	12	7562.12	Zr I
26	7485.79	Ru I	9	7526.45	Nd II	12	7562.44	Ce I
12 h	7485.90	V I	11	7527.46	Ce I	10	7562.86	Ce I
23	7486.01	Ta I	30 h	7527.46	Yb I	75	7562.93	Hf I
16	7486.57	Ce II	11	7527.68	Ce I	19	7562.94	Sm II
16	7486.90	Pd I	19 bl	7528.21	La La O	40	7562.96	Dy II
170	7488.08	Ba I	50 bl	7528.39	La La O	55	7562.97	Gd I
12 h	7488.08	V I	4	7528.49	Th I	35	7563.13	Y I
6	7489.44	Gd II	50 cw	7528.70	Eu I	10 h	7563.19	Gd II
26	7489.61	Ti I	9	7528.70	U I	10	7563.60	Ce I
75	7490.20	Tm I	12	7528.99	Nd II	15	7564.22	Hf I
5 h	7491.00	Eu I	5	7531.17	Fe I	1	7564.96	Co I
12 h	7492.44	V I	7	7532.07	Ru I	6	7566.10	Gd I
17	7494.88	Y I	22	7532.34	Er I	7	7566.53	Th II
18	7495.09	Fe I	5 h	7533.02	Eu I	18	7567.74	Th I
12	7495.24	Rh I	7 h	7533.16	Dy I	3	7568.92	Fe I
9	7495.45	Th I	2	7533.48	Co I	6	7569.23	Ta I
11 h	7495.59	Pr I	30	7533.59	La I	17	7569.92	W I
45	7496.12	Tb I	10	7533.73	Ce I	23	7570.95	Sm II
19	7496.12	Ti I	45	7533.91	U I	7	7571.53	Mo I
5 h	7496.20	Ho I	5	7536.41	Th I	23	7572.29	Sm II
40 bl	7496.50	La La O	7 h	7536.71	Y I	11	7572.64	Mo I
95 bl	7496.78	La La O	9	7537.45	W I	8	7574.05	Ni I
50	7498.83	La I	10	7538.26	Nd II	6 h	7574.21	Er I
6 h	7499.42	Pr I	6 h	7539.18	Er I	15 h	7574.44	Sc I
17	7499.69	Tb II	85	7539.23	La I	170 c	7574.58	Nb I
70	7499.75	Ru I	4	7539.52	Ce I	6	7574.86	Pr I
9	7500.70	Ce I	4	7539.58	Ce I	11	7576.95	Hf I
5	7501.62	Mo I	20 h	7540.62	Zr I	8	7577.22	Rh I
23 h	7502.39	Sm II	5	7540.97	Nd II	20 h	7577.46	Dy II
9	7502.92	Zr I	14	7541.02	Pr II	5	7577.54	Nd II
7	7504.13	W I	23 h	7541.42	Sm II	19	7578.09	Sm II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
40 cw	7578.73	Re I	40	7608.90	Cs I	35 h	7641.09	Dy I
12 h	7578.75	V I	9	7609.16	U I	9 c	7641.14	Ho I
7	7579.58	Mo I	4	7609.17	Dy I	40 hl	7642.91	Ba I
12	7580.55	Ti I	3 h	7610.24	Co I	45	7645.09	Sm II
17 h	7580.61	Tm I	20	7610.48	Ba I	20	7645.64	Hf I
7	7580.91	U II	8	7610.83	Zr I	20	7645.66	Pr II
27 h	7582.03	Tb II	13 h	7611.55	Dy I	16 h	7645.67	Er I
5	7582.88	W I	10	7611.78	Gd I	12	7645.82	Sm I
17 c	7583.21	Nb I	13	7611.89	Re I	17	7645.86	Dy I
4	7583.80	Fe I	14	7612.08	Zr I	8	7646.00	Nd II
160	7583.91	Eu I	3	7612.18	W I	12	7646.08	Ce I
12	7585.69	Th I	19 h	7612.94	La II	13	7646.64	Dy I
12	7585.78	Th I	5	7612.94	Ru I	30	7647.38	Th I
30	7585.85	Sm II	11	7613.52	Er I	13	7647.71	Nb I
9	7586.01	Ce I	12	7613.94	Sm II	10	7647.88	Ce I
10	7586.04	Fe I	17	7614.15	W I	19	7648.02	Sm II
2	7586.72	Co I	15	7614.50	Ti I	4	7648.11	Dy II
27	7587.49	Tb I	5	7614.72	Nd I	4	7648.16	Ho I
3	7587.55	U II	17	7616.01	Tb II	5 h	7648.76	Tm II
7	7587.65	Nd II	25	7616.11	Ce II	7	7649.52	Mo I
3	7587.76	Dy I	5 h	7616.21	Dy I	6	7649.62	Ta I
10	7588.20	Gd I	23	7617.00	Ni I	21	7650.32	Gd I
23	7588.31	Sm II	12	7617.05	Ho I	8	7650.63	Er I
18	7589.20	Ho I	11	7617.45	Sc I	7	7652.89	Y I
9 bl	7589.62	Ti Ti O	11 h	7617.70	Dy I	5	7653.26	Mo I
9	7590.22	Ta I	8 h	7617.72	Y I	4	7653.62	U I
45	7590.24	Tb I	70	7618.93	Rb I	14 c	7653.80	Ho I
5 h	7590.51	Er I	9	7619.21	Ni I	7	7653.83	Th I
5	7590.52	U I	16	7619.34	U I	23	7654.44	Ti I
2 h	7590.57	Co I	7 cw	7620.25	Re I	22	7654.45	Er II
6	7590.75	Nd II	3	7620.54	Fe I	3	7654.81	W I
9 h	7591.24	V I	20	7621.17	Zr I	17	7655.00	Tm I
27 h	7591.30	Dy I	18	7621.50	Ru I	10	7655.78	Sm II
7	7591.66	Mo I	50	7621.50	Sr I	17 h	7656.76	Mo I
25	7591.87	Ho I	5	7621.61	Zr I	12 h	7658.05	Er I
35 bl	7592.26	La La O	7	7621.95	U I	4	7658.32	Th I
11	7592.96	Hf I	21	7621.96	Gd I	29	7658.60	Zr I
9 h	7593.64	Ho I	19 h	7622.94	Y I	22	7659.25	Er I
20 h	7593.74	Tm I	6	7623.48	Er I	4	7660.32	Tm I
7 h	7594.35	Ho I	22 h	7624.05	Tb I	2	7661.22	Fe I
