

VI.—*The Solar Spectrum at Medium and Low Altitudes. Observations of the Region between Wave-Lengths 6024 and 4861 Å.U., made at Lord Crawford's Observatory, Dun Echt, during the Years 1887 to 1889.* By LUDWIG BECKER, Ph.D., Temporary Second Assistant-Astronomer, Royal Observatory, Edinburgh.

(Read 21st July 1890.)

1. INTRODUCTION.

At the end of 1886 a method occurred to me of rapidly recording the positions of the lines of the solar spectrum, which I thought might be used with advantage for determining the faint "Telluric dry-gas lines" near *D*, mentioned in Professor PIAZZI SMYTH's maps of *The Visual Solar Spectrum in 1884*.^{*} The fundamental idea of the recording apparatus is that of magnifying by some mechanical means the motion of the grating, or prism, to such an extent that it can be recorded on a continuous fillet of paper. The viewing telescope being then firmly clamped, the exact positions of the grating can be pricked off on the strip of paper as the lines are successively brought to the fixed cross in the field of view.

For the satisfactory use of the method two conditions suggest themselves as desirable. First, the punctures should not be less than a good-sized pin hole, and the interval between the closest lines, which the spectroscope is able to separate, should be represented on the paper strip by a space of several tenths of an inch. Now, in one of ROWLAND's gratings, the angular interval between the two positions of the grating which bring the components of the *E_i* line to the same direction is but 1' second of arc in the second spectrum. To represent this small quantity by several tenths of an inch, we must either use an enormous radius or multiply the angular movement some thousands of times.

By way of experiment, I geared together on a board five pairs of well-finished wheels and pinions, belonging to an excellent screw-cutting lathe, and observed under the highest magnifying power of a microscope the motion of the slowest wheel, when the fastest one was steadily turned by hand. The results being very satisfactory, Professor COPELAND, then Astronomer at Lord CRAWFORD's Observatory, suggested continuing these experiments with the head of the lathe mentioned. Soon afterwards Lord CRAWFORD, whose attention had been drawn to the promising state of the problem, kindly decided to erect a temporary station where the sun could be observed near the horizon. The place selected was the top of the Barmekin, a commanding eminence about a mile and a half west of Dun Echt Observatory. Lord CRAWFORD also sent from his own workshop a horizontal

^{*} *Trans. Roy. Soc. Edin.*, vol. xxxii. part 3.

lathe suitably altered to replace the one first used. Since it formed a part of the recording apparatus, it will be described later on.

Dr COPELAND was kind enough to undertake all the trouble of arranging and superintending the erection of the observing station, where camping accommodation was also provided on account of the short interval between sunset and sunrise in summer. The first week Dr COPELAND camped out, but had to abandon his intention of partaking in the work, because the preparations for observing the solar eclipse of 1887 in Russia required all his attention. There was only one fine sunrise during that week, when the Rain-band was observed. But on account of the difference between our scales of intensity, it was necessary to exclude these observations. For the same reason I also struck out the first four sets of my observations which were taken in the first spectrum. The whole of the later readings were made on a uniform plan in the second spectrum.

During the years 1887 and 1888, I spent all the nights on the hill from the beginning of June to the middle of August, by which time the lengthening nights made it practicable to sleep below. This change was by no means unwelcome, as the slight wooden hut became very damp as the season advanced. The observations, however, were continued up to the end of September. It would have been advantageous to have extended them over the winter, but a range of hills to the south of the Barmekin, which rise about 4° above the horizon, prevent all observations at the most desirable altitudes, while the prevailing mild winter temperature offered little change in the atmospheric conditions. It was therefore considered not worth while to alter the position of the heliostat, which was standing too near the hut for winter observations.

The top of the Barmekin being 850 feet above the level of the sea, and about 14 miles from the coast, is a most suitable place for this kind of work. To the east many of the hills are below the horizontal plane, and the sea can be seen at various points; to the west there is a range of hills about 7 miles distant, rising at but a few points more than a fraction of a degree above the horizon. Further south, however, as we have said, the Deeside hills obstruct the view considerably.

The original working plan of restricting our survey to the yellow part of the spectrum was soon abandoned, and we proposed observing as much of the solar spectrum near the horizon as possible. In 1887 the lines from $\lambda = 6030$ to b were surveyed, and in the following year the tract from b to F was added. Beyond F it was found impracticable to proceed, as the finest condition of the atmosphere, such as very rarely occurs, is required to see the fainter lines when the sun approaches the horizon. There was already great difficulty experienced in observing the spectrum from c to F , and we had often to break off work at this part of the spectrum, because the wires of the viewing telescope were no longer discernible, although there was still sufficient light to study the less refrangible parts of the spectrum. Three sets of observations were added in 1889 to settle some doubtful points.

