NBS MONOGRAPH 145
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.

Tables of Spectral-Line Intensities

Part II - Arranged by Wavelengths

Second Edition

William F. Meggers, Charles H. Corliss and
Bourdon F. Scribner

Institute for Basic Standards
National Bureau of Standards
Washington, D.C. 20234

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
NATIONAL BUREAU OF STANDARDS, Richard W. Roberts, *Director*

Issued May 1975

Library of Congress Cataloging in Publication Data

Meggers, William Frederick, 1888-1966.
Tables of spectral-lines intensities.

(National Bureau of Standards Monograph 145)
"The intensity, character, wavelength, spectrum, and energy levels of 39,000 lines between 2000 Å and 9000 Å observed in copper arcs containing 0.1 atomic percent of each of 70 elements."

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CONTENTS: Pt. 1. Arranged by elements.—Pt. 2. Arranged by wavelengths.
Supt. of Docs. No.: C13.44:145.
1. Spectrum analysis—Tables, etc. I. Corliss, Charles H., joint author. Tables of spectral-line intensities. II. Title. III. Series: United States. National Bureau of Standards. Monograph 145.
QC100.U556 No. 145 [QC453] 389'.08s [535'.84] 74-16256

National Bureau of Standards Monograph 145

Nat. Bur. Stand. (U.S.), Monogr. 145, 228 pages (May 1975)
CODEN: NBSMA6

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON: 1975

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
(Order by SD Catalog No. C13.44:145/II). Price $8.55 (Part I); $6.80 (Part II)
Stock Number 0303–01337 (Part I); 0303–01338 (Part II)

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.

References

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Charles H. Corliss

Washington, D.C., April 25, 1974

Contents

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][1] 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

[1] 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 Zaîdel, Prokof'ev, and Raiskiĭ [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 quantitively 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 alkalies 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 considered 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 intensities 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

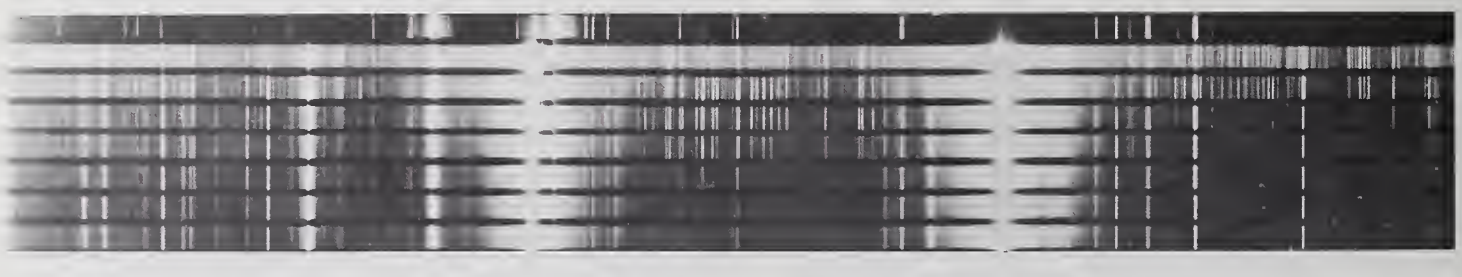

FIGURE 1. *Arc spectra of elements (V, Nb, Ta) diluted progressively in silver, and burned on copper electrodes.*
Spectral range 3880 to 4320 Å.

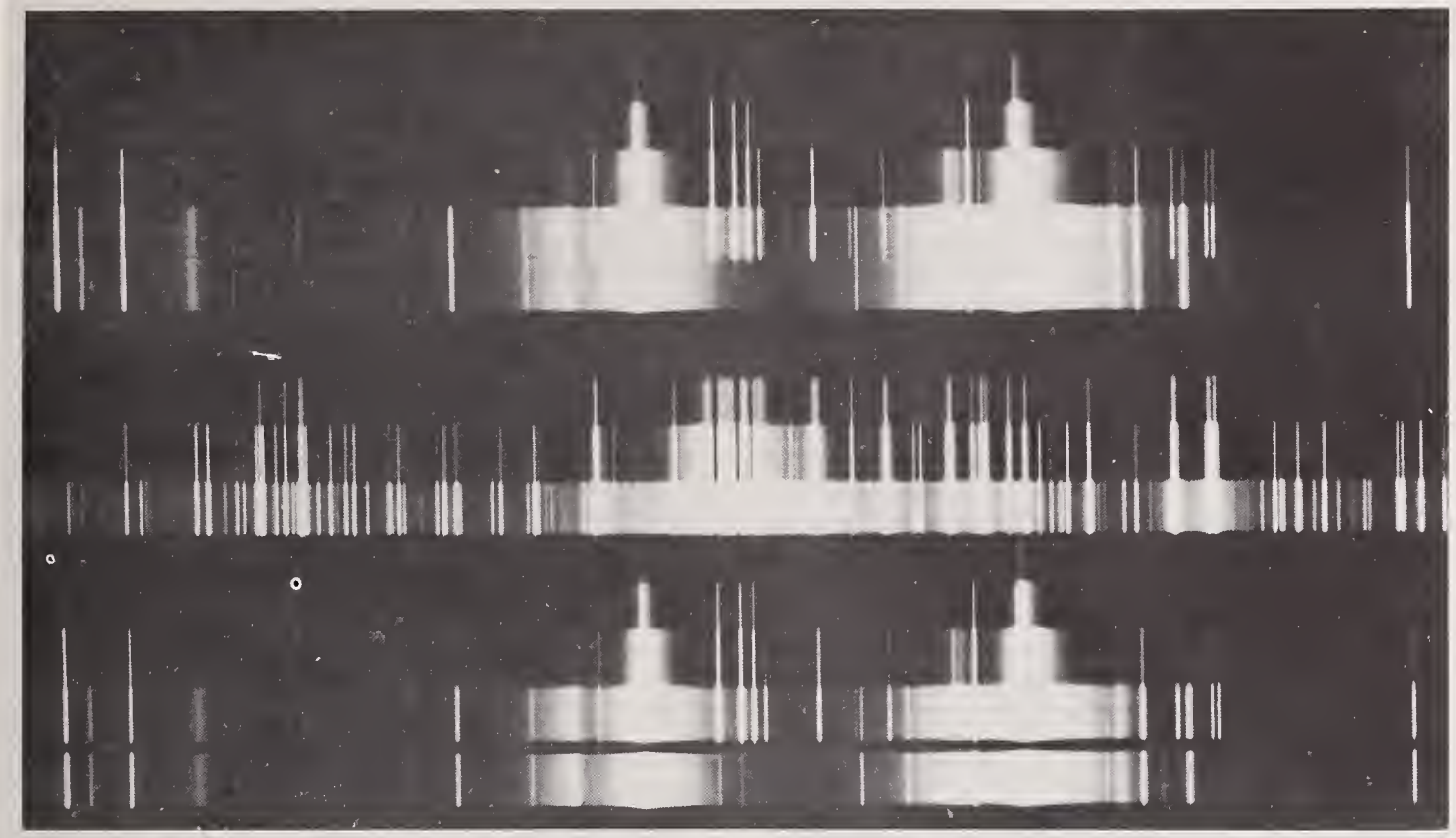

FIGURE 2. *Arc spectra of pure manganese (center), and of copper containing 0.1 percent Mn (above and below), all through a rotating step sector.*

Spectral range 3960 to 4105 Å.

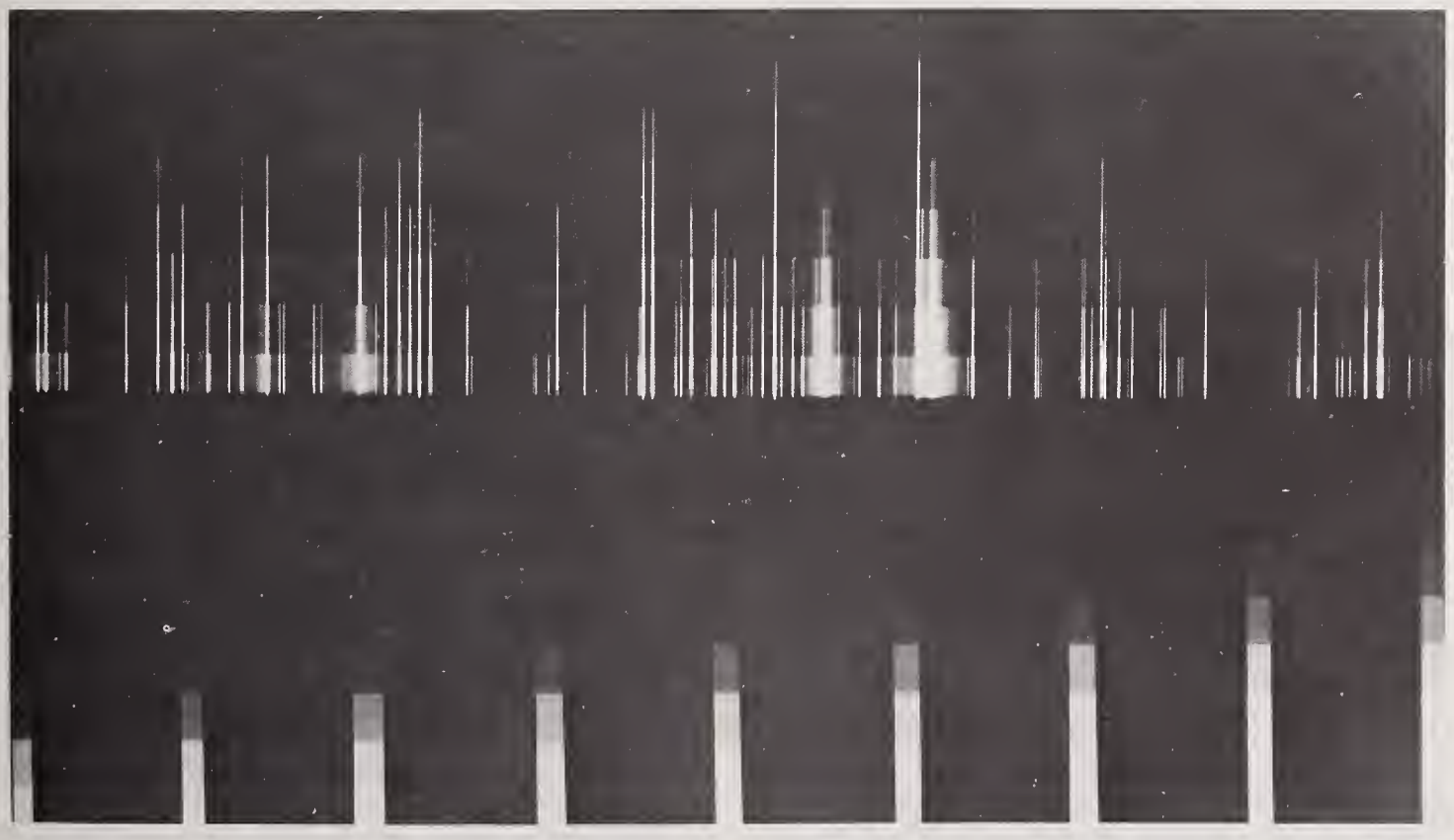

FIGURE 3. *Energy calibration of copper lines.*

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 ¼ in in diameter, ¼ 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 5A/mm, and the practical resolving power about 50,000 with a slit width of 30 μ.

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[2] 103–0 Ultraviolet 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:

[2] 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
A	*K*	*K*
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 λ 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 λ 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 ± 300 K has been obtained as the average temperature of the 10 A, 220 V, copper arc.

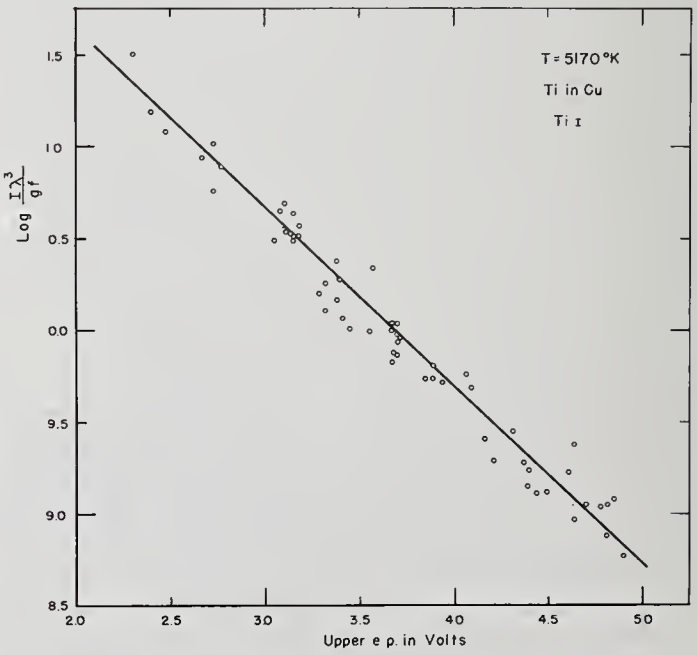

FIGURE 4. *Plot of log intensity* λ^3 *over* gf *versus upper excitation potential of* Ti I *lines.*

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 ± 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 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, 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 cm^{-1}. This direct and simple procedure avoids the labor of converting all energy levels from cm^{-1} to electron volts by means of the relation one $eV = 8065\ cm^{-1}$.

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 abstracted 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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WASHINGTON, D.C., January 1, 1961.

Tables of Spectral-Line Intensities—Part II

Arranged by Wavelengths

Table 1.