5 h	7594.86	Dy I	360	7624.40	Hf I	9	7661.48	Dy I
5	7595.04	U I	24	7624.81	V I	80	7662.36	Dy I
17	7595.07	Tm II	19 b	7624.99	La La O	7 h	7663.39	Ce II
11 h	7595.16	Mo I	7	7625.70	Th I	6	7663.52	Nd II
65	7596.44	Tb I	5	7627.18	Th I	6	7664.30	Fe I
14 h	7596.92	V I	30	7627.81	Tb I	21	7664.34	La I
11	7597.33	Er I	14	7627.98	Ho I	18000	7664.90	K I
10	7598.01	Sm I	40 c	7628.42	Ho I	4	7665.64	Er I
4	7598.20	Th I	5	7629.85	Tm I	14 h	7665.72	Sc I
12 h	7598.28	V I	4 h	7630.31	Th I	7 h	7666.24	Tm I
4	7600.27	U I	3	7631.29	W I	11	7666.78	Dy II
17 h	7601.18	Tb II	11	7631.72	U I	19	7667.20	Sm II
11	7601.84	Mo I	10 h	7631.77	Sm II	12 c	7667.30	Ho I
12	7602.31	Ho II	7	7632.55	Ce I	4	7668.73	U II
26	7602.95	Os I	7	7634.74	U I	4	7669.69	U II
10	7603.10	Ce I	5 h	7635.32	Dy I	7	7670.76	Ce II
6	7603.73	Nd II	10 hl	7636.90	Ba I	500	7672.09	Ba I
16	7605.35	Ho I	23	7637.94	Sm II	8	7672.49	Sm II
5	7605.92	Nd II	9 h	7639.05	Tb II	25	7672.56	Gd I
3 h	7606.30	Co I	5 h	7639.30	Dy I	8	7672.72	Tb II
80	7607.15	Zr I	14	7639.54	U I	40 h	7673.06	Sr I
6	7607.23	Er I	9	7639.79	Nd II	8	7676.04	Tm II
23 d	7607.48	Sm II	13	7639.81	Nb I	10	7676.06	Gd I
	7607.74	Sm I	7 ch	7640.08	Lu I	7	7676.21	Th II
13	7608.59	Hf I	50 cw	7640.94	Re I	9 h	7676.69	Dy I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
7	7677.16	Gd I	9	7723.63	Mo I	11	7761.84	U I
4	7678.12	Th I	9	7723.95	Zr I	4	7762.16	Er I
7	7678.13	Ce I	19	7724.08	Y I	5	7762.95	Ce I
10	7678.79	Sm II	6	7724.61	Ce II	11	7763.11	Ta I
13	7679.49	Mo I	8	7726.19	Er II	120	7764.03	Pd I
35	7680.01	Er I	75	7726.68	Nb I	10	7764.72	Mn I
12	7680.20	Mn I	22	7726.97	Tb II	8	7765.70	Zr I
12	7682.47	Ce I	19	7727.61	Ni I	10	7766.48	Gd II
7	7683.36	Gd I	30	7728.56	Sm II	10	7766.55	Zr I
21	7685.30	Th II	18	7729.72	Sc I	6	7769.75	Ce I
320	7687.78	Ag I	45	7729.76	Dy II	6	7771.06	Sc I
13	7688.97	W I	5	7729.91	Ru I	18	7772.90	Rh I
25	7689.17	Ce II	80	7731.53	Tm I	6	7773.06	Nd II
5	7689.49	Y I	10	7731.72	Th II	3	7776.73	W I
11	7690.05	Rh I	10	7732.33	Ce I	4	7778.27	Tm I
20	7690.43	Ho I	9	7732.49	Mo I	9	7779.67	Ta I
18	7690.83	Zr I	80	7733.50	Gd I	300	7780.48	Ba I
50	7693.15	Ho I	2	7734.23	Co I	10	7780.59	Fe I
4	7693.80	Th I	30	7736.26	Sm II	4	7780.89	Dy I
3	7693.86	Dy I	30	7737.63	Tb I	7	7782.32	Th I
13	7694.45	Gd I	6	7738.09	Gd II	12	7782.35	Tm I
8	7694.74	Tb II	16	7738.98	Ho I	14	7784.13	U I
10	7695.78	Sm I	5	7739.38	Dy II	11	7784.15	W I
5	7696.54	Dy I	110	7740.17	Hf I	5	7785.10	Ce II
12	7696.56	Nd II	55	7741.17	Sc I	15	7785.17	Sc I
30	7697.73	Sc I	5	7741.43	Ce II	8	7785.51	Tm I
8	7698.00	Y I	4	7742.55	Th I		7785.90	Tm I
9000	7698.96	K I	60	7742.57	Eu I	6	7786.16	Pr II
750	7699.48	Yb I	2	7743.27	Co I	27	7786.67	Pd I
4	7701.01	W I	8	7743.57	Hf I	6	7787.11	Nb I
8	7701.10	Th II	4	7743.77	Ce I	7	7787.22	Gd II
5	7701.37	V I	4	7743.90	Nd II	15	7787.79	Th II
4	7701.46	Os I	3	7743.93	Th II	13	7788.42	Y I
8	7701.46	Tm I	70	7746.19	Eu I	15	7788.93	Th I
9	7702.84	Ce I	4	7746.65	Ce II	10	7788.94	Ni I
25	7703.33	Nb I	11	7747.44	Er I	7	7789.96	Os I
14	7704.27	Zr I	7	7748.19	U I	8	7790.02	Dy I
8	7704.81	V I	10	7748.28	Fe I	40	7790.90	Hf I
7	7704.98	Pr II	16	7748.35	Ce I	29	7791.61	Rh I
11	7705.21	Ti Ti O	3	7748.37	Gd II	22	7791.86	Ru I
22	7706.16	Tb II	19	7748.89	Ni I	7	7792.22	Nd II
10	7708.42	Zr I	4	7748.92	Nd II	22	7793.20	Tb I
9	7709.54	Mo I	35	7749.30	Gd I	10	7794.50	Sm I
5	7709.59	Th II	30	7749.30	Sm II	8	7794.68	Sc I
4	7710.26	Th I	4	7750.15	Dy I	13	7796.32	Y I
6	7711.91	Dy II	5	7750.37	Sc I	6	7796.40	Nd II
23	7712.04	Sm II	10	7750.95	Nd II	9	7796.69	Er I
10	7712.42	Mn I	20	7751.62	Dy II	7	7796.81	Hf I