It may be mentioned that in the summer of 1889 the work was continued below $\lambda = 6030$ towards the red end, but this section was not completed when I removed to Edinburgh

at the beginning of September of that year. I hope, however, to have an opportunity of completing the survey next summer.

The weather in 1887, though fine for low sun observations, was generally unfavourable when the sun was at a considerable altitude. The Barmekin, too, being forty minutes' walk from the Observatory, it was not, of course, possible to utilise every opportunity. In 1888, however, the remaining parts of the high sun observations were supplied.

2. SHORT SUMMARY.

In this memoir we publish a catalogue of 3637 lines of the solar spectrum between the wave-lengths 6024 and 4861 Ångström units, including 928 telluric lines. They are deduced from 26,107 observations, yielded by 47 sunsets and 32 sunrises, and from 8325 observations made when the sun was at medium altitudes. 28 lines excepted, the whole telluric spectrum is found by these observations to consist of three bands ranging from $\lambda = 6020$ to 5666 Å.U., $\lambda = 5530$ to 5386 Å.U., and $\lambda = 5111$ to 4981 Å.U. They contain respectively 678, 106, and 116 lines.

All the darker lines of these bands are due to water-vapour. For the fainter lines, however, the small variations in the amount of water-vapour in our atmosphere did not suffice to produce different intensities of blackness at the same altitude of the sun. Nevertheless, investigations on the behaviour of the lines, combined with the results obtained by former observers, led us to assume that the water-vapour lines of the first band are split into two distinct groups by a band of faint lines, which are probably due to oxygen. These two groups have been called the Rain-band and the δ -band. They were known to Sir DAVID BREWSTER more than fifty years ago, and the description he gives of them virtually contains the assumption, that they are caused by the absorption of water-vapour. His drawing of telluric absorption bands gives also our other two bands under the designation ζ and ι , besides some other bands, which our observations do not attribute to atmospheric absorption. The ζ -band has never been mentioned by later observers to my knowledge.

Of all the telluric bands within our zone, the Rain-band is the only one which has hitherto been resolved into lines. The names of ÅNGSTRÖM, KIRCHHOFF, HOFMANN, JANSSEN, PIAZZI SMYTH, and CORNU, mark a continuous progress in our knowledge of its structure. Whilst ÅNGSTRÖM's drawing (1869) of this band contains only 19 lines, M. CORNU resolves it into 170 lines, by observations made with a RUTHERFORD grating in the years 1879 to 1882. Of the δ -band there is an interesting account in ÅNGSTRÖM's *Recherches sur le Spectre Solaire*.^{*} We have also to mention that in Professor PIAZZI SMYTH's maps of *The Visual Solar Spectrum in 1884*,[†] the region where the δ -band begins is marked as *Region of Low Sun-Band of Thin and closely-set Telluric Dry-Gas Lines*. But as this note stands within the spectrum copied from ÅNGSTRÖM's map for

^{*} Upsal, 1868.

[†] *Trans. Roy. Soc. Edin.*, vol. xxxii. part 3.

reference, and ÅNGSTRÖM himself ascribes the δ -band to the same medium which produces the A , B , and α -groups, it is not clear whether Professor SMYTH arrived at this conclusion from his own observations, or from those of the Swedish physicist. However, since ÅNGSTRÖM's band extends much further to the refrangible side, we are inclined to think that the note represents Professor SMYTH's opinion.

The water-vapour band (ι), between b and F , is described by ÅNGSTRÖM as very strong in summer. It is the same which Mr MAXWELL HALL has utilised as a rain-indicator at Jamaica.

3. THE INSTRUMENT.

The optical part of the instrument is the same as has been used at Dun Echt Observatory for several years. The sun's rays, after reflection by the heliostat, fall on an object-glass, of 6 inches aperture and 7 feet focal length, which forms an image of the sun on the slit attached to the collimator. By two endless cords the observer can correct the position of the heliostat without going outside the hut. The slit is formed by two plates of platinum with both jaws opening simultaneously by the motion of a screw. By a rack and pinion the slit can be brought into the focus of the collimating lens. The latter has a free aperture of 4 inches and a focal length of 4 feet. Two feet in front of it the ROWLAND grating stands on the faceplate of the recording apparatus. It is fixed in a brass frame with a T footpiece, with levelling screws at the ends. The ROWLAND grating—a present from the Johns Hopkins University at Baltimore to the Earl of Crawford's Observatory—contains 14,438 lines to every inch, ruled on speculum metal, its ruled surface being 5.5 by 3.5 inches. Although there is a slight difference in the focus of the spectra on either side of the normal, we are convinced that the irregularities in ruling which cause this defect have been without influence on this work. This is satisfactorily shown by the fact, that close double lines, which were separated by Professor PIAZZI SMYTH with similar optical appliances, were found to be double and well defined at Dun Echt. Moreover, a great number of faint lines, never recorded before, were observed on both sides of the normal of the grating, their reality being often abundantly established by their increased intensity in a low sun.

