JOURNAL OF RESEARCH of the National Bureau of Standards
Volume 83, No. 1, January-February 1978

The First Spectrum of Ytterbium (Yb I)

William F. Meggers* and Jack L. Tech

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

(September 15, 1977)

Wavelengths and estimated intensities for 1791 lines of neutral ytterbium in the region 2155 to 31 308 Å are reported. The Zeeman effect has been investigated for 249 of these lines. Analysis of the data has resulted in classification of 787 lines as transitions between 102 even and 77 odd levels. Even levels have been assigned to the electron configurations $4f^{14}6s^2$ (the ground state), $4f^{14}6sns$, $4f^{14}6snd$, $4f^{13}6s^26p$, $4f^{14}6p^2$, $4f^{14}5d^2$, and $4f^{13}5d6s6p$. Odd levels have been assigned to $4f^{14}6snp$, $4f^{14}6snf$, and $4f^{13}5d6s^2$. Many odd levels are still unassigned, but the majority undoubtedly belong to the configuration $4f^{13}5d^26s$.

Key words: Energy Levels, Yb I; spectrum, Yb I; wavelengths, Yb I; Yb I; ytterbium; Zeeman effect.

1. Introduction

The first regularities in Yb I were reported by Meggers and Scribner [1937][1] in their description of the conventional arc and spark spectra of this element in the range 2000 to 11 000Å. In that paper they reported some 400 lines of Yb I observed by burning Yb salt in an arc. Their assignment of lines of successive spectra agrees almost perfectly with King's [1931] separation of ionization stages based upon a study of the spectra of ytterbium excited in an electric-furnace. Their first measurements of Yb spectra were, however, made in 1929 when the investigation of Lu spectra was begun. Since all available samples of lutecium at that time were contaminated with ytterbium, it was necessary to study Yb spectra simultaneously in order to derive trustworthy descriptions of Lu spectra. Meggers thus carried on the work intermittently for a period spanning 37 years until his death in 1966. He left most of the analysis presented here.

Most of the Yb I lines used in the present analysis were published in the general description of ytterbium spectra by Meggers and Corliss [1966]. That list extends from 2155 to 11 603 Å and includes wavelengths, estimated intensities as observed with a "Meggers lamp" and with a "Thomson lamp," and the Zeeman type. A typical spectrogram from which the wavelengths were measured is shown in figure 1.

Humphreys and Paul [1959] extended the observations to 24 552 Å with an electrodeless lamp as source, and in 1964 they reported three more lines at still longer wavelengths, reaching 31 308 Å (unpublished).

Sugar [1962] developed a pulsed-arc light source for producing self-reversed lines in the first and second spectra of rare-earth elements. The first observations he made with this source were with ytterbium electrodes and covered the range 2400 to 7000 Å. These spectrograms were evaluated by Meggers, who found that 22 lines of Yb I were absorbed or self-reversed.

In 1963 N. Spector photographed the spectra of ytterbium emitted by a sliding spark in the region from 6600 to 11 600 Å, and Meggers found some new Yb I lines on these spectrograms in the region longer than 9000 Å.

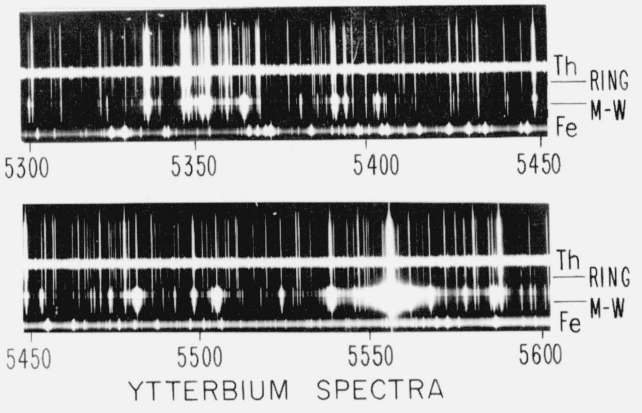

FIGURE 1. *Typical spectrogram of ytterbium in the green region of the spectrum.*

This analysis is thus based mainly on the wavelengths, intensities and Zeeman patterns published by Meggers and Corliss [1966] and on the infrared wavelengths and intensities reported by Humphreys and Paul [1959].

Meggers and Scribner [1937] reported that as early as 1930 three energy levels with separations of 703.5 cm^{-1} and 1718.4 cm^{-1} were detected from repeated differences among the wavenumbers. These were immediately interpreted by H. N. Russell as the intervals of the term $4f^{14}6s6p\ ^3P^o$. He also identified two singlet terms, $4f^{14}6s6p\ ^1P^o$ and the ground term $4f^{14}6s^2\ ^1S_0$, The *raie ultime* 3987.990 Å was thus classified as this singlet transition $^1S_0 - {}^1P^o_1$. Eight terms and 22 classified lines were reported by Meggers and Scribner in the 1937 paper, all of which formed the beginning of the present work. At that time, the authors pointed out that Zeeman observations were needed to extend the analysis of the spectrum. The Zeeman observations are discussed in section 4.1.

* Deceased.
[1] Years in brackets indicate the literature references at the end of this paper.

The lowest nine atomic energy levels of Yb I with their observed g-values are listed in the abstract by Meggers and Corliss [1960], which concludes with the statement that "nearly all of the strong lines of Yb I are found to be combinations of these nine levels with some 70 higher energy levels. In that abstract, the ^{3}D and ^{1}D terms from the configuration $4f^{14}5d6s$ were added for the first time to the list of levels published in 1937.

Until 1964 the analysis of Yb I did not extend beyond the identification of levels belonging to two-electron configurations of the type $4f^{14}nlnl'$, which produce a spectrum resembling that of an alkaline earth. Meggers then encouraged N. Spector to perform some theoretical calculations to predict the positions of several configurations of the type $4f^{13}nlnl'nl''$, in which one of the $4f$ electrons is excited. As a result of these calculations and a number of computer searches, Spector [1971] was able to identify for the first time levels belonging to the configuration $4f^{13}5d6s^2$, thus shedding new light on the probable positions of such important configurations as $4f^{13}5d6s6p$, $4f^{13}5d^26s$, and $4f^{13}6s^26p$.

During the years of fruitful collaboration on the analysis of Yb II with the late G. Racah [1967], there was also some discussion of work on Yb I. In 1964 Racah requested the new list of levels in order to complete the theoretical interpretation. A letter to Racah from Meggers in 1965 stated that the analysis of Yb I had been extended to include classifications for a large number of the 1800 observed lines.

After Racah's death in 1966, Z. B. Goldschmidt agreed to continue his theoretical work on Yb I and began to construct the energy matrices for the high even configurations $f^{13}(d^2 + ds + s^2)p$. In the same year, Meggers sent his first list of levels to her and noted that "this is the first complex spectrum in my experience that has more even than odd levels."

2. Structure of the Spectrum

Neutral ytterbium has two systems of energy levels: (1) those arising from electron configurations of the type $4f^{14}nlnl'$, in which the $4f$ electrons form a closed shell, and (2) those from configurations of the type $4f^{13}nlnl'nl''$, in which one of the $4f$ electrons is excited. The configurations involving the closed $4f$ shell produce a spectrum resembling that of an alkaline earth. In all the neutral lanthanides, the lowest configuration of the first type is $4f^N6s^2$ and the lowest of the second type is $4f^{N-1}5d6s^2$.

The ground state of neutral ytterbium is $4f^{14}6s^2\ ^1S_0$. It combines strongly with the $4f^{14}6s6p\ ^{1,3}P^\circ$ terms, as well as with the higher terms of the $6snp$ series. In the present observations this series has been observed to $n = 13$. In absorption it has been observed by Camus and Tomkins [1969] to $n = 48$. The first series number, $4f^{14}6s^2\ ^1S_0 - 4f^{14}6s6p\ ^1P^\circ_0$ at 3988 Å, is the strongest line of Yb I, and the second member $6s^2\ ^1S_0 - 6s7p\ ^1P^\circ_0$ at 2464 Å, is the fifth strongest line according to Meggers, Corliss, and Scribner [1975].

The configuration $4f^{14}6s6p$ in turn combines with the series $6sns$ which has been observed to $n = 13$. The first member of the triplet series, $4f^{14}6s6p\ ^3P^\circ_2 - 4f6s7s\ ^3S_1$ at 7699 Å, is the fourth strongest line of the spectrum. The $6s6p$ configuration is also observed to combine with the $6snd$ series of terms to $n = 9$.

S. Nir [1970] identified higher members of the $6sns$, $6snp$, and $6snd$ series by using calculations based on the Ritz-Rydberg formula and by analogy with known data on similar configurations in Eu I and Ba I.

As with the heavy elements of group II of the periodic table, intersystem transitions are strong in the two-electron spectrum of Yb I. The resonance intersystem transition $6s^2\ ^1S_0 - 6s6p\ ^3P^\circ_1$ at 5556 Å is actually the third strongest line in the spectrum. It gives rise to the brilliant characteristic green color of an ytterbium arc or metal vapor lamp.

The lowest configuration of the rare-earth type, in which one of the $4f$ electrons is excited, is $4f^{13}5d6s^2$ starting at 23 188 cm^{-1}. There are 20 levels grouped into four terms in J_1j coupling. The $(3^1/_2,\ 1^1/_2)^\circ$ and $(3^1/_2,\ 2^1/_2)^\circ$ terms in the lower half of the configuration are known, but the $(2^1/_2,\ 1^1/_2)^\circ$ and $(2^1/_2,\ 2^1/_2)^\circ$ terms, which have been calculated to lie between 33 000 and 41 000 cm^{-1}, have not been found. The transition from the level $(3^1/_2,\ 2^1/_2)^\circ_1$ at 28 857 cm^{-1} to the ground state produces the second strongest line in the spectrum. The high intensity of this transition is qualitatively explained by the fact that the calculation in LS coupling shows that the level at 28 857 cm^{-1} is 17 percent $6s6p\ ^1P^\circ_1$. These calculations were made by S. Nir and Z. B. Goldschmidt (unpublished). N. Spector [1971], who originally collaborated with Meggers in identifying this configuration, has interpreted it as being J_1l-coupled, but the calculations of Nir and Goldschmidt indicate somewhat higher purity in J_1j coupling.

The rare-earth type configuration $4f^{13}6s^26p$ starts at 32 065 cm^{-1} and has been calculated in J_1j coupling by Nir and Goldschmidt (unpublished) and, in part, in J_1l coupling by Spector [1971]. Ten of the twelve levels of this configuration have been found. In 1967 Z. Goldschmidt noted in a letter to Meggers that "a prominent feature of all $4f^{13}6s^26p$ levels is the weakness of their transitions (with only a few exceptions) both to the low odd levels belonging to the configuration $4f^{14}6s6p$ and to the high (as yet unidentified) odd levels. The forbidden transitions $4f^{13}6s^26p$ to $4f^{14}6s6p$ exist as a result of configuration interaction of the types $4f^{13}6s^26p + 4f^{13}5d6s6p$ and/or $4f^{14}6s6p + 4f^{13}5d6s^2$."

The positions of energy levels in the configurations $4f^{13}6s^26p$ and $4f^{13}5d6s^2$ are shown in figures 2 and 3, respectively. Dashed bars denote levels that have not yet been found, and the positions shown are based on unpublished calculations by Nir and Goldschmidt.

Using a photoionization mass spectrometer, Parr and Elder [1968] measured the photoionization efficiency of ytterbium in the range 1350–2000 Å and tentatively analyzed the observed line structure as arising from the configurations $4f^{14}5dnp$, $4f^{14}6pnd$, $4f^{13}6s^2nd$, and $4f^{13}5d6snd$. Their identification of lines involving the configuration $4f^{14}5d6p$ places the levels $^3D^\circ_1$, $^3P^\circ_1$, and $^1P^\circ_1$ of this configuration above the ionization limit.

The relative positions of the configurations discussed above are displayed in figure 4.

3. Ionization Potential

The most accurate value for the ionization potential for Yb I has been determined from absorption spectra by Camus and Tomkins [1969] using the series $6s^2\ ^1S_0 \rightarrow 6snp\ ^1P^\circ_1$ for values of n from 6 to 48. They obtained the value 50 441.0

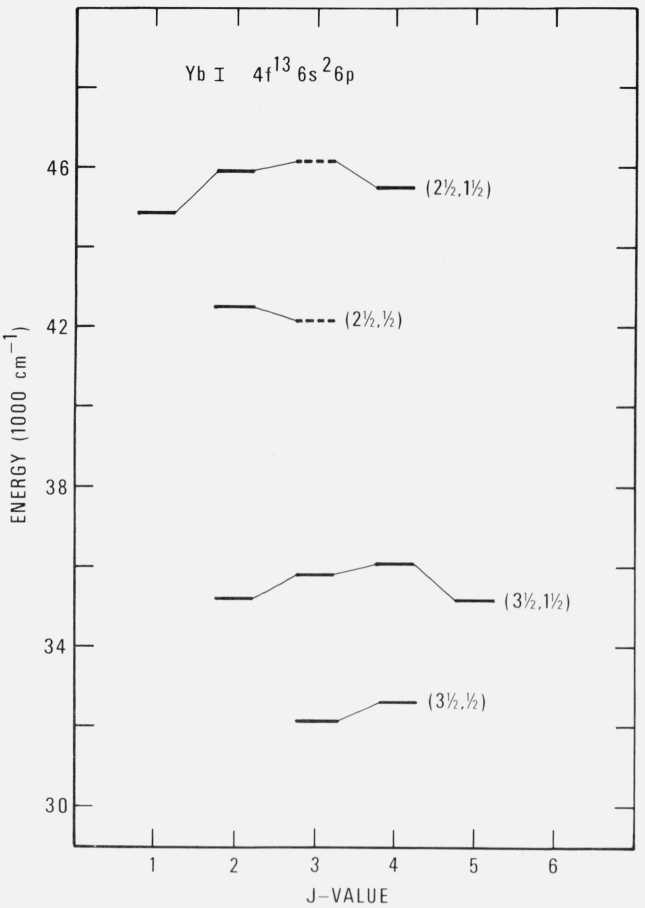

FIGURE 2. *Schematic representation of the energy levels of the configuration* $4f^{13}6s^26p$.

The positions of known levels are represented by solid horizontal bars. Dashed bars indicate calculated positions of levels that have not yet been found. Levels are connected into terms in the J_1j coupling scheme.

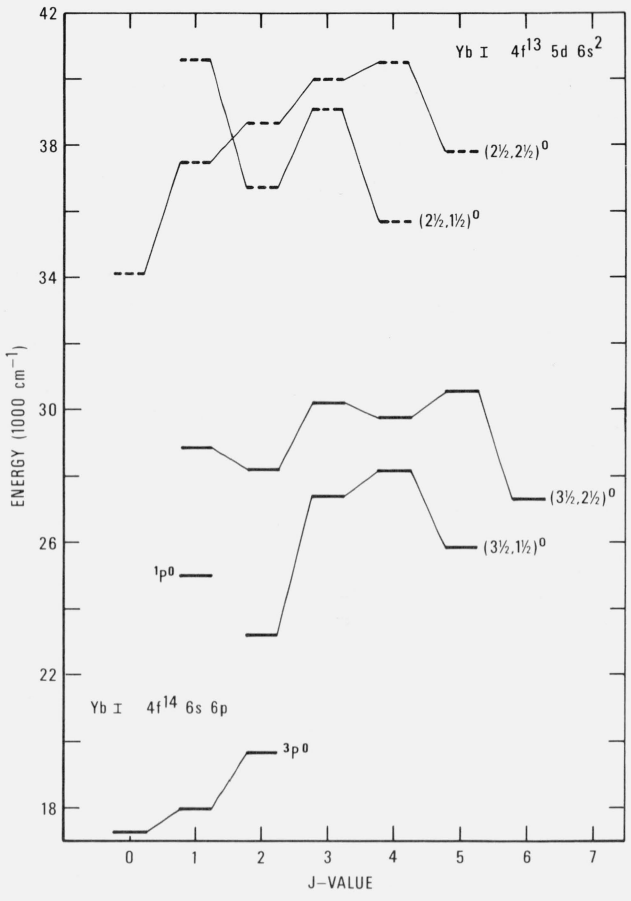

FIGURE 3. *Energy level diagram for the configurations* $4f^{13}5d6s^2$ and $4f^{14}6s6p$.

Levels are connected into terms in the J_1j coupling scheme. Dashed bars indicate calculated positions of levels that have not yet been found.

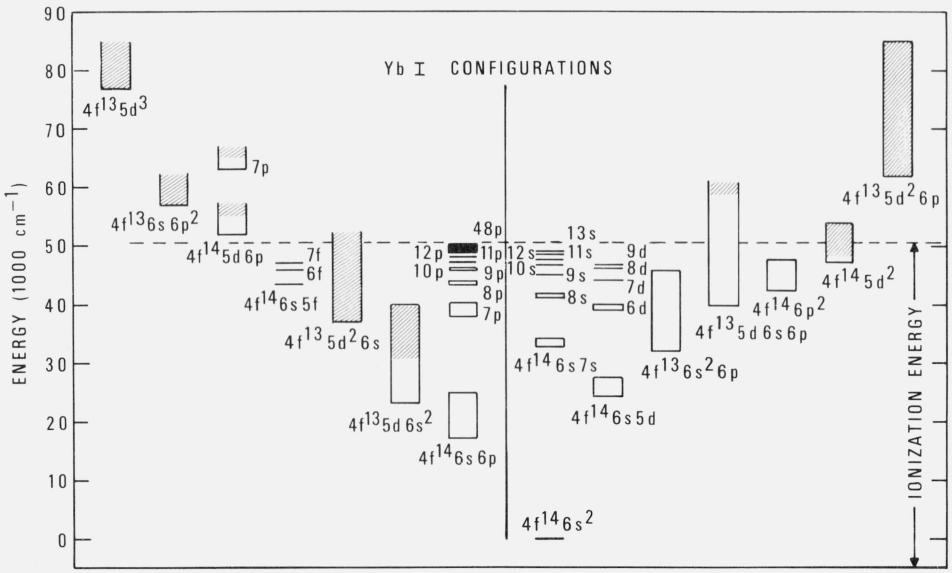

FIGURE 4. *Relative positions of known and predicted configurations in Yb* I.

The cross-hatching indicates calculated positions of levels that have not yet been found.

$\pm$ 0.2 cm^{-1} for the limit, which is the ground state $4f^{14}6s\ ^2S_{1/2}$ of Yb II. The conversion factor 8065.479 $\pm$ 0.021 cm^{-1}/eV has been used to calculate an ionization potential: 6.25394 $\pm$ 0.00003 eV. This value is in agreement with the value 6.25 eV calculated by Reader and Sugar [1966] from the $6sns$ series.

4. Tables

4.1. Zeeman Effect

A major contribution to this analysis was provided by the Zeeman effect. The first set of observations of Yb Zeeman effect was made by Meggers at M.I.T. with the Bitter magnet in 1939. The high excitation provided by the d-c arc in the large magnetic field produced Zeeman patterns for Yb II and Yb III but none for Yb I. The later development of electrodeless lamps, which produce lower excitation, paved the way for the first observation of Zeeman patterns for Yb I as described in detail by Meggers and Corliss [1966].

All of the observed Zeeman data are tabulated in table 1. Column 1 contains the wavelength as given in the list of observed lines (table 4). Column 2 gives the type of pattern. The standard Zeeman types, 1, 2, 3 for odd multiplicity and Type 7 which has a single undisplaced parallel (p) component and two symmetrically displaced normal (n) components, are excellently illustrated in a paper on hafnium spectra by Corliss and Meggers [1958]. Columns 3 and 4 list the measured splitting, in Lorentz units, of the observed p and n components, respectively. Except for resolved patterns these data refer to the strongest p and n components. Italics denote the splitting of the strong components in the case of a resolved pattern. Columns 5 and 6 give the observed g-values for the low and high levels, respectively, involved in the transition producing the line (see table 4). For example, the line at 5955.34 Å is classified as $27445^{\circ}_{3} - 44232_{4}$. In table 1 the "1st g", 1.24, is an observed g-value of the level 27445°_{3}, the "2nd g", 1.48, is that of the level 44232_{4}.

In the case of unresolved patterns, it is often possible to derive a g-value for one level if the g-value for the other is already known. In the table, values that have been assumed in deriving the other are enclosed in parentheses.

Most of the final g-values were derived by Meggers, who completed the measurement and reduction of all Zeeman observations and interpreted practically all of the resolved patterns. A number of additional g-values from unresolved patterns have been derived by Charlotte E. Moore as described above.