8	7712.68	Co I	8	7752.01	Ho I	8	7797.32	Nd II
16	7714.32	Ni I	4	7752.34	Mo I	35	7797.47	Er I
40	7715.06	Ho I	5	7752.72	Sc I	13	7797.59	Ni I
35	7715.33	Dy I	4	7752.86	Ce II	10	7797.70	Ce I
5	7715.58	Ni I	7	7754.18	U I	4	7797.89	Ru I
4	7717.66	Gd I	22	7754.63	Er I	5	7798.32	Nd II
6	7717.68	Ce II	23	7755.20	Sm II	5	7798.36	Th I
6	7718.20	Nd II	10	7755.97	Gd I	30000	7800.23	Rb I
16	7719.05	Ho I	25	7757.31	Nb I	30	7800.44	Sc I
19	7719.89	Y I	5	7757.32	Dy I	6	7800.74	Zr I
27	7720.77	Mo I	110	7757.65	Rb I	10	7801.54	Sm I
5	7721.01	Dy II	5	7757.89	Hf II	7	7802.40	U II
16	7721.84	Pr I	7	7758.30	Lu I	6	7802.52	Y I
11	7722.02	Ta I	20	7759.43	Rb I	8	7803.32	Eu I
9	7722.14	Er I	7	7759.87	U I	17	7803.93	Tm I
6	7722.48	Zr I	4	7760.08	Dy I	4	7806.80	Ce I
18	7722.87	Ru I	5	7761.16	W I	4	7806.82	Ru I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
8	7807.33	Tb II	10	7845.80	Gd I	5	7886.48	W I
10	7808.47	Nd II	35	7846.35	Gd II	7	7886.60	Nd II
7	7808.96	W I	15	7846.50	Rh I	8	7887.74	Mo I
35	7812.06	Dy I	7	7846.56	Hf I	35	7887.99	Eu I
17	7812.16	Y I	15	7847.54	Th I	6 cw	7888.56	Pr II
7	7812.70	Ce I	16	7847.55	Er I	16	7890.37	Ru I
8 h	7812.75	Sm II	30	7847.80	Ru I	60	7894.64	Ho I
3	7813.43	Ru I	4	7848.44	Th I	7	7895.08	Yb I
35	7814.55	Hf I	90	7849.35	Zr I	16	7895.96	Sm I
4	7814.60	Dy I	4	7849.62	Th II	12	7896.40	V
60 cw	7815.48	Ho I	16	7850.02	Ce II	4 h	7896.50	Nd II
7 h	7815.9	Lu I	16	7851.18	Ce II	7	7897.9	Th ThO
7	7816.32	U I	8 h	7851.18	V	10	7897.98	Zr I
12	7816.32	Zr I	7	7852.17	Os I	14 h	7898.81	V
21	7817.77	Th I	15	7854.45	Mo I	16	7898.96	Ce II
8	7818.21	Eu I	29	7855.52	Y I	18	7899.55	Er I
7	7818.83	Nd II	30	7855.79	Tb II	11	7900.31	Th I
110	7819.35	Zr I	2	7855.85	Co I	9	7900.40	Nd II
16	7820.15	Sm II	40	7856.08	Tm I	9	7900.43	U I
11	7821.64	Sc I	35	7856.93	Gd I	6	7904.28	U I
35	7822.94	Zr I	22	7857.54	Ce II	170	7905.75	Ba I
40 cw	7823.63	Ho I	6	7859.53	Sm I	5 h	7906.03	Nd I
2	7823.82	W I	3	7861.67	Tm I	6 h	7907.96	U I
55	7824.91	Rh I	12	7863.04	Nd II	4 h	7908.06	Gd II
5	7825.20	Nd II	4	7863.47	W I	16	7908.46	Zr I
40	7826.72	Zr I	19	7863.65	Sm II	7	7908.71	Co I
4	7829.22	Tm I	8	7864.31	Dy II	27	7909.38	Dy I
17	7829.65	Mo I	12	7864.49	Ce I	6	7910.08	Gd I
4	7829.81	Ru I	8	7864.96	Dy I	75 bl	7910.19	La LaO
15	7830.05	Rh I	15	7864.99	Tb I	150 bl	7910.54	La LaO
10	7831.40	Sm II	14 bl	7865.51	V VO	80	7911.34	Ba I
3	7832.02	U I	12	7865.95	Th I	65 cw	7912.94	Re I
14	7832.22	Fe I	10	7866.04	Ce I	8	7913.08	Er I
7	7832.77	Dy I	2	7867.04	W I	6	7913.11	Tb I
16	7832.91	Tb II	5	7867.73	Gd I	11	7913.52	Ce I
5 h	7833.39	Ru I	10 bl	7868.3	Th ThO	26	7914.96	Sm II
6	7834.32	Ir I	14	7868.75	U I	6	7915.19	Pr II
8	7834.45	Th II	14	7869.72	Gd I	45	7915.80	Pd I
8	7834.46	Gd I	1	7869.90	Co I	12	7917.01	Nd II
40 w	7835.08	Sm II	35	7869.99	Zr I	2	7917.44	Ni I
7 h	7835.52	Dy II	1	7871.39	Co I	5	7917.62	Mo I
2	7835.71	U I	14	7871.67	Pr I	5	7918.10	Tm I
9	7835.88	Ce I	5 h	7872.03	Nd I	9	7918.80	U I
26	7837.27	Sm II	13 cw	7873.41	Nb I	130	7920.71	Hf I
9	7837.71	U II	2	7874.13	Ce I	35	7921.85	Er I
5	7838.17	Co I	2	7874.22	Ce I	11	7923.15	Mo I
4	7838.38	Ce II	5	7875.36	Er I	6	7924.20	Zr I
9	7838.80	Er I	14	7875.36	U I	16	7924.43	Ru I
7	7838.84	Gd II	14	7876.25	Zr I	10	7925.03	Nd II
8 h	7839.57	Ba I	21 b	7876.87	La LaO	3	7926.55	Co I
2	7840.05	Co I	75 bl	7877.22	La LaO	10	7927.30	Ce CeO
3	7840.29	Th I	8 h	7879.22	Ho I	55	7927.51	Tm I
3	7840.44	Th I	5	7879.36	Er I	10	7927.72	Ce I
6 cw	7841.27	Pr I	10 h	7880.01	Sm II	27	7927.90	Tb II
5	7841.78	Th I	4	7880.40	W I	90	7928.14	Sm II
15 h	7841.80	La I	6	7881.09	Pr I	25	7930.25	Gd II
6 h	7841.90	Ru I	80	7881.49	Ru I	110	7930.84	Tm I