The Strong Lines

in Order of Wavelength

TABLE 1. *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 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	
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	Ga	I
1800		2490.64	Fe	I	1000		2758.31	Ta	I	830		2943.90	U	II
2400		2496.78	B	I	4400	d	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		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	c	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	c	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	d	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	c	3662.29	Ho	I
4100	c	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	d	3617.02	Th	II	13000		3710.30	Y	II
4800		3554.43	Lu	II			3617.12	Th	II	1000	d	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	cw	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	2500	3805.36	Nd II	1500	3871.04	U I
2700	3739.80	Nb I	3200	3806.72	Mn I	3400	3871.64	La II
1300	3741.18	Th II	1000	3808.11	Ce II	7000	3872.11	Dy II
3500	3742.28	Ru I	1600	3810.33	Er I	5500	3873.12	Co I
1700	3742.39	Nb I	8900 c	3810.73	Ho II	3500 w	3874.17	Tb II
4500	3743.47	Gd II	1900	3812.00	U I	1700 c	3877.19	Pr II
5000	3744.06	Tm I	3700	3813.97	Gd II	1100	3878.36	Ce II
2400	3745.56	Fe I	1300 h	3816.03	Pr II	1500	3880.61	Er II
2800	3745.59	Ru I	39000 cw	3819.67	Eu II	1200	3880.78	Nd II
870	3747.17	Tb II	5000	3820.43	Fe I	1000	3881.46	U II
870	3747.34	Tb II	1300	3820.73	Hf I	1500	3882.45	Ce II
3200 cw	3748.17	Ho II	3800	3822.26	Rh I	6800	3883.13	Tm I
950	3748.68	U II	2100	3823.51	Mn I	3700	3885.29	Sm II
4000	3749.49	Fe I	3200	3825.88	Fe I	1500	3885.42	Zr I
3700	3752.52	Os I	1600	3826.20	Sm II	1800	3886.28	Fe I
650	3752.57	Th II	1200	3826.42	Nd II	1700	3886.37	La II
5200	3752.86	Ti I	750	3826.51	U II	5400	3887.35	Tm I
1100	3755.24	Tb II	1500	3830.26	Tb I	3000 c	3888.96	Ho II
4700	3757.37	Dy II	3600	3830.48	Er II	1300	3889.93	Nd II
3000	3758.24	Fe I	960	3830.70	Pr II	1000	3889.98	Ce II
2400	3759.08	La II	2000	3831.46	U II	2900	3890.32	Zr I
1900	3760.69	Sm II	4000	3832.88	Y II	2200	3890.36	U II
6000	3761.33	Tm II	1700	3833.75	Mo I	1300	3890.58	Nd II
4800	3761.91	Tm II	2200	3835.96	Zr I	1300	3890.94	Nd II
510	3762.88	Th II	2300	3836.50	Dy II	13000 c	3891.02	Ho II
	3762.94	Th I	1300	3836.76	Zr II	2000	3891.38	Zr I
1700	3763.79	Fe I	1100	3838.54	Ce II	4200	3892.68	Er I
1700	3765.14	Tb I	1700	3838.98	Nd II	7900	3894.08	Co I
8700	3768.39	Gd II	1200	3839.62	U I	5200	3896.23	Er II
10000	3774.33	Y II	840	3839.74	Th II	1600	3896.98	Sm II
1400	3775.50	Nd II	2600	3840.75	V I	5800	3898.53	Dy II
12000 cw	3775.72	Tl I	1600	3843.50	Sm II	2400	3899.20	Tb II
2100	3776.49	Tb II	6900	3845.47	Co I	2000	3900.21	Nd II
1400	3777.64	Hf I	8900	3848.02	Tm II	1600	3901.33	Tb I
1900	3782.84	U II	1700 d	3848.24	Nd II	1300	3901.84	Nd II
2900	3783.05	Gd I		3848.31	Nd II	2400	3902.25	V I
2400	3784.25	Nd II	1500	3848.52	Nd II	19000	3902.96	Mo I
1400	3785.46	Hf I	860	3848.59	Ce II	1700	3905.89	Nd II
3900	3786.06	Ru I	3700	3848.73	Tb II	11000	3906.31	Er II
3300	3786.18	Dy II	1600	3849.02	La II	28000 cw	3907.10	Eu II
860	3786.63	Ce II	3300	3850.69	Gd II	20000	3907.49	Sc I
1800	3786.84	Er II	1200	3850.79	Pr II	3100	3908.42	Pr II
1700	3787.06	Nb I	5100	3850.97	Gd II	2000	3911.16	Nd II
1500	3788.12	Sm II	2400 d	3851.66	Nd II	23000	3911.81	Sc I
7400	3788.70	Y II		3851.74	Nd II	980	3912.44	Ce II
1300	3790.15	Nb I	4300	3852.45	Gd II	1300	3916.05	La II
6000	3790.51	Ru I	960	3852.80	Pr II	3500	3916.48	Tm I
3700	3790.83	La II	860	3853.15	Ce II	2200	3916.51	Gd II
3500	3791.21	Nb I	1800 c	3854.07	Ho II	1300 c	3918.85	Pr II
3800	3793.22	Rh I	1200	3854.18	Ce II	1900	3919.16	Cr I
1600	3793.97	Sm II	2700	3854.21	Sm II	1100	3921.54	La II
3900	3794.78	La II	1200	3854.31	Ce II	2500	3922.40	Sm II
7100	3795.75	Tm II	2400	3854.66	U II	960	3925.44	Pr II
5100	3796.37	Gd II	3000	3855.84	V I	3300	3925.92	Ru I
8900 c	3796.75	Ho II	5900	3856.52	Rh I	1900	3928.28	Sm II
1600	3797.73	Sm II	4900	3859.58	U II	2200	3929.22	La II
2700	3798.12	Nb I	4200	3859.91	Fe I	1200	3929.53	Zr I
29000	3798.25	Mo I	2700 c	3861.68	Ho II	590	3929.67	Th II
7600	3798.90	Ru I	7500	3862.85	Er I	32000 cw	3930.48	Eu II
4900	3799.31	Rh I	3700 d	3863.33	Nd II	2000	3932.03	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		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 c	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			
2400	4177.32	Nd II	1500	4305.76	Pr II	3000	4522.57	Eu II
8000	4177.54	Y II	6000	4305.92	Ti I	6000	4533.24	Ti I
620	4178.06	Th II	2800	4309.63	Y II	65000	4554.03	Ba II
5200	4179.38	Pr II	2200	4318.83	Tb I	5400	4554.51	Ru I
						2100	4562.36	Ce II
2400	4184.25	Gd II	1900	4318.94	Sm II			
3500	4186.60	Ce II	2600 d	4325.57	Gd II	1100	4572.28	Ce II
12000	4186.82	Dy I		4325.69	Gd I	640	4576.21	Yb I
8800	4187.62	Tm I	3000	4326.43	Tb I	11000	4594.03	Eu I
2500	4188.32	Mo I	1800	4329.02	Sm II	1200	4606.77	Nb I
						6500	4607.33	Sr I
2500	4189.48	Pr II	4600	4333.74	La II			
2200	4190.78	Gd I	1300	4333.97	Pr II			
1200	4190.88	Nb I	870	4336.43	Tb I	9800	4627.22	Eu I
6800	4194.84	Dy I	980	4337.77	Ce II	1700	4628.16	Ce II
1300	4195.66	Nb I	1700	4338.41	Tb I	1600	4646.17	Cr I
						8300	4661.88	Eu I
1500	4196.55	La II	680	4341.69	U II	2300	4687.80	Zr I
7600	4199.90	Ru I	1900	4344.51	Cr I			
910	4202.94	Ce II	2200	4346.46	Gd I			
6000	4203.73	Tm I	2300	4351.77	Cr I	1900	4710.08	Zr I
60000 cw	4205.05	Eu II	1100	4351.84	Pr II	1400	4739.48	Zr I
						1400	4810.53	Zn I
2500 c	4206.71	Pr II	870	4356.81	Tb I	2200 cw	4889.14	Re I
620	4208.89	Th II	4000	4358.35	Hg I	20000	4934.09	Ba II
16000	4211.72	Dy I	2700	4359.93	Tm I			
5400	4212.06	Ru I	910	4364.66	Ce II	710	4935.50	Yb I
3700	4215.16	Dy I	1200	4368.33	Pr II	5800	4981.73	Ti I
						4600	4991.07	Ti I
32000	4215.52	Sr II	2400	4372.21	Ru I	4000	4999.51	Ti I
4400	4218.09	Dy I	4200	4374.80	Rh I	5300	5204.52	Cr I
4400	4221.11	Dy I	12000	4374.94	Y II			
1500	4222.60	Ce II	12000	4379.24	V I			
3800	4222.98	Pr II	1900	4381.64	Mo I	8400	5206.04	Cr I
						11000	5208.44	Cr I
2700	4225.16	Dy I	1300	4381.86	Th II	18000	5350.46	Tl I
3800	4225.31	Pr II	910	4382.17	Ce II	1400	5409.79	Cr I
4800	4225.85	Gd I	1700	4383.55	Fe I	3200	5460.74	Hg I
11000	4226.73	Ca I	7000	4384.72	V I			
2000	4227.04	Ho I	4800	4389.97	V I			
						7800	5506.49	Mo I
3600 c	4227.46	Re I	1600	4390.86	Sm II	5200	5533.05	Mo I
2000	4227.76	Zr I	1100	4391.11	Th II	6500	5535.48	Ba I
1300	4232.38	Nd II	1700	4391.66	Ce II	2400	5556.47	Yb I
1500	4232.59	Mo I	3600	4395.23	V I	2500	5570.45	Mo I
1600	4238.38	La II	2300	4406.64	V I			
						20000	5889.95	Na I
2000	4239.31	Zr I	2800	4407.64	V I	10000	5895.92	Na I
980	4239.92	Ce II	3600	4408.20	V I	20000	6141.72	Ba II
960	4241.02	Pr II	4600	4408.51	V I	12000	6496.90	Ba II
1000	4241.67	U II	1700	4408.84	Pr II	1400	6645.11	Eu II
1200	4241.69	Zr I	2500	4411.57	Mo I			
				4411.70	Mo I			
3000	4242.15	Tm II				36000	6707.84	Li I
15000	4246.83	Sc II	980	4418.78	Ce II	690	6799.60	Yb I
2000	4247.38	Nd II	4900	4420.47	Os I	18000	7664.90	K I
1100	4248.68	Ce II	1500	4420.53	Sm II	9000	7698.96	K I
20000	4254.35	Cr I	2900	4424.34	Sm II			
2100	4256.39	Sm II	1200 c	4429.20	Pr II	750	7699.48	Yb I
4900	4260.85	Os I	2000	4429.90	La II	30000	7800.23	Rb I
16000	4274.80	Cr I	1600	4433.88	Sm II	15000	7947.60	Rb I
2200	4280.79	Sm II	1800	4434.32	Sm II	15000	8521.24	Cs I
700	4282.04	Th II	14000 cw	4435.56	Eu II	8000	8943.59	Cs I00

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		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		7200		2076.95	Os	I	2400		2121.59	W	II
40000		2020.30	Mo	II	7200		2078.09	Os		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

559-795 O - 75 - 3 (Pt. 2)

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
							2269.22	Al I
1100	2174.60	Co I	460	2225.70	Cu 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
										100		2326.10	Pt	I
140		2288.57	Rh	I	2600		2309.02	Co	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	d	2326.56	W	I
												2326.70	W	I
1600		2289.98	Ni	I	1800		2311.60	Co	II					
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		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	d	2350.37	W	II	900		2362.77	Os	I
120		2334.96	Ru	II	220	d	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
												2363.97	Tm	III
460		2337.49	Ni	I	680		2352.07	Re	I					
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	h	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	d	2353.95	Re	I	1200		2365.90	Re	I
170		2340.18	Pt	I			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	h	2342.85	Ru	II	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	h	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 h	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		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	h	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
50		2496.24	Ta	I			2501.90	W	II	130		2507.15	Tm	II
210		2496.27	Ir	I	60		2501.84	Os	I	35		2507.18	Os	II
170		2496.31	Cr	I	55		2501.89	Ru	I	150		2507.40	Re	I
35		2496.35	Gd	II	140		2501.98	Ta	II	600		2507.45	Ta	I
70		2496.45	Os		70		2502.02	Yb	II	120		2507.63	Ir	I
45		2496.48	Zr	II	29		2502.28	Co	I	60		2507.64	Er	II
140		2496.53	Fe	I	330		2502.29	Os	I	290		2507.68	Co	I
65		2496.56	Ru	I	570		2502.35	Re	II	240		2507.78	V	I
60		2496.61	Os	I	130		2502.46	Rh	I	100		2507.90	Fe	I
70		2496.64	Ta	I	28		2502.49	Nb	II	55		2507.92	Th	II
230		2496.64	W	II	110		2502.53	Cr	I	24		2508.00	W	II
35		2496.70	Re	I	250		2502.63	Ir	I	11		2508.07	Yb	II
380		2496.71	Co	I	70		2502.66	Hf	I	50		2508.11	Cr	I
2400		2496.78	B	I	55		2502.70	Tm	II	130		2508.27	Ru	I
50		2496.97	W	I	65		2502.84	Mo	II	85		2508.35	Ir	I
290		2496.99	Hf	II	35		2502.88	Th	II	95		2508.44	W	I
95		2497.48	W	II	170		2502.91	Ho	II	120		2508.50	Pt	I
20		2497.56	Th	III	4100		2502.98	Ir	I	80		2508.53	Ho	II
4800		2497.73	B	I	100		2503.01	Ta	II	170		2508.61	Os	I
50		2497.77	Ta	II	60		2503.02	V	II	50	h	2508.67	Mo	I
900		2497.96	Ge	I	14		2503.04	W	I	190		2508.73	W	I
200		2498.22	Re	I	35		2503.16	Os		100		2508.92	Ta	II
85		2498.28	Mo	II	75		2503.30	V	I	60		2508.98	Cr	I
90		2498.33	Ta	II	80		2503.48	Er	II	1800	c	2508.99	Re	I
55		2498.40	Th	II	95		2503.67	Os		110		2509.07	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	
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		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		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
				2542.35	Ta II			
50	2534.82	W 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
						85	2579.44	U II
30	2568.98	U II	960	2574.35	Co I			
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						
70	2572.07	Ir I	45	2577.29	V I	320	2582.54	Hf II
70	2572.10	Nb I	130	2577.32	U II	22	2582.56	La II
95	2572.24	Co I	600	2577.37	Ta II	90	2582.58	Fe II
170 d	2572.24	W II	100	2577.65	Cr I	110	2582.62	Os I
	2572.35	W II	29	2577.73	Tb II	110	2582.77	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
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 I	2596.45	Ta II
130	2584.42	U II	130	2591.33	Hf II	170 h	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
							2597.29	Os I
100	2585.61	Ta I	70	2591.98	Mo 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		2592.53	Ta II	75	2597.73	W I
40	2586.35	W I	75	2592.54	Dy II	65	2597.96	Re I
80	2586.52	Ho I	5000	2592.54	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 h	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		2629.00	W II	310	2635.83	Re II
400	2622.21	W I	200	2628.93	U II	220	2635.86	Ru I
			80	2628.97	Mo I			
95	2622.43	Co 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		2638.75	W I
						85	2638.67	Ta II
60	2625.20	Ho II	45	2632.13	Ru I			
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

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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
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	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	270		2692.34	Ir	I	40		2696.30	U	II
30	h	2686.50	Rh		200		2692.36	U	II	45		2696.49	Ni	I
30	h	2686.91	Rh		260		2692.40	Ta	I	40		2696.61	Os	I
230		2687.09	Cr	II	480		2692.42	Th	II	14		2696.62	Yb	II
130		2687.13	Th	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	Ge	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		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		2704.18	Ho	II	21		2708.84	Yb	II	65		2713.91	U	II
40	h	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	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
												2742.86	Re	I
11		2733.21	Th	II	65		2738.46	Os	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	2748.26	Au I	3600	2754.17	Lu II	80	2759.39	Cr II
110 h	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	1	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	1	28		2771.36	Mo	I
95		2761.37	Co	1	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										
					20		2766.91	Fe	I	180		2772.08	Fe	I
110		2761.78	Sn	I	160		2766.96	Hf	I	95	d	2772.18	U	II
70		2761.91	Zr	II	35		2767.01	Ce	II	45		2772.32	Hf	II
110		2761.93	Re	I	35		2767.02	Tb	II	70		2772.42	Dy	II
160		2762.03	Fe	I	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	1	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	1					
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	1	17		2769.57	Nb	II	180		2774.02	Hf	II
150		2763.94	Os	1	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	1	190		2774.39	Mo	II
20		2764.33	Fe	1	270		2769.89	Ho	II	35		2774.48	Ru	I
80	h	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	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	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
										2817.87	Ti	II
65		2808.57	W	I	420	2813.84	Os	I				
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
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
				2827.29	W I			
110	2822.03	Ru 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
				2827.60	Ta II			
30	2822.43	Mo I				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	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	h	2845.13	Lu	I
35		2836.57	Ru	I	190	d	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	c	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	h	2836.91	Cd	I	90		2841.16	Th	II	70		2845.60	Fe	I
180	c	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	h	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	h	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	
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
		2849.56	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
		2850.90	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		40	d	2855.82	Ir	I			2860.76	Rh	I
120		2851.36	Cr	II			2855.93	Ir	I	170		2860.80	U	II
					45		2855.90	La	II					
80		2851.44	Th	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				
		120	2866.09 Sm II	28	2870.90 Mo I
420	2861.41 Ru I	70	2866.14 Ta I	40	2870.91 W I
250	2861.49 Ho II	150	2866.16 U II	340	2870.97 U II
45	2861.62 Ce II	85	2866.26 Dy II	45	2871.08 Ce II
760	2861.70 Hf 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

559-795 O - 75 - 5 (Pt. 2)