The technique of optical double resonance has been used by Baumann and Wandel [1968] (BW) and by Budick and Snir [1967] (BS) to measure very accurate g-values for several levels of Yb I, as listed below. The values derived by Meggers (WFM) are in excellent agreement with these.

Level	g-value	Reference
$4f^{14}6s6p\ ^3P^{\circ}_1$	1.49285 (5)	BW
	1.49280 (4)	BS
	1.48	WFM
$4f^{14}6s6p\ ^1P^{\circ}_1$	1.035 (5)	BW
	1.03	WFM
$4f^{13}5d6s^2\ (3\frac{1}{2}, 1\frac{1}{2})^{\circ}_1$	1.2635 (9)	BS
	1.26	WFM

4.2. Energy Levels

The even levels and terms of Yb I are listed in table 2 and the odd levels and terms in table 3. Each table has six columns containing the following data: (1) configuration, (2) term designation, (3) J-value, (4) level value in cm^{-1}, (5) observed g-value, and (6) number of observed combinations. Since levels with $J = 0$ do not have a defined g-value, a Z in column 5 has been used for such a level to denote that the Zeeman effect has been observed for lines involving that level.

A number of levels in the original working list of Meggers have been rejected as spurious or unconfirmed. The present list includes, also, a number of important new levels added to Meggers' list in the present work. A few changes in the J-values assigned by Meggers have also been made.

The configuration and term assignments for many of the even levels have been generously provided by Z. Goldschmidt in advance of her publication of the theoretical interpretation of these configurations. For some of these levels, the calculated eigenvector purities are so low that meaningful names cannot be assigned. In such cases, only a configuration assignment has been made. The remaining unassigned odd levels undoubtedly belong for the most part to the configuration $4f^{13}5d^26s$.

The two even levels at 42437 cm^{-1} are peculiar in several ways. It was believed at first that this pair of levels was actually a single one, but that assumption resulted in a spread of observed-minus-calculated positions for the lines classified by this level that is much greater than for other levels. We concluded, therefore, that we are dealing with a pair of very close levels and have tentatively identified the upper member of the pair as $4f^{14}6p^2\ ^3P^{\circ}_0$. This interpretation is also supported by the isotope shifts of spectral lines involving these levels as measured by Miller and Ross [1976]. It should be noted that the Zeeman pattern of each of the observed lines involving these levels is anomalous in some respect.

The first three members of the $4f^{14}6snf\ ^3F^{\circ}_2$ series have been tentatively identified. As in Yb II [1973] the quantum defects of these series members are close to unity, as expected.

TABLE 1. *Zeeman effect of* Yb I

Wavelength (air) Å	Type	Zeeman components (L.U.)						1st g	2nd g
		p			n				
8325.18	3	0.81			1.04	1.45		1.45	1.04
8091.73	1	*0.00*	0.24		*0.76*	1.00?		1.47	1.23
8039.83	1	*0.00*	0.60		0.00			(1.22)	1.82
7922.40	1	*0.00*	0.36		0.34			1.44	1.08
7895.08	2	*0.00*	0.13		1.30			1.17	1.04
7758.04	7	0.00			1.01			1.01	1.01
7734.53	3	0.52			0.50	1.02		0.50	1.02
7699.49	1	*0.00*	0.50		0.99			1.49	1.99
7679.91	1	*0.00*	0.24		0.62			1.10	1.34
7527.45	1	*0.00*	0.17		0.99			1.33	1.50
7448.28	7	0.00			1.18			(1.16)	1.14
7350.04	7	0.00			0.49			0.49	0.00
7327.87	1	*0.00*	0.38					(1.14)	1.52
7313.05	2	0.00W			1.25			(1.16)	1.07
7305.23	3	0.64						(0.50)	1.14
7244.41	3	0.67			1.17	1.50		1.17	1.50
7187.07	1	0.00			0.94				
6799.60	3	0.51			1.50	2.01		1.50	2.01
6782.17	3	0.52			0.50	1.02		1.02	0.50
6768.70	2	*0.00*	0.13		1.30			1.04	1.17
6765.24	7	0.00			1.04			1.09	(1.08)
6749.40	2	*0.00*	0.79		2.62			1.04	1.83
6715.79	7	0.00			1.18			1.18	1.18
6692.42	1	*0.00*	0.30		0.20			1.10	1.40
6678.17	3	0.45			1.01	1.25		1.01	1.25
6667.82	7	0.00			1.03			1.02	1.03
6643.55	7	0.00			1.01			1.01	1.01
6626.73	2	*0.00*	0.21		1.66			1.24	1.03
6607.07	1	*0.00*	0.21		0.69			1.09	1.29
6555.15	7	0.00w			1.26			1.16	(1.14)
6550.14	3	0.08			1.30w				
6489.06	2	0.00			2.02			0.00	2.02
6421.53	2	0.00w			1.25			1.10	(1.14)
6417.91	2	0.00			1.15			(1.01)	1.06
6404.62	1	*0.00*	0.44		0.57			1.01	1.45
6400.35	7	0.00			1.04			(1.01)	1.02
6393.73	2	0.00W			1.48			(1.09)	1.17
6372.71	1	*0.00*	0.11		0.76			1.09	1.20
6344.97	3	0.64			0.68	1.00		1.00	0.68
6335.72	1	*0.00*	0.13		0.96			1.21	1.34
6286.25	2	0.00w			1.44			1.25	(1.34)
6247.99	3	0.18						1.09	(1.14)
6194.84	2	*0.00*	0.20		1.63			1.02	1.22
6181.78	7	0.00			1.26			(1.23)	1.24
6118.28	7	0.00			1.02			(1.01)	1.00
6111.27	2	0.00			1.52			1.52	0.00
6065.72	2	0.00			1.35			1.25	(1.30)
6054.57	7	0.00			1.13			(1.18)	1.17
6048.44	1	*0.00*	0.24		0.43			1.15	1.39
6035.72	7	0.00			1.17			(1.18)	1.16
6031.80	3	0.74			1.02	1.39		1.02	1.39
6014.95	1	*0.00*	0.25		0.36			1.11	1.36
6004.52	3	0.66			1.15	1.48		1.48	1.15
6003.62	1	0.00W			1.04+				
5989.33	3	0.72			1.48	1.84		1.48	1.84
5959.33	2	0.00w			1.26			(1.01)	1.09
5958.70	1	*0.00*	0.12		1.09			1.45	1.33
5955.34	2	*0.00*	0.24	0.47	1.73	1.96	*2.20*	1.24	1.48

TABLE 1. *Zeeman effect of* Yb I—Continued

Wavelength (air) Å	Type	Zeeman components (L.U.)				1st g	2nd g
		p		n			
5950.66	3	0.20		1.13w		1.15	1.10
5936.49	1	0.00W		0.42		1.01	(0.86)
5925.46	2	0.00		1.03		1.03	0.00
5854.510	3	0.74		0.89	1.04	1.04	0.89
5831.82	3	0.56		1.04	1.32	1.04	1.32
5810.67	1	*0.00*	0.43	0.62		1.48	1.05
5803.44	2	0.00W		1.31		(1.14)	1.18
5755.89	3?	0.32		0.72	*1.36*		
5749.91	3	0.16		1.19		1.18	1.21
5745.80	1	*0.00*	0.18	0.83		1.01	1.19
5728.853	7	0.00		1.11			
5724.58	1	0.00		0.98		(1.03)	1.00
5719.99	3	0.00		0.99		(1.01)	0.97
5701.922	3	0.20		1.15W		1.17	1.13
5699.95	1	*0.00*	0.13	0.68		1.20	1.07
5689.917	7	0.00		1.16			
5683.09	7	0.00		1.14		1.14	1.14
5597.189	7	0.00		1.05		(1.09)	1.08
5586.362	3	0.14		1.21		1.17	1.24
5578.232	7	0.00		1.23			
5568.11	2	0.00w		1.30		(1.04)	1.08
5562.093	3	0.29		1.02	1.17	1.17	1.02
5556.466	2	0.00		1.48		0.00	1.48
5539.053	1	0.00W		1.01			
5524.544	7	0.00		1.16		(1.16)	1.16
5505.49	2	*0.00*	0.75	2.00		0.50	1.25
5498.75	7	0.00		1.01			
5493.088	2	*0.00*	0.32	2.00		1.04	1.36
5481.925	2	*0.00*	0.52	1.55		0.49	1.02
5474.037	1	0.00w		1.06		1.18	(1.21)
5454.007	1	0.00w		0.97		(1.22)	1.15
5403.079	1	0.00W		0.88		(1.16)	1.06
5393.757	1	0.00W		1.01		(1.34)	1.49
5390.845	3	0.33		1.27W		1.33	1.22
5390.622	1	0.00W		0.77		(1.16)	1.03
5380.54	2	0.00w		1.56		(1.08)	1.20
5380.24	7	0.00		0.98		(1.08)	1.10
5363.66	2	0.00W		1.66		(1.45)	1.51
5351.29	3	0.96		0.68	1.15	1.15	0.68
5323.10	1	*0.00*	0.40	0.74		1.14	1.54
5299.852	3	0.81		0.86	1.06	1.06	0.86
5288.51	7	0.00		1.21		(1.14)	1.16
5287.45	1	*0.00*	0.32	0.83		1.15	1.47
5277.04	2	0.00w		0.85		(0.50)	0.68
5275.592	3	0.30		1.20	1.30	1.20	1.30
5244.11	2	0.00W		1.27		(1.16)	1.20
5228.172	7	0.00w		1.16		(1.34)	1.30?
5227.271	1	0.00W		0.87		1.04	(1.08)
5214.95	3	0.99		0.49	1.48	0.49	1.48
5211.604	3	0.75		1.10	1.35	1.35	1.10
5196.085	3	0.60		1.15	1.25	1.15	1.25
5193.850	1?	0.28		*1.17*	1.74	(1.45)	1.73?
5182.755	7	0.00		1.18?		(1.03)	1.10
5139.53	1	0.00w		0.92		(1.14)	1.10
5126.80	3	0.42				(1.16)	1.37
5113.34	3	0.65		1.09W		1.03	1.16
5104.85	1	*0.00*	0.33				
5080.981	2	0.00w		1.34		(1.14)	1.06

TABLE 1. *Zeeman effect of* Yb I—Continued

Wavelength (air) Å	Type	Zeeman components (L.U.)				1st g	2nd g
		p		n			
5076.744	2	*0.00*	0.32	1.66		1.02	1.34
5074.34	1	0.00		1.04		(1.16)	1.12
5069.144	7	0.00		1.17		(1.16)	1.18
5067.800	2	0.00W		1.50		(1.14)	1.21
5058.613	2	*0.00*	0.88	2.27		0.51	1.39
5043.708	7	0.00		0.99		(1.01)	1.03
5027.67	2	*0.00*	0.35	2.04		1.34	0.99
5019.691	1	*0.00*	0.10	0.60		1.00	1.10
4974.16	2	*0.00*	1.01	2.52		1.51	0.50
4966.902	3	0.69		1.16	1.51	1.51	1.16
4956.512	3	0.66		1.52	1.85	1.52	1.85
4935.500	1	*0.00*	0.17	0.99		1.50	1.33
4931.953	2	*0.00*	0.28	1.58		1.02	1.30
4918.118	7	0.00		1.22		1.22	1.22
4912.365	3	0.96		1.04	1.52	1.52	1.04
4899.78	3	0.36		0.97	1.15	1.15	0.97
4893.465	7	0.00		1.12?		(1.16)	1.20?
4891.992	7	0.00		1.41			
4853.826	1	0.00w		0.96		(1.16)	1.20
4837.46	2	*0.00*	0.48	1.47		0.51	0.99
4831.30	3	0.78		0.50	1.28	0.50	1.28
4816.43	1	*0.00*	0.28	0.24			
4812.918	3	0.28		1.00	1.14	1.00	1.14
4781.867	1	*0.00*	0.15	0.80		1.40	1.25
4780.32	1	*0.00*	0.17	0.98		1.33	1.50
4778.982	3	0.35		1.02	1.11	1.11	1.02
4762.587	2	W		1.84W			
4758.320	7	0.00		0.94			
4751.789	1	0.00W		0.60		(1.14)	1.32
4743.356	3	0.19		1.17W		1.15	1.20
4720.79	2	*0.00*W	0.54	1.85		(1.04)	1.18
4718.56	7?	0.00w		1.02			
4687.593	1?	0.17		1.00		1.17	1.34
4684.268	7	0.00		1.24		(1.22)	1.22
4666.735	7	0.00		1.13		(1.16)	1.19
4656.971	2	*0.00*	0.21	0.93		0.51	0.72
4651.67	3	0.40		1.19w		1.16	1.22
4650.05	7	0.00		1.13		(1.16)	1.15
4644.54	1	0.00		1.27		(1.45)	1.39
4624.41	2	0.00w		1.26		(1.16)	1.06
4615.947	1	0.00W		0.53		(1.22)	1.04
4610.172	3	0.72		0.52	1.24	0.52	1.24
4590.834	3	0.21		1.08W		1.06	1.10
4589.211	2	*0.00*	0.25	1.84		1.34	1.09
4585.916	7	0.00		0.98			
4582.355	3	0.99		0.50	1.50	1.50	0.50
4580.724	7?	0.00		1.13			
4576.209	1	*0.00*	0.33	0.80		1.46	1.13
4568.853	3	0.57		0.50	1.07	0.50	1.07
4567.368	2	*0.00*	0.32	2.16		1.52	1.84
4563.95	1	*0.00*	0.50	1.02		1.52	2.02
4533.506	3	0.90		1.04	1.22	1.04	1.22
4531.333	1	0.00w		1.06			
4529.87	1	*0.00*	0.46	0.57		1.49	1.03
4513.408	3	0.30		1.30	1.45	1.45	1.30
4503.636	3	0.45		1.05	1.14	1.05	1.14
4488.282	1	*0.00*	0.24	0.73		1.45	1.21
4482.422	3	0.16		1.08	1.16	1.16	1.08

TABLE 1. *Zeeman effect of* Yb I—Continued

Wavelength (air) Å	Type	Zeeman components (L.U.)				1st g	2nd g
		p		n			
4472.470	7	0.00		1.06		(1.03)	1.04
4439.19	2	0.00		0.51		0.00	0.51
4430.208	3?	0.66?		*0.40*	1.06?		
4411.095	3?	0.54		1.26W,d			
4402.605	7	0.00		1.03			
4398.96	1?	0.23		1.29		(1.50)	1.73?
4396.254	7	0.00		1.06			
4393.688	7	0.00		1.05		(1.03)	1.04
4376.456	3	0.45		0.50	0.95	0.50	0.95
4359.528	3	0.88		0.48	1.36	0.48	1.36
4352.948	3	0.25		1.28W		1.32	1.24
4329.718	7	0.00h		1.08h			
4326.404	1	*0.00*	0.12	0.98		1.11	1.23
4309.823	7	0.00		0.49			
4305.966	3	0.27		1.24	1.33	1.33	1.24
4300.984	7	0.00		1.02		(1.04)	1.04
4284.170	7	0.00		1.01			
4277.738	3	0.80		0.50	1.30	0.50	1.30
4251.521	3	0.30		1.34	1.49	1.49	1.34
4233.445	1	0.00w		1.04		(1.01)	1.02?
4231.972	3	0.51		1.51	2.02	1.51	2.02
4218.693	7	0.00		1.15		1.15	1.15
4211.82	2	0.00		1.30		(1.16)	1.21
4210.299	7	0.00		1.21			
4174.56	2	0.00		1.50		1.50	0.00
4149.066	7	0.00		1.51		1.51	1.51
4109.574	2	0.00		2.01		0.00	2.01
4089.68	3?	0.34		1.47	1.82		
4059.470	7	0.00		1.20			
4052.283	1	*0.00*	0.17	0.99		1.49	1.32
4052.072	1	*0.00*	0.41	0.19		1.44	1.02
4007.356	3	0.14		1.37	1.44	1.44	1.37
3993.753	3	0.30		1.19W			
3990.885	3	0.30		1.34	1.49	1.49	1.34
3987.99	7	0.00		1.02		0.00	1.02
3975.283	2?	0.32		1.74		0.00	1.74?
3961.98	1	*0.00*	0.14	1.20		1.47	1.33
3911.272	3	0.30		1.13w		1.16	1.10
3900.85	3	0.37		1.31	1.50	1.50	1.31
3872.852	7	0.00		1.47		1.47	1.47
3839.907	1	*0.00*	0.14	1.04		1.47	1.33
3838.287	2	*0.00*	0.48	0.97			
3791.741	1	*0.00*	0.38	0.71		1.47	1.09
3774.323	2	*0.00*	0.20	2.22			
3770.095	7	0.00		1.46		0.00	1.46
3736.237	3	0.71		1.12	1.48	1.48	1.12
3734.694	1	*0.00*	0.14	1.21		1.49	1.35
3734.435	1	*0.00*	0.16	1.00			
3706.023	3?	0.66		1.33			
3700.580	2	*0.00*	0.07	1.51		1.07	1.14
3684.997	3	0.50		1.48	1.98	1.48	1.98
3666.62	7	0.00		0.85			
3655.729	1	*0.00*	0.18	1.11		1.47	1.29
3629.233	7	0.00		0.66		0.00	0.66
3614.994	7	0.00		1.13		(1.09)	1.10
3578.561	1	0.00W		0.96		(1.50)	1.32
3559.032	7	0.00		1.48		1.48	0.00
3517.001	3	0.21		1.41w		1.46	1.36

TABLE 1. *Zeeman effect of* Yb I—Continued

Wavelength (air) Å	Type	Zeeman Components (L.U.)				1st g	2nd g
		p		n			
3513.573	3	0.95		0.49	1.44	1.44	0.49
3510.764	1	*0.00*	0.33	0.80		1.46	1.13
3464.37	7	0.00		1.26		0.00	1.26
3460.269	7	0.00		1.07			
3459.663	7	0.00		1.04			
3452.398	3	0.21		1.11w		1.09	1.14
3443.587	7	0.00		1.18			
3431.140	7	0.00		1.09			
3431.107	7	0.00		1.12			
3426.044	7	0.00		1.00			
3418.390	7	0.00		1.04		(1.14)	1.12
3412.453	7	0.00		1.13		(1.14)	1.13
3387.505	1	0.00w		0.96			
3319.412	7	0.00		1.16			
3316.496	1	0.00w		1.28		(1.48)	1.38
3299.828	7	0.00		0.73		0.00	0.73
2671.958	7	0.00		1.01		0.00	1.01

TABLE 2. *Even levels of* Yb I

Configuration	Designation	J	Level cm^{-1}	Obs. g	No. Comb.
$4f^{14}(^1S)6s^2$	^1S	0	0.000	Z	11
$4f^{14}(^1S)5d6s$	^3D	1	24489.102	0.50	41
		2	24751.948	1.16	47
		3	25270.902	1.34	31
$4f^{14}(^1S)5d6s$	^1D	2	27677.665	1.01	43
$4f^{13}(^2F^\circ_{3\frac{1}{2}})6s^26p$	$(3\frac{1}{2}, \frac{1}{2})$	3	32065.282	1.23	18
		4	32273.597		15
$4f^{14}(^1S)6s7s$	^3S	1	32694.692	2.01	24
$4f^{14}(^1S)6s7s$	^1S	0	34350.65	Z	10
$4f^{13}(^2F^\circ_{3\frac{1}{2}})6s^26p$	$(3\frac{1}{2}, 1\frac{1}{2})$	5	35178.78		8
		2	35196.98	1.05	12
		3	35807.52	1.08	13
		4	36060.98		13
$4f^{14}(^1S)6s6d$	^3D	1	39808.72	0.50	5
		2	39838.04	1.16	6
		3	39966.09	1.33	3
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^4F^\circ_{1\frac{1}{2}})$	$(3\frac{1}{2}, 1\frac{1}{2})$	2	39880.26	1.83	6
		5	42935.78	0.89	6
		4	44984.75	1.08	8
		3	45462.54	1.20	7
$4f^{14}(^1S)6s6d$	^1D	2	40061.51	1.03	5
$4f^{14}(^1S)6s8s$	^3S	1	41615.04	2.02	5