12	7842.59	Ce I	110	7881.90	Y II	9	7931.92	Sm I
20 c	7842.76	Ta I	50	7881.94	U I	200	7933.13	Cu I
11	7844.00	Er I	16	7882.18	Zr I	10	7934.50	Ce II
9	7844.71	U I	100	7882.37	Ta I	5	7934.98	Dy I
10	7844.82	Sm II	4	7884.39	Gd I	19	7937.09	Sm II
11 h	7844.87	Gd I	35	7885.31	Nb I	14	7937.17	Fe I
22	7844.94	Ce II	6 h	7885.70	Tb I	30	7937.84	Er I
310	7845.35	Hf I	6	7886.27	Th I	24	7937.92	V I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
29	7938.06	Hf I	12	7982.85	Dy II	5	8030.69	Ce II
25	7938.89	Nb I	4	7984.35	Mo I	5	8031.45	Ce I
20	7940.47	Zr I	11	h 7985.93	Tm I	6	8031.92	Pr I
9	7940.92	W I	15	7986.60	Mo I	16	8032.03	Sm II
11	7941.72	Th I	9	7987.38	Co I	11	8032.43	Th I
11	h 7942.04	Cr I	11	7987.97	Th I	9	8034.79	U I
50	b 7944.61	La LaO	6	7991.30	U I	14	h 8035.38	V
160	7944.61	Zr I	6	7993.82	Gd I	12	8035.91	Er I
110	bl 7944.95	La LaO	250	7994.73	Hf I	11	h 8036.09	Rh I
14	7945.88	Fe I	30	7996.53	Ti I	4	8037.40	Gd I
15000	7947.60	Rb I	11	7998.03	Tb I	15	8039.08	Ta I
5	7947.93	Nd II	9	7998.60	U I	6	8040.02	Ce I
16	7948.12	Sm II	6	7998.75	Ta I	6	8040.09	Dy I
5	7948.15	Ru I	14	7998.97	Fe I	3	8040.10	U II
30	7949.17	Ti I	10	h 7999.33	Y I	4	h 8040.10	Zr I
10	7949.68	Nd II	12	8000.76	Nd II	7	8041.29	Os I
30	7950.19	Ta I	17	8001.04	Tb I	10	8043.24	Nd I
5	7952.07	Ta I	19	w 8001.61	Sm II	5	8043.33	Co I
8	7952.93	Er I	35	h 8001.89	La I	29	8045.36	Rh I
5	7953.61	Ce I	9	8002.56	Ce I	14	h 8045.71	V
8	7954.76	Nb I	9	8002.70	Ce I	25	8046.05	Zr I
13	7955.31	Tb I	7	h 8003.55	Ti I	12	8046.07	Fe I
5	h 7955.38	Nd II	4	8004.47	Dy II	4	8047.28	Dy I
80	7956.66	Zr I	160	8005.27	Zr I	6	8048.08	Gd I
3	7957.06	W I	6	8006.26	Gd I	40	8048.70	Sm II
12	7958.95	Nd I	13	8007.27	Co I	4	8050.85	Dy I
6	7959.96	U I	9	8007.70	Nd I	8	8051.33	Nd II
80	7959.98	Zr I	8	8008.70	Dy II	35	hc 8051.39	La I
18	7961.08	Pd I	13	h 8010.16	Tb II	12	8051.89	V
26	h 7961.58	Ti I	6	8010.53	Gd II	16	8053.06	Zr I
3	7962.77	Dy I	7	8010.58	Hf I	6	8053.80	Tb I
6	h 7963.25	Gd II	3	8012.96	U I	8	8053.93	Ta I
20	7963.63	Zr I	21	b 8014.43	La LaO	4	8054.52	Th II
14	7963.96	U I	14	h 8014.77	Tm I	7	8054.89	W I
12	7964.51	Er I	65	bl 8014.79	La LaO	20	8055.29	Zr I
40	7964.83	La I	19	w 8014.92	Sm II	6	8055.43	Pr I
12	7965.73	Nd II	7	8015.26	Zr I	6	8055.61	U I
4	7966.66	Gd I	7	8015.47	Eu I	22	8055.64	W I
9	7967.84	Ru I	60	hl 8015.72	Cs I	20	8055.76	Zr I
11	7968.63	Dy I	22	8017.19	W I	6	8056.06	Co I
9	7968.85	Mo I	95	8017.90	Tm I	25	8056.52	Hf I
18	U 7970.46	U I	5	8019.38	U I	60	8058.08	Zr I
6	7971.56	Tm I	30	b 8019.48	La LaO	4	8058.22	Mo I
9	7972.11	Ce I	6	8019.82	Gd I	5	8060.38	W I
7	7972.34	Ce II	4	h 8020.07	Nd I	11	8062.64	Th I
7	h 7972.60	Th I	3	h 8021.33	Tm I	150	8063.09	Zr I
9	7973.13	Dy I	6	8022.09	Ta I	7	8063.50	Rh I
3	7974.66	U I	3	8022.13	Co I	5	8064.00	Nd II
9	7975.08	U I	5	8023.03	Er I	16	8065.16	Sm I
3	7975.47	U I	55	8024.84	Ti I	9	8065.47	U I
9	7976.88	U II	23	8025.12	Sm II	3	8065.84	U I
6	7978.15	Gd I	9	h 8025.31	Dy I	1	8066.49	Co I
60	7978.88	Ti I	30	8025.42	Tb II	5	h 8066.91	Ce I
24	7978.98	Th I	30	8025.56	Ce II	19	8067.35	Tb II
8	7979.03	Er II	23	w 8026.32	Sm II	14	8067.44	Pr I
9	7979.07	Ti I	8	8026.35	Nd I	30	8068.24	Ti I
35	b 7979.34	La LaO	75	8026.50	Ta I	45	8068.46	Sm II
75	bl 7979.70	La LaO	6	h 8027.22	Dy I	15	8068.98	Ta I
35	cw 7980.77	Re I	7	8027.32	Mo I	790	8070.08	Zr I
8	7980.87	Er I	29	c 8027.39	V I	16	8070.71	Ce I
6	7981.20	Os I	14	8028.13	V I	9	8074.03	U II
5	7981.21	Th II	3	8028.34	Fe I	5	8075.65	Th I
4	7981.67	Th II	5	8029.04	Ta I	13	8077.59	Gd I
15	7982.09	Nd II	3	8029.26	Co I	80	hl 8079.03	Cs I