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	d	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	h	2880.77	Cd	I	570	h	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		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		45		2911.68	Cr	II	30		2915.56	Ce	II
		2907.99	Sm	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	
170		2915.82	Ho	II
300		2915.99	Zr	II
45	h	2916.02	V	I
50		2916.10	Mo	I
120		2916.24	Tb	II
27		2916.25	Zr	I
1100		2916.26	Ru	I
440		2916.36	Ir	I
40		2916.37	Th	I
18		2916.43	Yb	II
220		2916.46	U	II
2000		2916.48	Hf	I
130		2916.53	Tm	II
110		2916.64	Zr	II
45		2916.68	Ce	II
65	h	2916.73	Re	II
45		2917.03	Th	II
65		2917.05	Nb	II
35		2917.12	Ta	I
530		2917.26	Os	I
120		2917.37	V	II
160		2917.41	Th	II
30		2917.44	Eu	II
30		2917.49	Hf	II
35		2917.56	Ta	II
50		2917.67	W	I
28		2917.77	Ru	I
55		2917.79	Th	II
130		2917.83	Os	I
45		2917.90	Th	II
60		2917.93	V	I
80		2918.03	Fe	I
270		2918.24	Zr	II
360		2918.25	W	I
210		2918.27	Tm	II
2800		2918.32	Tl	I
95		2918.37	U	II
45		2918.52	Gd	II
230		2918.57	Ir	I
580		2918.58	Hf	I
50		2918.63	W	II
70		2918.65	Dy	II
100		2918.67	Ce	II
95		2918.68	U	II
25		2918.78	Ce	II
40		2918.83	Er	II
120		2918.83	Mo	II
65		2918.88	Re	I
120		2918.89	Tb	II
95		2918.96	Ta	II
170		2918.97	U	II
65		2919.00	Tb	II
160		2919.05	Y	I
24		2919.20	Mo	I
100		2919.28	Er	II
70		2919.34	Pt	I
280		2919.35	Yb	II
55		2919.38	Mo	I
100		2919.41	Re	I
320		2919.59	Hf	II
150		2919.61	Ru	I
300		2919.62	Ho	II
2100		2919.79	Os	I
140		2919.84	Th	II
210		2919.99	V	II
80		2920.24	Er	II
45		2920.37	Th	II
380		2920.38	V	II
50		2920.69	Fe	I
45		2920.93	Th	II
70		2920.98	Tm	II
55		2921.07	Os	I
55		2921.12	Yb	II
90		2921.24	Cr	II
50		2921.26	Nd	
60		2921.26	Tm	II
23		2921.37	Th	II
30		2921.38	Pt	I
440		2921.52	Tl	I
160		2921.53	Th	II
		2921.62	Th	II
440	d	2921.68	U	II
		2921.72	U	II
60		2921.82	Cr	II
55		2921.85	Ho	II
95		2922.06	U	II
70		2922.09	Tm	II
35		2922.11	Ta	II
35		2922.37	Ce	II
520		2922.49	Pd	I
25		2922.58	Ce	II
70		2922.60	Ho	II
70		2922.60	Th	II
45		2922.80	Th	II
70		2922.84	Ta	II
70		2922.84	Tm	II
23		2922.99	Th	II
30		2923.10	Rh	I
360		2923.10	W	I
95		2923.17	U	II
35		2923.18	Os	
80		2923.29	Fe	I
80		2923.30	Er	II
95		2923.32	Gd	II
1300		2923.39	Mo	II
270		2923.50	U	II
230		2923.54	W	I
710		2923.62	V	I
50		2923.85	Fe	I
70		2923.85	Zr	I
180		2924.02	Rh	I
2400		2924.02	V	II
23		2924.10	Th	II
120		2924.16	Tb	II
45		2924.24	Yb	II
35		2924.25	Gd	II
140		2924.32	Mo	II
110		2924.49	Os	I
120		2924.53	Tb	II
170		2924.58	U	II
160		2924.60	Re	I
180		2924.62	Hf	I
1700		2924.64	V	II
45		2924.64	Zr	II
4400		2924.79	Ir	I
850		2925.04	Eu	II
250		2925.05	Th	II
230		2925.13	W	I
75		2925.19	Ce	II
410		2925.19	Ta	I
120		2925.20	Re	I
95		2925.22	U	II
40		2925.28	Os	I
110		2925.35	Ho	II
190	h	2925.57	Mn	I
300		2925.57	Os	I
270		2925.57	U	II
270		2925.65	Tm	II
35		2925.66	Ta	I
70		2925.92	Tm	II
65		2925.94	Tb	II
170		2925.98	U	II
160		2926.09	Ho	II
95		2926.13	U	I
60		2926.26	V	I
95		2926.39	U	II
100		2926.46	Ta	I
60		2926.59	Fe	II
220		2926.59	U	II
680		2926.74	Tm	II
65		2926.93	Re	I
90		2926.99	Ho	II
90		2926.99	W	I
320		2926.99	Zr	II
70		2927.06	Dy	II
60		2927.08	Cr	II
28		2927.12	Ru	I
29		2927.31	Tm	II
60		2927.36	Er	II
320		2927.38	U	II
830	c	2927.42	Re	I
65		2927.54	Mo	II
35		2927.54	Ru	II
95		2927.67	Co	I
50		2927.67	Tm	II
150		2927.71	Er	II
1100		2927.81	Nb	II
25		2927.85	Yb	II
50		2927.93	W	I
80		2928.15	Cr	II
90		2928.19	W	I
110		2928.22	Tm	II
250		2928.25	Th	II
160		2928.28	Er	II
95		2928.30	Cr	II
300	c	2928.30	Ho	II
35		2928.34	Gd	II
340		2928.34	Ti	I
110		2928.45	Er	II
490		2928.60	U	II
29		2928.63	Tm	II
50		2928.66	W	I
27		2928.68	Mn	I
40		2928.70	Th	III
16		2928.75	Mg	II
30		2928.81	Co	I
200		2929.01	Fe	I
60		2929.01	Hf	I
30		2929.11	Ce	II
130		2929.11	Rh	I
170		2929.12	U	II
350		2929.27	Er	II
40		2929.30	Th	II
26		2929.44	Cr	II
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
												2940.48	Mn	I
120		2930.64	Er	II	27		2935.29	Nb	II					
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		2940.77	Hf	I
70		2931.00	Dy	II	630		2935.99	Tm	II	45	h	2940.79	Ce	II
15		2931.03	Ti		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	
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 cw	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 c	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 h	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 c	2954.94	Ho II
90	2945.46	Zr II	270 h	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 d	2949.81	Os I	50	2955.05	Tm II
				2949.90	Os I			
35	2945.69	Ta I				35	2955.27	Ho II
95	2945.70	Tb II	65	2949.88	Re I	100 c	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	d	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
		2988.79	Nb	I	400		2993.61	W	I	28		2999.27	Th	II
50		2988.71	Dy	II	70		2993.63	Th	II	70		2999.37	Ta	II
240		2988.71	U	II	170		2993.70	U	II	22		2999.43	Ce	II
1400		2988.95	Ru	I	160		2993.80	Th	II	22		2999.48	Ce	II
340		2988.95	Sc	I	120		2993.90	Tm	II	360		2999.51	Fe	I
2800		2989.03	Bi	I	28		2993.94	Yb	II	5500		2999.60	Re	I
60		2989.05	Ta	I	230		2994.07	Cr	I	130		2999.60	Tm	II
110		2989.13	Os	I	30		2994.09	Er	II	20		2999.64	Ca	I
160		2989.19	Cr	II	29		2994.33	Tm	II	45		2999.80	Th	II
1800		2989.27	Lu	I	110		2994.42	Ce	II	75		3000.07	Ce	II
140		2989.31	Er	II	1200		2994.43	Fe	I	170		3000.09	U	II
190		2989.50	Ta	I	120		2994.45	U	II	170		3000.10	Hf	II
80		2989.56	Er	II	1000		2994.46	Ni	I	27		3000.12	Nb	I
690		2989.59	Co	I	110		2994.47	Er	I	50		3000.23	Mo	I
45		2989.60	V	II	75		2994.54	V	II	50		3000.24	W	I
35		2989.66	Ru	I	470		2994.73	Nb	II	50		3000.45	Fe	I
70		2989.77	Dy	II	40		2994.73	Nd		70		3000.46	Yb	II
190		2989.80	Mo	I	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 c	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 h	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
						120	3015.68	U II
70	3005.26	Y I	170	3010.75	U II	85	3015.72	Th II
45	3005.29	Ho II	70	3010.84	Cu I	500	3016.02	Re I
100	3005.37	Zr I	110	3010.84	Ta II	95	3016.05	U II
160	3005.50	Zr I	80	3010.90	Gd II	70 d	3016.09	Tm II
130	3005.52	Tb II	180	3011.12	Ta I		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	3016.43	Ir I	120	3020.57	U II	80	3026.47	Nd II
60	3016.45	Mn I	2800	3020.64	Fe I	26	3026.49	Y II
520	3016.47	W I	430	3020.67	Cr I	150	3026.57	Th II
300	3016.49	Re I	65	3020.67	Nb I	35	3026.62	Ce II
			95	3020.86	Os	85	3026.65	Cr II
540	3016.78	Hf I						
80	3016.78	Mo I	75	3020.88	Ce II	310 d	3026.67	W I
180	3016.78	V II	310	3020.88	Ru I		3026.79	W I
35	3016.79	Tm II	120	3020.92	U II	160	3026.67	Yb II
230	3016.84	Er II	100	3021.01	Sm	190	3026.70	U II
			50	3021.04	Ce II	120	3027.29	Lu II
1100	3016.94	Hf II						
180	3016.95	Dy II	1600	3021.07	Fe I	170	3027.33	Tb II
290	3016.96	U II	320	3021.22	U II	290 d	3027.48	Ta I
40	3016.97	Re I	40	3021.49	Th II		3027.61	Ta II
270	3017.09	Tm II	200	3021.50	Hg I	85	3027.56	Dy II
			2800	3021.56	Cr I	50	3027.58	Tb II
85	3017.13	Th II				1900	3027.60	Gd II
120	3017.19	Ti II	130	3021.73	Y I			
370	3017.20	Ce II	120	3021.88	Re I	25	3027.63	Ce II
330	3017.24	Ru I	55	3021.95	Tb II	240	3027.66	U I
570	3017.25	Os I	35	3022.07	Tm II	95	3027.77	Mo II
			110	3022.09	Th II	1500	3027.91	Pd I
70	3017.26	Tm II	40	3022.10	Gd II	500	3028.04	Zr II
270	3017.31	Ir I	35	3022.15	Eu I	110	3028.18	Ho II
170	3017.35	U II	630	3022.21	U II	320	3028.19	U II
27	3017.37	Hf I	90	3022.28	Y I	270	3028.27	Er II
770	3017.44	W I	80	3022.41	Ir I	50	3028.43	Rh I
690	3017.55	Co I	60	3022.73	Er II	350	3028.44	Nb II
160	3017.56	Yb II	65	3022.74	Nb II	130	3028.58	Th II
2800	3017.57	Cr I	70	3022.75	Mn I	55	3028.73	Tm II
200	3017.63	Fe I	30	3022.79	Ce II	90	3028.78	Ta I
45	3017.73	Ho II	60	3022.99	Re I	60	3028.96	Ce II
120	3017.74	Er II	160	3023.14	Ho II	120	3028.98	Gd II
30	3017.88	Pt I	25	3023.43	Ce II	220	3029.13	U II
4400	3018.04	Os I	110	3023.43	Tb II	170	3029.16	Cr I
150	3018.10	U II	35	3023.49	Ce II	320	3029.20	Au I
70	3018.16	Ho II	75	3023.70	Tb II	85	3029.23	Tb II
29	3018.26	Tm II	130	3023.91	Rh I	50	3029.27	Pr II
980	3018.31	Hf I	260	3024.03	Fe I	380	3029.36	Ir I
95	3018.35	Nd II	90	3024.09	Ta I	120	3029.42	U II
110	3018.49	Th II	1100	3024.35	Cr I	880	3029.52	Zr I
430	3018.50	Cr I	130 c	3024.38	Ho II	140	3029.73	Ti II
95	3018.59	Tm II	170	3024.38	U II	35	3029.74	Nb II
120	3018.59	U II	110	3024.50	W II	210	3029.81	Dy II
240	3018.82	Cr I	320	3024.51	U II	500	3029.83	Sb I
55	3018.95	Y I	35	3024.57	Ce II	190	3030.15	Fe I
180	3018.98	Fe I	80	3024.60	Hf I	710	3030.24	Cr I
350	3019.14	Ni I	2400	3024.64	Bi I	110	3030.29	Ta I
130	3019.17	Tb II	40	3024.67	Th II	170	3030.31	Ce II
140	3019.23	Ir I	140	3024.74	Nb II	110	3030.40	Dy II
2700	3019.34	Sc I	80	3024.76	Hf II	380	3030.45	Re I
18	3019.37	Ru I	210	3024.93	W I	40	3030.49	Th I
480	3019.38	Os I	250	3025.00	Mo I	45	3030.65	Gd II
110	3019.42	Th II	180	3025.16	Ta I	1100	3030.70	Os I
50	3019.54	Rh I	140	3025.29	Hf II	360	3030.76	Sc I
60	3019.67	Ta I	170	3025.59	Dy II	120	3030.83	U II
100	3019.76	Er II	180	3025.64	Fe I	40	3030.86	Th II
60	3019.79	Tm II	110	3025.82	Ir I	180	3030.92	Zr II
160	3019.84	Zr II	380	3025.84	Fe I	120	3031.01	Os I
80	3020.01	Ir I	290	3025.95	Er II	70	3031.01	V I
120	3020.24	U II	330	3026.07	Tm II	55	3031.06	Mn II
170	3020.29	Tb 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 d	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		3040.91	Cr 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 d	3041.73	W I	70	3045.72	Sc II
120	3035.96	U II		3041.86	W I	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
310	3036.22	Er II	95	3041.86	U II	110	3046.08	Hf II
100	3036.31	Mo I	95	3041.9	U II	55	3046.38	Dy II
350 d	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
							3068.98	Th	II					
80		3063.68	Pr	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
							3071.50	Nd	II					
1100		3065.31	Pd	I						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	Nb 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
170	3096.50	Ce II
65	3096.50	Nb I
330	3096.57	Ru I
85	3096.68	Sm II
200	3096.76	Hf I
95	3096.86	Tb II
60	3096.88	Ce II
120	3096.88	Sm II
120	3096.88	U II
140 hl	3096.90	Mg I
120	3096.96	Tm II
40	3097.06	Mn I
35	3097.08	Ce II
260	3097.12	Ni I
180	3097.19	Ti II
140	3097.27	Th II
50	3097.40	Tb II
120	3097.45	Eu II
120	3097.60	Ru I
50	3097.77	Pr II
320	3098.01	U II
220	3098.20	Co I
140	3098.48	Nd II
80	3098.50	Pr II
740	3098.60	Tm II
460	3098.64	Gd II
190	3098.90	Gd II
210	3099.12	Ni I
370	3099.19	Er II
140	3099.19	Nh II
280	3099.23	Zr II
830	3099.28	Ru I
55	3099.52	Nd II
70	3099.60	Er II
75	3099.60	Tm II
100 d	3099.74	Th II
	3099.86	Th II
550 d	3099.90	Fe I
	3099.97	Fe I
110	3099.93	Mo I
130	3100.01	Pt I
510	3100.29	Ir I
260	3100.30	Fe I
510	3100.45	Ir I
3500	3100.50	Gd II
260	3100.67	Fe I
700	3100.67	Re I
180	3100.67	Ti I
28	3100.74	Yb I
200 d	3100.79	Th II
	3100.94	Th II
740	3100.84	Ru I
110	3100.88	Mo I
180	3100.94	V II
75	3101.03	Ta II
120	3101.18	Gd II
40 d	3101.27	Pr II
560	3101.34	Mo I
45	3101.36	Yb II
340	3101.40	Hf II
310	3101.53	Os I
2600	3101.55	Ni I
50	3101.69	Th II
40	3101.72	Ta I
55	3101.85	Tm II
1300	3101.88	Ni I
230	3101.91	Gd II
280	3101.93	Dy II
28	3102.07	Yb II
100 h	3102.30	Sm II
3000	3102.30	V II
580	3102.39	U II
230	3102.54	Tb II
580	3102.55	Gd II
45	3102.56	Ce II
150	3102.61	U II
200	3102.66	Th II
150	3102.69	Er II
180	3102.69	Ho II
75	3102.87	Tm II
85	3102.90	U II
480	3102.96	Tb II
140	3103.06	Re II
20	3103.11	Pr II
220	3103.24	Dy II
560	3103.25	Ta I
140	3103.26	Re II
370	3103.38	Ce II
120	3103.77	U II
230	3103.80	Ti II
190	3103.83	Dy II
85	3104.01	Ce II
460	3104.16	U II
40	3104.42	Ta I
70	3104.46	Er II
180	3104.59	La II
140	3104.65	Re I
85 d	3104.97	Th I
	3105.05	Th II
95	3104.98	Os I
180	3104.99	Dy II
230	3105.08	Ti II
150	3105.10	U II
150	3105.18	Ho II
40	3105.38	Pr II
130	3105.43	Nd II
220	3105.47	Ni I
120	3105.65	U II
280	3105.75	Th II
65	3105.88	W I
360	3105.99	Os I
320	3106.18	Eu I
95	3106.18	Nd II
260	3106.23	Ti II
55	3106.34	Mo I
250	3106.52	Sm II
690	3106.58	Zr II
50	3106.69	Th II
230	3106.78	Er II
70	3106.81	Ti I
200	3107.03	Th II
75	3107.21	Ta I
240	3107.23	W I
55	3107.38	Os I
200	3107.47	Ce II
55	3107.76	Yb II
170	3107.90	Yb II
65	3108.01	Nd II
240	3108.02	W I
510	3108.30	Th II
200	3108.31	Ho II
130	3108.36	Gd II
110	3108.37	Zr I
95	3108.41	Tb II
60	3108.46	La II
150	3108.65	Ho II
700	3108.81	Re I
100	3108.96	Ce II
310	3108.98	Os I
710	3109.12	Hf II
65	3109.15	Tb II
28	3109.34	Cr I
620	3109.38	Os I
410	3109.76	Dy II
40	3109.78	Pr I
65	3109.82	Tb II
200 c	3109.91	Ho II
250	3110.02	Th II
220	3110.20	Sm II
320	3110.28	Ce II
95	3110.52	U II
90	3110.55	Ru I
40	3110.58	Pr II
50	3110.67	Ti II
40	3110.68	Mn I
2600	3110.71	V II
85	3110.75	Dy II
40	3110.82	Ta II
150	3110.83	U II
28	3110.86	Cr I
340	3110.86	Re I
130	3110.87	Hf II
150	3110.88	Er II
210	3110.88	Zr II
250	3111.09	Os I
65	3111.12	W I
300	3111.17	Ce II
170	3111.19	Gd I
100	3111.34	Pr II
950	3111.43	Eu I
150	3111.45	Nb I
140	3111.56	Re I
970	3111.62	U II
45	3111.81	Y I
65	3111.85	Ho II
55	3112.04	Y II
50	3112.09	Th II
1400	3112.12	Mo I
240	3112.25	U II
65	3112.43	Tb II
50	3112.48	Ti I
50	3112.53	Tb II
160	3113.17	Gd II
55	3113.31	Tm II
310 d	3113.43	Er II
	3113.54	Er II
90	3113.57	V II
75	3113.62	Tb II
100	3113.90	Ta I
2600	3114.04	Pd I
45	3114.05	Ce II
60	3114.05	Ir I
50	3114.07	Th II
270	3114.12	Ni I
30	3114.13	Pr II