TABLE 2. *Even levels of* Yb I—Continued

Configuration	Designation	J	Level cm^{-1}	Obs. g	No. Comb.
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^4F^\circ_{2\frac{1}{2}})$	$(3\frac{1}{2}, 2\frac{1}{2})$	3	41827.30	1.52	7
		1	42436.70	1.73	5
		6	43814.11	1.08	9
		5	45410.91	1.17	6
		4	45775.68	1.14	8
$4f^{14}(^1S)6s8s$	^1S	0	41939.90	Z	3
$4f^{14}(^1S)6p^2$	^3P	0	42436.91	Z	2
		1	43805.42	1.47	7
		2	44760.37	1.34	8
$4f^{13}(^2F^\circ_{2\frac{1}{2}})6s^26p$	$(2\frac{1}{2}, \frac{1}{2})$	3			
		2	42531.87	1.01	7
$4f^{13}5d6s6p$		2	43224.78	1.34	7
$4f^{13}5d6s6p$		4	44232.66	1.48	4
$4f^{14}(^1S)6s7d$	^3D	1	44311.38		5
		2	44313.05		6
		3	44380.82	1.32	5
$4f^{14}(^1S)6s7d$	^1D	2	44357.60	1.10	5
$4f^{13}5d6s6p$		3	44713.12	1.39	6
$4f^{13}(^2F^\circ_{2\frac{1}{2}})6s^26p$	$(2\frac{1}{2}, 1\frac{1}{2})$	1	44834.61	0.66	6
		4	45497.62		5
		2	45913.86		7
		3			
$4f^{14}(^1S)6s9s$	^3S	1	45121.37	1.98	5

TABLE 2. *Even levels of* Yb I—Continued

Configuration	Designation	J	Level cm^{-1}	Obs. g	No. Comb.
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^2D^\circ_{2\frac{1}{2}})$	$(3\frac{1}{2}, 2\frac{1}{2})$	2	45338.53	1.30	8
		6	47036.62	1.18	6
		4	48787.71	1.21	4
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^4F^\circ_{3\frac{1}{2}})$	$(3\frac{1}{2}, 3\frac{1}{2})$	1	45595.14	1.19	7
		0	46081.54	Z	3
		4	47772.94	1.22	5
		5	48057.77	1.13	5
		6	48688.18		6
$4f^{13}5d6s6p$		3	46395.60	1.35	7
$4f^{13}5d6s6p$		2	46431.49		5
$4f^{14}(^1S)6s8d$	^3D	1	46444.96	0.49	5
		2	46467.70	1.12	6
		3	46480.65	1.35	2
$4f^{13}5d6s6p$		6	46554.81	1.25	7
$4f^{14}(^1S)6s10s$	^3S	1	46877.10		3
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^4D^\circ_{\frac{1}{2}})$	$(3\frac{1}{2}, \frac{1}{2})$	4	47047.69	0.86	8
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^4D^\circ_{1\frac{1}{2}})$	$(3\frac{1}{2}, 1\frac{1}{2})$	5	47088.16	1.16	8
		3	47646.62	1.32	6
		4	47673.71		6
$4f^{14}(^1S)5d^2$		2	47341.82		5
$4f^{14}(^1S)6s9d$	^1D	2	47420.96	1.04	7
		1	47584.34	0.73	5

TABLE 2. *Even levels of* Yb I—Continued

Configuration	Designation	J	Level cm^{-1}	Obs. g	No. Comb.
$4f^{14}(^1S)5d^2$	^3F	2	47634.41		4
		3	47860.28	1.02	7
		4			
		3	47673.45		4
$4f^{13}5d6s6p$		5	47636.11	1.09	9
$4f^{13}5d6s6p$		1	47645.40		7
$4f^{14}(^1S)6p^2$	^1D	2	47821.78	1.04	8
$4f^{14}(^1S)6s11s$	^3S	1	47885.81		3
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^2D^\circ_{1\frac{1}{2}})$	$(3\frac{1}{2}, 1\frac{1}{2})$	5	47911.48	1.21	8
		2	48135.60	1.37	6
		4	49103.64	1.04	7
		1	48309.41		6
		1?	48357.54		5
		1	48360.43		6
$4f^{14}(^1S)6s12s$	^3S	1	48519.71		2
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^4D^\circ_{2\frac{1}{2}})$	$(3\frac{1}{2}, 2\frac{1}{2})$	3	48647.78		7
		5	49079.34		9
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6P(^3P^\circ)(^4D^\circ_{3\frac{1}{2}})$	$(3\frac{1}{2}, 3\frac{1}{2})$	6	48806.57	1.22	8
		5	49638.73		6
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^4F^\circ_{4\frac{1}{2}})$	$(3\frac{1}{2}, 4\frac{1}{2})$	1?	48838.33		6
		2	48883.11		6
$4f^{14}(^1S)6s13s$	^3S	1	48943.42		3

TABLE 2. *Even levels of* Yb I—Continued

Configuration	Designation	J	Level cm^{-1}	Obs. g	No. Comb.
$4f^{13}5d6s6p$		3	49223.35	1.32	7
$4f^{13}5d6s6p$		2	49246.79		5
$4f^{13}5d6s6p$		4	49260.75	1.20	7
$4f^{13}5d6s6p$		3	49444.52		5
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^4P^\circ_{2\frac{1}{2}})$	$(3\frac{1}{2}, 2\frac{1}{2})$	6	52874.79	1.13	4
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^3P^\circ)(^2P^\circ_{1\frac{1}{2}})$	$(3\frac{1}{2}, 1\frac{1}{2})$	5	54718.25		6
$4f^{13}5d6s6p$		5	57429.68	1.11	4
		6	57432.05	1.16	3
		5	57480.54	1.13	3
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d(^2D)6s6p(^1P^\circ)(^2F^\circ_{3\frac{1}{2}})$	$(3\frac{1}{2}, 3\frac{1}{2})$	4	58732.06	1.14	6
		5	58911.39	1.09	4
		4	59081.36		5
		2	59377.13		6
		5	61384.00		5
		2	64178.70	1.02	6
		2	72190.20		6

TABLE 3. *Odd levels of* Yb I

Configuration	Designation	J	Level	Obs. g	No. Comb.
$4f^{14}(^1S)6s6p$	$^3P^\circ$	0	*17288.439*	Z	18
		1	*17992.007*	1.48	46
		2	*19710.388*	1.50	53
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d6s^2$	$(3\frac{1}{2}, 1\frac{1}{2})^\circ$	2	*23188.518*	1.45	41
		5	*25859.682*	1.04	32
		3	*27445.638*	1.22	38
		4	*28184.512*	1.14	36
$4f^{14}(^1S)6s6p$	$^1P^\circ$	1	*25068.227*	1.03	35
$4f^{13}(^2F^\circ_{3\frac{1}{2}})5d6s^2$	$(3\frac{1}{2}, 2\frac{1}{2})^\circ$	6	*27314.919*	1.16	19
		2	*28195.960*	1.02	28
		1	*28857.014*	1.26	30
		4	*29774.958*	1.09	34
		3	*30207.380*	1.08	31
		5	*30524.714*	1.18	29
$4f^{13}(^2F^\circ)5d^26s$?		1	*37414.59*	1.02	7
$4f^{14}(^1S)6s7p$	$^3P^\circ$	0	*38090.71*		3
		1	*38174.17*	1.14	7
		2	*38551.93*	1.50	9
$4f^{13}(^2F^\circ)5d^26s$?		1	*38422.36*	1.07	7
$4f^{14}(^1S)6s7p$	$^1P^\circ$	1	*40563.97*	1.01	6
		2	*42647.72*	1.25	4
		2	*42725.76*	1.02	6
		3	*43254.78*	1.06	3
		3	*43297.51*	1.03	3
$4f^{14}(^1S)6s5f$	$^3F^\circ$	2	*43433.85*	0.68	4
		3			
		4			
		1	*43532.77*	1.54	3

TABLE 3. *Odd levels of* Yb I—Continued

Configuration	Designation	J	Level	Obs. g	No. Comb.
$4f^{14}(^1S)6s8p$	$^3P^\circ$	0	*43614.27*		2
		1	*43659.38*	1.48	6
		2	*43805.69*	1.49	6
		3	*43815.67*	1.21	5
$4f^{14}(^1S)6s8p$	$^1P^\circ$	1	*44017.60*	1.00	7
		2	*44251.88*	1.38	5
		4?	*44392.70*	1.30?	4
		3	*44453.47*	1.10	6
		2	*45155.33*	0.98	6
		1	*45181.69*	1.28	5
$4f^{14}(^1S)6s6f$	$^3F^\circ$	2	*45956.27*	0.72	6
		3			
		4			
$4f^{14}(^1S)6s9p$	$^3P^\circ$	0	*46082.17*		2
		1	*46078.91*	1.34	6
		2	*46184.15*	1.50	5
		1	*46174.21*	1.22	4
		3	*46251.06*	1.15	7
$4f^{14}(^1S)6s9p$	$^1P^\circ$	1	*46370.30*	1.07	5
		2	*47055.05*	1.08	5
		3?	*47325.19*		5
		1	*47332.26*	0.95	3
$4f^{14}(^1S)6s7f$	$^3F^\circ$	2	*47326.65*		4
		3			
		4			
$4f^{14}(^1S)6s10p$	$^3P^\circ$	0	*47409.82*		1
		1	*47420.93*	1.36	2
		2	*47471.10*		5
$4f^{14}(^1S)6s10p$	$^1P^\circ$	1	*47498.83*	1.03	4
		3?	*47843.13*		6
		1	*47859.31*	1.30	4
		4	*47939.10*		6
		3	*48154.71*		3

TABLE 3. *Odd levels of* Yb I—Continued

Configuration	Designation	J	Level	Obs. g	No. Comb.
$4f^{14}(^1S)6s\,11p$	$^3P^\circ$	0			
		1	*48212.10*		2
		2			
		2	*48234.12*		7
		3	*48237.39*	1.24	7
$4f^{14}(^1S)6s\,11p$	$^1P^\circ$	1	*48258.47*		3
		2	*48324.89*		7
		2	*48449.27*	1.15	5
		3	*48487.98*	1.23	4
		2	*48701.60*		4
$4f^{14}(^1S)6s\,12p$	$^3P^\circ$	0			
		1	*48719.03*		3
		2			
$4f^{14}(^1S)6s\,12p$	$^1P^\circ$	1	*48761.84*		3
		2	*48965.16*		5
		1	*49005.74*		2
$4f^{14}(^1S)6s\,13p$	$^1P^\circ$	1	*49127.38*		2
		4	*49282.36*		5
		1	*49920.15*		1
		4	*52540.35*		4
		5	*60053.78*		10
		5	*62308.46*		13
		5	*62395.51*	1.10	13
		6	*62687.40*		9
		5	*63672.48*		9
		6	*67844.34*		8

4.3. Observed Lines and Classifications

The list of Yb I lines in table 4 is taken from Meggers and Corliss [1966] in the region 2155 to 11 604 Å and from Humphreys and Paul [1959] in the region 12 000 to 25 000 Å. The three lines at longer wavelengths were reported privately to Meggers by Humphreys and Paul in 1964.

The wavelengths in air appear in the first column of table 4. Estimated intensities as observed in the electrodeless microwave discharge lamp (Meggers lamp) and in the ring discharge (Thomson lamp) appear in the next two columns. Literal symbols in the intensity column have the following meanings:

A —nearly all absorbed in the pulsed arc
R —wide reversal in the pulsed arc
r —narrow reversal in the pulsed arc
d —double but not resolved
w —wide
h —hazy
l —shaded to longer wavelengths
s —shaded to shorter wavelengths
Z —Zeeman pattern observed

The wavenumbers are in column 3 followed by the classification in column 4. The first entry in this column is the lower energy level and its *J*-value, which is followed by the upper level with its *J*-value. The odd levels are distinguished from the even ones by a superscript degree symbol. The difference between the observed wavenumber of the line and its value calculated from the two energy levels (O–C) appears in the last column in units of 0.01 cm^{-1}.

We wish to acknowledge with sincere thanks the contribution to this work by Charlotte E. Moore, who furnished the collation of Meggers' original material and completed his derivation of *g*-values. We are also most grateful for the cordial cooperation of Mrs. Z. B. Goldschmidt for providing us some of the results of her theoretical calculations in advance of publication.

Dr. Meggers especially appreciated the early contributions of N. Spector [1971] to the interpretation of this spectrum.

We would like to thank C. H. Corliss for many helpful discussions and for the photographs of ytterbium spectra reproduced here in figure 1.

Finally, we acknowledge the continuing interest of W. C. Martin and R. Zalubas in this spectrum and the illuminating discussions with them on its interpretation. They were also very generous in helping to get the manuscript to press.

5. References

Baumann, M., and Wandel, G. [1968], Phys. Lett. **28A,** 200.
Budick, B., and Snir, J. [1967], Phys. Lett. **24A,** 689.
Camus, P., and Tomkins, F. S. [1969], J. Phys. (Paris) **30,** 545.
Corliss, C. H., and Meggers, W. F. [1958], J. Res. Nat. Bur. Stand. (U.S.), **61,** No. 4, 269–272 (Oct. 1958) RP 2904.
Humphreys, C. J., and Paul, E. [1959], Infrared Atomic Spectra, Quarterly Report Foundational Research Projects NAVORD Report 5970, NOLC Report 473, 57 pp.
Kaufman, V., and Sugar, J. [1973], J. Opt. Soc. Am. **63,** 1168.
King, A. S. [1931], Astrophys. J. **74,** 328.
Meggers, W. F. (C. E. Moore, Editor), [1967], J. Res Nat. Bur. Stand. (U.S.), **71A,** No. 6, 396–544 (Nov.–Dec. 1967).
Meggers, W. F. and Corliss, C. H. [1960], J. Opt. Soc. Am. **50,** 1136 A.
Meggers, W. F. and Corliss, C. H. [1966], J. Res. Nat. Bur. Stand. (U.S.), **70A,** No. 1, 63–106 (Jan.–Feb. 1966).
Meggers, W. F., Corliss, C. H. and Scribner, B. F. [1975], Tables of Spectral-Line Intensities, NBS Mono. 145, Pt. I (U.S. Gov't Printing Office, Washington, D.C.).
Meggers, W. F., and Scribner, B. F. [1937], J. Res. Nat. Bur. Stand. (U.S.), **19,** 651–664 (Dec. 1937)RP1053.
Miller, G. E., and Ross, J. S. [1976], J. Opt. Soc. Am. **66,** 585.
Nir, S. [1970], J. Opt. Soc. Am. **60,** 354.
Parr, A. C. and Elder, F. A. [1968], J. Chem. Phys. **49,** 2665.
Reader, J. and Sugar, J. [1966], J. Opt. Soc. Am. **56,** 1189.
Spector, N. [1971], J. Opt. Soc. Am. **61,** 1350.
Sugar, J. [1962], J. Res. Nat. Bur. Stand. (U.S.), **66A,** No. 4, 321–324 (July–Aug. 1962).

TABLE 4. *Observed and classified lines of* Yb I

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
31308.3	3		3193.17	$^{\circ}_{3}$ − 47646$_3$	+2
29813.2	4		3353.30		
28896.7	2		3459.66		
24552.51	10		4071.79	34350$_0$ − $^{\circ}_{1}$	+8
24448.31	45		4089.15	$^{\circ}_{4}$ − 32273$_4$	+6
23117.83	12		4324.48		
22592.6	400		4425.02		
21640.70	100		4619.66	$^{\circ}_{3}$ − 32065$_3$	+2
21480.74	80		4654.06	$^{\circ}_{5}$ − 35178$_5$	+0
21180.98	10		4719.93	32694$_1$ − $^{\circ}_{1}$	+3
20920.26	85		4778.75	$^{\circ}_{2}$ − 24489$_1$	+4
20706.52	38		4828.08	$^{\circ}_{3}$ − 32273$_4$	+12
20036.01	42		4989.65	$^{\circ}_{3}$ − 35196$_2$	+5
19829.77	3600		5041.55	$^{\circ}_{2}$ − 24751$_2$	−1
19776.44	20		5055.14		
19452.96	10		5139.20		
18526.88	45		5396.09	32694$_1$ − $^{\circ}_{0}$	+7
18244.0	1000		5479.76	32694$_1$ − $^{\circ}_{1}$	+27
18196.8	200		5493.97		
18057.11	250		5536.47		
17979.09	2500		5560.50	$^{\circ}_{2}$ − 25270$_3$	−2
17851.79	400		5600.15	$^{\circ}_{3}$ − 35807$_3$	+1
17454.72	175		5727.55	32694$_1$ − $^{\circ}_{1}$	−12
17151.32	20		5828.86	$^{\circ}_{2}$ − 44380$_3$	−3
17078.60	35		5853.68	$^{\circ}_{3}$ − 36060$_4$	+8
17068.36	850		5857.19	32694$_1$ − $^{\circ}_{2}$	−4
16571.55	700		6032.79		
16089.88	185		6213.39	34350$_0$ − $^{\circ}_{1}$	+7
15903.98	550		6286.02	$^{\circ}_{4}$ − 36060$_4$	+0
15768.68	200		6339.95	$^{\circ}_{1}$ − 35196$_2$	−1
15586.88	3500		6413.90	$^{\circ}_{5}$ − 32273$_4$	−1
15387.34	1250		6497.07	$^{\circ}_{1}$ − 24489$_1$	−2
15308.15	35		6530.68		
14789.02	30000		6759.93	$^{\circ}_{1}$ − 24751$_2$	−1
14293.67	200		6994.19	$^{\circ}_{4}$ − 35178$_5$	−8
14279.64	700		7001.06	$^{\circ}_{2}$ − 35196$_2$	+4
13883.85	20000		7200.64	$^{\circ}_{0}$ − 24489$_1$	−2
13689.96	17		7302.63		
13134.21	275		7611.62	$^{\circ}_{2}$ − 35807$_3$	+6
13119.05	3		7620.42		
13114.42	35		7623.11	$^{\circ}_{4}$ − 35807$_3$	+10
13108.27	42		7626.69		
12712.91	4500		7863.87	$^{\circ}_{6}$ − 35178$_5$	+1
12692.48	450		7876.53	$^{\circ}_{4}$ − 36060$_4$	+6
12547.90	100		7967.28	$^{\circ}_{2}$ − 27677$_2$	+0