12	7982.68	Nd II	21	8029.91	Rh I	5	8079.37	Ce I

TABLE 2. All observed lines in order of wavelength - Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
25	8080.32	Hf I	26	8161.82	Sm II	7	8217.22	Th II
30	8085.06	Tb II	10	8163.12	Th II	11	8218.08	Gd I
10	8085.20	Fe I	5 h	8163.18	Cr I	11	8218.62	Dy II
5	8085.23	Th I	27	8164.17	Tb I	26 w	8218.76	Sm II
75	8086.05	La I	7 h	8164.97	Nd I	30	8220.41	Fe I
3	8089.96	Gd II	3	8165.72	W I	9	8220.70	Ce I
400	8092.63	Cu I	7	8166.44	Th II	7	8223.61	Ce I
14	8093.48	V I	4 h	8169.06	Dy II	7	8224.29	Ce II
5	8093.63	Th I	7	8169.79	Th I	10	8224.74	Pt I
9	8093.96	Co I	14	8171.35	V I	15 cw	8226.81	Eu I
10	8094.43	Ce I	6	8171.39	Ce I	9	8230.33	Sm I
9	8097.62	U I	13	8171.70	Tb I	6	8230.83	U I
10	8099.17	Nd I	8	8172.56	Nd II	10	8231.52	Nd II
5	8100.11	Ta I	16	8173.89	Hf I	3	8232.35	Fe I
8	8102.44	V I	16	8174.30	U I	6	8233.56	Dy II
5	8104.67	Mo I	5	8175.59	Ce II	6	8239.48	Ce I
12	8108.59	V I	6	8175.84	U I	13 cw	8240.00	Nb I
9 h	8109.07	V I	9 c	8178.16	Lu I	20	8240.37	Zr I
9	8112.47	Ru I	9	8179.83	Nd II	3	8240.51	U I
10	8114.28	Zr I	7	8180.21	V I	16	8240.98	Sm II
2	8116.41	Co I	5 c	8180.74	Ta I	15	8241.13	Sc I
120 cw	8116.80	V I	5	8181.34	Pr II	10	8241.55	Ce II
8	8116.90	Dy II	12	8181.85	Er I	24	8241.61	V I
9 w	8117.16	Sm II	9	8182.41	Nd II	4	8243.91	Dy II
20	8120.17	Zr I	1100	8183.26	Na I	22 h	8245.06	Mo I
16	8120.36	Ce I	4	8185.58	Nd II	7	8245.20	Ce I
10	8120.93	Nd II	4 h	8185.90	Gd I	5	8246.82	Ce I
12	8122.07	Nd II	35	8186.71	V I	50	8247.44	La I
15 b	8122.20	La LaO	15	8186.92	Th I	4	8248.76	Nd II
7	8122.72	Th I	24	8187.33	V I	7	8248.81	Hf I
10 cw	8122.78	Pr II	9	8188.20	U II	13 c	8248.95	Ta I
13	8123.82	W I	12	8188.77	Zr I	5 h	8249.68	Nd II
9	8125.12	Sm II	4 h	8192.60	Mo I	6	8250.64	Ce II
5	8126.23	U I	4	8193.03	Co I	5	8252.40	Th I
480	8126.34	Li I	7 h	8193.67	Rh I	29 c	8253.51	V I
13	8128.76	Ta I	14	8194.19	Tm I	40 h	8254.10	Be I
55	8132.82	Pd I	40	8194.73	Zr I	29	8255.88	V I
390	8132.99	Zr I	2200	8194.82	Na I	8	8259.08	Tb I
40	8135.20	Nb I	65	8194.82	Tb II	4	8261.01	Th I
15	8136.20	Rh I	19 w	8195.50	Sm II	12	8261.09	Ce I
11 h	8136.79	V I	11 h	8196.98	Sc I	18	8262.05	U I
6	8137.21	U I	27	8198.77	Dy II	4 h	8262.80	Nd II
11	8138.47	Th I	29	8198.87	V I	5	8263.93	Th I
5 h	8139.90	Th II	3	8198.95	Fe I	20 d	8264.85	Ta I
3	8140.72	Dy II	5	8199.29	Ce I	18	8264.96	Ru I
11	8141.10	Pr I	100	8201.57	Dy II	20	8265.53	Dy I
12	8141.75	Nd II	60	8201.73	Zr I	7 h	8266.72	Nd II
18	8143.14	Th I	35	8203.07	V I	8	8267.62	Ti I
5	8143.19	W I	12	8203.19	Th II	4	8272.79	Nd II
12	8143.27	Nd II	7 h	8203.38	La I	500	8273.52	Ag I
4 h	8144.00	Gd I	130	8204.58	Hf I	10	8275.42	Gd I
4	8144.30	Dy II	7 h	8205.38	Nd II	18	8275.63	Th I
29	8144.59	V I	6	8206.30	Sm II	55	8276.95	Hf I
18	8146.15	Gd I	3	8208.34	Dy II	5 h	8280.39	V I
13	8147.29	Dy I	3	8208.66	Co I	75	8281.62	Ta I
1	8152.11	Co I	5	8209.07	Gd I	19	8282.37	V I
5	8152.39	Th II	24 cw	8209.80	Eu I	40	8283.81	Zr I
20	8152.58	Zr I	5	8210.22	W I	19 w	8289.26	Sm II
9	8153.45	Mo I	60 h	8210.24	Ba I	6	8289.93	Pr I
6	8153.71	U I	6	8210.27	U II	5	8294.52	Tm I
9	8154.55	V I	5 c	8211.93	Pr I	7	8299.81	Zr I
9	8158.54	Ta I	280	8212.53	Zr I	2	8300.59	Ce I
15 b	8159.02	La LaO	95	8212.57	Tb I	2	8300.73	Ce I
12	8159.74	Th I	11	8214.33	Tb I	45	8300.83	Pd I
70 c	8161.07	V I	8 h	8217.04	Dy II	10	8300.88	Sm II



TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	
4	h	8302.74	Nd	II	75		8364.24	Ti	I
40	w	8305.79	Sm	II	8	h	8365.64	Y	I
140		8305.90	Zr	I	7		8365.75	Tm	I
13		8305.91	Hf	II	5		8367.58	Er	II
14	h	8306.31	Ti	I	4		8369.33	Th	I
9	h	8307.41	Ti	I	5	h	8369.67	Rh	I