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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	Yb 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
	3119.80	Ti II	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	Yb	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
410	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 1	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 1
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 1	400	3177.89	Dy II	75	3182.83	U II
2400	3171.36	Lu 1	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 1	3200	3183.41	V 1
150	3171.68	La III	75	3178.20	Tm II	410	3183.42	Er II
390 dI	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 1	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 1	270	3179.05	Th II	720	3183.92	Sm II
80	3172.62	Er II	130	3179.06	W 1	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 1	70	3179.73	Rh I	100	3184.37	Ni I
110	3173.06	Y II	95	3179.77	Mo I	130	3184.42	W 1
140	3173.09	Re 1	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 1
55	3173.43	Th I	1100	3180.20	Th II	1100	3184.76	Re 1
380	3173.58	Tm II	220	3180.20	U II	200	3184.79	Dy II
270	3173.59	Ta 1	140	3180.23	Fe 1	60	3184.90	Fe 1

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	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 c	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	Nb	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		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		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	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	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	Nb 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
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	Nb 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	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
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		3343.07	Yb II	100	3347.89	Nd
80	3336.74	Er II	50	3342.98	Tb II	210	3348.07	Tb II
90	3336.98	Gd II	55	3343.26	Th II	110	3348.11	Co I
240	3337.17	Yb II	110 d	3343.28	Sc II	180	3348.14	Er II
630 c	3337.23	Ho II	30	3343.34	Cr I	170	3348.17	Nd II
370	3337.25	Er II	30	3343.47	Ta I	85	3348.23	Tb II
1500	3337.49	La II	240	3343.49	Sm II	150	3348.54	Tb II
290	3337.79	Er II	980 c	3343.58	Ho II	110	3348.61	Ho II
390	3337.79	U II	130	3343.62	Tb II	240	3348.68	Sm II
70	3337.80	Ta I	110	3343.64	Sm II	60	3348.76	Er II
70	3337.84	Cu I	150	3343.68	Er II	310	3348.77	Th I
620	3337.87	Th II	1300	3343.71	Nb I	130	3348.95	Th II
310	3338.03	Tb II	95	3343.72	Mo I	4300	3349.04	Ti II
2000	3338.18	Re I	120	3343.77	Tb II	1700	3349.06	Nb I
60	3338.37	Ir I	260	3343.77	Ti II	65	3349.07	Cr I
130	3338.40	Th II	330	3343.86	Ce II	65	3349.19	Mo I
190	3338.41	Zr II	50	3343.93	Tb II	130 c	3349.21	Ta II
150	3338.48	U II	85	3343.96	Nb II	55	3349.32	Cr I
85	3338.49	Ta I	80	3344.20	Rh I	12000	3349.41	Ti II
330	3338.54	Rh I	810	3344.32	Re I	760	3349.42	Tb II
45	3338.75	Eu II	240	3344.35	Sm II	420	3349.52	Nb I
390 c	3338.86	Ho II	90	3344.37	Er II	100	3349.96	Ce II
250	3339.00	Tb II	200	3344.47	Ho II	45	3349.98	Ce II
290	3339.07	Nd II	60	3344.53	Ru I	230	3349.99	Tm I
100	3339.51	Ce II	870	3344.56	La II	470	3350.06	Er II
190	3339.51	Dy II	1300	3344.75	Mo I	200	3350.10	Gd II
930	3339.55	Ru I	440	3344.76	Ce II	350	3350.26	Er II
120	3339.61	Tb II	65	3344.79	Ho II	40	3350.27	Pr II
140	3339.68	Re I	380	3344.79	Zr II	130	3350.30	Mo I
190	3339.78	Co I	130	3344.87	Th II	110	3350.40	Eu I
130	3339.80	Cr II	150	3344.87	U II	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	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	Yb 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
				3361.26	Ti I			
90	3356.09	Hf II				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
										160		3380.60	Tb	II
4300		3371.45	Ti	I	150		3376.48	Sm	II	150		3380.70	U	II
320		3371.50	Tb	II	45		3376.49	Ta	II	650		3380.71	Sr	II
640		3371.54	Ta	I	6200		3376.50	Lu	I	240		3380.85	Ni	I
160		3371.69	Dy	II	120		3376.55	U	II	130		3380.86	Nb	I
250		3371.80	Th	II	130		3376.62	Dy	II			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 c	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	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	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 d	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	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 1	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 1	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 1
170	3386.21	Hf 1	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 1	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

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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	Yb 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 c	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	Yb 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	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		3462.20	Tm	II	250		3467.85	Mo	I
85		3457.05	Eu	II	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	Yb	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	
		3471.60	Dy	II	45		3477.22	Ta	I	85		3481.50	Tb	II
970		3471.71	Er	II	35		3477.39	Ce	II	55		3481.54	Cr	I
270		3471.73	Tb	II	45		3477.45	Ce	II	340		3481.75	Tm	II
70		3471.96	Th	I	100		3477.45	Ta	I	100		3481.79	Mo	I
120		3472.25	Rh	I	75		3477.50	U	II	1700		3481.80	Gd	II
230	c	3472.31	Ho	II	70		3477.70	Th	II	80		3481.82	W	I
270		3472.37	Tb	II	200		3477.75	Ho	II	110		3482.10	Dy	II
710		3472.40	Hf	I	60		3477.77	Ir	I	120		3482.11	Os	I
4800		3472.48	Lu	II	270		3477.84	U	II	140		3482.14	Ce	II
390		3472.51	U	II	90		3477.93	Dy	II	65		3482.23	Os	I
45		3472.52	Ta	I	100		3477.93	Er	II	240		3482.23	Re	I
1600		3472.54	Ni	I	160		3477.94	W	I	240		3482.35	Ce	II
150		3472.56	U	II	200	c	3478.06	Ho	II	190		3482.40	Mo	I
160		3472.72	Re	I	130		3478.13	Th	II	680		3482.49	U	II
16		3472.76	Cr	I	130		3478.30	Zr	II	130		3482.55	Th	II
810	d	3472.79	Tb	II	130		3478.46	Th	II	50		3482.56	Yb	II
25		3472.90	Zr	I	90		3478.48	Dy	II	490		3482.60	Gd	II
24		3472.91	Cr	I	65		3478.50	Zr	II	130		3482.76	Th	II
210		3473.00	Tb	II	120		3478.53	Os	I	75		3482.80	Tb	II
140		3473.02	Nb	I	65		3478.56	Co	I	190		3482.81	Zr	I
130		3473.03	Th	II	290		3478.69	Nb	I	290		3482.91	Mn	II
1400		3473.22	Gd	II			3478.78	Nb	II	190		3483.01	Zr	I
65		3473.22	Mo	I	200		3478.79	Zr	I	230		3483.04	Tb	II
55		3473.28	Tb	II	500		3478.84	Yb	II	130		3483.16	Ru	I
100		3473.42	Th	II	2100		3478.91	Rh	I	130		3483.29	Ru	I
320		3473.43	U	I	60		3478.92	Ti	I	1900		3483.41	Co	I
40		3473.61	Cr	I	200		3478.99	Hf	II	60		3483.43	Pt	I
380		3473.70	Dy	II	180		3479.02	Zr	II	760		3483.54	Zr	II
260		3473.75	Ru	I	120		3479.16	U	I	95		3483.67	Mo	I
75		3473.79	Tb	II	250		3479.17	Th	II	230		3483.69	Tb	II
65		3473.84	Pr	II	480		3479.28	Hf	II	550		3483.77	Ni	I
45		3473.90	Ta	I	55		3479.29	Th	II	190		3483.84	Mo	I
810	c	3473.91	Ho	II	1200		3479.39	Zr	II	80		3483.89	Ho	II
130		3473.96	Sm	II	610		3479.41	Er	II	95		3484.04	Rh	I
8000		3474.02	Co	I	180		3479.43	Mo	I	100		3484.05	Nb	II
360	h	3474.04	Mn	II	130		3479.53	Sm	II	80		3484.48	Ir	I
		3474.13	Mn	II	200		3479.56	Nb	II	100		3484.55	Er	II
75		3474.22	Ce	II	100		3479.60	Ce	II	45		3484.62	Ta	I
5400	c	3474.26	Ho	II	70		3480.05	Th	I	220		3484.68	Dy	II
220		3474.27	Dy	II	100		3480.09	Mo	I	55		3484.70	Ce	II
150		3474.54	U	II	380		3480.17	Tb	II	75		3484.74	Ce	II
4700		3474.78	Rh	I	130		3480.26	Sm	II	6300		3484.84	Ho	II
120		3474.89	Sr	II	65		3480.28	Ce	II	120	h	3484.88	Nd	I
150		3474.99	U	II	35		3480.34	Ce	II	710		3485.05	Ce	II
190		3475.03	Mo	I	360		3480.36	U	I	190		3485.16	Er	II
800		3475.45	Fe	I	45		3480.38	Ce	II	200		3485.21	Th	II
50		3475.58	Nb	I	400		3480.38	Re	I	160		3485.27	Pt	I
100		3475.67	Ce	II	150		3480.41	Zr	II	130		3485.32	Zr	II
55		3475.72	Th	II	90		3480.42	Dy	II	60		3485.34	Fe	I
80		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
110		3476.29	Tb	II	240		3480.53	Ti	I	170		3485.73	Y	I
500		3476.30	Yb	II	170		3480.56	Sm	II	85		3485.76	Yb	II
150		3476.31	Gd	II	220		3480.81	Dy	II	970		3485.85	Er	II
240		3476.44	Re	I	320		3480.85	Re	I	200	c	3485.87	Ho	II
150		3476.44	U	II	75		3480.98	Ce	II	130		3485.89	Ni	I
80		3476.46	Ir	I	340		3480.98	Tm	I	190		3485.92	Dy	II
170		3476.54	Th	II	50		3481.05	Nb	I	110		3485.92	V	II
340		3476.69	Tm	I	10000		3481.15	Pd	I	240		3485.93	Mo	I
320		3476.70	Fe	I	1300		3481.15	Zr	II	50		3485.93	Nb	I
480		3476.84	Ce	II	75		3481.16	Ce	II	220		3486.20	Gd	I
1300		3477.07	Dy	II	2200		3481.28	Gd	II	120		3486.30	U	II
75		3477.07	Eu	I	70		3481.30	Cr	I	160	c	3486.34	Ho	II
80		3477.14	Re	I	240		3481.30	Ru	I	390		3486.51	Th	II
600		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	Rc 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	h	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	d	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
												3517.76	Nb	I
60		3506.50	Fe	I	1100		3512.50	Gd	II					
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	c	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
					250		3513.02	Tm	II					
780		3507.34	U	I						70		3518.90	Th	II
8300	c	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	c	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	c	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	cw	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		3524.54	Ni	I	90		3530.95	Ce	II	85		3536.62	Tb	I
80		3524.54	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		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	h	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			3532.00	Mn	I	320		3537.46	Re	I
240		3525.65	U	I	140		3531.93	Th	II	1300		3537.48	Nb	I
75		3525.73	U	II	1100		3532.12	Mn	I	290		3537.66	Dy	II
270		3525.74	Dy	II	40		3532.21	Ta	I	110		3537.69	Tb	

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						130		3550.27	Ru	I
670		3539.59	Th	II	55		3545.40	Tb	II	70		3550.29	Th	II
110		3539.64	Dy	II	240		3545.44	U	I	300		3550.45	Nb	I
100		3539.65	Nb	I	210		3545.60	Ce	II	630		3550.46	Zr	I
240		3539.65	U	I	240		3545.67	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	Nb	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
										100		3569.57	Gd	II
430		3558.47	Gd	II	240		3564.13	Rh	I	70		3569.62	Th	II
80		3558.52	Cr	I	120		3564.18	U	I	200		3569.66	Dy	II
650		3558.52	Fe	I	220		3564.24	Dy	II	310		3569.78	Os	I
6600		3558.55	Sc	II	150		3564.31	Hf	I	720		3569.80	Mn	I
40		3558.71	Ce	II	130		3564.56	Ru	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		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	
120		3571.56	U	II	90		3576.58	Dy	II	85		3582.67	Sm	II
110		3571.57	Th	II	160		3576.64	Tb		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	
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				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		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				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	
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
												3596.88	U	II
160		3587.64	Ce	II	490		3592.02	V	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	cw	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		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										
					110		3609.25	Dy	II	1100		3613.10	Zr	II
120		3603.74	U	I	980		3609.44	Th	II	340		3613.31	Ho	II
70		3604.06	Th	I	40		3609.48	Cr	I	95		3613.36	Tb	II
65		3604.07	Mo	I	3400		3609.49	Sm	II	140		3613.37	Mo	I
50		3604.08	Nb	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			3626.41	Gd	II
670	d	3617.02	Th	II	1700		3621.23	Sm	II	570		3626.50	Tb	II
		3617.12	Th	II										
					240		3621.46	Fe	I	1800		3626.59	Rh	I
320		3617.08	Re	I	160		3621.46	Re	I	980		3626.62	Ta	I
430		3617.16	Gd	II	160		3622.00	Fe	I	430	c	3626.69	Ho	II
130		3617.20	Dy	II	75		3622.04	U	I	370		3626.74	Ru	I
190		3617.21	Ir	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
20000		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		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		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		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		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

559-795 O - 75 - 8 (Pt. 2)