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
11603.94	425		8615.40	$27445^{\circ}_{3} - 36060_{4}$	+6
11262.27	5250	10	8876.77	$23188^{\circ}_{2} - 32065_{3}$	+1
10992.33	2*h*		9094.76	$38551^{\circ}_{2} - 47646_{3}$	+7
10770.10	3750	400	9282.42	$25068^{\circ}_{1} - 34350_{0}$	+0
10727.72	200	20	9319.09	$25859^{\circ}_{5} - 35178_{5}$	−1
10717.02	2		9328.40		
10633.24	5		9401.90		
10567.5	1		9460.38	$38174^{\circ}_{1} - 47634_{2}$	+14
10516.61	60		9506.16	$23188^{\circ}_{2} - 32694_{1}$	−1
10397.88	4		9614.71		
10343.85	3		9664.93		
10341.77	7		9666.88	$34350_{0} - 44017^{\circ}_{1}$	−7
10321.68	500	80	9685.69	$17992^{\circ}_{1} - 27677_{2}$	+3
10267.37	200	100	9736.92	$27677_{2} - 37414^{\circ}_{1}$	+0
10212.27	1		9789.46		
10110.87	10		9887.64		
9970.44	5		10026.90		
9894.20	8		10104.16		
9888.40	2		10110.09		
9882.33	1		10116.30		
9870.17	200	15	10128.76	$25068^{\circ}_{1} - 35196_{2}$	+1
9831.13	7		10168.98		
9826.14	1		10174.15		
9823.76	9	2	10176.61		
9817.16	1		10183.45	$38174^{\circ}_{1} - 48357_{1}$	+8
9799.96	400	10	10201.33	$25859^{\circ}_{5} - 36060_{4}$	+3
9775.49	1		10226.86		
9734.62	2		10269.80	$38090^{\circ}_{0} - 48360_{1}$	+8
9718.81	3		10286.50	$38551^{\circ}_{2} - 48838_{1}$	+10
9695.71	2		10311.01		
9688.77	25		10318.40		
9670.80	5		10337.57		
9659.43	2		10349.74		
9656.05	20		10353.36		
9640.78	2		10369.76		
9606.08	3		10407.22	$37414^{\circ}_{1} - 47821_{2}$	+3
9592.23	1		10422.25		
9589.34	1		10425.39		
9580.31	30		10435.21		
9572.65	5		10443.56	$35807_{3} - 46251^{\circ}_{3}$	+2
9532.64	1		10487.40		
9524.36	300	6	10496.51	$27677_{2} - 38174^{\circ}_{1}$	+1
9512.32	2		10509.80		
9505.71	2		10517.11		
9468.54	2	3	10558.39		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
9382.31	2		10655.43		
9377.90	7		10660.44	$32065_3 - 42725^{\circ}_2$	−3
9304.35	1000	80	10744.71	$27677_2 - 38422^{\circ}_1$	+2
9298.90	3		10751.01		
9291.74	2		10759.29	$35196_2 - 45956^{\circ}_2$	+1
9258.76	1		10797.62	$52874_6 - 63672^{\circ}_5$	−7
9230.17	7		10831.06	$34350_0 - 45181^{\circ}_1$	+2
9224.21	6		10838.06	$32694_1 - 43532^{\circ}_1$	−2
9188.34	10		10880.37		
9177.47	1		10893.26		
9176.14	1		10894.84	$37414^{\circ}_1 - 48309_1$	+2
9155.30	40		10919.64	$32694_1 - 43614^{\circ}_0$	+6
9140.64	10		10937.15		
9128.47	20		10951.73	$28857^{\circ}_1 - 39808_1$	+3
9121.11	3		10960.57		
9117.68	100	4	10964.69	$32694_1 - 43659^{\circ}_1$	+1
9104.10	200	7	10981.05	$28857^{\circ}_1 - 39838_2$	+2
9097.69	2		10988.79		
9089.55	2*d*		10998.63		
9073.18	1		11018.47		
9069.22	20		11023.28	$28857^{\circ}_1 - 39880_2$	+4
9045.47	1		11052.22	$48324^{\circ}_2 - 59377_2$	−2
9043.95	5		11054.08	$35196_2 - 46251^{\circ}_3$	+0
9039.08	1		11060.04		
9020.90	10		11082.33		
9016.21	2		11088.09		
8997.66	400	10	11110.95	$32694_1 - 43805^{\circ}_2$	−5
8980.79	3		11131.82		
8948.02	2		11172.59		
8946.38	1		11174.64		
8922.50	1000	40	11204.54	$28857^{\circ}_1 - 40061_2$	+5
8902.99	2		11229.10		
8898.89	1		11234.27		
8888.66	3		11247.20	$48806_6 - 60053^{\circ}_5$	−1
8883.16	10		11254.17		
8874.68	2		11264.92		
8864.06	2		11278.42		
8831.38	2		11320.15		
8829.26	30		11322.87	$32694_1 - 44017^{\circ}_1$	−4
8827.46	1		11325.18		
8806.80	6		11351.74		
8794.91	5		11367.09		
8788.45	5		11375.45		
8783.75	4		11381.53		
8780.63	10		11385.58		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
8736.45	20		11443.15		
8736.03	4		11443.70		
8731.29	30		11449.92		
8724.18	4		11459.25		
8717.80	1		11467.63		
8686.28	2		11509.25		
8681.93	3		11515.01		
8679.50	2		11518.24		
8670.82	2		11529.77		
8667.69	50		11533.93	$47843\frac{0}{3} - 59377_2$	−7
8663.92	10		11538.95		
8661.59	5		11542.05	$32273_4 - 43815\frac{0}{3}$	−2
8655.52	15*h*		11550.15		
8654.91	100*w*		11550.96		
8654.42	20		11551.62		
8650.23	2		11557.21	$32694_1 - 44251\frac{0}{2}$	+2
8634.68	9		11578.03		
8612.57	50		11607.75		
8603.56	80		11619.90	$30207\frac{0}{3} - 41827_3$	−2
8601.25	1		11623.02		
8594.75	2		11631.81		
8592.00	200		11635.54		
8591.26	20		11636.54		
8590.94	20		11636.97		
8590.08	1		11638.14		
8585.99	20		11643.68		
8584.20	2		11646.11		
8575.25	10		11658.27		
8574.91	2		11658.73		
8558.47	2*h*		11681.12		
8546.26	40		11697.81		
8535.68	20		11712.31		
8528.08	10		11722.75		
8525.66	3		11726.07		
8524.07	3		11728.26	$34350_0 - 46078\frac{0}{1}$	+0
8522.92	2		11729.84		
8520.34	50		11733.40		
8520.12	7		11733.70		
8519.66	20		11734.33		
8518.01	20		11736.61		
8516.60	2		11738.55		
8515.78	3		11739.68		
8515.24	2		11740.42	$32065_3 - 43805\frac{0}{2}$	+2
8508.02	10		11750.39	$32065_3 - 43815\frac{0}{3}$	+0
8505.96	2		11753.23		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
8494.37	50		11769.27		
8493.74	4		11770.14	$28195^{\circ}_{2} - 39966_{3}$	+1
8487.84	1		11778.32		
8485.10	30		11782.13	$36060_{4} - 47843^{\circ}_{3}$	−2
8474.21	3		11797.27		
8463.32	1		11812.45		
8462.25	4		11813.94		
8446.74	5		11835.64		
8446.35	20		11836.18		
8443.99	5		11839.49		
8430.76	2		11858.07	$35196_{2} - 47055^{\circ}_{2}$	+0
8429.59	3		11859.71		
8428.24	10		11861.61		
8423.84	1		11867.81		
8418.43	10		11875.44		
8416.53	20		11878.12	$36060_{4} - 47939^{\circ}_{4}$	+0
8400.65	20		11900.57		
8400.35	5		11900.99		
8391.62	3		11913.38		
8383.90	2		11924.35		
8378.93	6		11931.42		
8376.33	2		11935.12		
8375.94	40		11935.68		
8360.09	2		11958.31		
8352.03	2		11969.85		
8349.52	2*h*		11973.45		
8346.11	3*h*		11978.34		
8335.12	1		11994.13		
8333.30	10		11996.75		
8327.71	3		12004.80		
8325.18	800	5*Z*	12008.45	$23188^{\circ}_{2} - 35196_{2}$	−1
8320.33	8		12015.45		
8317.43	20		12019.64	$34350_{0} - 46370^{\circ}_{1}$	−1
8310.61	3		12029.51		
8309.10	2		12031.69		
8306.38	2		12035.63	$35807_{3} - 47843^{\circ}_{3}$	+2
8299.77	2		12045.22		
8296.83	4		12049.48		
8294.85	150		12052.36	$29774^{\circ}_{4} - 41827_{3}$	+2
8267.87	10		12091.69		
8266.06	2		12094.34		
8265.64	2		12094.95		
8259.34	1		12104.18		
8249.18	50		12119.09	$32273_{4} - 44392^{\circ}_{4}$	−2
8242.95	1		12128.25	$35196_{2} - 47325^{\circ}_{3}$	+4

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
8242.03	1		12129.60	$351962 - 47326^{\circ}_{2}$	−7
8240.67	2		12131.60	$35807_{3} - 47939^{\circ}_{4}$	+2
8234.61	15		12140.53		
8225.59	1*h*		12153.84		
8224.13	10		12156.00		
8221.74	10		12159.53		
8221.35	10		12160.11		
8220.44	2		12161.46		
8213.96	9		12171.05		
8213.02	30		12172.44		
8212.03	5		12173.91		
8210.33	4		12176.43	$36060_{4} - 48237^{\circ}_{3}$	+2
8207.98	40		12179.92	$32273_{4} - 44453^{\circ}_{3}$	+4
8200.20	1		12191.47		
8197.43	6		12195.59		
8190.31	5		12206.19		
8180.75	10		12220.46		
8180.64	30		12220.62		
8145.56	20		12273.25		
8145.36	5		12273.55		
8140.53	2		12280.84	$47772_{4} - 60053^{\circ}_{5}$	+0
8136.38	9		12287.10		
8122.77	1		12307.69		
8116.08	10		12317.83		
8114.26	9		12320.59		
8111.71	90		12324.47	$30207^{\circ}_{3} - 42531_{2}$	−2
8109.79	100		12327.39	$32065_{3} - 44392^{\circ}_{4}$	−3
8098.66	2		12344.33		
8095.74	1		12348.78		
8092.95	3		12353.04		
8091.73	1000	10*Z*	12354.90	$19710^{\circ}_{2} - 32065_{3}$	+1
8089.66	7		12358.06		
8086.68	10		12362.61		
8085.56	4		12364.33		
8084.50	1		12365.95		
8071.28	10		12386.20		
8070.00	50		12388.17	$32065_{3} - 44453^{\circ}_{3}$	−2
8067.21	7		12392.45	$27445^{\circ}_{3} - 39838_{2}$	+5
8066.43	7		12393.65		
8058.91	80		12405.21		
8056.20	10		12409.39		
8055.12	20		12411.05	$30524^{\circ}_{5} - 42935_{5}$	−1
8052.35	20		12415.32		
8051.48	20		12416.66		
8042.91	4		12429.89	$35807_{3} - 48237^{\circ}_{3}$	+2

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
8039.83	200	2*Z*	12434.65	$27445^{\circ}_{3} - 39880_{2}$	+3
8023.11	3		12460.57	$32694_{1} - 45155^{\circ}_{2}$	−7
8018.74	3*h*		12467.36		
7990.35	30		12511.66		
7946.26	50		12581.08		
7933.25	2		12601.71		
7924.65	4		12615.38		
7922.40	4000	100*Z*	12618.97	$23188^{\circ}_{2} - 35807_{3}$	−4
7910.08	10		12638.62		
7896.38	100		12660.55		
7895.08	1000	50*Z*	12662.63	$24751_{2} - 37414^{\circ}_{1}$	−1
7883.96	2		12680.49	$35807_{3} - 48487^{\circ}_{3}$	+3
7877.06	60		12691.60		
7875.15	10		12694.68		
7844.11	20	2	12744.91		
7834.65	15		12760.30	$35178_{5} - 47939^{\circ}_{4}$	−2
7821.37	2		12781.97		
7820.89	50		12782.75		
7799.33	1		12818.09		
7789.80	2		12833.77		
7771.01	4		12864.80		
7761.45	2		12880.65		
7760.49	5		12882.24		
7758.04	500	20*Z*	12886.31	$27677_{2} - 40563^{\circ}_{1}$	+0
7746.98	6*h*		12904.70		
7744.97	5		12908.05		
7734.53	200	2*Z*	12925.48	$24489_{1} - 37414^{\circ}_{1}$	−1
7717.58	6		12953.86		
7706.29	2*h*		12972.84		
7699.49	20000	2000*Z*	12984.30	$19710^{\circ}_{2} - 32694_{1}$	+0
7692.75	5*h*		12995.68		
7679.91	200	1*Z*	13017.40	$30207^{\circ}_{3} - 43224_{2}$	+0
7662.08	2		13047.69	$49260_{4} - 62308^{\circ}_{5}$	−1
7659.90	20		13051.41		
7659.14	50		13052.70		
7657.60	100		13055.33		
7650.02	4		13068.26		
7641.45	3		13082.92	$28857^{\circ}_{1} - 41939_{0}$	+3
7637.27	15		13090.08	$32065_{3} - 45155^{\circ}_{2}$	+3
7623.90	20		13113.04		
7616.34	3		13126.05	$54718_{5} - 67844^{\circ}_{6}$ $46251^{\circ}_{3} - 59377_{2}$	−4 −2
7611.28	3		13134.78	$49260_{4} - 62395^{\circ}_{5}$	+2
7603.42	2		13148.36		
7598.01	2		13157.72	$35807_{3} - 48965^{\circ}_{2}$	+8

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
7596.22	200	1	13160.82	$29774^{\circ}_{4} - 42935_{5}$	+0
7588.43	8		13174.33		
7582.90	30		13183.94		
7576.41	2		13195.23		
7561.42	4		13221.39	$36060_{4} - 49282^{\circ}_{4}$	+1
7547.08	5		13246.51		
7527.45	10000	200*Z*	13281.05	$25270_{3} - 38551^{\circ}_{2}$	+3
7522.73	200	2	13289.39	$30524^{\circ}_{5} - 43814_{6}$	−1
7507.59	5		13316.19	$49079_{5} - 62395^{\circ}_{5}$	+2
7499.87	30		13329.89		
7496.33	100	2	13336.19		
7478.77	4		13367.50		
7472.44	2		13378.82		
7469.44	60		13384.20	$32694_{1} - 46078^{\circ}_{1}$	−2
7467.58	40	30	13387.53	$32694_{1} - 46082^{\circ}_{0}$	+5
7458.79	5*h*		13403.31		
7448.28	6000	100*Z*	13422.22	$24751_{2} - 38174^{\circ}_{1}$	+0
7438.92	25	1	13439.11		
7419.22	10		13474.79	$35807_{3} - 49282^{\circ}_{4}$	−5
7416.64	40		13479.48	$32694_{1} - 46174^{\circ}_{1}$	−4
7414.13	5		13484.05		
7411.17	200	2	13489.43	$32694_{1} - 46184^{\circ}_{2}$	−3
7405.94	6		13498.96	$46554_{6} - 60053^{\circ}_{5}$	−1
7404.35	10		13501.86	$48806_{6} - 62308^{\circ}_{5}$	−3
7400.67	7		13508.57	$34350_{0} - 47859^{\circ}_{1}$	−9
7387.69	2		13532.30		
7382.17	3		13542.42		
7361.90	200	1	13579.71	$28857^{\circ}_{1} - 42436_{1}$	+2
7356.92	3		13588.90	$48806_{6} - 62395^{\circ}_{5}$	−4
7350.04	6000	100*Z*	13601.62	$24489_{1} - 38090^{\circ}_{0}$	+1
7346.60	3		13607.99	$49079_{5} - 62687^{\circ}_{6}$	−7
7339.99	10		13620.24	$48688_{6} - 62308^{\circ}_{5}$	−4
7334.01	50		13631.35	$28195^{\circ}_{2} - 41827_{3}$	+1
7328.57	8		13641.47		
7327.87	500	2*Z*	13642.77	$28184^{\circ}_{4} - 41827_{3}$	−2
7323.32	4		13651.25		
7313.05	3000	50*Z*	13670.42	$24751_{2} - 38422^{\circ}_{1}$	+1
7310.70	400	1	13674.81	$28857^{\circ}_{1} - 42531_{2}$	−4
7305.23	2500	50*Z*	13685.05	$24489_{1} - 38174^{\circ}_{1}$	−2
7298.05	8*h*		13698.52		
7256.62	20		13776.72		
7253.76	40		13782.16		
7244.41	2000	40*Z*	13799.94	$24751_{2} - 38551^{\circ}_{2}$	−4
7227.21	5		13832.79		
7205.93	4		13873.64		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
7202.20	100	1	13880.82	$48806_6 - 62687^{\circ}_6$	−1
7198.08	10*h*		13888.77		
7196.92	3		13891.00	$32065_3 - 45956^{\circ}_2$	+2
7190.33	6		13903.73		
7187.07	200	2*Z*	13910.04		
7175.10	1000	10	13933.25	$24489_1 - 38422^{\circ}_1$	−1
7173.96	10		13935.46		
7169.25	10		13944.62		
7160.31	2		13962.03		
7156.48	3		13969.50		
7153.51	3		13975.30		
7152.40	10		13977.47	$32273_4 - 46251^{\circ}_3$	+1
7141.28	6		13999.23	$48688_6 - 62687^{\circ}_6$	+1
7136.82	5		14007.98		
7135.61	10		14010.36		
7134.85	5		14011.85		
7108.98	200	2	14062.84	$24489_1 - 38551^{\circ}_2$	+1
7032.91	2		14214.94		
7031.21	3		14218.38		
7020.18	500	4	14240.72	$28195^{\circ}_2 - 42436_1$	−2
7001.79	3		14278.12	$45775_4 - 60053^{\circ}_5$	+2
6990.51	100		14301.16		
6976.89	3*h*		14329.08		
6973.58	10		14335.88	$28195^{\circ}_2 - 42531_2$	−3
6965.46	1		14352.59		
6958.11	300	3	14367.76	$28857^{\circ}_1 - 43224_2$	−1
6953.29	1		14377.71		
6951.38	50		14381.67	$27445^{\circ}_3 - 41827_3$	+0
6943.98	4		14396.99	$47911_5 - 62308^{\circ}_5$	+1
6914.84	2		14457.66	$29774^{\circ}_4 - 44232_4$	−4
6913.73	50	1	14459.98	$30524^{\circ}_5 - 44984_4$	−5
6902.28	2		14483.97	$47911_5 - 62395^{\circ}_5$	−6
6892.61	5		14504.29		
6891.94	20		14505.70	$30207^{\circ}_3 - 44713_3$	−4
6869.56	200	1	14552.96	$30207^{\circ}_3 - 44760_2$	−3
6862.08	2*h*		14568.82	$49103_4 - 63672^{\circ}_5$	−2
6850.64	4		14593.15	$49079_5 - 63672^{\circ}_5$	+1
6833.56	4		14629.62	$48057_5 - 62687^{\circ}_6$	−1
6831.17	7		14634.74	$47673_4 - 62308^{\circ}_5$	−1
6817.16	100		14664.82		
6813.65	5*h*		14672.37	$47636_5 - 62308^{\circ}_5$	+2
6806.67	10*h*		14687.42		
6799.60	60000*R*	6000*Z*	14702.69	$17992^{\circ}_1 - 32694_1$	+1
6782.17	1000	20*Z*	14740.47	$25068^{\circ}_1 - 39808_1$	−2
6779.74	2		14745.76		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
6777.22	600	10	14751.24	$28184_4^\circ - 42935_5$	−3
6773.47	2		14759.41	$47636_5 - 62395_5^\circ$	+1
6772.26	20		14762.05		
6768.70	6000	1000Z	14769.81	$25068_1^\circ - 39838_2$	+0
6765.67	40	1	14776.42	$32694_1 - 47471_2^\circ$	+2
6765.24	200	1Z	14777.36	$30207_3^\circ - 44984_4$	−1
6761.64	3*h*		14785.23		
6757.29	1		14794.75		
6753.01	2		14804.12	$32694_1 - 47498_1^\circ$	−1
6749.40	1000	20Z	14812.04	$25068_1^\circ - 39880_2$	+1
6732.17	2		14849.95		
6731.02	5*h*		14852.49		
6724.92	1		14865.96	$48806_6 - 63672_5^\circ$	+5
6720.85	2		14874.96		
6719.87	6*h*		14877.13		
6717.05	30		14883.38		
6715.79	1000	20Z	14886.17	$30524_5^\circ - 45410_5$	−2
6707.91	3		14903.66		
6707.76	5		14903.99		
6702.48	2		14915.73		
6701.26	15		14918.45		
6697.64	10*h*		14926.51		
6692.42	700	5Z	14938.15	$29774_4^\circ - 44713_3$	−1
6687.82	60		14948.43	$28857_1^\circ - 43805_1$	+2
6678.17	20000	1000Z	14970.03	$27677_2 - 42647_2^\circ$	−3
6667.82	50000	2000Z	14993.27	$25068_1^\circ - 40061_2$	−2
6656.70	2		15018.31		
6643.55	10000	300Z	15048.04	$27677_2 - 42725_2^\circ$	−6
6642.12	10*h*		15051.28	$47636_5 - 62687_6^\circ$	−1
				$49127_1^\circ - 64178_2$	−4
6640.79	7		15054.29		
6639.34	150	1	15057.58		
6636.42	6*h*		15064.20		
6634.28	5		15069.06	$44984_4 - 60053_5^\circ$	+3
6630.85	2*h*		15076.86		
6626.73	800	2Z	15086.23	$27445_3^\circ - 42531_2$	+0
6625.27	4*h*		15089.56		
6607.07	2000	40Z	15131.12	$30207_3^\circ - 45338_2$	−3
6594.65	3*h*		15159.62		
6592.47	40		15164.63	$32694_1 - 47859_1^\circ$	+2
6572.90	300	2	15209.78	$29774_4^\circ - 44984_4$	−1
6568.35	60	1	15220.32	$47088_5 - 62308_5^\circ$	+2
6565.72	1		15226.42		
6561.65	3		15235.86		
6555.15	1500	15Z	15250.97	$30524_5^\circ - 45775_4$	+0