4		8307.56	U	II	50		8370.23	Zr	I
10		8307.72	Nd	II	9		8372.84	Co	I
7		8309.50	Zr	I	4		8374.76	Gd	I
9		8310.23	Ce	I	4		8375.16	Nd	II
7		8310.69	U	I	4		8375.33	Nd	II
9	h	8311.76	Ti	I	4		8377.79	Gd	I
7		8312.34	Ce	I	100		8377.85	Ti	I
35		8312.82	Er	I	3		8378.39	Co	I
8	h	8312.85	Ti	I	8	h	8379.80	La	I
5	h	8315.02	Gd	II	6		8379.84	Pr	I
10		8315.45	Sm	I	5		8380.06	Hf	I
13	h	8316.04	La	I	18		8381.86	U	I
7		8316.38	Gd	II	17		8382.08	Lu	I
16		8318.34	U	I	100		8382.54	Ti	I
7		8320.16	Zr	I	55		8382.82	Ti	I
15		8320.86	Th	I	3		8382.94	W	I
29	cw	8320.93	Nb	I	5		8382.98	Hf	I
4		8322.05	W	I	19		8383.71	Sm	I
4		8323.85	Dy	I	6		8387.09	Th	II
8		8324.42	V	I	7		8387.19	U	I
6		8324.50	Nd	II	19		8387.77	Sm	II
85		8324.69	La	I	35		8387.78	Fe	I
35		8326.10	Dy	I	5		8388.53	Dy	I
40		8327.06	Fe	I	11		8389.06	Ta	I
5	h	8327.67	Ce	II	11		8389.16	U	I
40	h	8328.44	Mo	I	45	h	8389.32	Mo	I
18		8328.57	Er	II	120		8389.41	Zr	I
9		8329.61	Y	I	35		8392.01	Dy	II
6		8329.74	U	I	4		8394.71	Nd	II
30		8330.46	Th	I	9		8396.39	Ce	I
14	h	8331.23	V	I	7		8396.76	U	I
9		8331.94	Fe	I	75		8396.87	Ti	I
4		8332.01	Nd	II	11		8398.30	Gd	I
14		8332.44	Zr	I	7		8400.85	Nd	II
12		8334.37	Ti	I	4		8402.58	U	I
16		8337.50	U	II	4		8402.60	W	I
10		8338.08	W	I	7		8402.81	V	I
4		8339.43	Fe	I	18		8403.79	Th	II
14		8342.03	V	I	6	d	8405.25	Ce	II
25		8344.25	Hf	I	12		8405.85	Dy	II
24		8344.43	Y	I	55		8409.90	Er	I
29		8346.08	Nb	I	120		8412.36	Ti	I
12		8346.36	Nd	II	70		8414.00	Zr	I
95		8346.53	La	I	5		8415.73	Ta	I
11		8346.74	U	I	20		8416.64	Dy	II
9		8348.28	Cr	I	15		8416.74	Th	I
19	w	8348.68	Sm	II	19		8416.98	Ti	I
4		8348.81	W	I	40		8417.13	Re	I
11		8348.98	Ru	I	5		8418.00	Th	I
10		8349.73	Gd	I	16		8418.23	Ce	II
10		8350.04	Nb	I	12		8421.23	Th	I
9		8351.15	Mo	I	15		8424.41	Ti	I
6		8352.94	Ru	I	8		8425.59	Rh	I
14		8353.15	Ti	I	170		8426.52	Ti	I
9	h	8353.58	Pd	I	6	h	8427.82	Pr	I
6		8355.15	Ce	II	30	w	8432.64	Sm	II
6		8357.07	U	I	190		8434.94	Ti	I
7		8358.72	W	I	240		8435.70	Ti	I
4		8358.73	Th	I	4		8435.77	Ru	I
24		8438.58	Dy	II	24		8438.58	Dy	II
40		8438.93	Ti	I	40		8438.93	Ti	I
17		8439.77	Nb	I	17		8439.77	Nb	I
16		8441.20	U	I	16		8441.20	U	I
7		8442.58	Gd	II	7		8442.58	Gd	II
9		8444.46	Dy	II	9		8444.46	Dy	II
35		8445.35	U	I	35		8445.35	U	I
10		8445.47	Gd	I	10		8445.47	Gd	I
8		8445.50	Th	I	8		8445.50	Th	I
21		8446.52	Th	I	21		8446.52	Th	I
25	cw	8447.62	Ta	I	25	cw	8447.62	Ta	I
18		8450.02	U	I	18		8450.02	U	I
40		8450.06	Tb	II	40		8450.06	Tb	II
6		8450.26	Cr	I	6		8450.26	Cr	I
17		8450.36	Y	I	17		8450.36	Y	I
5		8450.68	Th	II	5		8450.68	Th	II
40		8450.89	Ti	I	40		8450.89	Ti	I
50		8453.17	Zr	I	50		8453.17	Zr	I
8	b	8453.55	La	La O	8	b	8453.55	La	La O
3		8455.24	Cr	I	3		8455.24	Cr	I
5	h	8456.87	Nd	II	5	h	8456.87	Nd	II
9	h	8457.10	Ti	I	9	h	8457.10	Ti	I
6		8457.48	Zr	I	6		8457.48	Zr	I
35		8459.19	Lu	II	35		8459.19	Lu	II
35		8460.01	Hf	I	35		8460.01	Hf	I
7		8460.79	Tm	II	7		8460.79	Tm	II
50		8464.65	Zr	I	50		8464.65	Zr	I
10	h	8464.66	Ho	I	10	h	8464.66	Ho	I
6	h	8464.71	Eu	I	6	h	8464.71	Eu	I
8	h	8465.80	Tb	II	8	h	8465.80	Tb	II
11		8466.18	Er	II	11		8466.18	Er	II
19	h	8467.15	Ti	I	19	h	8467.15	Ti	I
8	h	8467.62	La	I	8	h	8467.62	La	I
12		8468.41	Fe	I	12		8468.41	Fe	I
45		8468.50	Ti	I	45		8468.50	Ti	I
27		8472.01	Tm	II	27		8472.01	Tm	II
35		8472.42	Er	I	35		8472.42	Er	I
5		8472.58	Dy	II	5		8472.58	Dy	II
19	w	8473.54	Sm	II	19	w	8473.54	Sm	II
11		8473.64	Ru	I	11		8473.64	Ru	I
4		8475.14	W	I	4		8475.14	W	I
17	cw	8475.98	Nb	I	17	cw	8475.98	Nb	I
26		8476.48	La	I	26		8476.48	La	I
18		8478.35	Th	I	18		8478.35	Th	I
10	d	8478.50	Lu	I	10	d	8478.50	Lu	I
4		8480.66	Dy	II	4		8480.66	Dy	II