The diffracted rays are received by the 4-inch object-glass of the viewing telescope, of which the focal length is 4 ft. 11 in. There is a filar micrometer provided with two cross wires inclined 45° to the horizon. Their intersection serves as the zero point. An eye-piece, with a magnifying power of 120 diameters, was employed on all occasions. The viewing telescope forms an angle of 25° with the collimator. Each is supported on a separate concrete pier.

The recording apparatus consists of two distinct parts, one for magnifying the angular motion of the grating, and the other for recording the corresponding arc on a broad fillet of paper. The grating stands on a plate attached to the same vertical axis as a 6-inch worm-wheel (A) of 180 teeth. This wheel is turned by a tangent-screw (α) on

the end of a half-inch steel rod 12 inches in length, the other end carries a $12\frac{1}{2}$ -inch gun-metal wheel (B) with 150 teeth. The position of the rod can be adjusted to insure proper contact of the screw with the worm-wheel. A system of wheelwork turns the wheel B. The latter is geared into a $1\frac{3}{4}$ -inch pinion (*b*) of 15 teeth, on the axis of which a second wheel (C) of $11\frac{1}{2}$ inches diameter and 140 teeth gears with a second pinion (*c*) of the same dimensions as the first. The two horizontal axes of *b*, C, and *c* are clamped in the slot of an adjustable bracket. All these appliances are attached to a strong mahogany frame, 2 feet square by 2 feet high, provided with three foot screws, and carried by a massive concrete pier.

It is apparent that the angular motion of the second pinion (*c*) is $180 \times \frac{150}{15} \times \frac{140}{15}$ equal to 16,800 times as large as that of the grating. By a long $\frac{3}{8}$ -inch iron rod the second pinion can be turned by the observer from the eye-end of the viewing telescope.

The rod, however, is not fixed immediately to the pinion, but transmits its angular motion by a very useful kind of joint, without communicating any longitudinal vibration. It is employed by Mr L. CASELLA in his recording anemometers, and was introduced here at the suggestion of Dr COPELAND. Two square bars are screwed crosswise together, each of which fits exactly without tightness into a deep groove in a corresponding disk. The grooved surfaces of the disks face each other, and turn in parallel planes, the only connection between them being the gliding cross. If the axes of rotation be parallel, although not necessarily in the same line, the transmission of rotary motion from one to the other is perfect. To prevent the cross from altering its plane of rotation, one of its bars has a projecting plate which slides in narrow channels at the back of the groove of the corresponding disk. In our instrument one of the disks is carried by the second pinion (*c*), while the axis of the other is supported by the pillar of the viewing telescope, and is connected with the long iron rod by a HOOKE's joint.

Underneath the eye-end of the viewing telescope, the other end of the iron bar is attached, by another HOOKE's joint, to the axis of a wooden "recording" wheel. This wheel, which is $6\frac{1}{4}$ inches in diameter, rotates inside a narrow box in such a way that its rim, 2 inches in breadth, is level with the outside of the lid of the box. Above the exposed part of the recording wheel is a loaded swing frame carrying a roller of the full breadth of the wheel. Both wheel and roller are covered with sand paper, to insure a grip on the paper fillet which passes between them. A load of about 5 lbs. is sufficient to prevent slipping. When observing, it is by turning this roller that the grating is moved. The paper, $1\frac{7}{8}$ inch wide, is supplied from a large roll inside the box, and passes through a slit in the lid and over a flat surface to the wheels. On the lid, turning on a common axis, are five recording levers provided with prickers at their free ends. The prickers, which form dots in a straight line across the fillet about $\frac{3}{8}$ inch apart, are easily worked by the thumb and fingers of one hand, either singly or simultaneously. To this end the levers are suitably played at the fulcrum ends. The levers are smartly raised by springs as soon as the pressure is removed. Thirty-one different records can be made by the various combinations of the five needles, but only 19 have been employed. The

full revolutions of the recording wheel are registered in a simple manner. A strong nail was driven into the rim of the wheel, and filed away to a sharp edge, which leaves a distinct mark in the paper every time it passes beneath the roller. These marks served as zero points in reading off the observations. We may mention that in the 3500 feet of paper that contain the observations, not one of these marks is wanting; and judging from the intervals between them, the fillet has never once slipped. Apart from this safeguard, the observer, when turning the roller, could always see in the viewing telescope that the grating had moved; and this could not possibly happen unless the fillet had correspondingly advanced. If the recording wheel was intentionally held fast, it was impossible to draw the fillet over it by turning the roller.