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
6553.35	900	9	15255.16	30207_3° − 45462$_3$	+0
6550.90	1		15260.86	47047$_4$ − 62308_5°	+9
6550.14	400	10*Z*	15262.63		
6547.82	4*h*		15268.04		
6547.43	2		15268.95		
6538.31	20		15290.25	30207_3° − 45497$_4$	+1
6531.00	25	1	15307.36	47088$_5$ − 62395_5°	+1
6513.78	5		15347.83	47047$_4$ − 62395_5°	+1
6509.09	60	1	15358.89	47036$_6$ − 62395_5°	+0
6508.81	1		15359.55	44017_1° − 59377$_2$	+2
6507.98	2		15361.51		
6505.29	1		15367.86		
6503.96	3		15371.00		
6489.06	80000*R*	10000*Z*	15406.30	17288_0° − 32694$_1$	+4
6477.98	5		15432.65		
6475.98	8		15437.41		
6468.88	70		15454.36	28857_1° − 44311$_1$	−1
6468.18	1500	5	15456.03	28857_1° − 44313$_2$	−1
6464.66	3		15464.44		
6464.46	1		15464.92		
6461.37	3*h*		15472.32		
6460.89	2		15473.47		
6460.66	1		15474.02		
6456.90	2		15483.03		
6456.64	1		15483.65		
6456.33	5		15484.40		
6455.41	1000		15486.60	19710_2° − 35196$_2$	+1
6452.73	1		15493.04		
6452.46	1		15493.68		
6450.88	40		15497.48		
6449.59	1500	15	15500.58	28857_1° − 44357$_2$	−1
6448.41	4*h*		15503.41		
6446.22	20		15508.68		
6435.61	3*h*		15534.25		
6433.44	15	1	15539.49	32694$_1$ − 48234_2°	+6
6421.53	1500	10*Z*	15568.31	30207_3° − 45775$_4$	+1
6421.04	400	20	15569.50	32273$_4$ − 47843_3° 34350$_0$ − 49920_1°	−3 +0
6417.91	20000	1000*Z*	15577.09	27677$_2$ − 43254_3°	−2
6408.77	4		15599.31	47088$_5$ − 62687_6°	+7
6408.44	4		15600.11		
6404.62	800	20*Z*	15609.41	28195_2° − 43805$_1$	−5
6400.35	40000	2000*Z*	15619.83	27677$_2$ − 43297_3°	−2
6393.74	700	5*Z*	15635.98	29774_4° − 45410$_5$	+2
6387.68	100	2	15650.81	47036$_6$ − 62687_6°	+3

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
6381.68	10		15665.52	$32273_4 - 47939^{\circ}_4$	+2
6372.71	1500	20*Z*	15687.57	$29774^{\circ}_4 - 45462_3$	−1
6365.05	30		15706.45	$30207^{\circ}_3 - 45913_2$	−3
6359.22	2*h*		15720.85		
6358.49	20		15722.66	$29774^{\circ}_4 - 45497_4$	+0
6348.85	2*h*		15746.53		
6344.97	3000	100*Z*	15756.16	$27677_2 - 43433^{\circ}_2$	−3
6343.01	8		15761.03	$47911_5 - 63672^{\circ}_5$	+3
6336.23	100	1	15777.89	$32065_3 - 47843^{\circ}_3$	+5
6335.72	3000	70*Z*	15779.16	$27445^{\circ}_3 - 43224_2$	+2
6328.19	4		15797.94		
6322.56	400	3	15812.01	$24751_2 - 40563^{\circ}_1$	−2
6318.91	20	1	15821.14	$44232_4 - 60053^{\circ}_5$	+2
6311.10	2		15840.72	$46554_6 - 62395^{\circ}_5$	+2
6309.82	20	1	15843.93		
6305.37	90	1	15855.11	$27677_2 - 43532^{\circ}_1$	+1
6304.79	8		15856.57		
6299.71	2		15869.36		
6297.95	90	1	15873.79	$32065_3 - 47939^{\circ}_4$	−3
6286.25	2000	20*Z*	15903.34	$28857^{\circ}_1 - 44760_2$	−2
6262.43	1		15963.83	$32273_4 - 48237^{\circ}_3$	+3
6261.50	2		15966.20		
6257.03	20		15977.60	$28857^{\circ}_1 - 44834_1$	+1
6255.43	200	2	15981.69	$27677_2 - 43659^{\circ}_1$	−2
6247.99	1500	15*Z*	16000.72	$29774^{\circ}_4 - 45775_4$	+0
6244.69	3		16009.18		
6236.55	600	5	16030.07	$30524^{\circ}_5 - 46554_6$	−2
6235.25	200	3	16033.41		
6234.12	25		16036.32	$47636_5 - 63672^{\circ}_5$	−5
6228.53	1		16050.71		
6219.16	15		16074.89	$24489_1 - 40563^{\circ}_1$	+3
6210.59	900	1	16097.08	$19710^{\circ}_2 - 35807_3$	−6
6209.04	2		16101.09		
6198.67	20		16128.03	$27677_2 - 43805^{\circ}_2$	+1
6196.90	3		16132.64	$46554_6 - 62687^{\circ}_6$	+5
6194.84	900	4*Z*	16138.00	$27677_2 - 43815^{\circ}_3$	+0
6192.32	60	1	16144.57		
6183.01	2		16168.88	$32065_3 - 48234^{\circ}_2$	+4
6182.14	1		16171.15		
6181.78	100	2*Z*	16172.10	$32065_3 - 48237^{\circ}_3$	−1
6176.91	1		16184.85	$28195^{\circ}_2 - 44380_3$	−1
6175.62	150	50	16188.23	$30207^{\circ}_3 - 46395_3$	+1
6172.53	5		16196.33	$28184^{\circ}_4 - 44380_3$	+2
6171.87	20		16198.06		
6161.97	50		16224.09	$30207^{\circ}_3 - 46431_2$	−2

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
6160.74	6		16227.32		
6156.02	2		16239.77	$43814_6 - 60053^{\circ}_5$	+10
6148.50	15		16259.63	$32065_3 - 48324^{\circ}_2$	+2
6148.24	1		16260.32	$30207^{\circ}_3 - 46467_2$	+0
6144.20	3*h*		16271.01		
6130.67	1		16306.92		
6118.28	3000	100*Z*	16339.94	$27677_2 - 44017^{\circ}_1$	+1
6113.42	10		16352.93		
6111.27	4000	60*Z*	16358.68	$17992^{\circ}_1 - 34350_0$	+4
6101.83	40		16383.99	$32065_3 - 48449^{\circ}_2$	+0
6096.15	15	2	16399.26		
6094.49	4		16403.72		
6087.44	20		16422.72	$32065_3 - 48487^{\circ}_3$	+2
6086.48	2		16425.31		
6073.17	7		16461.31		
6066.51	15		16479.38	$36060_4 - 52540^{\circ}_4$	+1
6065.72	300	3*Z*	16481.53	$28857^{\circ}_1 - 45338_2$	+1
6059.22	6000	80	16499.21	$27314^{\circ}_6 - 43814_6$	+2
6054.57	4000	50*Z*	16511.88	$30524^{\circ}_5 - 47036_6$	−3
6052.63	150		16517.17	$28195^{\circ}_2 - 44713_3$	+1
6050.48	2		16523.04	$30524^{\circ}_5 - 47047_4$	+6
6048.44	4000	50*Z*	16528.61	$28184^{\circ}_4 - 44713_3$	+0
6046.91	9		16532.79	$45775_4 - 62308^{\circ}_5$	+1
6045.95	6*h*		16535.42		
6044.96	3*h*		16538.13		
6041.79	100	1	16546.80	$25068^{\circ}_1 - 41615_1$	−1
6035.72	400	4*Z*	16563.44	$30524^{\circ}_5 - 47088_5$	+0
6035.37	3		16564.41	$28195^{\circ}_2 - 44760_2$	+0
6034.26	1		16567.45		
6031.80	3000	40*Z*	16574.21	$27677_2 - 44251^{\circ}_2$	−1
6029.05	7*h*		16581.77		
6027.50	1*h*		16586.03		
6023.82	2*hl*		16596.17		
6018.16	5*h*		16611.77		
6014.95	1500	10*Z*	16620.64	$29774^{\circ}_4 - 46395_3$	+0
6014.16	10		16622.82		
6011.18	1		16631.06		
6008.44	200	1	16638.65	$28195^{\circ}_2 - 44834_1$	+0
6004.52	2000	20*Z*	16649.51	$23188^{\circ}_2 - 39838_2$	−1
6003.62	400	10*Z*	16652.00		
6003.33	2*hl*		16652.81		
6000.28	20		16661.27		
5989.33	5000	100*Z*	16691.73	$23188^{\circ}_2 - 39880_2$	−1
5987.58	20		16696.61		
5984.98	3*hl*		16703.87		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
5983.12	2		16709.06		
5980.83	2		16715.46		
5978.35	2		16722.39		
5976.21	20		16728.38		
5975.70	2		16729.81		
5975.29	2		16730.96		
5974.63	2		16732.80	$35807_3 - 52540^{\circ}_4$	−3
5972.73	150	1	16738.13	$28857^{\circ}_1 - 45595_1$	+0
5969.95	3		16745.92		
5969.84	2		16746.23		
5968.23	2*hl*		16750.75		
5966.86	2		16754.59		
5966.43	20		16755.80		
5965.48	1		16758.47		
5963.60	2		16763.75		
5960.20	1		16773.31		
5960.04	10		16773.76		
5959.33	1000	10*Z*	16775.76	$27677_2 - 44453^{\circ}_3$	−4
5958.70	4000	100*Z*	16777.54	$23188^{\circ}_2 - 39966_3$	−4
5955.34	1500	8*Z*	16787.00	$27445^{\circ}_3 - 44232_4$	−2
5954.19	2*h*		16790.24		
5950.66	1500	10*Z*	16800.20	$28184^{\circ}_4 - 44984_4$	−3
5947.71	2		16808.54		
5947.54	1		16809.02		
5946.79	4*hl*		16811.14		
5946.23	1		16812.72		
5945.44	8		16814.95		
5945.33	3		16815.26		
5945.27	3		16815.44		
5945.10	4		16815.92		
5944.93	2		16816.40		
5944.73	4		16816.96		
5944.41	3		16817.87		
5944.24	2		16818.35		
5943.63	9		16820.07		
5942.89	3		16822.17		
5942.73	3		16822.62		
5942.02	4		16824.63		
5941.72	2		16825.48		
5941.04	1		16827.41		
5940.68	20		16828.43		
5936.49	900	10*Z*	16840.30	$30207^{\circ}_3 - 47047_4$	+0
5935.88	2		16842.03		
5935.56	2		16842.94		
5934.27	3		16846.60		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
5933.775	2		16848.01		
5932.98	2		16850.27		
5932.562	4		16851.46		
5931.853	3		16853.47	$47325^{\circ}_{3} - 64178_{2}$	−4
5931.73	3*h*		16853.82		
5930.722	6		16856.68		
5929.82	4		16859.25		
5928.761	5		16862.26		
5928.63	2		16862.63		
5927.69	60		16865.30		
5926.958	10		16867.39	$27445^{\circ}_{3} - 44313_{2}$	−2
5926.688	5		16868.16		
5925.46	600	5*Z*	16871.65	$25068^{\circ}_{1} - 41939_{0}$	−2
5925.00	60		16872.96	$23188^{\circ}_{2} - 40061_{2}$	−3
5924.498	15		16874.39		
5924.165	2		16875.34		
5922.991	5		16878.69		
5922.153	15		16881.07		
5920.48	2		16885.84		
5919.710	8		16888.04		
5919.585	2		16888.40		
5917.826	3		16893.42		
5917.130	6		16895.40		
5916.00	5*hl*		16898.63		
5915.052	3		16901.34		
5914.415	5		16903.16		
5912.35	5*hl*		16909.06		
5912.15	2		16909.64		
5911.55	5		16911.35		
5911.35	20		16911.92	$27445^{\circ}_{3} - 44357_{2}$	−4
5910.10	4		16915.50		
5909.10	2		16918.36		
5906.45	2		16925.95		
5905.85	2		16927.67		
5905.22	3		16929.48		
5902.71	2		16936.68		
5899.30	2		16946.47		
5895.16	2		16958.37		
5894.98	5		16958.89		
5886.05	5		16984.61	$45410_{5} - 62395^{\circ}_{5}$	+2
5877.68	10		17008.80	$32273_{4} - 49282^{\circ}_{4}$	+4
5861.11	10		17056.89	$28857^{\circ}_{1} - 45913_{2}$	+4
5854.510	4000	200*Z*	17076.12	$25859^{\circ}_{5} - 42935_{5}$	+2
5845.50	6*h*		17102.44		
5842.44	80	1	17111.39	$30524^{\circ}_{5} - 47636_{5}$	+0

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
5841.96	20		17112.80		
5839.25	2*h*		17120.74		
5838.91	6*h*		17121.74		
5838.27	70	1	17123.61	$47055^{\circ}_{2} - 64178_{2}$	−4
5834.58	200	3	17134.44	$30207^{\circ}_{3} - 47341_{2}$	+0
5833.62	20		17137.26		
5831.82	300	3*Z*	17142.55	$28195^{\circ}_{2} - 45338_{2}$	−2
5830.82	2		17145.49		
5829.63	200	2	17148.99	$30524^{\circ}_{5} - 47673_{4}$	+0
5829.11	5*h*		17150.52		
5820.17	2		17176.87		
5812.64	3*h*		17199.12		
5810.67	3000	7*Z*	17204.95	$17992^{\circ}_{1} - 35196_{2}$	−2
5806.58	7		17217.07	$32065_{3} - 49282^{\circ}_{4}$	−1
5804.06	80	1	17224.54	$28857^{\circ}_{1} - 46081_{0}$	+2
5803.44	5000	80*Z*	17226.38	$28184^{\circ}_{4} - 45410_{5}$	−1
5802.36	200	1	17229.59		
5798.82	2*h*		17240.11		
5796.09	80		17248.23	$30524^{\circ}_{5} - 47772_{4}$	+0
5789.93	1500	15	17266.58	$28195^{\circ}_{2} - 45462_{3}$	+0
5789.63	100		17267.47	$27445^{\circ}_{3} - 44713_{3}$	−1
5787.86	500	5	17272.75	$29774^{\circ}_{4} - 47047_{4}$	+2
5786.09	400	3	17278.04	$28184^{\circ}_{4} - 45462_{3}$	+1
5784.43	3*h*		17283.00		
5784.026	10		17284.20		
5774.34	500	5	17313.19	$28184^{\circ}_{4} - 45497_{4}$ $29774^{\circ}_{4} - 47088_{5}$	+9 −1
5773.82	1000	10	17314.75	$27445^{\circ}_{3} - 44760_{2}$	+2
5772.39	3*hl*		17319.04		
5765.21	5*h*		17340.61		
5759.84	4*h*		17356.78		
5758.25	9		17361.57	$35178_{5} - 52540^{\circ}_{4}$	+0
5755.89	3000	40*Z*	17368.69	$25068^{\circ}_{1} - 42436_{0}$	+1
5753.20	2		17376.81	$25270_{3} - 42647^{\circ}_{2}$	−1
5749.91	1000	400*Z*	17386.75	$30524^{\circ}_{5} - 47911_{5}$	−1
5745.80	2000	30*Z*	17399.19	$28195^{\circ}_{2} - 45595_{1}$	+1
5741.99	15		17410.74	$44984_{4} - 62395^{\circ}_{5}$	−2
5738.53	2		17421.23		
5733.00	2*hl*		17438.04		
5732.60	4*hl*		17439.25	$30207^{\circ}_{3} - 47646_{3}$	+1
5731.94	6*hl*		17441.26		
5731.26	6*hl*		17443.33		
5730.41	7*hl*		17445.92		
5729.26	5*hl*		17449.42		
5728.853	150	5*Z*	17450.66		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
5728.58	5*hl*		17451.49		
5727.47	90		17454.87	$25270_3 - 42725^{\circ}_2$	+2
5726.68	10*h*		17457.28		
5724.58	500	2*Z*	17463.69	$25068^{\circ}_1 - 42531_2$	+4
5723.70	600	7	17466.37	$30207^{\circ}_3 - 47673_4$	+4
5719.99	20000	1000*Z*	17477.70	$27677_2 - 45155^{\circ}_2$	+3
5711.38	1		17504.05	$27677_2 - 45181^{\circ}_1$	+2
5701.922	250	3*Z*	17533.08	$30524^{\circ}_5 - 48057_5$	+3
5699.95	3000	50*Z*	17539.15	$27445^{\circ}_3 - 44984_4$	+4
5698.21	2		17544.50		
5696.93	2		17548.45		
5689.917	1000	30*Z*	17570.07		
5688.48	200	3	17574.51	$28857^{\circ}_1 - 46431_2$	+4
5684.13	2		17587.96	$28857^{\circ}_1 - 46444_1$	+2
5683.09	500	5*Z*	17591.18	$28184^{\circ}_4 - 45775_4$	+1
5670.02	500	2	17631.73		
5663.21	200	2	17652.93	$30207^{\circ}_3 - 47860_3$	+3
5642.446	40		17717.89	$28195^{\circ}_2 - 45913_2$	−1
5628.958	10		17760.35		
5625.92	20		17769.94		
5616.66	2*h*		17799.23		
5614.68	1		17805.51		
5614.116	3		17807.30		
5613.39	5*h*		17809.60		
5611.50	1		17815.60		
5610.60	2		17818.46		
5610.281	3		17819.47		
5609.44	1		17822.14		
5608.041	6		17826.59		
5605.847	3		17833.57		
5600.45	10		17850.75		
5598.14	2		17858.12		
5597.189	800	10*Z*	17861.15	$29774^{\circ}_4 - 47636_5$	+0
5595.84	5		17865.46		
5591.19	10		17880.32		
5590.10	10		17883.80		
5587.249	200	2	17892.93	$27445^{\circ}_3 - 45338_2$	+4
5586.362	2000	100*Z*	17895.77	$24751_2 - 42647^{\circ}_2$	+0
5585.426	400	5	17898.77	$29774^{\circ}_4 - 47673_4$	+2
5578.232	400	20*Z*	17921.85		
5576.25	5		17928.22	$30207^{\circ}_3 - 48135_2$	+0
5568.11	1000	100*Z*	17954.43	$25859^{\circ}_5 - 43814_6$	+0
5562.093	2000	200*Z*	17973.85	$24751_2 - 42725^{\circ}_2$	+4
5558.98	800	8	17983.92	$25270_3 - 43254^{\circ}_3$	+4
5556.466	50000*A*	10000*Z*	17992.05	$0_0 - 17992^{\circ}_1$	+5

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
5554.62	500	5	17998.03	$29774^{\circ}_{4} - 47772_{4}$	+5
5548.79	100		18016.94	$27445^{\circ}_{3} - 45462_{3}$	+4
5545.814	500	10	18026.61	$25270_{3} - 43297^{\circ}_{3}$	+0
5539.053	20000	1000Z	18048.61		
5538.016	50		18051.99	$27445^{\circ}_{3} - 45497_{4}$	+1
5535.47	7		18060.30		
5528.403	3		18083.38		
5527.81	50		18085.32	$29774^{\circ}_{4} - 47860_{3}$	+0
5526.37	5		18090.03		
5524.544	3000	30Z	18096.01	$27314^{\circ}_{6} - 45410_{5}$	+2
5521.76	10		18105.14		
5518.352	70	1	18116.32		
5514.79	1		18128.02		
5512.47	20		18135.65		
5512.19	20		18136.57	$29774^{\circ}_{4} - 47911_{5}$	+5
5506.11	1500	5	18156.60	$25068^{\circ}_{1} - 43224_{2}$	+5
5505.49	10000	300Z	18158.64	$24489_{1} - 42647^{\circ}_{2}$	+3
5504.17	60		18163.00	$25270_{3} - 43433^{\circ}_{2}$	+5
5504.026	300	3	18163.47	$30524^{\circ}_{5} - 48688_{6}$	+1
5498.75	5000	500Z	18180.90		
5493.088	700	5Z	18199.64	$28195^{\circ}_{2} - 46395_{3}$	+0
5491.285	6		18205.62	$49638_{5} - 67844^{\circ}_{6}$	+1
5489.633	80		18211.09	$28184^{\circ}_{4} - 46395_{3}$	+1
5481.925	20000	400Z	18236.70	$24489_{1} - 42725^{\circ}_{2}$	+4
5476.90	2		18253.43		
5474.565	400	5	18261.22		
5474.037	1500	15Z	18262.98	$30524^{\circ}_{5} - 48787_{4}$	−2
5469.353	400	5	18278.62	$27677_{2} - 45956^{\circ}_{2}$	+1
5468.387	150	2	18281.85	$30524^{\circ}_{5} - 48806_{6}$	−1
5468.099	1		18282.81	$29774^{\circ}_{4} - 48057_{5}$	+0
5463.24	4		18299.07		
5454.007	2500	25Z	18330.05	$27445^{\circ}_{3} - 45775_{4}$	+1
5453.47	60	1	18331.85		
5441.259	200	1	18372.99	$25859^{\circ}_{5} - 44232_{4}$	+2
5438.01	2		18383.97		
5432.89	400	6	18401.29	$27677_{2} - 46078^{\circ}_{1}$	+5
5425.445	100	1	18426.55	$23188^{\circ}_{2} - 41615_{1}$	+2
5421.361	7		18440.43	$30207^{\circ}_{3} - 48647_{3}$	+3
5413.195	15		18468.24	$27445^{\circ}_{3} - 45913_{2}$	+2
5408.348	100	2	18484.80	$28857^{\circ}_{1} - 47341_{2}$	−1
5405.541	60	1	18494.39	$43814_{6} - 62308^{\circ}_{5}$	+4
5404.899	300	5	18496.59	$27677_{2} - 46174^{\circ}_{1}$	+5
5403.079	3000	100Z	18502.82	$24751_{2} - 43254^{\circ}_{3}$	−1
5402.00	150	2	18506.52	$27677_{2} - 46184^{\circ}_{2}$	+3
5393.757	2500	90Z	18534.80	$25270_{3} - 43805^{\circ}_{2}$	+1