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
			660	3649.53	Sm II			
11000	3645.40	Dy 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	Sc 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		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
		80	3667.71 W I		
220	3662.69 Sm II			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
							3678.95	Tm	II	85		3684.29	Nd	
140	c	3674.36	Ho	II										
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
					19		3681.69	Cr	I					
260		3676.55	Co	I						470		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			3694.82	Tm	II	60		3699.53	Pr	II
					140		3694.75	Tb	II					
250		3689.06	Os	I						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			3707.92	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	120		3708.36	Dy	II	80		3713.47	Mo	I
2400		3703.92	Tb	II	480		3708.41	Sm	II	550		3713.54	La	II
680		3704.06	Co	I	100		3708.42	Tb	I	350	d	3713.56	U	I
		3704.08	Th	II	80		3708.56	Mo	I			3713.65	U	II
230		3704.09	U	I	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			3709.42	Nb	I	370		3714.20	Nd	II
330		3704.85	Tm	II	720		3709.26	Zr	II	60		3714.23	W	I
85	d	3704.86	Th	I	250		3709.27	Ho	II	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			3714.81	Nd	II
220		3704.98	Ce	II	320		3709.76	Ho	I	230		3714.76	U	II
100		3705.02	Re	I	110		3709.87	U	I	110		3714.77	Ce	II
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	50		3711.78	Nb	I	140		3716.07	Mo	I
40		3707.00	Th	I	100		3711.82	Er	II	140		3716.08	Tb	II
80		3707.17	Mo	I	240		3712.11	Sm	II	60		3716.08	W	II
110		3707.17	Sm	II	45		3712.18	Co	I	110		3716.14	U	I
230	d	3707.29	U	I	110		3712.30	Ru	I	110		3716.18	Ru	I
		3707.39	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	
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	cw	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	d	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
										90		3725.05	La	II
160		3716.94	Dy	II	85		3720.46	Nb	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
										50		3726.29	Pr	II
80		3717.90	Tb	I	85		3722.24	W	I					
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		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	
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	
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			3732.80	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
												3740.84	Nb	I
110		3731.88	Ce	II	35		3735.85	La	II					
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	I40	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	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		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
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
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	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	h	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	d	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	h	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	c	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	h	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		85	d	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		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	d	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	c	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	c	3801.35	Pr	II	60		3806.63	Nb	I
55		3796.73	Th	I	70		3801.36	Eu		60		3806.70	Fe	I
8900	c	3796.75	Ho	II	75	h	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	d	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	c	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	d	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			3817.98	V	I	120		3822.56	U	II
200		3812.53	Nd	II	95		3817.87	Pr	II	280		3822.58	Dy	II
120		3812.58	U	I	160		3818.06	U	I	60		3822.78	Pr	II
600		3812.72	Ru	I	1300		3818.19	Rh	I	450		3822.89	V	I
240		3812.73	Tb		70		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	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	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		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	
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		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
860	3853.15	Ce II
95	3853.29	Lu I
530	3853.30	Sm I
110	3853.38	Nb I
130	3853.73	Ti I
1800 c	3854.07	Ho II
1200	3854.18	Ce II
140	3854.18	Gd II
2700	3854.21	Sm II
190	3854.22	Cr I
620	3854.22	U I
1200	3854.31	Ce II
390	3854.51	Th II
480	3854.56	Sm I
2400	3854.66	U II
35	3854.70	Nb I
130	3854.91	La II
65	3855.15	Nb I
620	3855.29	Ce II
110	3855.29	Cr I
1200	3855.37	V I
75	3855.38	Tb I
110	3855.43	Zr II
65	3855.45	Nb I
150	3855.55	W I
470	3855.56	Gd II
140	3855.57	Cr I
170	3855.58	Tb II
3000	3855.84	V I
95	3855.88	Pr II
680	3855.90	Er I
800	3855.90	Sm II
850	3856.37	Fe I
480	3856.46	Ru I
5900	3856.52	Rh I
390 cw	3856.94	Ho II
95 c	3856.99	Pr II
	3857.13	Pr II
390	3857.02	Ce II
230	3857.09	Os I
170	3857.23	Ce II
1300	3857.55	Ru I
260	3857.63	Cr I
370	3857.64	Ce II
720	3857.72	Ho II
75	3857.81	Ce II
140	3857.84	Tm II
480	3857.91	Sm II
50	3857.93	Ce II
170	3858.14	Ti I
120	3858.25	Pr II
1200	3858.30	Ni I
600	3858.31	Hf I
540	3858.39	Er II
420	3858.40	Dy I
140	3858.45	Gd I
190	3858.52	Sm I
340	3858.55	Nd II
65	3858.68	V I
400	3858.74	Sm I
290	3858.95	Nb I
110	3859.14	Pr II
60	3859.22	Fe I
150	3859.30	W I
250	3859.34	Ho I
75	3859.34	V I
120	3859.42	Nd II
4900	3859.58	U II
40	3859.80	Ta I
140	3859.84	Th II
4200	3859.91	Fe I
220	3860.72	Ru I
35	3860.86	Nb I
230	3860.91	Hf I
270	3860.94	Nd II
75	3861.07	W I
160	3861.14	Gd II
650	3861.16	Co I
490	3861.16	U I
35	3861.24	W I
75	3861.30	Pr II
2700 c	3861.68	Ho II
75	3862.04	Pr II
660	3862.05	Sm II
150	3862.22	V I
350	3862.23	Sm II
200	3862.46	Ce II
300	3862.52	Nd II
540	3862.62	Ho I
650	3862.69	Ru I
7500	3862.85	Er I
140 d	3862.93	Nb I
	3863.05	Nb II
250	3863.05	Gd II
120	3863.09	U I
3700 d	3863.33	Nd II
	3863.40	Nd II
350	3863.38	Nb I
450	3863.40	Th II
190 h	3863.42	Sm II
130	3863.87	V I
2900	3863.87	Zr I
150	3864.05	Sm II
75	3864.08	Pr II
29000	3864.11	Mo I
240	3864.30	U II
180	3864.34	W I
770	3864.34	Zr I
240	3864.48	U II
80	3864.49	La II
130	3864.79	Gd I
250	3864.80	Er II
1300	3864.86	V I
110	3864.91	Ho II
65	3865.02	Nb II
	3865.04	Nb I
320	3865.24	Sm II
85	3865.40	Ce I
130	3865.40	Ru I
480 c	3865.45	Pr II
230	3865.47	Os I
210	3865.48	Dy II
340	3865.53	Fe I
190	3865.57	Eu I
170	3865.64	Ir I
80	3865.69	Sm II
1900	3865.92	U II
170	3865.98	Nd II
65	3866.06	W I
240	3866.44	Ti I
240	3866.52	Nd II
370	3866.58	Dy II
35	3866.69	Mo I
380	3866.80	U II
160	3866.81	Ce II
220	3866.81	Nd II
1600	3866.99	Gd I
240	3867.17	U I
20	3867.22	Fe I
140	3867.26	Gd II
80	3867.34	Hf II
210	3867.52	Pr II
230	3867.60	V I
1300	3867.84	Ru I
95	3867.85	Dy II
270	3867.92	Nb I
1800	3867.99	W I
200	3868.13	Ce II
50	3868.23	Er II
170	3868.40	Ti I
120	3868.42	U II
560	3868.45	Dy II
60	3868.47	Ce II
100	3868.51	Ce II
65	3868.52	Pr II
1600	3868.81	Dy I
140	3868.90	Tb II
850	3869.07	Nd II
580	3869.08	Mo I
75	3869.17	Pr II
300	3869.42	Dy II
60	3869.56	Ce II
450 d	3869.75	Tb II
95	3869.85	Pr II
820	3869.86	Dy II
240	3869.94	Re I
490	3870.01	Rh I
240	3870.02	U II
75	3870.41	Pr II
40	3870.58	V I
210	3870.72	Pr II
160	3870.87	Ce II
1500	3871.04	U I
170	3871.08	V I
65	3871.19	Nb I
140	3871.54	Gd II
210	3871.63	Dy II
3400	3871.64	La II
50	3871.75	Er I
800	3871.78	Sm II
35	3871.80	Ce II
95	3871.88	U II
360	3872.05	Ho II
7000	3872.11	Dy II
70	3872.39	Rh I
340	3872.50	Fe I
200	3872.55	Hf II
140	3872.62	Gd II
40	3872.69	Pr II
45	3872.72	Eu I
340	3872.72	Th II
250	3872.84	W I
340	3872.85	Yb I
85	3873.00	Tb I
50	3873.01	Pr II

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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	c	3874.09	Ho	II	120		3879.06	Ce	II	120		3884.62	Co	I
3500	w	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	c	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 h	3892.03	Zr I	170	3895.90	Nb I
50	3888.29	Pr II	470	3892.06	Nd II	85	3895.91	Nd
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 Ta O
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	3904.58	Ce II	270	3909.31	Ce II
680	3900.79	Tm II	60 h	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	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	3911.16	Nd II
250	3902.45	Pr II	200	3906.92	Ce II	110 h	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	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
							3912.00	Cr I
60	3903.16	Cr I	770 c	3908.05	Pr II			
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	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				280	3921.88	Er II
500	3913.46	Ti II	230	3917.29	Eu I	100	3921.90	V I
280	3913.48	Tb I	75	3917.30	Tb I	35	3922.03	Os I
120	3913.51	Rh I	620	3917.44	Sm II	190	3922.05	Sm II
310	3913.55	Pr II	80	3917.45	Hf II	300	3922.10	Tb II
140	3913.62	Dy I	150	3917.54	Mo I	240	3922.19	Rh I
90	3913.62	Sm II	35	3917.60	Cr I	55	3922.22	Th II
340	3913.69	Nd II	230	3917.64	Ce II	65	3922.23	Pr II
65	3913.78	Gd II	340	3917.65	Nd II	75	3922.32	Mo I
55	3913.82	Th II	23	3917.70	Eu II	110	3922.35	Nb I
130	3913.92	Re I	75	3917.78	Mo I	2500	3922.40	Sm II
160	3913.97	Dy II	120	3917.82	U II	55	3922.42	Ta II
110	3913.99	Ce II	75 c	3917.96	Pr II	230	3922.43	V I
190	3914.20	U II	280	3918.05	Er I	90	3922.70	Sm II
190	3914.27	U II	120	3918.06	Gd II	480	3922.74	Tb II
140	3914.33	V II	80	3918.06	U II	80	3922.75	Co I
500	3914.34	Ti I	85	3918.07	Th I	140	3922.78	Ta I
40	3914.34	Zr II	620	3918.09	Hf II	550	3922.91	Fe I
150	3914.63	Tb I	120	3918.24	Gd II	140	3922.92	Ta I
670	3914.70	Nb I	50 h	3918.25	Y I	110	3922.96	Pt I
24	3914.74	Ti I	770	3918.28	Ce II	120	3923.05	U II
210	3914.76	Pr II	65	3918.32	Mn I	560	3923.11	Ce II
150	3914.85	Ru I	210	3918.35	Er II	450	3923.25	Gd II
540	3914.87	Dy II	55	3918.50	Th II	100 c	3923.28	Ho II
100	3914.95	Ce II	210	3918.51	Ta I	150	3923.31	Tb II
440	3915.13	Nd II	40	3918.52	Eu I	320	3923.38	Dy II
45	3915.24	Eu II	110	3918.55	Dy II	1500	3923.47	Ru I
480	3915.38	Ir I	75	3918.59	W I	45	3923.51	Sc II
650	3915.43	Tb I	190	3918.62	Sm II	95	3923.55	Pr II
110	3915.44	Mo I	30	3918.65	Fe I	120	3923.75	Mo I
170	3915.46	Pr II	95	3918.78	Tb II	28	3923.80	Th I
390	3915.52	Ce II	1300 c	3918.85	Pr II	200	3923.90	Hf II
540	3915.59	Dy II	50	3918.86	Lu I	130	3924.15	Pr II
50	3915.69	Er II	85	3918.90	Nd II	190	3924.27	U II
120	3915.84	Cr I	35	3918.97	Os I	35	3924.36	W I
380	3915.88	U II	65	3919.00	Nb I	65 d	3924.42	Tb II
310	3915.94	Zr II	75	3919.02	Tb I	110	3924.47	Dy II
610	3915.95	Nd II	110	3919.02	Th I	65	3924.49	Nb I
85	3916.00	Er I	100	3919.09	Eu II	140	3924.49	Nd II
45	3916.00	Eu I	140	3919.12	Dy I	1100	3924.53	Ti I

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
												3949.46	Nb	II
140		3939.52	Nd	II	520		3943.67	Nb	I					
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	
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		3959.53	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		3960.29	Tb	I
65		3952.11	Pr	II	4500		3956.34	Ti	I	70		3960.33	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
							3956.69	Th	II					
65		3952.37	Nb	II						35		3960.98	Nb	I
40		3952.40	Cr	I	70		3956.68	Fe	I	45		3961.00	Co	I
120		3952.52	W	I	17		3956.74	Ce	I	200		3961.02	Os	I
3100		3952.54	Ce	II	380		3956.75	Pr	II	280		3961.04	Re	I
20		3952.61	Fe	I	28		3956.78	Ce	I	160		3961.21	Er	I
30		3952.62	Ir	I	40		3956.79	Zr		55		3961.28	Pr	II
310		3952.68	Ru	I	19		3956.82	Ta	I	9000		3961.52	Al	I
50		3952.76	Th	I	140		3956.90	Ce	II	190		3961.80	Sm	II
55		3952.77	Os	I	35		3957.05	Ca	I	150		3962.09	Ce	II
65		3952.84	Mn	I	35		3957.15	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		3963.12	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		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		3955.17	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

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	II
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
												3990.02	Sm	I
560		3980.88	Ce	II	17		3984.98	Ta	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			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	
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		4035.40	Gd	I
140		4024.35	Ce	II	85		4030.68	Cr	I	90	h	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
							4064.58	Sm II
300	4052.87	Tb II	16000 c	4058.94	Nb I			
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	h	4074.97	Sc	I	55		4080.71	Th	I
910		4069.20	Th	II	710		4075.12	Nd	II	500	c	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	h	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	h	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	h	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	d	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

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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	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 h	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

Intensity and Character	Wavelength in Å	Element and Spectrum
55	4149.48	Gd I
420	4149.79	Ce II
810	4149.83	Sm II
980	4149.94	Ce II
140	4149.96	Re I
450	4149.99	Th II
80	4150.04	Pr II
55	4150.10	Tm I
870	4150.12	Nb I
55	4150.30	Ru I
55	4150.54	Tb
45	4150.61	Gd II
45	4150.67	V I
55	4150.87	Tb I
420	4150.91	Ce II
40	4150.94	Pr II
170	4150.96	Ti I
160	4150.97	Zr II
6900	4151.11	Er I
30	4151.52	Eu II
40	4151.63	Gd II
45	4151.64	Eu II
170	4151.68	Nd II
28	4151.74	Pr II
75	4151.88	Mo I
1400	4151.97	Ce II
1100	4151.97	La II
120	4152.04	Nb I
55 d	4152.20	Th I
	4152.34	Th I
1200	4152.21	Sm II
85	4152.24	Tb I
70	4152.29	Re I
720	4152.36	Sc I
150 h	4152.48	Dy II
4400	4152.58	Nb I
980 cw	4152.61	Ho II
50	4152.63	Re I
200	4152.64	Zr I
45	4152.66	V I
30	4152.78	Cr I
220	4152.78	La II
55	4152.93	Ce II
100	4153.12	Dy I
230	4153.13	Ce II
530	4153.33	Sm II
110	4153.51	Gd II
100	4153.73	Nd II
75	4153.75	Zr I
120	4153.82	Cr I
50	4153.93	Ce II
880	4153.97	U I
90	4154.01	Pr II
460	4154.08	Lu I
75	4154.24	Dy I
240	4154.37	Rh I
40	4154.50	Fe I
160	4154.66	W I
55 h	4154.72	Sc
190	4154.86	Gd II
560	4155.22	Sm II
85	4155.28	Ce II
250	4155.28	Mo I
110	4155.30	Th
270	4155.41	U II
70	4155.47	Th
180	4155.53	Ce II
180	4155.58	Mo I
27	4155.70	Ir I
3000	4156.08	Nd II
130	4156.24	Th II
290	4156.24	Zr II
130	4156.25	Sm II
510	4156.26	Nd II
85	4156.28	Tb I
200	4156.50	Pr II
340	4156.51	Th II
380	4156.66	U I
35	4156.68	Nb II
40	4156.79	Mo I
40	4156.80	Fe I
35	4156.82	Pr II
28	4157.27	Th I
28	4157.39	Th I
200	4157.40	Mo I
40	4157.52	La I
70	4157.58	Nd II
100 h	4157.63	Y I
30	4157.72	Eu I
55	4157.73	Pr II
190	4157.78	Gd I
170	4158.01	Nb I
55	4158.28	Tb II
28	4158.42	Co I
40	4158.48	Gd I
350	4158.53	Tb I
110	4158.54	Th I
120	4158.60	Tm I
65	4158.78	Os I
80	4158.88	Hf II
24	4158.98	Lu I
450	4159.03	Ce II
35	4159.17	Ru I
120	4159.31	Dy I
100	4159.40	Sm II
40	4159.46	Pr II
100	4159.51	Sm II
70	4159.54	Tm II
140	4159.57	Nd II
85	4159.64	Ti I
85	4159.66	Th II
150	4159.69	V I
28	4159.73	Pr II
90	4159.92	Re I
65	4159.96	Os I
55	4160.03	W I
70	4160.11	Ce II
70	4160.18	Ce II
75	4160.25	Dy I
100	4160.26	La I
60	4160.31	Er I
45	4160.34	W I
45	4160.47	Pr II
340	4160.57	Nd II
50	4160.80	Nb I
70	4160.95	U I
75 h	4161.00	Ta I
110	4161.18	Ce II
400	4161.21	Zr II
75	4161.25	Nb I
120 cw	4161.35	Tb I
85	4161.42	Cr I
55 d	4161.59	Th II
	4161.74	Th I
130	4161.66	Ru I
200	4161.80	Sr II
90 hd	4161.88	Sc I
45 h	4162.17	Co I
75	4162.25	Dy I
150	4162.36	Hf II
240	4162.43	U I
55	4162.51	Th I
150	4162.63	Ce II
180	4162.68	Mo I
140	4162.68	Th II
110	4162.69	Hf I
540	4162.73	Gd II
50	4162.81	Nb I
8100	4163.03	Ho I
280	4163.09	Gd II
160	4163.14	Sm II
870	4163.47	Nb I
310	4163.52	Ce II
140	4163.62	Cr I
170	4163.64	Th II
70	4163.65	Ti II
4400	4163.66	Nb I
350	4163.68	U II
100	4163.72	Sm II
40	4164.08	Mo I
35	4164.14	Ti I
1700 c	4164.16	Pr II
110	4164.25	Th II
60	4164.41	Nd II
80	4164.56	Pt I
4000	4164.66	Nb I
70	4164.79	U II
190	4164.83	Er I
60	4164.85	Nd II
150	4165.04	Nd II
55	4165.07	Th II
1100 h	4165.19	Sc I
70	4165.52	Cr I
45	4165.54	Sm II
1300	4165.61	Ce II
270	4165.68	U II
140	4165.77	Th I
85	4165.85	Nb I
200	4166.00	Ba II
15	4166.04	Ir I
55	4166.20	Ce II
40	4166.28	Mo I
40	4166.32	Ti I
50	4166.34	Sm II
400	4166.36	Zr I
55	4166.51	Tb
70	4166.64	U I
150	4166.65	Ce II
620	4166.88	Ce II
110	4166.88	Ru I
280	4167.16	Gd II
	4167.27	Gd I
870	4167.51	Ru I
2400	4167.52	Y 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
					340		4176.70	Ce	II					
450		4171.17	W	I						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
							4178.02	Sm	II					
150		4171.80	Tb	I						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 hs	4210.94	Ag I	16	4216.19	Fe I
6000	4203.73	Tm I	50	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
							4218.69	Yb I
95	4205.81	Mo I	2500	4212.95	Pd 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 Hf O	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		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		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	Rc	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
										45		4336.74	Sm	II
170		4322.87	Tb	I	440		4330.02	Sm	I					
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
												4337.38	Th	II
85	d	4323.66	Tb	II	55		4330.42	Pr	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		4340.75	Mo	I
55		4327.40	W	I	1300		4334.15	Sm	II	55	d	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
										760		4341.01	V	I
55		4328.21	Pr	II	120		4334.81	Mo	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		4342.07	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	h	4342.38	Sm	II	440	h	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	h	4355.75	U	I
430	cw	4342.53	Tb	I	85		4349.10	Nd	II	150		4355.94	V	I
80	d	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	h	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	h	4350.33	Ba	I	29		4356.85	Nb	I
55	h	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	h	4350.74	Tb	I	120		4357.73	Y	I
620	cw	4344.30	Pr	II	24		4350.82	Sm	I	24		4357.90	Sm	I
85		4344.31	Ta	I	140	h	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	h	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	d	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	c	4359.79	Pr	II
70		4346.83	Cr	I	430	d	4353.20	Tb	II	65	c	4359.85	Nb	I
100	cw	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	c	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	h	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	h	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	La O
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	La O	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	La O
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