As to the linear distance between two lines on the paper, it may easily be computed from the figures given, that the D lines for instance are $19\frac{3}{4}$ inches apart, whilst the whole region from $\lambda = 6024$ to 4861 would require a strip 314 feet long.

The apparatus works in the following manner:—The observer with his right hand turns a toothed wheel on the same axis as the roller; this drives the recording wheel and moves the paper along by friction. The long iron rod transmits this motion to the disk of the connecting joint, and then by means of the cross to the other disk which is fixed to the second pinion. This second pinion, acting through the wheels and endless screw, slowly rotates the grating, thus causing the lines of the spectrum to move across the field of view. When the line under observation coincides with the intersection of the wires, the fingers of the left hand depress one or more of the needles according to the degree of blackness of the line. If the lines of the spectrum are near together, they can be registered as quickly as the eye can appreciate their individual characteristics.

In spite of all the connections and the smallness of the worm-wheel, the probable error of one observation of the relative position of the grating is but $\pm 0''.77$ of arc as computed from lines half-way between standard lines. This corresponds to $\frac{1}{36,666}$ inch in the circumference of the worm-wheel.

For effecting a quick motion of the grating, the bracket to which the wheelwork is fastened turns round a pivot at the upper end, and can be raised out of position by a string. By a long wooden handle the observer can then rotate the tangent-screw directly, without quitting his seat at the eye-end of the viewing telescope.

The instrument could be much simplified. A small table moving easily round a vertical axis from which a rigid arm projects as far as its rigidity permits, and of course balanced, and a screw of low pitch acting on the arm similarly to the slow motion of a Transit-Circle in Declination, would be a simple substitute for all our multiplying gear.

When a great number of lines have to be determined by eye-observations, such an instrument will always give accurate results in a comparatively short time, provided it is possible to introduce a sufficient number of standard lines.

4. THE OBSERVATIONS.

The working plan of 1887 embraced the region 603 to b , to be observed both in the evening and morning in both the second spectra. For the sunsets the plan was carried out, whilst the sunrise observations are complete in only one of the spectra. In the following year, 1888, the deficiency of observations in the one spectrum was made up to such an extent as was consistent with the idea of finishing the spectrum up to F during that year. The sun at medium altitudes has been observed at least once on both sides of the normal in the two spectra.

On beginning a set of observations the first line was identified in Professor SMYTH'S maps of the Solar Spectrum. This work has afforded us the greatest help, not only while the observations were in progress, but also in the identification of the standard lines in the reductions.

The day of the month was entered on each strip, followed by readings of the dry and wet bulb thermometers and notes about the weather. Sometimes the intensity of one or two water-vapour lines between the sodium lines was also noted. The time at which a line was observed was occasionally put down, to allow of computing the sun's altitude above the horizon and the quantity of air traversed by the rays that entered the spectro-scope. At the end of each set the last line was again identified and the meteorological observations repeated.

As the five needles of the recording apparatus made marks in a line at right angles to the motion of the paper, any of them sufficed to record the position of the grating; while certain combinations served to describe the lines. Of the 19 signals employed 14 refer to the comparative blackness of the lines. With the left hand resting on the five levers the thumb was used to indicate 1, and the consecutive fingers respectively 2, 3, 4, 5. This covers the five lowest classes of intensity. The following numbers up to 14 were obtained by addition, thus:—

$$\begin{aligned} 6 &= 5, 1; 7 = 5, 2; 8 = 5, 3; 9 = 5, 4; 10 = 5, 4, 1; 11 = 5, 4, 2; 12 = 5, 4, 3; 13 = 5, 4, 3, 1; \\ 14 &= 5, 4, 3, 2. \end{aligned}$$

Since the main object of our work was the determination of telluric lines, it was of the utmost importance to retain a uniform scale of intensity that did not alter during the time the same part of the spectrum was under observation. All the observations had therefore to be made in either of the two second spectra and with the same eye-piece on the viewing telescope. We defined by intensity = 3 the faintest lines that could just be distinctly seen across the whole breadth of the second spectrum, while those barely visible were designated by 1. The two webs forming the cross in the field of view being of different thicknesses were used as standards for intensities 6 and 8. The remaining classes were correspondingly estimated. If a line appeared much broader than corresponded to its intensity, the record of the line was closely followed by a sign made with the needles 3 and 2; and when the breadth was considerable, both its borders were

marked in this way. Most of these lines have been resolved into two or more lines on other occasions. A close double line whose components were not readily separated was marked as a single one with the sign "3, 1" affixed. There were also signs for indicating the blackness of an interval between two dark lines, for suspected irregularities in the working of the apparatus, and lastly for recording the interference of clouds.