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
5390.845	2500	40Z	18544.81	$25270_3 - 43815^{\circ}_3$	+4
5390.622	4000	150Z	18545.58	$24751_2 - 43297^{\circ}_3$	+2
5387.99	90	8	18554.64	$30524^{\circ}_5 - 49079_5$	+1
5385.29	200	2	18563.94	$28857^{\circ}_1 - 47420_2$	−1
5382.55	2		18573.39	$27677_2 - 46251^{\circ}_3$	+0
5380.94	1		18578.95	$30524^{\circ}_5 - 49103_4$	+2
5380.54	500	7Z	18580.33	$30207^{\circ}_3 - 48787_4$	+0
5380.24	70	2Z	18581.36	$43814_6 - 62395^{\circ}_5$	−4
5379.15	6		18585.13		
5363.66	10000	200Z	18638.80	$23188^{\circ}_2 - 41827_3$	+2
5351.29	5000	300Z	18681.89	$24751_2 - 43433^{\circ}_2$	−1
5348.208	300	3	18692.65	$27677_2 - 46370^{\circ}_1$	+2
5341.10	2		18717.53		
5338.31	60		18727.31	$28857^{\circ}_1 - 47584_1$	−1
5335.82	10		18736.05	$30524^{\circ}_5 - 49260_4$	+1
5335.49	50		18737.21	$25068^{\circ}_1 - 43805_1$	+2
5330.79	1		18753.73		
5330.348	6		18755.28		
5327.593	4		18764.98	$49079_5 - 67844^{\circ}_6$	−2
5323.10	300	3Z	18780.82	$24751_2 - 43532^{\circ}_1$	+0
5320.962	5		18788.37	$28857^{\circ}_1 - 47645_1$	−2
5320.324	6		18790.62		
5299.852	2000	10Z	18863.20	$28184^{\circ}_4 - 47047_4$	+3
5297.153	150	4	18872.81	$29774^{\circ}_4 - 48647_3$	−1
5297.02	50	1	18873.29	$43814_6 - 62687^{\circ}_6$	+0
5290.578	150	3	18896.27	$30207^{\circ}_3 - 49103_4$	+1
5288.51	2000	15Z	18903.66	$28184^{\circ}_4 - 47088_5$	+1
5287.45	3000	70Z	18907.45	$24751_2 - 43659^{\circ}_1$	+2
5277.04	30000	3000Z	18944.75	$24489_1 - 43433^{\circ}_2$	+0
5275.592	1000	10Z	18949.94	$27445^{\circ}_3 - 46395_3$	−2
5271.473	400	20	18964.75	$28857^{\circ}_1 - 47821_2$	−1
5266.964	15		18980.99	$25270_3 - 44251^{\circ}_2$	+1
5265.558	40		18986.05		
5264.238	10		18990.82		
5258.165	800	10	19012.75	$29774^{\circ}_4 - 48787_4$	+0
5257.29	90		19015.91	$30207^{\circ}_3 - 49223_3$	−6
5255.61	2		19021.99	$27445^{\circ}_3 - 46467_2$	−7
5253.448	1		19029.82		
5250.804	100	2	19039.40	$30207^{\circ}_3 - 49246_2$	−1
5247.94	15		19049.79		
5246.857	400	4	19053.73	$24751_2 - 43805^{\circ}_2$	−2
5244.11	10000	250Z	19063.71	$24751_2 - 43815^{\circ}_3$	−2
5230.292	60		19114.07	$30524^{\circ}_5 - 49638_5$	+5
5228.172	1000	30Z	19121.82	$25270_3 - 44392^{\circ}_4$	+2
5227.271	4000	80Z	19125.12	$24489_1 - 43614^{\circ}_6$ $25859^{\circ}_5 - 44984_4$	−5 +5

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
5224.53	1		19135.15		
5221.606	50	1	19145.87	$28195^{0}_{2} - 47341_{2}$	+1
5218.792	1		19156.19	$48688_{6} - 67844^{0}_{6}$	+3
5214.95	500	5Z	19170.30	$24489_{1} - 43659^{0}_{1}$	+2
5211.604	6000	400Z	19182.61	$25270_{3} - 44453^{0}_{3}$	+4
5200.10	4		19225.05	$28195^{0}_{2} - 47420_{2}$	+5
5196.81	40		19237.22	$30207^{0}_{3} - 49444_{3}$	+8
5196.085	5000	200Z	19239.90	$27314^{0}_{6} - 46554_{6}$	+1
5195.20	100	1	19243.18	$25068^{0}_{1} - 44311_{1}$	+3
5194.752	2000	80	19244.84	$25068^{0}_{1} - 44313_{2}$	+2
5193.850	2000	20Z	19248.18	$23188^{0}_{2} - 42436_{1}$	+0
5189.14	200	2	19265.65	$24751_{2} - 44017^{0}_{1}$	+0
5182.755	2000	50Z	19289.38	$25068^{0}_{1} - 44357_{2}$	+1
5178.715	90	20	19304.43	$29774^{0}_{4} - 49079_{5}$	+5
5175.45	250	2	19316.61	$24489_{1} - 43805^{0}_{2}$	+2
5172.214	50	1	19328.70	$29774^{0}_{4} - 49103_{4}$	+2
5168.29	90		19343.37	$23188^{0}_{2} - 42531_{2}$	+2
5163.862	1		19359.96		
5160.47	7		19372.68	$42935_{5} - 62308^{0}_{5}$	+0
5156.285	100	2	19388.41	$28195^{0}_{2} - 47584_{1}$	+3
5148.75	1		19416.78		
5140.38	120	2	19448.40	$29774^{0}_{4} - 49223_{3}$	+0
5140.11	20		19449.42	$28195^{0}_{2} - 47645_{1}$	−2
5139.53	900	10Z	19451.61	$28184^{0}_{4} - 47636_{5}$	+2
5139.35	40		19452.29	$28857^{0}_{1} - 48309_{1}$	−10
5137.389	6		19459.72	$42935_{5} - 62395^{0}_{5}$	−1
5136.76	2		19462.10	$28184^{0}_{4} - 47646_{3}$	−1
5132.71	90	1	19477.46	$28195^{0}_{2} - 47673_{3}$	−3
5130.523	100	2	19485.76	$29774^{0}_{4} - 49260_{4}$	−3
5130.095	7		19487.39		
5129.688	200	2	19488.93	$28184^{0}_{4} - 47673_{3}$	+0
5127.64	2		19496.72		
5126.80	2000	20Z	19499.91	$24751_{2} - 44251^{0}_{2}$	−2
5119.29	100	1	19528.52	$24489_{1} - 44017^{0}_{1}$	+2
5114.606	40	1	19546.40		
5113.34	700	10Z	19551.24	$25859^{0}_{5} - 45410_{5}$	+1
5111.89	2		19556.79		
5106.95	1		19575.70		
5105.75	600	30*hl*	19580.30		
5104.85	2000	30Z	19583.76		
5103.724	5	1	19588.08		
5103.644	5		19588.38	$28184^{0}_{4} - 47772_{4}$	−4
5100.08	100	1	19602.07	$27445^{0}_{3} - 47047_{4}$	+2
5093.92	2		19625.78	$28195^{0}_{2} - 47821_{2}$	−4

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
5090.77	80		19637.92	$25859^{\circ}_{5} - 45497_{4}$	−2
5088.275	15		19647.55	$27677_{2} - 47325^{\circ}_{3}$	+2
5087.89	4		19649.04	$27677_{2} - 47326^{\circ}_{2}$	+5
5086.45	15		19654.60	$27677_{2} - 47332^{\circ}_{1}$	+0
5083.938	90	1	19664.31	$28195^{\circ}_{2} - 47860_{3}$	−1
5082.590	250	9	19669.53	$29774^{\circ}_{4} - 49444_{3}$	−4
5080.981	500	9Z	19675.75	$28184^{\circ}_{4} - 47860_{3}$	−1
5076.744	5000	150Z	19692.17	$25068^{\circ}_{1} - 44760_{2}$	+3
5074.34	20000	2000Z	19701.50	$24751_{2} - 44453^{\circ}_{3}$	−2
5069.144	4000	150Z	19721.70	$27314^{\circ}_{6} - 47036_{6}$	+0
5067.800	1500	40Z	19726.93	$28184^{\circ}_{4} - 47911_{5}$	−4
5063.605	8		19743.27	$27677_{2} - 47420^{\circ}_{1}$	+1
5060.722	2		19754.52		
5058.613	900	5Z	19762.75	$24489_{1} - 44251^{\circ}_{2}$	−2
5055.933	15		19773.23	$27314^{\circ}_{6} - 47088_{5}$	−1
5055.485	2		19774.98		
5050.77	15		19793.44	$27677_{2} - 47471^{\circ}_{2}$	+1
5043.708	150	4Z	19821.16	$27677_{2} - 47498^{\circ}_{1}$	−1
5034.262	5	1	19858.35	$43814_{6} - 63672^{\circ}_{5}$	−2
5032.899	2		19863.72	$29774^{\circ}_{4} - 49638_{5}$	−5
5032.14	2		19866.72		
5029.03	6		19879.01		
5027.67	2000	80Z	19884.38	$25270_{3} - 45155^{\circ}_{2}$	−4
5021.860	400	4	19907.39		
5019.691	1500	15Z	19915.99	$25859^{\circ}_{5} - 45775_{4}$	−1
5004.79	15		19975.29	$27445^{\circ}_{3} - 47420_{2}$	−4
5003.306	2		19981.21	$28857^{\circ}_{1} - 48838_{1}$	−10
4992.786	2		20023.31		
4992.102	2		20026.05	$28857^{\circ}_{1} - 48883_{2}$	−4
4989.924	6		20034.80		
4989.57	100	1	20036.22	$23188^{\circ}_{2} - 43224_{2}$	−4
4986.88	6	3	20047.02		
4985.36	2		20053.14	$25068^{\circ}_{1} - 45121_{1}$	−1
4982.82	2		20063.36		
4981.34	1		20069.32		
4974.16	2000	100Z	20098.29	$19710^{\circ}_{2} - 39808_{1}$	−4
4972.42	10	2	20105.32		
4970.41	40	7	20113.45	$28195^{\circ}_{2} - 48309_{1}$	+0
4966.902	10000*R*	700Z	20127.66	$19710^{\circ}_{2} - 39838_{2}$	+1
4962.28	1		20146.41		
4960.28	1		20154.53		
4957.83	8		20164.49	$28195^{\circ}_{2} - 48360_{1}$	+2
4956.512	500	9Z	20169.85	$19710^{\circ}_{2} - 39880_{2}$	−2
4953.72	1		20181.22		
4951.88	2		20188.72	$27445^{\circ}_{3} - 47634_{2}$	−6

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4942.254	250	3	20228.04	$27445^{\circ}_{3} - 47673_{4}$	−3
4935.500	20000*R*	2000*Z*	20255.72	$19710^{\circ}_{2} - 39966_{3}$	+2
4932.81	5		20266.76	$32273_{4} - 52540^{\circ}_{4}$	+1
4931.953	1000	40*Z*	20270.28	$25068^{\circ}_{1} - 45338_{2}$	−2
4931.16	5		20273.54		
4919.595	100	2	20321.20	$27314^{\circ}_{6} - 47636_{5}$	+1
4918.118	150	2*Z*	20327.31	$27445^{\circ}_{3} - 47772_{4}$	+0
4912.365	3000	100*Z*	20351.11	$19710^{\circ}_{2} - 40061_{2}$	−1
4906.335	50		20376.12	$27445^{\circ}_{3} - 47821_{2}$	−2
4904.93	1		20381.96		
4899.78	500	5*Z*	20403.38	$24751_{2} - 45155^{\circ}_{2}$	+0
4897.08	5		20414.63	$27445^{\circ}_{3} - 47860_{3}$	−1
4895.606	150	5	20420.78		
4894.596	3000	400	20424.99		
4894.296	50		20426.24		
4893.465	500	5*Z*	20429.71	$24751_{2} - 45181^{\circ}_{1}$	−3
4891.992	200	4*Z*	20435.86		
4888.18	25	1	20451.80	$28195^{\circ}_{2} - 48647_{3}$	−2
4885.45	90	3	20463.23	$28184^{\circ}_{4} - 48647_{3}$	−4
4882.15	2		20477.06	$27677_{2} - 48154^{\circ}_{3}$	+2
4870.288	30		20526.93	$25068^{\circ}_{1} - 45595_{1}$	+2
4868.511	8		20534.43	$27677_{2} - 48212^{\circ}_{1}$	−1
4863.295	40		20556.45	$27677_{2} - 48234^{\circ}_{2}$	−1
4862.524	2		20559.71	$27677_{2} - 48237^{\circ}_{3}$	−2
4857.542	50	1	20580.79	$27677_{2} - 48258^{\circ}_{1}$	−1
4856.50	1		20585.21		
4855.922	15		20587.66		
4854.92	1		20591.91		
4853.826	500	7*Z*	20596.55	$27314^{\circ}_{6} - 47911_{5}$	−1
4849.034	100	1	20616.90	$23188^{\circ}_{2} - 43805_{1}$	+0
4845.612	3		20631.46		
4841.918	50	2	20647.20	$27677_{2} - 48324^{\circ}_{2}$	−2
4839.462	2		20657.68		
4838.657	7		20661.12		
4837.46	4000	100*Z*	20666.23	$24489_{1} - 45155^{\circ}_{2}$	+0
4832.989	200	5	20685.35	$25270_{3} - 45956^{\circ}_{2}$	−2
4831.912	400	20	20689.96	$27445^{\circ}_{3} - 48135_{2}$	+0
4831.30	600	10*Z*	20692.58	$24489_{1} - 45181^{\circ}_{1}$	−1
4830.704	500	10	20695.13	$25859^{\circ}_{5} - 46554_{6}$	+1
4828.29	3		20705.48		
4825.655	1		20716.79		
4824.28	1		20722.69		
4819.59	20	1	20742.86	$27314^{\circ}_{6} - 48057_{5}$	+1
4816.43	5000	600*Z*	20756.47		
4812.918	400	40*Z*	20771.61	$27677_{2} - 48449^{\circ}_{2}$	+1