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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		4409.44	Mo	I	220		4417.28	Ti	I	22		4424.16	Pr	II
95	d	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	4437.90	Nb I	60	4444.99	Nd I
60	4430.99	Dy II	100 bl	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			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			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			4461.24	Th	I	110		4467.69	Tb	I
1200		4454.63	Sm	II	150		4461.08	Mn	I	85		4467.85	Nd	II
					450		4461.14	Ce	II					
140		4454.68	Pr	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	Eu 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
				4482.26	Fe I			
620	4473.02	Sm II				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
												4521.24	Th	II
200		4501.27	Ti	II	90		4512.55	Ho	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		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	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 cw	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 bl	4619.85	Zr Zr O
130 hl	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 h	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 h	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 h	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 h	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 h	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 c	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 h	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 cw	4614.66	Re I	26	4625.05	Th II
420	4606.40	Ce II	50	4614.82	Dy I	18 h	4625.78	Co I
40 h	4606.45	Pr II	23	4614.83	W I	25 h	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 d	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 bl	4615.6	Gd Gd O	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 h	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 c	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	1
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		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	1
170		4635.69	Ru	I	35		4646.14	W	I	26		4656.18	Ir	1
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	1
60		4637.88	Ti	I	40		4647.28	Ce	II	20		4658.73	Tb	
65		4638.10	Nb	I	40		4647.38	Ce	II	35		4658.74	Pr	1
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	1
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	1
		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
25	4661.24	W I
130 c	4661.33	Ho II
630 bl	4661.75	Lu LuO
8300	4661.88	Eu I
75	4661.93	Mo I
35	4661.98	W I
40	4662.49	Re I
360	4662.51	La II
50	4662.72	Dy I
220	4662.76	Mo I
80	4662.79	Tb I
23	4663.20	Th I
40	4663.24	Ce II
40	4663.33	Cr I
85	4663.41	Co I
290	4663.56	Sm I
50	4663.75	U I
230	4663.76	La II
140	4663.82	Os I
70	4663.83	Cr I
450	4663.83	Nb I
80	4664.12	Hf II
45	4664.27	Gd II
70 h	4664.45	Nd II
140	4664.65	Pr II
110	4664.66	Dy II
95	4664.80	Cr I
75	4665.13	Sm II
35	4665.28	Ce II
26	4665.33	Nb I
110	4665.44	Er II
50 c	4665.45	Tb I
35	4665.90	Cr I
65	4666.00	Th II
30	4666.14	V I
22	4666.22	Cr I
340	4666.24	Nb I
55	4666.45	Gd II
70	4666.51	Cr I
35	4666.70	Tm II
35	4666.71	Ce II
50	4666.80	Th I
140	4666.86	U II
70	4667.14	Zr I
240	4667.22	Nb I
85	4667.47	Y I
30	4667.59	Er II
840	4667.59	Ti I
90	4668.17	Th I
40	4668.46	W I
60 hl	4668.48	Ag I
200	4668.91	La II
17 h	4668.99	Ir I
24	4669.14	Ru I
130	4669.14	Ta I
26	4669.24	Hf I
50	4669.34	Cr I
740	4669.40	Sm II
40	4669.40	Tb I
110	4669.50	Ce II
620	4669.65	Sm II
35	4669.87	Nb I
70	4669.98	Ru I
50 h	4669.98	Th I
350	4670.40	Sc II
160	4670.49	V I
130	4670.56	Nd II
85	4670.74	Ce II
470 d	4670.75	Sm I
	4670.83	Sm I
60	4670.82	Y I
140 h	4670.87	Gd I
50	4670.89	Ce I
22	4670.91	Ce I
45	4671.10	Nd I
100	4671.41	U II
45	4671.59	Er I
35	4671.69	Mn I
160	4671.83	La II
130	4671.90	Mo I
35	4671.99	Tm II
580	4672.09	Nb I
270 c	4672.09	Pr II
310 bl	4672.31	Lu LuO
310	4673.16	Er I
35	4673.59	Nb I
85	4673.60	Dy II
30	4673.62	Ba I
75	4673.66	Th I
24	4673.97	Nd I
85	4674.49	Ce I
1100	4674.60	Sm II
140 c	4674.62	Ho II
95	4674.65	Ru I
2000	4674.84	Y I
150	4675.03	Rh I
35	4675.10	Tm I
70	4675.12	Ti I
80	4675.31	Tm I
530	4675.37	Nb I
60	4675.52	Nd I
570	4675.62	Er II
65	4676.06	Th I
50	4676.62	W I
80	4676.90	Tb I
680	4676.91	Sm II
60	4677.69	W I
40	4677.86	Tm II
800	4678.16	Cd I
55	4678.20	Pr II
55	4678.25	Gd I
60	4678.35	Y I
110	4678.48	Nb I
30	4679.04	W I
150	4679.06	Er II
40	4679.09	Pr II
170	4679.18	Gd I
260	4680.04	Gd I
150	4680.13	Ce II
400	4680.14	Zn I
40 h	4680.49	Sc I
640	4680.51	W I
40	4680.54	Cr I
30	4680.64	Th II
170	4680.74	Nd II
19	4680.87	Cr I
28	4680.99	Ce II
210	4681.55	Sm I
290	4681.79	Ru I
70 c	4681.87	Tb I
450	4681.88	Ta I
950	4681.92	Ti I
160	4681.92	Tm I
50	4682.03	Dy II
28	4682.31	Os I
50	4682.32	Re I
260	4682.32	Y II
50	4682.38	Co I
50	4682.52	Tb I
26	4682.66	Nb I
75	4682.69	Sm II
25 c	4682.79	Tb II
65	4683.07	Gd I
55	4683.08	Ho I
430	4683.33	Gd I
260	4683.42	Zr I
310	4683.45	Nd I
40	4683.54	W I
35	4683.81	Yb II
30	4683.83	Mo I
190	4684.02	Ru I
110	4684.04	Nd I
420 bl	4684.16	Lu LuO
70	4684.25	Zr I
40	4684.27	Yb I
24	4684.45	V I
270	4684.61	Ce II
45	4684.87	Ta I
55 c	4684.92	Pr II
70	4685.11	Tm I
320	4685.14	Nb I
23	4685.19	Zr II
55	4685.23	Ce II
40	4685.27	Ta I
30	4685.81	Mo I
55	4685.83	Ho II
60	4685.84	Ge I
26	4686.10	Mo I
15	4686.20	Th I
23	4686.22	Ni I
65 h	4686.41	Gd I
23	4686.57	Zr I
65	4686.77	Ce II
21	4686.92	Ti I
35	4686.92	V I
370	4687.18	Sm II
180	4687.80	Pr I
2300	4687.80	Zr I
25	4687.86	Re I
140	4688.12	Gd I
45	4688.19	Ho II
130	4688.22	Mo I
510	4688.45	Zr I
14	4688.55	Nd I
80	4688.63	Tb II
35	4688.64	Er II
370	4688.73	Sm I
19	4688.84	Ta I
80	4688.89	Ce I
170	4689.07	U II
100	4689.17	Th II
70	4689.37	Cr I
18	4689.50	Ce II
40	4689.57	Sm II
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	470		4706.54	Nd	II	35		4715.89	V	I
25	c	4694.99	Re	I	80		4706.57	V	I	40	w	4716.07	Tb	II
23		4695.04	Zr	I	140		4706.96	Nd	I	730		4716.10	Sm	I
24		4695.15	Cr	I	120		4706.97	Sc	I	170		4716.44	La	II
270	bl	4695.46	Lu	LuO	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	45	h	4708.84	Hf	I	29		4718.64	Sm	I
30		4698.62	W	I	35		4708.85	Y	I	35		4718.69	Er	I
95		4698.68	Dy	II	21		4708.88	Ir	I	40		4718.88	Mo	I
190		4698.76	Ti	I	120		4709.34	Sc	I	240		4719.02	Nd	I
120		4699.01	Hf	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		180		4730.67	Pr	I	790		4741.02	Sc	I
		4722.83	Bi		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		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	
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		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		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 c	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 h	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
												4851.90	Tm	II
50		4829.68	Dy	II	100		4840.27	Co	I					
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		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

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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 1	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 1	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 1
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 GdO
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	29	4907.26	Nd I	22	4921.92	Ce I
40 h	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 d	4904.29	V I	240	4919.82	Th II	16	4930.70	Ce I
	4904.34	V I	130	4919.87	Ti I	35	4930.72	Nd II
40	4904.41	Ni I	28	4919.88	Ce I	30	4930.87	Zr I
27	4904.43	Er II	110	4920.11	Ta I	35	4930.93	Y I
65	4904.53	Nb I	75	4920.38	Sm II	40	4931.55	W I
65	4904.59	Ta 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 d	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 h	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

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	II	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	Lu O
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	Sc O
50		5147.58	Tb	I	280		5159.69	Ce	I	160	d	5171.08	Mo	I
75		5147.62	Ta	1	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 c	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 h	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	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 c	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 h	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 h	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 h	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 h	5228.80 Sm II	22 c	5242.71 Pr II
40	5214.28 Tb I	200	5229.27 Sr I	110 h	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 c	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 c	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		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		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	Dy O	16		5272.72	Pr	II
		5251.81	Nb	I	55		5263.50	Ti	I	25		5272.82	Sm	II
55		5251.67	Ru	I										
					30		5263.81	Gd	I	80		5272.91	Er	I
65	c	5251.71	Pr	II	180		5263.88	Pr	II	55		5272.91	Gd	I
65		5251.82	Ho	I	530		5264.15	Cr	I	590		5273.43	Nd	II
260		5251.92	Sm	I	85		5264.18	Ce	I	30		5273.44	Cr	I
55		5251.99	Ce	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		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		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		5266.83	Ru	I	70		5277.50	Th	II
45		5255.82	Os	I	20	h	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		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
11 h	5280.12	Rh I
19	5280.29	Cr I
70	5280.38	U I
45 h	5280.65	Co I
40	5280.82	Ru I
210	5280.86	Mo I
18	5281.02	Ta I
75	5281.05	Tb I
17	5281.35	Ce I
20	5281.80	Fe I
55	5282.07	Dy I
40	5282.39	Ti I
55	5282.48	Gd I
150	5282.82	Eu I
250	5282.91	Sm I
280	5283.08	Gd I
140	5283.45	Ti I
9	5283.49	Co I
40	5283.63	Fe I
20	5283.84	Mo I
20	5283.89	Os I
130	5284.08	Ru I
35	5284.39	Ti I
35	5284.97	Sc I
28	5284.99	Dy II
50	5285.26	Nb I
90	5285.65	Pr II
210	5285.76	Sc I
22	5286.09	Hf I
55	5286.68	Nd II
35	5286.81	Ce I
35	5287.13	Nd II
10	5287.19	Cr I
55	5287.25	Eu I
13	5287.30	Tb I
7	5287.57	Co I
8	5287.81	Co I
18	5288.40	U II
26	5288.81	Ti
60	5289.25	Eu I
45	5289.34	Pr I
60	5289.82	Y II
25 h	5289.94	Sm I
140	5290.84	La II
45	5290.92	Ce I
40	5291.14	Tm I
40	5291.16	Ru I
120	5291.26	Eu I
17	5291.29	Ce I
17	5291.29	Ce I
110	5291.67	Nd I
340 c	5292.02	Pr II
55	5292.08	Mo I
14	5292.14	Rh I
17	5292.45	Ce I
40 h	5292.52	Cu I
340	5292.62	Pr II
680	5293.17	Nd II
35	5293.46	Mo I
60	5293.68	Eu I
65	5294.05	Ce I
40	5294.32	Tm I
120	5294.64	Eu I
35	5294.65	Sm I
60	5294.82	Zr I
120	5294.87	Hf I
17	5294.95	Ce I
90	5295.01	Ta I
55	5295.47	Mo I
120	5295.63	Pd I
20	5295.65	Os I
65	5295.79	Ti I
35	5296.34	Nb I
130	5296.56	Ce I
340	5296.69	Cr I
120	5296.79	Zr I
120	5297.26	Ti I
70 h	5297.36	Cr I
30	5297.75	Th I
40	5297.82	Dy II
45	5298.06	Hf II
230	5298.09	Pr II
35	5298.26	Ce I
660	5298.27	Cr I
65	5298.44	Ti I
30	5298.58	Gd I
40	5298.78	Os I
23	5298.88	Nd I
17	5299.16	Ce I
35	5300.21	Tm I
27	5300.58	Nd I
85	5300.75	Cr I
17	5300.94	Yb II
40	5301.02	Pt I
26	5301.06	Co I
90	5301.25	Ho I
35	5301.40	Th II
160	5301.58	Dy I
280	5301.67	Gd I
35	5301.94	Sc I
60	5301.97	Zr I
370	5301.98	La II
15	5302.11	Ce I
160	5302.28	Nd II
45	5302.30	Er II
25	5302.31	Fe I
16	5302.35	Mo I
13	5302.58	Os I
27	5302.61	Nd I
140	5302.62	La II
35	5302.69	Tm I
220	5302.76	Gd I
12	5303.05	Th II
15	5303.08	Ce I
65	5303.21	Nd II
35	5303.23	Sm I
23	5303.32	Ce I
11	5303.33	Ce I
180	5303.55	La II
90	5303.85	Eu I
45	5304.02	La I
17	5304.21	Cr I
40	5304.40	Lu I
12	5304.62	Th II
65	5304.72	Tb I
80	5304.86	Ru I
30	5305.56	Re I
17	5305.58	Th II
55	5305.87	Tm II
20	5306.26	Mo I
110	5306.47	Nd II
55	5306.70	Gd I
650	5307.12	Tm I
280	5307.30	Gd I
30	5307.47	Th II
24	5307.53	La I
30	5307.82	Hf I
29	5308.19	Tb I
27	5308.28	Nd I
23	5308.30	Ce I
23	5308.30	Ce I
27	5308.42	Nd II
65	5308.53	Ce I
40	5308.54	U I
22	5308.96	Pr II
40	5309.02	Dy II
260	5309.27	Ru I
29	5309.46	Tb I
22	5309.50	Sm I
45	5309.68	Hf I
13	5309.89	Ce I
13	5309.89	Ce I
45	5310.01	Nd II
21	5310.04	U II
4	5310.20	Co I
40	5310.26	Th II
90	5311.11	Pr II
110	5311.40	Zr I
220	5311.46	Nd II
55	5311.60	Hf II
45	5311.84	Gd I
40	5311.88	U II
35	5312.00	Th I
35	5312.23	Sm II
65 cw	5312.37	Pr II
35	5312.53	Th I
18	5312.57	Pd I
17 h	5312.66	Co I
16	5312.73	U II
24	5312.88	Cr I
28	5313.41	Pr II
22	5313.76	Sm I
55	5313.89	Mo I
35	5313.93	Ce I
35	5314.38	Ce I
35	5314.55	Nd II
14	5314.79	Rh I
23	5314.84	Ce I
35	5315.04	Mo I
23	5315.05	Ce I
18	5315.27	U I
13	5315.33	Ru I
50	5315.55	Nb I
22 h	5315.79	Gd II
16	5316.56	Pr I
55	5316.60	Nd II
10	5316.78	Co I
30	5316.80	Gd II
17	5317.01	Nb I
20	5317.28	Re I
19	5317.59	Ce I
22	5318.35	Sc II
250	5318.60	Nb I
40 c	5318.67	Ta 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 cw	5341.55	Pr I
45	5319.11	Nd	14 h	5331.08	Rh I	30	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		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		5351.89	W	I	75		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		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	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 hl	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		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