10	h	8482.67	Ho	I	10	h	8482.67	Ho	I
45	h	8483.39	Mo	I	45	h	8483.39	Mo	I
11		8483.56	Ru	I	11		8483.56	Ru	I
45	w	8485.99	Sm	II	45	w	8485.99	Sm	II
5		8490.15	Dy	I	5		8490.15	Dy	I
11		8495.82	Ce	I	11		8495.82	Ce	I
9		8495.98	Zr	I	9		8495.98	Zr	I
15		8496.04	Ti	I	15		8496.04	Ti	I
7		8496.09	U	I	7		8496.09	U	I
120		8498.02	Ca	II	120		8498.02	Ca	II
40		8498.44	Zr	I	40		8498.44	Zr	I
12		8499.52	V	I	12		8499.52	V	I
5		8500.67	Th	II	5		8500.67	Th	II
13		8502.70	Tb	I	13		8502.70	Tb	I
7		8504.53	U	I	7		8504.53	U	I
13	h	8507.37	La	I	13	h	8507.37	La	I
29	c	8508.08	Lu	I	29	c	8508.08	Lu	I
9		8510.79	Dy	II	9		8510.79	Dy	II
30	w	8510.90	Sm	II	30	w	8510.90	Sm	II

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
6 h	8511.36	Ce I	2 h	8574.57	Co I	10 h	8670.92	Mn I
30 h	8511.80	Tb I	7	8574.59	U I	12 h	8672.06	Mn I
50	8512.94	Ho I	4	8575.35	Co I	19 hw	8672.11	La I
13 h	8513.57	La I	8	8575.58	Dy II	7	8672.62	Dy I
5	8513.78	Zr I	17	8575.87	Nb I	10 h	8673.97	Mn I
9	8514.08	Fe I	15	8575.92	Ta I	40	8674.43	La I
8 h	8514.65	La II	4 h	8579.77	Gd II	9	8674.75	Fe I
5	8515.06	Zr I	5	8582.03	Nd II	5	8674.86	Gd I
3	8515.11	Fe I	45	8583.45	Tb II	90	8675.39	Ti I
6 h	8516.55	Th I	18	8584.21	Zr I	5	8677.48	Nd
4	8517.68	Dy II	27	8585.11	W I	12 w	8677.81	Sm II
14	8517.71	Er II	1	8586.74	Co I	9	8678.25	Tb I
19 h	8518.05	Ti I	5 h	8587.63	Th II	17	8678.49	Dy II
40	8518.32	Ti I	7	8587.84	Zr I	45	8682.99	Ti I
15000	8521.24	Cs I	3	8589.73	Co I	5	8685.26	Dy I
18	8521.37	Er II	9 h	8590.94	La I	4	8686.07	Th II
9 h	8523.34	Ce I	5	8591.53	Nd II	70	8688.63	Fe I
7	8525.73	Dy II	12	8591.83	Th II	23	8691.28	U I
17 b	8526.59	La LaO	10	8594.42	W I	6	8691.29	Nd II
25	8526.99	Nb I	7	8594.87	Nd II	23	8692.33	Ti I
29 cw	8527.73	Re I	10 cw	8595.84	Ta I	6	8695.07	Nd II
13 h	8527.88	Gd I	9 h	8598.18	Ti I	11	8696.83	Dy II
4 h	8528.32	Dy II	16 h	8599.10	Pd I	8 h	8697.32	Ho
8 h	8528.94	Y I	9 b	8600.81	La LaO	21 c	8697.55	Nb I
4	8530.53	Nd II	18	8601.84	Ho II	12 h	8701.05	Mn I
18 h	8532.74	Pd I	30	8603.40	Tb I	5	8702.08	U II
6	8534.49	V I	6 h	8605.27	Pr II	11 h	8702.38	Ce II
12	8539.08	Ce II	75	8607.96	U I	17 h	8703.76	Mn I
14	8539.38	Ti I	5	8610.24	Zr I	13	8706.32	Sm II
11	8540.19	U I	35 c	8610.98	Lu I	45 w	8708.43	Sm II
1000	8542.09	Ca II	6	8611.81	Fe I	5	8709.23	Th I
4	8542.32	U I	10	8612.64	Ce I	18	8710.77	U I
23	8543.22	Sm II	8	8613.27	W I	22	8710.84	Ru I
17 c	8543.46	La I	3	8614.50	W I	40	8711.24	Hf I
4	8543.72	Th I	4	8615.97	Gd II	6	8712.82	Nd II
4	8544.59	Th I	23 w	8617.03	Sm II	10	8714.59	Pr II
65	8545.44	La I	4	8618.96	U II	6	8715.03	Nd I
20	8545.61	Ho II	7 h	8624.22	La I	11 h	8715.95	Dy II
7 h	8546.07	Tm II	6 bl	8624.86	V VO	7	8716.66	Ce II
150	8546.48	Hf I	11	8630.12	Dy I	30 w	8717.89	Sm II
13 c	8547.25	Nh I	23 w	8632.82	Sm II	5	8719.62	Th II
40	8548.12	Ti I	9	8635.78	Dy II	13 h	8720.41	La I
6	8548.86	Cr I	15	8638.47	La I	5	8721.65	Th II
8	8548.93	Dy II	4	8639.44	Th I	14	8724.98	Ru I
11 h	8550.49	Ta I	160	8640.06	Hf I	7	8727.77	Eu I
8 h	8552.60	Sn I	5	8641.01	Zr I	8	8732.43	Th I
4 h	8556.32	Th I	9	8641.12	U I	19	8734.69	Ti I
7	8557.32	U I	21 cw	8642.67	Eu I	10	8734.86	Zr I
9	8557.79	Dy II	8 c	8643.43	Nd II	30 h	8740.93	Mn I
5	8559.11	Gd I	4	8645.31	Th I	21	8740.96	Nb I
400 h	8559.95	Ba I	10 h	8647.66	Ce I	18	8748.04	Th I
17 c	8560.54	Nb I	27	8655.94	Dy II	35	8748.38	La I
6	8561.72	Gd I	17	8657.68	Dy II	6	8749.17	Th I
15 b	8563.54	La LaO	7	8659.57	U I	12	8749.48	Zr I
9 h	8564.58	Ce I	6 h	8659.66	Gd I	20	8750.40	Dy II
11	8565.73	Tm II	2	8661.09	Co I	6	8752.77	Gd I
7 h	8567.48	Ce I	8 h	8661.48	Gd II	18	8753.68	U I
7	8567.71	U I	35	8661.91	Fe I	8	8757.19	Fe I