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4811.89	1		20776.05		
4810.51	40	4	20782.01		
4804.571	3		20807.70	$47036_6 - 67844^{\circ}_6$	−2
4800.535	2		20825.19	$38551^{\circ}_2 - 59377_2$	−1
4795.829	80	1	20845.63	$25068^{\circ}_1 - 45913_2$	−1
4794.96	1		20849.40		
4794.85	1		20849.88		
4794.57	1		20851.10		
4784.54	70	9	20894.81	$28184^{\circ}_4 - 49079_5$	−2
4781.867	10000	2000Z	20906.49		
4780.32	400	15Z	20913.25	$25270_3 - 46184^{\circ}_2$	+1
4778.982	200	7Z	20919.11	$28184^{\circ}_4 - 49103_4$	−2
4770.834	150	2	20954.84	$38422^{\circ}_1 - 59377_2$	+7
4765.51	1		20978.25		
4765.080	3		20980.14	$25270_3 - 46251^{\circ}_3$	−2
4762.587	300	5Z	20991.12		
4761.55	2		20995.69		
4758.320	80	4Z	21009.95		
4757.559	40	1	21013.31	$25068^{\circ}_1 - 46081_0$	−1
4755.15	4		21023.95	$27677_2 - 48701^{\circ}_2$	+2
4754.370	5		21027.40	$28195^{\circ}_2 - 49223_3$	+1
4751.789	400	10Z	21038.82	$28184^{\circ}_4 - 49223_3$	−2
4751.22	3		21041.34	$27677_2 - 48719^{\circ}_1$	−2
4745.27	2		21067.72		
4743.356	250	7Z	21076.22	$28184^{\circ}_4 - 49260_4$	−1
4741.574	8		21084.15	$27677_2 - 48761^{\circ}_1$	−3
4739.330	1		21094.13		
4736.89	1		21104.99		
4736.525	15		21106.62		
4732.505	18		21124.55	$23188^{\circ}_2 - 44313_2$	+2
4732.14	2		21126.18		
4731.04	2		21131.09		
4723.85	1		21163.25		
4722.53	2		21169.17	$23188^{\circ}_2 - 44357_2$	+9
4722.148	10		21170.88		
4720.79	2000	50Z	21176.97	$25859^{\circ}_5 - 47036_6$	+3
4718.56	3000	500Z	21186.98		
4718.34	200	2	21187.97	$25859^{\circ}_5 - 47047_4$	−4
4717.375	30		21192.30	$23188^{\circ}_2 - 44380_3$	+0
4715.16	6		21202.26	$27445^{\circ}_3 - 48647_3$	+11
4714.700	700	40	21204.32	$24751_2 - 45956^{\circ}_2$	+0
4712.73	2		21213.19		
4709.96	15	1	21225.66		
4709.330	40	1	21228.50	$25859^{\circ}_5 - 47088_5$	+3
4706.81	2		21239.87		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4706.700	2		21240.36		
4704.886	300	20	21248.55	$28195^{\circ}_{2} - 49444_{3}$	−1
4702.982	10		21257.16		
4702.355	200	10	21259.99	$28184^{\circ}_{4} - 49444_{3}$	−2
4696.286	40	2	21287.46	$27677_{2} - 48965^{\circ}_{2}$	−3
4695.832	7		21289.52	$46554_{6} - 67844^{\circ}_{6}$	−1
4695.70	2		21290.12		
4693.06	1		21302.10		
4689.069	15		21320.23		
4687.593	1000	50Z	21326.94	$24751_{2} - 46078^{\circ}_{1}$	−2
4685.28	4		21337.47		
4684.268	1500	80Z	21342.08	$27445^{\circ}_{3} - 48787_{4}$	+1
4681.666	10	1	21353.94		
4681.514	3		21354.63		
4680.136	6	1	21360.92		
4679.625	15		21363.25	$25068^{\circ}_{1} - 46431_{2}$	−1
4677.432	90	1	21373.27	$27314^{\circ}_{6} - 48688_{6}$	+1
4676.67	6		21376.75	$25068^{\circ}_{1} - 46444_{1}$	+2
4675.20	1		21383.47		
4673.62	1		21390.70		
4672.125	1		21397.55		
4671.701	30	1	21399.49	$25068^{\circ}_{1} - 46467_{2}$	+2
4669.510	2		21409.53		
4666.735	200	10Z	21422.26	$24751_{2} - 46174^{\circ}_{1}$	+0
4664.565	30		21432.23	$24751_{2} - 46184^{\circ}_{2}$	+2
4663.873	5		21435.41		
4663.44	1		21437.40	$27445^{\circ}_{3} - 48883_{2}$	−8
4661.878	5		21444.58		
4660.057	4		21452.96	$42725^{\circ}_{2} - 64178_{2}$	+2
4659.780	20		21454.23	$28184^{\circ}_{4} - 49638_{5}$	+2
4658.87	4*d*		21458.43		
4658.443	2	2	21460.39		
4656.971	3000	500Z	21467.17	$24489_{1} - 45956^{\circ}_{2}$	+1
4654.46	4		21478.76		
4653.310	5		21484.06		
4651.67	500	20Z	21491.64	$27314^{\circ}_{6} - 48806_{6}$	−1
4650.99	3		21494.78		
4650.05	1500	100Z	21499.13	$24751_{2} - 46251^{\circ}_{3}$	+1
4646.91	7		21513.65		
4644.54	3000	100Z	21524.63	$23188^{\circ}_{2} - 44713_{3}$	+3
4641.945	6	2	21536.66		
4638.81	3		21551.22		
4637.341	3		21558.04		
4634.38	4		21571.82	$23188^{\circ}_{2} - 44760_{2}$	−3
4633.196	30	4	21577.33		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4631.09	2		21587.14		
4630.522	20		21589.79	$24489_1 - 46078^{\circ}_1$	−2
4629.833	200	3	21593.00	$24489_1 - 46082^{\circ}_0$	−6
4628.861	2		21597.54		
4628.43	2		21599.55		
4627.556	4		21603.63		
4627.23	5		21605.15		
4626.054	2		21610.64		
4625.47	2		21613.37		
4624.41	1200	50Z	21618.33	$24751_2 - 46370^{\circ}_1$	−3
4621.80	3		21630.53		
4618.487	15		21646.05	$23188^{\circ}_2 - 44834_1$	−4
4617.900	5		21648.80		
4617.46	1		21650.86		
4615.947	300	15Z	21657.96	$27445^{\circ}_3 - 49103_4$	−4
4615.427	3		21660.40		
4610.172	600	30Z	21685.09	$24489_1 - 46174^{\circ}_1$	−2
4608.061	3		21695.02	$24489_1 - 46184^{\circ}_2$	−2
4606.854	1		21700.71		
4602.354	2		21721.93		
4594.033	10		21761.27		
4593.375	30	5	21764.39	$27314^{\circ}_6 - 49079_5$	−3
4591.780	5		21771.95		
4590.834	2000	200Z	21776.43	$25859^{\circ}_5 - 47636_5$	+1
4590.578	10		21777.65	$27445^{\circ}_3 - 49223_3$	−6
4589.211	1000	150Z	21784.13	$25270_3 - 47055^{\circ}_2$	−1
4585.916	40	4Z	21799.79		
4585.634	15		21801.13	$27445^{\circ}_3 - 49246_2$	−3
4582.924	60	6	21814.02	$25859^{\circ}_5 - 47673_4$	−1
4582.695	50	6	21815.11	$27445^{\circ}_3 - 49260_4$	+0
4582.355	6000*R*	600Z	21816.73	$17992^{\circ}_1 - 39808_1$	+1
4581.222	7		21822.12		
4580.724	9	1Z	21824.49		
4580.649	40	6	21824.85		
4577.722	10		21838.81		
4576.209	10000*R*	1000Z	21846.03	$17992^{\circ}_1 - 39838_2$	−1
4568.853	200	50Z	21881.20	$24489_1 - 46370^{\circ}_1$	+0
4567.368	700	60Z	21888.31	$17992^{\circ}_1 - 39880_2$	+6
4563.95	2000	200Z	21904.70	$19710^{\circ}_2 - 41615_1$	+5
4558.095	2		21932.84	$23188^{\circ}_2 - 45121_1$	−1
4555.47	3		21945.48		
4552.351	6		21960.51		
4547.788	10		21982.55		
4546.866	30	1	21987.01		
4545.770	8	1	21992.31		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4544.420	30	1	21998.84	$27445^{\circ}_{3} - 49444_{3}$	−4
4543.680	2		22002.42		
4541.452	1		22013.22		
4540.046	8	2	22020.03		
4538.678	4		22026.67		
4536.313	2		22038.16		
4533.506	1000	50Z	22051.80	$25859^{\circ}_{5} - 47911_{5}$	+0
4533.006	150	8	22054.23	$25270_{3} - 47325^{\circ}_{3}$	−6
4532.702	50	2	22055.71	$25270_{3} - 47326^{\circ}_{2}$	−4
4531.333	1500	200Z	22062.37		
4529.87	3000	400Z	22069.50	$17992^{\circ}_{1} - 40061_{2}$	+0
4520.918	2		22113.20		
4520.510	5	2	22115.20		
4520.161	200	2	22116.90	$19710^{\circ}_{2} - 41827_{3}$	−1
4513.408	1000	80Z	22149.99	$23188^{\circ}_{2} - 45338_{2}$	−2
4503.636	600	50Z	22198.05	$25859^{\circ}_{5} - 48057_{5}$	−3
4503.21	150	5	22200.15	$25270_{3} - 47471^{\circ}_{2}$	−4
4498.098	1		22225.38		
4495.840	1		22236.55		
4492.120	4		22254.96		
4490.161	2		22264.67		
4488.282	1000	60Z	22273.99	$23188^{\circ}_{2} - 45462_{3}$	−3
4483.152	8	1	22299.48		
4482.422	1500	150Z	22303.11	$24751_{2} - 47055^{\circ}_{2}$	+1
4478.271	30	1	22323.78	$27314^{\circ}_{6} - 49638_{5}$	−3
4473.005	20	2	22350.06	$30524^{\circ}_{5} - 52874_{6}$	−1
4472.470	1500	300Z	22352.74	$25068^{\circ}_{1} - 47420_{2}$	+0
4468.520	4		22372.50		
4468.18	10	1	22374.20		
4461.72	7		22406.59	$23188^{\circ}_{2} - 45595_{1}$	−3
4455.651	4	1	22437.11		
4441.031	9	2	22510.97		
4440.011	4		22516.15	$25068^{\circ}_{1} - 47584_{1}$	+3
4439.19	7000R	500Z	22520.31	$17288^{\circ}_{0} - 39808_{1}$	+3
4436.366	4		22534.65		
4434.795	20	1	22542.63		
4432.041	1		22556.64		
4430.208	900	150Z	22565.97	$24489_{1} - 47055^{\circ}_{2}$	+2
4428.980	30	1	22572.22	$25270_{3} - 47843^{\circ}_{3}$	+0
4428.782	700	100	22573.23	$24751_{2} - 47325^{\circ}_{3}$	−1
4428.02	3		22577.12	$25068^{\circ}_{1} - 47645_{1}$	−6
4427.387	600	200	22580.35	$24751_{2} - 47332^{\circ}_{1}$	+3
4422.070	1		22607.50		
4419.616	3		22620.05		
4415.202	1		22642.66		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4411.095	500	30*Z*	22663.74		
4410.230	200	8	22668.19	$25270_3 - 47939^{\circ}_4$	−1
4407.081	5	1	22684.39		
4402.605	40	2*Z*	22707.45		
4400.332	50	2	22719.18	$24751_2 - 47471^{\circ}_2$	+2
4398.96	2000	100*Z*	22726.26	$19710^{\circ}_2 - 42436_1$	−5
4396.254	100	5*Z*	22740.25		
4395.52	1		22744.05		
4394.973	70	3	22746.88	$24751_2 - 47498^{\circ}_1$	+0
4394.177	25	2	22751.00		
4393.688	2000	400*hZ*	22753.53	$25068^{\circ}_1 - 47821_2$	−2
4387.32	30	2	22786.56		
4386.50	200	5	22790.81		
4385.14	100	2	22797.88		
4384.29	3		22802.30		
4381.87	2	1	22814.90		
4379.452	200	20	22827.49		
4379.268	60	3	22828.45	$25859^{\circ}_5 - 48688_6$	−5
4377.527	3000	300*hl*	22837.53	$24489_1 - 47326^{\circ}_2$	−2
4376.456	2000	200*Z*	22843.12	$24489_1 - 47332^{\circ}_1$	−4
4373.116	20	1	22860.57		
4368.679	100	5*h*	22883.78	$25270_3 - 48154^{\circ}_3$	−2
4368.23	10		22886.14		
4366.284	1000	200*hl*	22896.34		
4363.71	3		22909.84		
4361.639	100	7*h*	22920.72	$24489_1 - 47409^{\circ}_0$	+0
4359.528	1000	150*hZ*	22931.82	$24489_1 - 47420^{\circ}_1$	−1
4359.165	3	2	22933.73		
4356.676	500	40	22946.83	$25859^{\circ}_5 - 48806_6$	−6
4354.037	2	1	22960.74		
4353.570	500	90*hl*	22963.20	$25270_3 - 48234^{\circ}_2$	−2
4352.948	2000	400*Z*	22966.48	$25270_3 - 48237^{\circ}_3$	−1
4351.67	1		22973.23		
4350.006	40	1	22982.01	$24489_1 - 47471^{\circ}_2$	+2
4349.470	2	1	22984.85		
4347.66	3		22994.42		
4344.762	300	20	23009.75	$24489_1 - 47498^{\circ}_1$	+2
4343.632	3		23015.74		
4343.110	2		23018.50		
4339.71	4		23036.54		
4339.38	30		23038.29		
4337.599	80	20	23047.75		
4336.430	1000	150*hl*	23053.96	$25270_3 - 48324^{\circ}_2$	−3
4335.360	20	1	23059.65		
4333.909	400	40	23067.37	$25068^{\circ}_1 - 48135_2$	+0

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4330.488	20	1	23085.59		
4329.718	70	4*Z*	23089.70		
4326.404	2000	200*Z*	23107.39	$24751_2 - 47859^\circ_1$	+2
4313.567	30	1	23176.15		
4313.156	70	4	23178.36	$25270_3 - 48449^\circ_2$	−1
4312.991	60	3	23179.25		
4312.356	600	40	23182.66		
4311.86	2		23185.33		
4309.823	3000	300*Z*	23196.28		
4307.820	300	10	23207.07	$23188^\circ_2 - 46395_3$	−1
4305.966	5000	2000*Z*	23217.06	$25270_3 - 48487^\circ_3$	−2
4305.484	150	20	23219.66	$25859^\circ_5 - 49079_5$	+0
4300.984	1000	80*Z*	23243.95	$25859^\circ_5 - 49103_4$	+0
4295.88	3		23271.57		
4295.026	500	50*hs*	23276.20		
4294.473	30	2	23279.19	$23188^\circ_2 - 46467_2$	+1
4292.99	3		23287.24		
4292.615	10	1	23289.27	$25068^\circ_1 - 48357_1$	−4
4292.083	70	2	23292.16	$25068^\circ_1 - 48360_1$ $23188^\circ_2 - 46480_3$	−5 +3
4291.954	3	2	23292.86		
4289.605	1		23305.61		
4288.840	80	7	23309.77		
4284.170	2000	500*hZ*	23335.18		
4282.098	40	2	23346.47		
4281.850	20	1	23347.82		
4277.738	4000	1000*Z*	23370.26	$24489_1 - 47859^\circ_1$	+6
4275.66	5		23381.62		
4275.48	2		23382.61		
4273.74	10	1	23392.13		
4272.647	400	40*hl*	23398.11		
4272.103	1000	40	23401.09	$25859^\circ_5 - 49260_4$	+2
4271.798	600	70*hl*	23402.76	$24751_2 - 48154^\circ_3$	+0
4268.39	1		23421.45		
4267.132	500	30*hl*	23428.35	$48761^\circ_1 - 72190_2$	−1
4266.983	300	30	23429.17		
4266.70	20	1	23430.72	$25270_3 - 48701^\circ_2$	+2
4266.135	3*d*		23433.82		
4261.346	20	1	23460.16	$24751_2 - 48212^\circ_1$	+1
4258.743	200	20*hl*	23474.50		
4257.550	40	10	23481.08		
4257.36	60	3	23482.12	$24751_2 - 48234^\circ_2$	−5
4256.756	1000	100	23485.46	$24751_2 - 48237^\circ_3$	+2
4253.363	3		23504.19		
4253.292	1		23504.58		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4252.941	20	1	23506.52	$24751_2 - 48258^\circ_1$	+0
4251.521	2000	200*Z*	23514.37	$19710^\circ_2 - 43224_2$	−2
4246.88	4		23540.07		
4245.245	10	1	23549.14		
4243.92	3		23556.49		
4242.86	4		23562.37		
4240.95	6		23572.98	$24751_2 - 48324^\circ_2$	+4
4238.63	2	1	23585.89		
4237.00	5		23594.96		
4235.69	7		23602.26		
4235.49	2		23603.37		
4233.445	150	8*Z*	23614.77	$40563^\circ_1 - 64178_2$	+4
4231.972	10000	1000*Z*	23622.99	$17992^\circ_1 - 41615_1$	−4
4229.657	4		23635.92		
4226.152	300	10*h*	23655.52		
4223.621	50	2	23669.70		
4222.32	5		23676.99		
4220.507	7	1	23687.16		
4219.706	500	20*h*	23691.66		
4219.247	1000	200	23694.24	$25270_3 - 48965^\circ_2$	−2
4218.693	3000	600*Z*	23697.35	$24751_2 - 48449^\circ_2$	+3
4216.766	20		23708.18		
4215.485	2		23715.38		
4214.29	3		23722.11		
4213.962	50*d*	20*h*	23723.95		
4213.106	10	1	23728.77		
4211.82	2000	300*Z*	23736.02	$24751_2 - 48487^\circ_3$	−1
4210.48	5		23743.57		
4210.299	200	20*Z*	23744.59		
4210.225	15		23745.01	$24489_1 - 48234^\circ_2$	−1
4209.342	8	1	23749.99		
4207.32	6	1	23761.41		
4205.907	2		23769.39	$24489_1 - 48258^\circ_1$	+2
4205.785	80	6*h*	23770.08	$25068^\circ_1 - 48838_1$	−3
4204.195	300	5	23779.07	$25859^\circ_5 - 49638_5$	+2
4202.907	6	2	23786.35		
4201.864	3	1	23792.26		
4201.291	200	8*h*	23795.50		
4200.72	60	1	23798.74		
4198.18	2		23813.14		
4197.876	400	100*h*	23814.86	$25068^\circ_1 - 48883_2$	−2
4196.54	1		23822.44		
4195.056	2		23830.87		
4194.39	2		23834.65		
4194.21	2*d*		23835.68	$24489_1 - 48324^\circ_2$	−11

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4191.36	1		23851.88		
4189.15	3		23864.47		
4188.993	70	5*h*	23865.36	$48324^{\circ}_{2} - 72190_{2}$	+5
4187.73	1		23872.56		
4186.75	1		23878.15		
4184.289	2	1	23892.19		
4183.129	5		23898.81		
4182.07	9	1	23904.87		
4179.95	20		23916.99		
4175.868	100	10	23940.37		
4174.56	3000	300*Z*	23947.87	$17992^{\circ}_{1} - 41939_{0}$	−2
4174.259	80	4*h*	23949.60	$24751_{2} - 48701^{\circ}_{2}$	−5
4173.134	9	1	23956.05	$48234^{\circ}_{2} - 72190_{2}$	−3
4172.422	200	20	23960.14	$24489_{1} - 48449^{\circ}_{2}$	−3
4171.222	20	1	23967.03	$24751_{2} - 48719^{\circ}_{1}$	−5
4169.260	50	5*h*	23978.31		
4169.141	50	5	23979.00		
4166.743	40	3	23992.80	$36060_{4} - 60053^{\circ}_{5}$	+0
4163.770	3		24009.93	$24751_{2} - 48761^{\circ}_{1}$	+4
4163.502	10	2	24011.47	$25270_{3} - 49282^{\circ}_{4}$	+2
4160.243	4		24030.28	$43814_{6} - 67844^{\circ}_{6}$	+5
4159.008	6	1	24037.42		
4155.385	8	1	24058.37		
4155.123	50	2*h*	24059.89		
4154.83	4		24061.59		
4152.290	2		24076.31		
4152.058	3		24077.65		
4151.19	9	1	24082.69		
4149.066	20000*R*	2000*Z*	24095.02	$19710^{\circ}_{2} - 43805_{1}$	−2
4146.870	80	5	24107.77		
4143.498	500	30*h*	24127.39		
4140.307	8	1	24145.99		
4139.397	2		24151.30		
4139.051	500	20	24153.32	$23188^{\circ}_{2} - 47341_{2}$	+1
4134.730	20	1	24178.56	$25068^{\circ}_{1} - 49246_{2}$	−1
4132.165	15	2	24193.56	$30524^{\circ}_{5} - 54718_{5}$	+3
4131.255	2		24198.89		
4130.645	2		24202.47		
4128.934	100	4*h*	24212.50	$24489_{1} - 48701^{\circ}_{2}$	+0
4128.815	30	2	24213.19	$24751_{2} - 48965^{\circ}_{2}$	−2
4128.115	4		24217.30		
4127.170	1		24222.84		
4125.955	3		24229.98	$24489_{1} - 48719^{\circ}_{1}$	+5
4125.538	150	5*h*	24232.43	$23188^{\circ}_{2} - 47420_{2}$	−1
4125.185	20	1	24234.50		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4123.75	6	1	24242.93		
4122.274	4	1	24251.61		
4122.143	8	1	24252.38		
4121.902	200	20	24253.80	$24751_2 - 49005^\circ_1$	+1
4119.25	30	20	24269.42		
4119.087	30	3	24270.38		
4118.180	8	2	24275.72		
4118.07	10	1	24276.37		
4116.89	1		24283.33		
4116.000	4		24288.58		
4115.70	1		24290.35		
4114.694	1		24296.29		
4113.805	2		24301.54		
4113.389	40	2*h*	24304.00		
4111.07	8		24317.71		
4109.79	40	2	24325.28		
4109.574	3000	400*Z*	24326.56	$17288^\circ_0 - 41615_1$	−4
4108.542	8	1	24332.67		
4107.222	20	3*h*	24340.49		
4104.60	2		24356.04		
4104.05	4		24359.30		
4101.335	30	3	24375.43	$24751_2 - 49127^\circ_1$	−1
4099.338	20	1	24387.30		
4098.920	4		24389.79		
4097.080	6	2	24400.74		
4089.908	20	4	24443.53		
4089.68	20000*R*	3000*Z*	24444.89	$17992^\circ_1 - 42436_0$	−1
4087.67	5	1	24456.91	$23188^\circ_2 - 47645_1$	+3
4087.480	30*d*	5*d*	24458.05	$23188^\circ_2 - 47646_3$	−5
4087.343	20	3	24458.87		
4084.47	4		24476.07	$24489_1 - 48965^\circ_2$	+1
4083.648	15	4*h*	24481.00		
4083.346	4		24482.81		
4082.992	500	20	24484.93	$23188^\circ_2 - 47673_3$	+0
4082.586	2		24487.37		
4078.000	10*h*		24514.90		
4077.713	30	10	24516.63	$24489_1 - 49005^\circ_1$	−1
4074.359	3		24536.81		
4073.846	8		24539.90	$17992^\circ_1 - 42531_2$	+4
4073.288	1		24543.26		
4072.923	2		24545.46		
4071.115	2		24556.36		
4067.461	4		24578.42		
4067.115	30	2	24580.51		
4067.00	1		24581.21		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
4065.963	20*h*	1	24587.48		
4063.726	1000	150	24601.01	$19710^{\circ}_{2} - 44311_{1}$	+2
4063.455	3000	500	24602.65	$19710^{\circ}_{2} - 44313_{2}$	−1
4061.382	10	1	24615.21		
4059.470	40	7*Z*	24626.80		
4058.625	60	6	24631.93		
4058.404	150	15	24633.27	$23188^{\circ}_{2} - 47821_{2}$	+1
4055.24	2		24652.49		
4052.283	5000	1000*Z*	24670.48	$19710^{\circ}_{2} - 44380_{3}$	+5
4052.072	1000	60*Z*	24671.76	$23188^{\circ}_{2} - 47860_{3}$	+0
4051.935	30	3	24672.60		
4046.37	1		24706.53		
4044.464	3	1	24718.17		
4039.938	15	1	24745.86		
4038.98	2	1	24751.73		
4036.772	20	15	24765.27		
4035.855	5	3	24770.90		
4035.51	5	1	24773.01		
4021.56	2	1	24858.95		
4018.966	30	3	24874.99	$35178_{5} - 60053^{\circ}_{5}$	−1
4010.825	3		24925.48		
4007.962	10	5	24943.28	$29774^{\circ}_{4} - 54718_{5}$	−1
4007.356	2000	500*Z*	24947.06	$23188^{\circ}_{2} - 48135_{2}$	−2
4006.828	15	2	24950.34		
4005.65	2*h*		24957.68		
4002.04	3*h*		24980.19		
4000.46	10		24990.06		
4000.212	4	1	24991.61		
3998.879	2	1	24999.94		
3998.133	3		25004.60		
3993.753	100	10*Z*	25032.03		
3990.885	10000*R*	1000*Z*	25050.01	$19710^{\circ}_{2} - 44760_{2}$	+3
3987.99	50000*A*	30000*Z*	25068.20	$0_{0} - 25068^{\circ}_{1}$	−3
3979.710	10	2	25120.35		
3979.095	60	4	25124.24	$19710^{\circ}_{2} - 44834_{1}$	+1
3975.283	2000	100*Z*	25148.33	$17288^{\circ}_{0} - 42436_{1}$	+7
3973.87	10	3	25157.27		
3972.18	3		25167.97		
3972.01	7		25169.05	$23188^{\circ}_{2} - 48357_{1}$	+3
3969.89	4	1	25182.49		
3963.07	5		25225.83		
3961.98	70	6*Z*	25232.77	$17992^{\circ}_{1} - 43224_{2}$	−1
3961.731	5	1	25234.35		
3961.503	5	1	25235.80		
3957.270	6	2	25262.80		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
3957.05	5		25264.20		
3943.29	4	1	25352.36		
3939.780	10	1	25374.95		
3934.182	3000*R*	200	25411.05	$19710^{\circ}_{2} - 45121_{1}$	+7
3931.273	4		25429.85		
3929.30	1		25442.62		
3926.724	30	3	25459.31	$23188^{\circ}_{2} - 48647_{3}$	+5
3924.527	10	2	25473.56		
3911.272	600	60*Z*	25559.89	$27314^{\circ}_{6} - 52874_{6}$	+2
3910.653	20	4	25563.94		
3905.51	5	1	25597.60		
3902.386	10*h*	4	25618.09		
3901.06	10	1	25626.80	$38551^{\circ}_{2} - 64178_{2}$	+3
3900.85	4000*R*	500*Z*	25628.18	$19710^{\circ}_{2} - 45338_{2}$	+4
3897.555	10	2	25649.84	$23188^{\circ}_{2} - 48838_{1}$	+3
3896.742	20	3	25655.20		
3890.767	20	3	25694.59	$23188^{\circ}_{2} - 48883_{2}$	+0
3882.068	40	4	25752.17	$19710^{\circ}_{2} - 45462_{3}$	+2
3875.76	1		25794.08		
3873.246	5	1	25810.82		
3872.852	5000*R*	1000*Z*	25813.45	$17992^{\circ}_{1} - 43805_{1}$	+4
3868.907	4	1	25839.77		
3865.95	3*h*		25859.53		
3865.43	1		25863.01		
3865.14	1		25864.95		
3864.33	20*h*		25870.37		
3862.59	2		25882.03		
3862.46	1		25882.90		
3862.18	10	1	25884.77	$19710^{\circ}_{2} - 45595_{1}$	+2
3860.975	2		25892.85		
3860.815	10		25893.93		
3860.64	3	1	25895.10		
3856.00	3		25926.26		
3855.883	50	8	25927.04		
3854.108	2		25938.99		
3851.65	1		25955.54		
3851.36	5		25957.49		
3850.98	7		25960.05		
3849.54	1		25969.76		
3848.792	5	1	25974.81		
3845.79	1		25995.09		
3845.64	3		25996.10		
3845.35	2		25998.06		
3843.30	2		26011.93		
3839.907	1500	80*Z*	26034.91	$23188^{\circ}_{2} - 49223_{3}$	+8