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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		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 h	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 1	25	5507.87	Zr I	320 hl	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 h	5520.05	Re I
28	5496.83	Dy I	17	5509.12	Nb I	20 c	5520.31	Pr II
13 h	5496.94	Mo I	65	5509.15	Pr II	660	5520.50	Sc I
16 c	5497.25	Pr I	22	5509.33	Os I	27 d	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 c	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 c	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 c	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 c	5524.15	Pr I
13	5501.02	Ru I	35 c	5512.82	Nb I	24	5524.22	Th II
470	5501.34	La I	25 h	5512.98	Ca I	19	5524.35	Hf II
10	5501.47	Fe I	13 h	5513.12	Ce II	17	5524.54	Yb 1
35	5501.47	Nd 1	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 h	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 c	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 c	5525.91	Pr II
26	5502.25	La 1	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 h	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 c	5527.93	Pr I
9	5504.65	Rh 1	15 c	5516.27	Ta I	12 h	5528.00	Th II
28	5504.87	V 1	18	5516.29	Nd I	30	5528.01	Dy I
27 h	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	Ho O
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
										240		5601.28	Ce	I
24	d	5576.00	Th	I	13		5588.10	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	c	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	
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	La O	14	h	5638.00	U	II
23		5613.07	Mo	I	45	b	5626.4	Ho	Ho O	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	La O	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	Zr O	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	Ti O	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	Zr O	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	bl	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		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	Ho O	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	Sc O	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	Zr O	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	Dy O	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	Sc O
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 hl	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		5806.24	W I
11	5777.77	U I	16	5790.86	Pr II	22	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	Sc O	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	
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	Sc O	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	Y O	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	Y O	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	bl	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	I
50		5869.33	Mo	I	55		5886.46	Gd	I	35		5902.96	Y	I
16	bl	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

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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 ZrO	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 GdO
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 ScO	100	5984.23	Zr I	75 h	6001.87	Gd GdO
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
13	5971.09	La II		5987.29	Pr 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	DyO	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	DyO	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	DyO	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	DyO	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
15	6142.92	Ce I
24 h	6142.98	La I
18	6143.09	Sm I
440	6143.20	Zr I
35	6143.36	Ce II
12	6143.59	Sm I
13	6143.94	W I
20	6144.53	Os I
65	6144.56	Ta I
13	6145.30	La I
35 c	6145.81	Re I
30	6146.22	Ti I
23	6146.43	Ce I
18	6146.53	La II
50	6146.82	Re I
19	6147.84	Ce I
50	6148.13	Nb I
65	6148.23	Pr I
	6148.24	Pr II
1100 bl	6148.36	Y YO
180 b	6148.70	Sc ScO
29	6149.10	Sm II
27	6149.28	Nd I
12	6149.32	Er II
9	6149.56	Ce I
21	6149.74	Ti I
180	6150.15	V I
23	6151.72	Ce I
120	6151.72	Y YO
14	6151.99	Th I
9	6152.25	U I
30	6152.54	Ta I
60	6152.57	Yb II
20	6153.72	W I
150 b	6153.93	Sc ScO
30 I	6154.23	Na I
130	6154.50	Ta I
20	6154.87	W I
27	6155.06	Nd I
30	6155.61	Zr I
14	6156.16	Nd I
13 c	6156.29	Tb I
35	6156.38	Ho I
27	6156.58	Ho I
14	6156.90	Sm II
14 h	6157.55	Sm II
75	6157.71	Zr I
22	6157.82	Pr II
35	6157.83	Nd II
11	6158.03	Os I
24	6158.28	Dy I
40	6158.84	Ta I
13	6159.10	Pr II
45 h	6159.56	Sm I
19	6159.82	Ce I
150	6159.94	Lu II
25	6160.20	Zr I
22	6160.42	Sm II
60 I	6160.75	Na I
190	6161.18	Pr II
30	6161.29	Ca I
19	6162.14	Ce I
1400	6162.17	Ca I
30 bl	6162.23	Ti TiO
30 h	6163.76	Ca I
50	6164.32	Nb I
8	6164.50	U I
12	6164.51	Sm II
16	6164.77	U II
820 bl	6165.08	Y YO
18	6165.38	Pr I
19	6165.45	Ce I
80	6165.70	La I
18	6165.84	Sm I
270	6165.94	Pr II
60 h	6166.44	Ca I
23	6166.67	Nd II
12 h	6168.33	Sm II
100	6168.43	Dy I
70	6169.05	Ca I
140 h	6169.56	Ca I
60	6169.82	Th I
30	6170.06	Er II
85	6170.36	V I
15	6170.46	Ta I
35	6170.49	Nd II
40	6171.85	U I
11	6171.88	Tb II
35	6172.73	La II
7	6172.84	Ce I
7	6172.86	Ce I
330	6173.05	Eu II
18	6173.95	Sm I
18	6174.45	Sm I
18	6174.96	Sm II
19	6175.28	Ce I
14	6175.29	Tm I
35	6175.38	U I
10	6176.81	Ni I
45	6178.59	Nd I
110	6178.76	Eu I
18	6179.41	Sm I
22 h	6179.82	Sm II
55	6180.42	Gd II
18	6181.05	Sm II
8	6181.37	U II
14	6181.41	Tm II
560 bl	6182.23	Y YO
55	6182.34	Pr II
50	6182.62	Th I
110 bl	6182.68	Gd GdO
29 h	6182.89	Sm II
27	6183.21	Er II
27	6183.91	Nd II
12	6184.79	Th I
95	6185.13	Hf I
35	6186.15	Ti I
35	6186.17	Ce I
8	6186.89	Rh I
9	6186.93	Ce I
13	6187.96	Pr I
15	6187.97	Ce I
22	6188.00	Sm II
26	6188.09	La II
150 b	6188.09	Sc ScO
260 cw	6188.13	Eu I
19	6188.13	Th I
12	6189.00	Co I
23	6189.35	V I
35	6189.40	Zr I
15	6189.66	Ta I
10	6191.18	Ni I
20	6191.56	Fe I
55	6191.68	Ho I
1200	6191.73	Y I
12	6191.91	Th I
29	6192.64	Sm II
150 b	6192.90	Sc ScO
60	6192.96	Zr I
15	6193.11	Ta I
11	6193.64	Tb I
24	6193.86	Th II
18	6194.39	Sm I
11	6194.52	Tb II
140	6195.07	Eu I
11 c	6195.14	Tb I
15	6195.23	Ce I
19	6195.53	Ce I
20	6196.23	Dy II
35	6197.45	Pr II
10	6197.66	Mo I
19	6198.05	Ce I
10	6198.14	Sm II
10	6198.22	Th I
450	6199.19	V I
26	6199.42	Ru I
160	6199.66	Lu II
590 bl	6199.82	Y YO
14	6199.99	Rh I
12	6200.43	Th II
35	6200.81	Pr II
110 bl	6200.86	Gd GdO
18	6201.13	Sm I
18	6201.74	Nd II
18	6203.24	Re I
12	6203.49	Th I
16	6203.51	La II
20	6203.51	W I
25	6203.86	Sm I
13	6205.63	Pr II
25	6206.31	Rh I
22	6206.87	Sm I
10	6207.13	Sm I
19	6207.22	Th I
15 h	6207.60	Eu I
13	6208.01	Nd II
27	6208.24	Nd I
25	6208.37	Ta I
70	6208.65	Ho I
35	6208.98	Ce I
9	6209.56	Ce I
13	6210.59	Pr I
9	6210.68	Nd II
620	6210.68	Sc I
55	6210.70	Hf I
9	6211.05	Ce I
110 bl	6211.71	Gd GdO
3	6212.29	Ce I
7	6212.49	Ce I
22	6212.73	Pr I
85	6213.05	Zr I
29	6213.06	Nb I
120 hs	6213.10	Cs I
130	6213.87	V 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	Gd	GdO		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	Gd	GdO		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			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	ZrO		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	GdO		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	
														6274.81	Pr	II	
20		6230.73	Fe	I		20		6254.28	W	I							
430		6230.74	V	I		35		6255.10	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	ZrO		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		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		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		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		6408.47	Sr	I
75		6356.16	Ta	I	75		6383.86	Eu	I	22		6408.55	Gd	I
9		6356.40	Tb	II	7		6384.67	Mn	I	19		6408.63	Th	II
29		6357.18	Sm	II	65		6385.20	Nd	II	26		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		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		6410.99	La	I
7		6358.62	Th	II	90	h	6386.50	Sr	I	55		6411.23	Pr	I
25		6358.82	V	I	14	h	6386.77	Sm	I	140		6411.32	Eu	I
55	c	6359.03	Pr	I	40		6386.80	Dy	I	14		6411.47	Re	I
28		6359.28	U	I	28		6386.84	Ce	I	9		6411.59	U	I
15	b	6359.48	Y	YO	11		6386.84	U	II	10		6411.66	Fe	I
9		6359.88	Tb	II	45		6388.19	Er	I	30		6411.90	Th	I
6		6360.22	Ce	I	60	h	6388.24	Sr	I	10		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		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		6413.59	Er	I
18		6362.09	Nd	II	29		6389.85	Sm	II	24		6413.62	Th	I
120	hl	6362.35	Zn	I	18		6390.00	Nd	II	40		6413.68	Pr	II
22		6362.87	Cr	I	16		6390.23	Ru	I	12		6414.72	Rh	I
17		6363.23	Gd	I	7		6390.32	Ce	I	10		6415.43	Pr	I
9	h	6363.41	Ru	I	170		6390.48	La	II	17		6416.10	Th	II
11	h	6363.62	Pr	II	25		6390.81	Sm	II	29		6417.50	Sm	II
25	h	6363.94	Sr	I	11		6391.12	Mo	I	8		6417.57	Ru	I
18		6365.55	Nd	II	6		6391.32	U	II	9		6417.82	Co	I
9		6365.79	Lu	I	18	c	6391.99	Pr	I	35	h	6417.91	Yb	I
16		6366.00	Lu	I	23	h	6392.21	Ta	I	11		6419.10	Ti	I
35		6366.35	Ti	I	28		6392.74	U	I	8		6421.36	Fe	I
14		6367.41	Sm	I	23		6393.02	Ce	II	50		6421.92	Dy	I
22		6368.28	Sm	II	40		6393.18	Pr	I	22		6422.42	Gd	II
14		6369.14	Th	I	14		6393.28	V	I	9		6423.05	Er	I
60		6369.25	Eu	I	10		6393.60	Fe	I	9		6423.17	Er	I
15		6369.87	Y	YO	450		6394.23	La	I	100		6424.37	Mo	I
35	h	6369.96	Sr	I	11		6395.16	Ce	I	13		6424.43	Tb	II
6		6371.01	Sm	I	5		6395.20	Co	I	17		6424.52	Gd	I
35		6371.11	Ce	II	90		6395.42	U	I	14		6424.81	Th	II
55		6372.43	U	I	7		6396.22	Ce	I	11		6424.89	U	II
30	c	6372.59	Ho	I	4		6396.27	Ce	I	11		6425.29	Ce	II
6		6372.97	U	I	24		6396.60	Dy	II	18		6425.79	Nd	II
6		6372.99	Ce	I	18		6397.14	U	I	12		6426.17	Zr	I
40		6373.06	Ta	I	45		6397.96	Pr	II	45		6426.64	Sm	II
14	h	6373.86	Ho	I	14		6398.13	Er	I	55		6428.29	Eu	I
11		6374.78	U	II	9		6398.86	Os	I	22		6428.32	Sm	II
11		6375.97	Nd	I	50		6399.05	La	II	65		6428.60	Ta	I
6		6375.98	U	II	6		6399.90	Ce	I	18		6428.65	Nd	II
9		6376.45	Ru	I	3		6399.94	Ce	I	10		6428.94	Sm	I
40		6376.93	Th	I	16		6400.02	Fe	I	45		6429.63	Pr	II
16		6377.61	Pr	I	35	h	6400.35	Yb	I	6		6429.84	Nd	I
28		6378.52	U	II	8		6400.36	U	II	5		6429.91	Co	I
75	bl	6378.56	Zr	ZrO	120	cw	6400.93	Eu	I	35		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		6430.47	V	I
15		6379.07	Ta	I	75		6402.01	Y	I	250		6430.79	Ta	I
23		6379.36	V	I	22		6403.15	Os	I	10		6430.85	Fe	I
23		6379.64	U	II	13		6403.20	Nd	I	8		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	Sc O
50	bl	6508.15	Zr	Zr O	13		6539.94	Nd	II	75		6567.87	Eu	I
7		6509.01	Ce	I	16		6540.47	Pr	I	10		6568.00	Gd	II
29	hl	6509.44	Sm	I,SmO	22		6541.57	Er	I	7		6568.47	Nd	II
16		6510.41	Rh	I	50		6542.76	Sm	II	140		6569.31	Sm	II
7	h	6511.36	Th	II	30	bl	6542.90	Zr	Zr O	30		6569.43	Zr	I
50		6511.47	Re	I	9		6542.98	U	I	10		6569.63	Th	II
9		6512.19	Tb	II	130		6543.16	La	I	35	h	6570.67	Sm	II
23		6513.59	Ce	II	28		6543.51	V	I	8		6570.96	La	II
100		6514.39	Ta	I	18		6544.57	Sm	II	7		6571.03	Pr	I
16		6514.96	Nd	II	65		6544.61	Nb	I	12	h	6572.58	Y	
14		6515.25	Re	I	12		6544.91	Re	I	13		6572.65	Nd	II
11		6515.30	Ho	I	6		6546.24	Fe	I	20		6572.78	Ca	I
100		6516.10	Ta	I	55		6546.28	Ti	I	5		6572.88	Th	II
8		6517.14	Pr	I	100		6546.79	Sr	I	9		6573.60	Ce	I
19		6517.31	Ce	I	8		6548.26	Dy	II	10		6573.80	Gd	I
18	h	6518.33	Y	YO	8	h	6549.12	Eu	I	20		6573.93	W	I
35	cw	6518.68	Tb	I	22		6549.25	Gd	I	24	c	6574.04	Tb	II
16		6518.79	Pr	II	14		6549.54	Nd	II	27		6574.38	Sm	II
16		6518.94	U	I	18	h	6549.77	Sm	II	15		6574.73	Nb	I
6		6519.12	Ce	I	16	h	6549.77	TI	I	100		6574.84	Ta	I
60		6519.59	Eu	I	7		6549.88	U	II	14	h	6575.18	Ti	I
19		6519.70	Rh	I	14		6550.19	Nd	II	8		6575.54	Tm	I
14		6519.78	Tm	I	170		6550.26	Sr	I	18	b	6575.85	Sc	Sc O
23		6519.84	Mo	I	35		6550.54	Zr	I	20		6576.56	Zr	I
13		6519.86	Nd	II	70		6550.97	Ho	I	11		6576.83	Os	I
12		6520.52	Er	I	3		6551.44	Co	I	35		6576.85	Y	I
21	h	6520.74	La	I	19		6551.70	Ce	I	35	c	6577.11	Re	I
6		6520.85	Os	I	13	h	6551.80	Sm	I	5		6577.45	Ce	I
5		6520.98	U	I	3		6552.75	U	I	19		6577.65	Th	II
15		6522.72	Eu	I	13		6553.07	Nd	II	6		6578.00	Pr	I
7		6523.15	Nd	II	7	h	6553.30	Pr	I	30	b	6578.06	Zr	Zr O
55	c	6523.18	Lu	I	12	h	6553.84	Y	YO	140		6578.51	La	I
9		6523.45	Pt	I	6		6554.16	Th	I	23		6579.10	Ce	I
55	b	6525.62	Sc	Sc O	65		6554.23	Ti	I	160		6579.37	Dy	I
7		6526.08	U	I	11	h	6554.83	Ti		18	h	6580.94	Nd	II
13	h	6526.64	Sm	II	14		6555.01	U	I	35		6581.82	Tb	I
110		6526.99	La	II	45		6555.65	Ce	I	10		6582.19	La	I
5		6527.04	U	I	75		6556.07	Ti	I	3		6582.78	U	I
700		6527.31	Ba	I	11		6556.33	Er	II	60		6583.48	Er	I
17		6527.63	Tb	II	15	h	6556.50	Hf	I	24		6583.91	Th	I
18	h	6528.02	Sm	I	70		6557.39	Y	I	6		6584.56	Pr	II
11		6528.74	Ru	I	7		6557.58	U	II	23		6584.87	Y	I
7		6528.87	Os	I	18		6557.82	Er	I	10		6585.13	Ta	I
18	h	6529.70	Sm	I	45	b	6557.84	Sc	Sc O	40	h	6585.21	Sm	II
10	h	6529.73	La	II	20		6558.02	Dy	I	18		6585.71	Nd	II
6		6530.68	Ce	I	17		6558.02	V	I	30	h	6586.51	Cs	I
50	h	6531.34	Th	I	13		6558.97	Nd	II	15	c	6587.16	Ta	I
110		6531.43	V	I	14		6560.06	Th	II	28		6587.23	Hf	I
18	h	6532.25	Sm	I	15		6560.08	Ho	I	7	h	6587.54	Sm	I
		6533.96	Sm	I	4		6560.45	Ru	I	7		6587.83	U	II
15		6532.39	W	I	6		6560.79	Ce	I	16		6588.03	Nd	II
7		6533.14	Os	I	25	h	6561.60	Ta	I	24		6588.54	Th	I
6		6534.51	Ce	I	9		6562.50	Tb	II	27		6588.91	Sm	I
8		6534.52	Pr	I	13		6563.20	W	I	110		6589.72	Sm	II
5		6534.60	U	II	15		6563.42	Co	I	6		6590.05	U	II
22	b	6535.30	Sc	Sc O	7		6563.46	Ce	I	7		6590.90	Mo	I
11		6535.46	U	II	25	cw	6564.26	Ta	I	19	cw	6591.00	Nb	I
18	h	6535.84	Y	YO	22		6564.62	Pr	II	11		6591.43	Nd	II
7		6536.58	U	II	55		6564.78	Gd	I	12		6591.48	Th	I
7		6537.49	Ce	II	26		6565.44	La	I	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 Sc O	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 Sc O
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 Ti O
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 h	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 Sc O
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 h	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 Sc O	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 Sc O
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		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		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	Sc O	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	Sc O	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		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 cw	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 c	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 c	6792.48	Tb II
19 c	6749.19	Pr I	8	6772.18	Th I	14 h	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
	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
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 d	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	c	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		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			6919.03	Sm	I	29		6950.28	Dy	II
13		6897.29	Nd	II	9		6919.27	Ce	II	24	h	6950.31	Y	I
14		6897.48	Er	II	21		6920.62	Gd	II	45	cw	6950.39	Ho	I
17		6897.95	Ho	I	6		6922.23	Zr	I	30		6950.51	Sm	II
15		6897.97	Dy	II	13	h	6923.09	Tb	II	65		6951.26	Ta	I
10		6898.01	Mo	I	110		6923.23	Ru	I	11		6951.42	Dy	I
21		6898.21	Eu	I	17		6923.86	Nd	I	10		6951.68	Y	II
10		6898.45	Ce	II	27	h	6924.13	Cr	I	18		6951.88	Er	I
6		6898.56	Tm	I	30		6924.81	Ce	I	8	h	6952.51	La	II
10		6898.98	Mo	I	15		6924.99	Gd	II	6		6952.93	Dy	II
9		6899.06	Ce	I	17	h	6925.20	Cr	I	6		6952.96	Th	II
65		6899.32	Dy	II	70		6925.24	La	I	8		6953.78	Mo	I
45	h	6899.95	Tb	I	7	h	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	bl	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		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	bl	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		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		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		21		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		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		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		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