7	8567.97	Dy I	550	8662.14	Ca II	30	8757.77	U I
4	8568.20	Th II	10	8665.49	Th I	15	8758.25	Th I
8	8568.54	Zr I	5	8667.07	Nd II	30 w	8758.28	Sm II
9	8569.77	Ti I	7 h	8667.37	Dy II	65	8761.35	Pd I
16	8570.51	U I	4	8668.12	Th I	19 h	8761.40	Sc I
7	8571.05	Zr I	21	8668.63	Gd I	550	8761.42	Cs I
11	8573.12	Th I	40	8670.19	Ho I	6	8762.93	Zr I

TABLE 2. All observed lines in order of wavelength—Continued

Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum	Intensity and Character	Wavelength in Å	Element and Spectrum
8	8764.00	Fe I	95	8800.62	Y I	26	8859.76	Sm II
65	8765.74	Tb II	16	8804.98	Zr I	30	8860.98	Ba I
23	8766.64	Ti I	16 h	8805.48	Ho II	9	8862.55	Ni I
21	8767.97	Nb I	140	8806.79	Mg I	13	8865.53	W I
22	8768.64	Er I	2	8809.42	Ni I	9	8866.84	Er II
11	8770.36	Gd I	12	8810.84	Ce I	10	8866.96	Fe I
25	8772.14	Ce II	29 cw	8815.56	Nb I	18 h	8867.31	Gd I
11 h	8774.8	Sc	8	8816.16	Th II	15	8868.82	Th I
8 h	8775.58	Th I	9	8816.56	U I	18	8870.30	Eu I
11 h	8776.63	Er II	19	8818.93	La I	30	8891.20	Ce II
9	8777.36	Ru I	3	8819.15	Co I	60	8899.52	Zr I
15 h	8778.71	Ti I	15 h	8823.8	Sc I	45	8905.75	Dy II
16 w	8780.59	Sm II	40	8824.23	Fe I	35	8905.78	Nb I
12	8780.83	Dy I	35	8825.82	La I	95	8913.66	Sm II
9	8782.17	Ce I	21 h	8832.06	Gd II	35	8914.99	Ba I
6	8782.46	Eu I	7	8832.81	Dy II	90	8915.98	Ho II
8 h	8784.55	Th II	13	8833.08	Dy II	50	8918.80	Se I
13	8784.85	Gd I	30 h	8834.35	Sc I	60 c	8919.85	V I
10	8786.23	Zr I	20 c	8834.49	Ho I	70 h	8922.56	Yb II
8	8787.37	U II	19 h	8835.85	Y II	29 c	8932.93	V I
23 w	8788.83	Sm II	70	8836.09	Zr I	8000	8943.59	Cs I
6	8789.87	Ge I	17	8839.10	Nd II	40	8947.15	Cr I
12 cw	8790.88	Eu I	21	8839.63	La I	15	8957.97	Th II
45	8791.39	Dy II	6	8841.17	Th I	40	8967.64	Th I
6	8793.38	Fe I	18	8842.07	Th II	12	8971.62	V I
15 h	8794.72	Sc I	14 h	8849.14	Gd I	15 bl	8971.96	Th ThO
10	8795.76	Gd I	24	8850.37	Dy II	19	8976.83	Cr I
						25	8999.56	Fe I
						65	9004.73	Hf I



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16. ABSTRACT (A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.)  The relative intensities, or radiant powers, of 39 000 spectral lines with wavelengths between 2000 and 9000 Ångstroms have been determined on a uniform energy scale for seventy chemical elements. This was done by mixing 0.1 atomic percent of each element in powdered copper, pressing the powder-mixture to form solid electrodes which were burned in a 10 ampere, 220 volt direct-current arc, and photographing the spectra with a stigmatic concave grating while a step sector was rotating in front of the slit. The sectored spectrograms facilitated the estimation of intensities of all element lines relative to copper lines which were then calibrated on an energy scale provided by standardized lamps, and all estimated line intensities were finally adjusted to fit this calibration. Comparisons with other intensity measurements in individual spectra indicate that the National Bureau of Standards spectral-line intensities may have average errors of 20 percent, but first of all they provide uniform quantitative values for the seventy chemical elements commonly determined by spectrochemists. These data are presented by element in part I, and all 39 000 observed lines are given in order of wavelength in part II.				
17. KEY WORDS (six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons)  Classification of spectral lines; intensities of spectral lines; spectral-line intensities; tables of spectral-line intensities; wavelengths of spectral lines.				
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