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
3838.287	80	4*Z*	26045.90		
3838.02	7	1	26047.71		
3837.57	5	1	26050.77		
3836.46	5	1	26058.30	$23188^{\circ}_{2} - 49246_{2}$	+3
3834.35	1		26072.64		
3830.905	2		26096.09		
3828.673	20	5	26111.30	$46078^{\circ}_{1} - 72190_{2}$	+1
3826.620	5	1	26125.31		
3824.956	1		26136.68		
3823.241	5	1	26148.40		
3817.09	1		26190.53		
3815.203	200	10	26203.49	$19710^{\circ}_{2} - 45913_{2}$	+2
3808.809	10	1	26247.48	$36060_{4} - 62308^{\circ}_{5}$	+0
3806.73	2		26261.81		
3801.386	2		26298.73		
3801.263	10	1	26299.58		
3798.402	4000	400	26319.39	$17992^{\circ}_{1} - 44311_{1}$	+2
3798.162	3000	300	26321.05	$17992^{\circ}_{1} - 44313_{2}$	+1
3796.495	2		26332.61		
3795.785	3	1	26337.53		
3791.741	7000	600*Z*	26365.62	$17992^{\circ}_{1} - 44357_{2}$	+3
3782.80	1		26427.94		
3781.415	1		26437.62		
3774.323	700	40*Z*	26487.29		
3770.095	2000*R*	500*Z*	26517.00	$17288^{\circ}_{0} - 43805_{1}$	+2
3767.714	8	2	26533.75	$28184^{\circ}_{4} - 54718_{5}$	+2
3764.59	1		26555.77		
3762.93	1		26567.49		
3760.481	200	6	26584.79		
3751.62	1		26647.58		
3751.13	1		26651.06		
3748.55	1		26669.40		
3746.33	3		26685.20	$19710^{\circ}_{2} - 46395_{3}$	−1
3744.943	40	5	26695.09		
3744.09	2		26701.17		
3741.296	50	6	26721.11	$19710^{\circ}_{2} - 46431_{2}$	+1
3739.411	30	3	26734.58	$19710^{\circ}_{2} - 46444_{1}$	+1
3737.80	2		26746.10		
3736.901	10	10	26752.53		
3736.237	400	100*Z*	26757.29	$19710^{\circ}_{2} - 46467_{2}$	−2
3734.694	3000*R*	300*Z*	26768.34	$17992^{\circ}_{1} - 44760_{2}$	−2
3734.435	1000	100*Z*	26770.20	$19710^{\circ}_{2} - 46480_{3}$	−6
3724.36	200		26842.62	$17992^{\circ}_{1} - 44834_{1}$	+1
3717.28	3		26893.74		
3717.23	1		26894.10		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
3715.409	50	4	26907.28	$30524^{\circ}_{5} - 57432_{6}$	−5
3712.666	10		26927.16		
3711.95	1		26932.36		
3706.023	10	5*Z*	26975.43		
3705.745	1		26977.45		
3700.580	1000	40*Z*	27015.10	$25859^{\circ}_{5} - 52874_{6}$	+0
3699.514	3000	100	27022.89	$17288^{\circ}_{0} - 44311_{1}$	−5
3698.81	2		27028.03		
3691.67	10	5	27080.30		
3688.81	10		27101.30		
3688.438	10	1	27104.03		
3684.997	500	40*Z*	27129.34	$17992^{\circ}_{1} - 45121_{1}$	−2
3679.932	200	20	27166.68	$19710^{\circ}_{2} - 46877_{1}$	−3
3677.81	2		27182.35		
3677.25	2		27186.49		
3675.720	20		27197.81		
3666.62	200	4*Z*	27265.31		
3659.427	4		27318.90		
3658.78	1		27323.73		
3657.233	3*h*		27335.29		
3656.312	10	2	27342.17		
3655.729	2000*R*	100*Z*	27346.53	$17992^{\circ}_{1} - 45338_{2}$	+1
3648.150	150	15	27403.34	$27314^{\circ}_{6} - 54718_{5}$	+1
3647.25	1		27410.11		
3639.445	20	8	27468.89		
3634.525	30	20	27506.07		
3630.975	4		27532.96		
3629.58	3		27543.54		
3629.233	800	15*Z*	27546.18	$17288^{\circ}_{0} - 44834_{1}$	+1
3624.109	10	1	27585.12		
3621.743	400	10	27603.14	$17992^{\circ}_{1} - 45595_{1}$	+1
3620.65	2		27611.48	$36060_{4} - 63672^{\circ}_{5}$	−2
3614.994	50	7*Z*	27654.68	$29774^{\circ}_{4} - 57429_{5}$	−5
3611.994	20	1	27677.65		
3608.356	3		27705.55	$29774^{\circ}_{4} - 57480_{5}$	−3
3607.703	700	70	27710.56	$19710^{\circ}_{2} - 47420_{2}$	−1
3598.662	9	1	27780.18	$32273_{4} - 60053^{\circ}_{5}$	+0
3596.416	3		27797.53	$44392^{\circ}_{3} - 72190_{2}$	+3
3594.93	1		27809.02		
3591.844	150	15	27832.91	$17288^{\circ}_{0} - 45121_{1}$	−2
3580.404	100	10	27921.84	$17992^{\circ}_{1} - 45913_{2}$	−1
3580.125	100	20	27924.01	$19710^{\circ}_{2} - 47634_{2}$	−1
3578.710	10	2	27935.06	$19710^{\circ}_{2} - 47645_{1}$	+4
3578.561	600	60*Z*	27936.22	$19710^{\circ}_{2} - 47646_{3}$	−1
3575.125	20	2	27963.07	$19710^{\circ}_{2} - 47673_{3}$	+1

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
3573.458	3	3	27976.11		
3573.247	20	2	27977.76		
3572.448	50		27984.02		
3569.500	2		28007.13		
3566.905	2	1	28027.51		
3559.570	10		28085.26		
3559.032	1000	50Z	28089.50	$17992^{\circ}_{1} - 46081_{0}$	−3
3556.263	200	15	28111.38	$19710^{\circ}_{2} - 47821_{2}$	−2
3556.013	10		28113.35		
3551.405	1		28149.83	$19710^{\circ}_{2} - 47860_{3}$	−6
3548.18	50	7	28175.41	$19710^{\circ}_{2} - 47885_{1}$	−1
3547.756	5	1	28178.78		
3544.162	10	1	28207.35	$30524^{\circ}_{5} - 58732_{4}$	+1
3541.924	8	1	28225.18		
3539.33	200		28245.86		
3536.815	3*h*		28265.95		
3531.725	20	1	28306.68	$17288^{\circ}_{0} - 45595_{1}$	−2
3528.075	2		28335.97		
3523.148	3	2	28375.59		
3521.773	5		28386.67	$30524^{\circ}_{5} - 58911_{5}$	+0
3519.82	2		28402.42		
3518.457	300	20	28413.43		
3517.001	500	60Z	28425.19	$19710^{\circ}_{2} - 48135_{2}$	−2
3515.238	20	2	28439.44	$17992^{\circ}_{1} - 46431_{2}$	−4
3513.573	400	30Z	28452.92	$17992^{\circ}_{1} - 46444_{1}$	−3
3510.764	600	50Z	28475.68	$17992^{\circ}_{1} - 46467_{2}$	−1
3504.737	3		28524.65	$30207^{\circ}_{3} - 58732_{4}$	−3
3503.988	20	7	28530.75	$43659^{\circ}_{1} - 72190_{2}$	−7
3500.813	10	5	28556.62	$30524^{\circ}_{5} - 59081_{4}$	−2
3495.623	10	1	28599.02	$19710^{\circ}_{2} - 48309_{1}$	+0
3491.133	2		28635.80		
3489.746	60	15	28647.18	$19710^{\circ}_{2} - 48357_{1}$	+3
3489.399	8	1	28650.03	$19710^{\circ}_{2} - 48360_{1}$	−1
3488.855	200	1	28654.50		
3487.971	20	5	28661.76		
3487.603	2		28664.78		
3484.176	7		28692.98		
3481.68	30		28713.55		
3470.106	10	3	28809.31	$19710^{\circ}_{2} - 48519_{1}$	−1
3467.26	10		28832.96		
3464.37	30000*A*	2000Z	28857.01	$0_{0} - 28857^{\circ}_{1}$	+0
3464.190	100	20	28858.51	$25859^{\circ}_{5} - 54718_{5}$	−6
3462.338	20	15	28873.95	$30207^{\circ}_{3} - 59081_{4}$	−3
3461.004	100	9	28885.08	$17992^{\circ}_{1} - 46877_{1}$	−2
3460.269	3000*R*	60Z	28891.21		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
3459.663	100	10*Z*	28896.27		
3459.095	60	3	28901.02		
3458.391	1000	20	28906.90		
3456.525	10		28922.50		
3454.75	10		28937.36	$19710^{\circ}_{2} - 48647_{3}$	−3
3452.398	300	30*Z*	28957.08	$29774^{\circ}_{4} - 58732_{4}$	−2
3451.82	2		28961.93		
3451.174	300*h*	1*h*	28967.35		
3443.587	30	20*Z*	29031.17		
3441.07	3		29052.40		
3437.17	5	1	29085.36		
3433.167	100	10	29119.28		
3432.143	150	15	29127.96	$19710^{\circ}_{2} - 48838_{1}$	+2
3431.140	700	20*Z*	29136.48	$29774^{\circ}_{4} - 58911_{5}$	+5
3431.107	3000*R*	80*Z*	29136.76		
3428.782	700	30	29156.52	$17288^{\circ}_{0} - 46444_{1}$	+0
3426.878	150	30	29172.71	$19710^{\circ}_{2} - 48883_{2}$	−1
3426.044	3000*R*	100*Z*	29179.82		
3424.610	1		29192.03		
3424.295	1		29194.72		
3420.345	150	20	29228.43		
3419.807	3		29233.03	$19710^{\circ}_{2} - 48943_{1}$	+0
3418.390	400	50*Z*	29245.15	$28184^{\circ}_{4} - 57429_{5}$	−2
3417.044	250	20	29256.67		
3412.453	80	40*Z*	29296.03	$28184^{\circ}_{4} - 57480_{5}$	+0
3411.240	10	8	29306.45	$29774^{\circ}_{4} - 59081_{4}$	+4
3408.95	2		29326.13		
3407.922	2		29334.98		
3406.200	200	5	29349.81	$17992^{\circ}_{1} - 47341_{2}$	+0
3397.037	50	2	29428.97	$17992^{\circ}_{1} - 47420_{2}$	+2
3394.519	3		29450.80		
3393.972	30	3	29455.55		
3389.904	8*h*		29490.89		
3387.505	200*r*	50*Z*	29511.78		
3387.370	20	2	29512.96	$19710^{\circ}_{2} - 49223_{3}$	−1
3385.329	2		29530.75		
3384.682	200	15	29536.39	$19710^{\circ}_{2} - 49246_{2}$	−1
3382.537	20	20	29555.12		
3379.386	2	2	29582.68		
3378.698	50	3	29588.70	$17288^{\circ}_{0} - 46877_{1}$	+4
3378.286	60	4	29592.31	$17992^{\circ}_{1} - 47584_{1}$	−2
3372.576	500	40	29642.41	$17992^{\circ}_{1} - 47634_{2}$	+1
3371.325	100	10	29653.41	$17992^{\circ}_{1} - 47645_{1}$	+2
3371.090	2		29655.48		
3367.324	1		29688.64		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
3366.928	10		29692.13		
3365.181	5		29707.55		
3362.770	1		29728.85		
3362.145	1		29734.37		
3361.927	4		29736.30		
3355.618	1		29792.21		
3353.607	1		29810.07		
3352.880	60	4	29816.54		
3351.382	6		29829.86	$17992^{\circ}_{1} - 47821_{2}$	+9
3351.265	20	20	29830.90		
3350.357	1		29838.99		
3350.209	3		29840.31		
3349.713	1		29844.73		
3347.016	2		29868.77		
3346.504	30	30	29873.34		
3345.958	2		29878.22		
3345.575	5		29881.64		
3345.012	20		29886.67		
3344.507	1		29891.18		
3344.212	30	3	29893.82	$17992^{\circ}_{1} - 47885_{1}$	+1
3339.644	2		29934.70		
3339.075	10*h*		29939.80		
3336.68	20	1	29961.29		
3332.150	9		30002.02		
3331.95	1		30003.82		
3329.93	4		30022.03		
3328.51	2		30034.83	$32273_{4} - 62308^{\circ}_{5}$	−3
3327.195	3	3	30046.70		
3319.674	5		30114.77	$27314^{\circ}_{6} - 57429_{5}$	+1
3319.412	700*r*	50*Z*	30117.15	$27314^{\circ}_{6} - 57432_{6}$	+2
3316.496	300	30*Z*	30143.63	$17992^{\circ}_{1} - 48135_{2}$	+4
3314.533	20	5	30161.48		
3314.27	1		30163.88		
3305.252	20	20	30246.17		
3302.978	3		30266.99		
3302.368	7		30272.58		
3301.481	1		30280.72		
3299.828	200	10*Z*	30295.89	$17288^{\circ}_{0} - 47584_{1}$	−1
3299.647	2		30297.55		
3297.486	8		30317.40	$17992^{\circ}_{1} - 48309_{1}$	+0
3293.685	7		30352.39		
3293.19	10		30356.95	$17288^{\circ}_{0} - 47645_{1}$	−1
3292.26	20		30365.53	$17992^{\circ}_{1} - 48357_{1}$	−1
3291.946	20		30368.42	$17992^{\circ}_{1} - 48360_{1}$	+0
3282.33	3		30457.39		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
3278.614	50	1	30491.91		
3278.56	5		30492.41		
3276.218	15		30514.21		
3274.770	6		30527.70	$17992^{\circ}_{1} - 48519_{1}$	−1
3272.644	30		30547.53	$28184^{\circ}_{4} - 58732_{4}$	−2
3268.811	2		30583.35		
3267.890	150	2	30591.97		
3267.313	10		30597.37	$17288^{\circ}_{0} - 47885_{1}$	+0
3265.247	2		30616.73		
3253.545	20	1	30726.84	$28184^{\circ}_{4} - 58911_{5}$	−4
3253.023	3		30731.77		
3244.46	2		30812.88		
3241.86	30	1	30837.59		
3240.946	20	1	30846.29	$17992^{\circ}_{1} - 48838_{1}$	−4
3239.580	200	5	30859.29	$30524^{\circ}_{5} - 61384_{5}$	+1
3237.888	10		30875.42		
3236.24	10		30891.14	$17992^{\circ}_{1} - 48883_{2}$	+4
3235.635	2		30896.92	$28184^{\circ}_{4} - 59081_{4}$	+7
3235.520	4		30898.01		
3229.93	2		30951.49	$17992^{\circ}_{1} - 48943_{1}$	+8
3227.478	100	2	30975.00		
3222.696	150	3	31020.96	$17288^{\circ}_{0} - 48309_{1}$	−1
3217.40	5		31072.02	$17288^{\circ}_{0} - 48360_{1}$	+3
3216.66	2		31079.17		
3207.870	2		31164.33		
3207.380	6		31169.09		
3195.349	15		31286.44	$27445^{\circ}_{3} - 58732_{4}$	+2
3183.90	3		31398.94	$32273_{4} - 63672^{\circ}_{5}$	+6
3183.07	2		31407.13		
3182.09	1		31416.80		
3169.558	10		31541.01		
3166.644	10		31570.04	$25859^{\circ}_{5} - 57429_{5}$	+4
3166.407	10		31572.40	$25859^{\circ}_{5} - 57432_{6}$	+3
3163.985	4		31596.57	$27314^{\circ}_{6} - 58911_{5}$	+10
3162.737	4		31609.03	$29774^{\circ}_{4} - 61384_{5}$	−1
3162.293	50	5	31613.47		
3161.55	2		31620.90	$25859^{\circ}_{5} - 57480_{5}$	+4
3158.145	1		31654.99	$17288^{\circ}_{0} - 48943_{1}$	+1
3152.880	2		31707.85		
3147.450	1		31762.55		
3130.862	2		31930.83		
3117.318	2		32069.56		
3112.742	5		32116.70		
3100.745	5		32240.96		
3089.04	10		32363.12		

TABLE 4. *Observed and classified lines of* Yb I—Continued

Wavelength (air) Å	Intensity		Wavenumber cm^{-1}	Classification	O − C 0.01 cm^{-1}
	Meggers Lamp	Thomson Lamp			
3085.21	8		32403.29		
3081.142	2		32446.07		
3079.264	7	1	32465.86		
3074.63	3		32514.79		
3074.60	2		32515.11		
3070.98	1		32553.44		
3060.440	5		32665.54	$35178_5 - 67844^{\circ}_6$	−2
3041.180	7		32872.41	$25859^{\circ}_5 - 58732_4$	+3
3027.476	7		33021.20		
3011.218	7		33199.48	$28184^{\circ}_4 - 61384_5$	−1
3010.735	2		33204.81		
3009.21	2		33221.63	$25859^{\circ}_5 - 59081_4$	−5
3005.118	5		33266.87		
3000.865	2		33314.01		
2952.55	4		33859.13		
2944.336	5		33953.59		
2934.360	60	3	34069.02	$27314^{\circ}_6 - 61384_5$	−6
2928.62	3		34135.79		
2927.48	3		34149.08		
2922.235	4		34210.37		
2888.24	15		34613.01		
2883.686	10	1	34667.67		
2873.490	15	1	34790.68		
2819.24	2		35460.11		
2814.14	2		35524.37	$25859^{\circ}_5 - 61384_5$	+6
2789.665	3		35836.03		
2785.903	2		35884.42		
2784.966	4		35896.49		
2671.958	1000*A*	10*Z*	37414.62	$0_0 - 37414^{\circ}_1$	+3
2652.28	2		37692.19		
2651.68	2		37700.72		
2618.800	40	1	38174.04	$0_0 - 38174^{\circ}_1$	−14
2601.87	20	1	38422.41	$0_0 - 38422^{\circ}_1$	+5
2580.36	3		38742.68		
2516.118	1		39731.80		
2464.50	1000*A*	10	40563.91	$0_0 - 40563^{\circ}_1$	−6
2324.44	30	9	43007.91		
2289.76	4		43659.24	$0_0 - 43659^{\circ}_1$	−14
2288.04	1		43692.05		
2271.11	40	2	44017.73	$0_0 - 44017^{\circ}_1$	+13
2212.60	3		45181.62	$0_0 - 45181^{\circ}_1$	−7
2155.88	3		46370.19	$0_0 - 46370^{\circ}_1$	−11