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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	La O	5		7198.62	W	I
27		7134.08	Mo	I	9		7162.64	W	I	6	h	7198.63	Gd	I
3		7134.32	Co	I	6		7164.30	Gd	II	3	h	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	hs	7164.88	Th	Th O	13		7201.41	Gd	II
12	h	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	h	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	b	7203.64	Ti	Ti O
16		7140.74	Zr	I	590		7169.09	Zr	I	65		7204.28	Tb	I
6	h	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	h	7206.77	Dy	I
4		7141.72	Ru	I	10		7172.67	Sm	I	12		7207.41	Fe	I
12	h	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	c	7208.85	Pr	II
9		7142.79	Lu	I	4		7173.40	Gd	II	19	c	7208.94	Nb	I
7		7143.10	Lu	I	13	c	7174.91	Ta	I	260		7209.44	Ti	I
10		7143.72	Nd		7		7175.00	Ce	II	5		7209.96	Os	I
40	d	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	II
16		7147.87	U	I	7		7182.08	V	II	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	II	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	d	7149.60	Sm	II	6	h	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	d	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	h	7189.95	Pr	I	11	h	7224.68	Eu	I
4		7154.71	Co	I	40		7191.13	Th	II	4		7226.06	W	I
10	hw	7154.95	Th	I	5	h	7191.33	W	I	8	h	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	hs	7155.5	Th	Th O	6		7191.49	Gd	II	20		7228.84	Ba	I
6	h	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	h	7230.04	Dy	I
16		7156.99	Ce	II	20		7192.01	Nd	II	5		7230.87	Th	I
40	h	7158.08	La	I	2		7193.60	Co	I	5	h	7231.33	Tm	I
13		7158.28	Gd	I	9		7194.63	U	I	13		7231.53	Pr	I
8	hs	7158.56	Th	Th O	570		7194.81	Eu	II	20		7232.27	Sr	I
18	hs	7159.10	Th	Th O	60		7195.24	Ba	II	25		7233.45	Gd	I
4		7159.18	Co	I	10	h	7195.89	Tb	II	8		7233.45	Ta	I
130		7159.43	Nb	I	10	h	7195.93	Y	I	5		7233.74	Tm	II
10	h	7159.88	Pr	I	5		7196.66	U	I	4	h	7234.68	Dy	II
5		7159.94	Th	I	14	h	7197.00	Er	I	19	h	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	c	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	
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		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	
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	
6		7272.29	Ta	I	14		7308.55	Ho		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	CeO
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	LaO
11		7358.66	V	I	3		7393.43	Th	II	110	bl	7434.36	La	LaO
5		7360.38	Mo	I	6	h	7393.49	V		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	LaO
90	cw	7369.09	Ta	I	110	bl	7403.52	La	LaO	12		7444.44	Ce	I
55	cw	7369.60	Eu	I	210	bl	7403.75	La	LaO	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	LaO	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	LaO	20		7417.53	Ba	I	6	h	7458.42	Ce	II
85	bl	7380.08	La	LaO	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		7563.19	Gd	II
26		7489.61	Ti	I	9		7528.70	U	I	10	h	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		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	h	7678.79	Sm	II	6	h	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	c	7726.68	Nb	I	10	h	7764.72	Mn	I
12		7680.20	Mn	I	22	h	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	h	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	h	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	h	7778.27	Tm	I
20		7690.43	Ho	I	9		7732.49	Mo	I	9	c	7779.67	Ta	I
18		7690.83	Zr	I	80		7733.50	Gd	I	300		7780.48	Ba	I
50	c	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	h	7782.35	Tm	I
8	h	7694.74	Tb	II	16	h	7738.98	Ho	I	14		7784.13	U	I
10	h	7695.78	Sm	I	5	h	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	h	7741.17	Sc	I	15		7785.17	Sc	I
30		7697.73	Sc	I	5		7741.43	Ce	II	8	h	7785.51	Tm	I
8	h	7698.00	Y	I	4		7742.55	Th	I			7785.90	Tm	I
9000		7698.96	K	I	60	cw	7742.57	Eu	I	6	h	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	h	7701.10	Th	II	4		7743.77	Ce	I	7	h	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	h	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	h	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	bl	7705.21	Ti	Ti O	3	h	7748.37	Gd	II	22		7791.86	Ru	I
22	h	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	h	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	c	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	cw	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	h	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	hl	7757.65	Rb	I	10		7801.54	Sm	I
5	h	7721.01	Dy	II	5		7757.89	Hf	II	7	h	7802.40	U	II
16		7721.84	Pr	I	7	cw	7758.30	Lu	I	6		7802.52	Y	I
11	h	7722.02	Ta	I	20		7759.43	Rb	I	8	h	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	La O	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	La O	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		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	La O	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	La O	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		7970.46	U	I	5		8019.38	U	I	60		8058.08	Zr	I
6		7971.56	Tm	I	30	b	8019.48	La	La O	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		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		30		8068.24	Ti	I
35	b	7979.34	La	La O	75		8026.50	Ta	I	45		8068.46	Sm	II
75	bl	7979.70	La	La O	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
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	24	8438.58	Dy II
40 w	8305.79	Sm II	8 h	8365.64	Y I	40	8438.93	Ti I
140	8305.90	Zr I	7	8365.75	Tm I	17	8439.77	Nb I
13	8305.91	Hf II	5	8367.58	Er II	16	8441.20	U I
14 h	8306.31	Ti I	4	8369.33	Th I	7	8442.58	Gd II
9 h	8307.41	Ti I	5 h	8369.67	Rh I	9	8444.46	Dy II
4	8307.56	U II	50	8370.23	Zr I	35	8445.35	U I
10	8307.72	Nd II	9	8372.84	Co I	10	8445.47	Gd I
7	8309.50	Zr I	4	8374.76	Gd I	8	8445.50	Th I
9	8310.23	Ce I	4	8375.16	Nd II	21	8446.52	Th I
7	8310.69	U I	4	8375.33	Nd II	25 cw	8447.62	Ta I
9 h	8311.76	Ti I	4	8377.79	Gd I	18	8450.02	U I
7	8312.34	Ce I	100	8377.85	Ti I	40	8450.06	Tb II
35	8312.82	Er I	3	8378.39	Co I	6	8450.26	Cr I
8 h	8312.85	Ti I	8 h	8379.80	La I	17	8450.36	Y I
5 h	8315.02	Gd II	6	8379.84	Pr I	5	8450.68	Th II
10	8315.45	Sm I	5	8380.06	Hf I	40	8450.89	Ti I
13 h	8316.04	La I	18	8381.86	U I	50	8453.17	Zr I
7	8316.38	Gd II	17	8382.08	Lu I	8 b	8453.55	La LaO
16	8318.34	U I	100	8382.54	Ti I	3	8455.24	Cr I
7	8320.16	Zr I	55	8382.82	Ti I	5 h	8456.87	Nd II
15	8320.86	Th I	3	8382.94	W I	9 h	8457.10	Ti I
29 cw	8320.93	Nb I	5	8382.98	Hf I	6	8457.48	Zr I
4	8322.05	W I	19	8383.71	Sm I	35	8459.19	Lu II
4	8323.85	Dy I	6	8387.09	Th II	35	8460.01	Hf I
8	8324.42	V I	7	8387.19	U I	7	8460.79	Tm II
6	8324.50	Nd II	19	8387.77	Sm II	50	8464.65	Zr I
85	8324.69	La I	35	8387.78	Fe I	10 h	8464.66	Ho I
35	8326.10	Dy I	5	8388.53	Dy I	6 h	8464.71	Eu I
40	8327.06	Fe I	11	8389.06	Ta I	8 h	8465.80	Tb II
5 h	8327.67	Ce II	11	8389.16	U I	11	8466.18	Er II
40 h	8328.44	Mo I	45 h	8389.32	Mo I	19 h	8467.15	Ti I
18	8328.57	Er II	120	8389.41	Zr I	8 h	8467.62	La I
9	8329.61	Y I	35	8392.01	Dy II	12	8468.41	Fe I
6	8329.74	U I	4	8394.71	Nd II	45	8468.50	Ti I
30	8330.46	Th I	9	8396.39	Ce I	27	8472.01	Tm II
14 h	8331.23	V I	7	8396.76	U I	35	8472.42	Er I
9	8331.94	Fe I	75	8396.87	Ti I	5	8472.58	Dy II
4	8332.01	Nd II	11	8398.30	Gd I	19 w	8473.54	Sm II
14	8332.44	Zr I	7	8400.85	Nd II	11	8473.64	Ru I
12	8334.37	Ti I	4	8402.58	U I	4	8475.14	W I
16	8337.50	U II	4	8402.60	W I	17 cw	8475.98	Nb I
10	8338.08	W I	7	8402.81	V I	26	8476.48	La I
4	8339.43	Fe I	18	8403.79	Th II	18	8478.35	Th I
14	8342.03	V I	6 d	8405.25	Ce II	10 d	8478.50	Lu I
25	8344.25	Hf I	12	8405.85	Dy II	4	8480.66	Dy II
24	8344.43	Y I	55	8409.90	Er I	10 h	8482.67	Ho I
29	8346.08	Nb I	120	8412.36	Ti I	45 h	8483.39	Mo I
12	8346.36	Nd II	70	8414.00	Zr I	11	8483.56	Ru I
95	8346.53	La I	5	8415.73	Ta I	45 w	8485.99	Sm II
11	8346.74	U I	20	8416.64	Dy II	5	8490.15	Dy I
9	8348.28	Cr I	15	8416.74	Th I	11	8495.82	Ce I
19 w	8348.68	Sm II	19	8416.98	Ti I	9	8495.98	Zr I
4	8348.81	W I	40	8417.13	Re I	15	8496.04	Ti I
11	8348.98	Ru I	5	8418.00	Th I	7	8496.09	U I
10	8349.73	Gd I	16	8418.23	Ce II	120	8498.02	Ca II
10	8350.04	Nb I	12	8421.23	Th I	40	8498.44	Zr I
9	8351.15	Mo I	15	8424.41	Ti I	12	8499.52	V I
6	8352.94	Ru I	8	8425.59	Rh I	5	8500.67	Th II
14	8353.15	Ti I	170	8426.52	Ti I	13	8502.70	Tb I
9 h	8353.58	Pd I	6 h	8427.82	Pr I	7	8504.53	U I
6	8355.15	Ce II	30 w	8432.64	Sm II	13 h	8507.37	La I
6	8357.07	U I	490	8434.94	Ti I	29 c	8508.08	Lu I
7	8358.72	W I	240	8435.70	Ti I	9	8510.79	Dy II
4	8358.73	Th I	4	8435.77	Ru I	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	Nb	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	
8		8764.00	Fe	I
65		8765.74	Tb	II
23		8766.64	Ti	I
21		8767.97	Nb	I
22		8768.64	Er	I
11		8770.36	Gd	I
25		8772.14	Ce	II
11	h	8774.8	Sc	
8	h	8775.58	Th	I
11	h	8776.63	Er	II
9		8777.36	Ru	I
15	h	8778.71	Ti	I
16	w	8780.59	Sm	II
12		8780.83	Dy	I
9		8782.17	Ce	I
6		8782.46	Eu	I
8	h	8784.55	Th	II
13		8784.85	Gd	I
10		8786.23	Zr	I
8		8787.37	U	II
23	w	8788.83	Sm	II
6		8789.87	Ge	I
12	cw	8790.88	Eu	I
45		8791.39	Dy	II
6		8793.38	Fe	I
15	h	8794.72	Sc	I
10		8795.76	Gd	I
95		8800.62	Y	I
16		8804.98	Zr	I
16	h	8805.48	Ho	II
140		8806.79	Mg	I
2		8809.42	Ni	I
12		8810.84	Ce	I
29	cw	8815.56	Nb	I
8		8816.16	Th	II
9		8816.56	U	I
19		8818.93	La	I
3		8819.15	Co	I
15	h	8823.8	Sc	I
40		8824.23	Fe	I
35		8825.82	La	I
21	h	8832.06	Gd	II
7		8832.81	Dy	II
13		8833.08	Dy	II
30	h	8834.35	Sc	I
20	c	8834.49	Ho	I
19	h	8835.85	Y	II
70		8836.09	Zr	I
17		8839.10	Nd	II
21		8839.63	La	I
6		8841.17	Th	I
18		8842.07	Th	II
14	h	8849.14	Gd	I
24		8850.37	Dy	II
26		8859.76	Sm	II
30		8860.98	Ba	I
9		8862.55	Ni	I
13		8865.53	W	I
9		8866.84	Er	II
10		8866.96	Fe	I
18	h	8867.31	Gd	I
15		8868.82	Th	I
18		8870.30	Eu	I
30		8891.20	Ce	II
60		8899.52	Zr	I
45		8905.75	Dy	II
35		8905.78	Nb	I
95		8913.66	Sm	II
35		8914.99	Ba	I
90		8915.98	Ho	II
50		8918.80	Se	I
60	c	8919.85	V	I
70	h	8922.56	Yb	II
29	c	8932.93	V	I
8000		8943.59	Cs	I
40		8947.15	Cr	I
15		8957.97	Th	II
40		8967.64	Th	I
12		8971.62	V	I
15	bl	8971.96	Th	ThO
19		8976.83	Cr	I
25		8999.56	Fe	I
65		9004.73	Hf	I

NBS-114A (REV. 7-73)

U.S. DEPT. OF COMM. BIBLIOGRAPHIC DATA SHEET	1. PUBLICATION OR REPORT NO. NBS-MN-145, Part II	2. Gov't Accession No.	3. Recipient's Accession No.

4. TITLE AND SUBTITLE

Tables of Spectral-Line Intensities, Part II
Arranged by Wavelengths

5. Publication Date May 1975

6. Performing Organization Code

7. AUTHOR(S) William F. Meggers, Charles H. Corliss, and Bourdon D. Scribner

8. Performing Organ. Report No.

9. PERFORMING ORGANIZATION NAME AND ADDRESS

NATIONAL BUREAU OF STANDARDS
DEPARTMENT OF COMMERCE
WASHINGTON, D.C. 20234

10. Project/Task/Work Unit No. 2320110 232.01

11. Contract/Grant No.

12. Sponsoring Organization Name and Complete Address (Street, City, State, ZIP)

Same as Number 9.

13. Type of Report & Period Covered N/A

14. Sponsoring Agency Code

15. SUPPLEMENTARY NOTES

Supersedes NBS Monograph 32, Parts I and II and its Supplement.
Library of Congress Catalog Card Number: 74 - 16256

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.

18. AVAILABILITY

[X] Unlimited

[ ] For Official Distribution. Do Not Release to NTIS

[X] Order From Sup. of Doc., U.S. Government Printing Office Washington, D.C. 20402, SD Cat. No. C13.44:145/II

[ ] Order From National Technical Information Service (NTIS) Springfield, Virginia 22151

19. SECURITY CLASS (THIS REPORT) UNCLASSIFIED

21. NO. OF PAGES 228

20. SECURITY CLASS (THIS PAGE) UNCLASSIFIED

22. Price $6.80

USCOMM-DC 29042-P74

U. S. GOVERNMENT PRINTING OFFICE : 1975 O - 559-795