The following table gives the number of the series, the day of the month and week, the Greenwich mean time at the beginning and end, and the wave-length to which they belong. These are followed by the number of lines observed and the apparent altitude of the sun at the given times. Further, the table shows the elastic force of water-vapour as computed from GUYOT's tables, the pressure of the air (at the observing station), the outside temperature, the degree of transparency of the air ranging from 1 equal very transparent to 5 for thick haze, the direction of the wind and its strength rising up to 10 for a gale. Amongst the remarks the intensities of 2 water-vapour lines have been given sometimes, a symbolising the double line, $\lambda = 5885.18 \text{ \AA.U.}$, and b $\lambda = 5833.24 \text{ \AA.U.}$

[TABLE

TABLE I.—SUN AT LOW ALTITUDES.

No.	Day of the Month.	Day of the Week.	Greenwich Mean Time at		Limits of Region Observed.		Number of Lines.	Apparent Altitude of the Sun at		Elastic Force of Water-Vapour.	Pressure of the Air.	Temperature in Fahr.	Transparency.	Wind.		Remarks.
			Begin-ning.	End.	Begin-ning.	End.		Begin-ning.	End.					Direction.	Velocity.	
1*	June 14	♂	16 5	16 10	589	590	18	4° 5'	5° 0'	INCH. 0.38	INCH. 29.40	54	2	...	...	Clouds near horizon.
1	" 16	♂	8 2	8 55	584	602	345	5-9	0-7	0.48	29.52	61	4	...	...	Spectrum faint.
2	" 17	♂	8 14	8 30	603	596	68	4-7	3-0	0.53	29.53	64	5	...	...	☉ blood-red; spectrum faint; last part with open slit.
3a	" 17	h	15 52	16 30	584	598	246	3-2	7-2	0.53	29.52	63	4	...	...	Spectrum faint in last part; open slit; clouds interrupted three times.
3b	" 17	...	16 50	16 53	588	590	18	9-5	9-7	...	...	...	...	...	...
4	" 18	h	7 58	8 35	603	591	185	6-3	2-6	0.57	29.55	63	3	...	...
5a	" 19	♂	15 35	16 6	589	597	131	1-6	4-5	0.25	29.65	42	2	...	...	Clouds near horizon.
5b	" 19	...	16 8	16 23	588	592	102	4-7	6-3	...	...	...	...	...	...	{ Observed till the sun had totally disappeared behind hills. Narrow slit throughout.
6a	" 20	♂	8 0	8 45	603	586	344	6-3	1-8	0.31	29.63	52	1	...	...
6b	" 20	...	8 48	9 3	593	586	150	1-5	0-2	0.27	...	...	...	...	...
7	" 21	♂	7 59	9 6	586	553	385	6-4	0-0	0.37	29.60	56	2	...	...	Stratus; clouds interrupted once.
8	" 21	♂	15 35	16 14	595	576	281	1-6	5-4	0.34	29.60	53	2	...	...	Clouds near horizon.
9	" 22	♂	8 0	9 5	576	545	449	6-3	0-0	0.37	29.59	58	1	...	...	Observed till upper limb of ☉ touched horizon; narrow slit throughout. At sunrise raining.
10	" 23	♂	8 3	8 57	561	538	317	6-1	0-8	0.39	29.59	53	3	...	...	Stopped by clouds.
11a	" 23	♂	15 29	15 46	591	582	139	0-9	2-3	0.31	29.59	45	2	...	...	{ Above the clouds; interrupted by mist.
11b	" 23	...	16 7	16 25	583	575	121	4-6	6-5	...	...	...	...	...	...
12	" 24	♀	8 5	8 55	555	537	251	5-9	0-9	0.46	29.55	59	4-5	...	...
13a	" 24	h	15 32	15 42	582	578	49	1-2	2-1	0.36	29.53	51	4	...	...	Interrupted by clouds; ☉ blood-red, and spectrum faint.
13b	" 24	...	15 45	16 27	583	567	269	2-4	6-6	...	...	...	...	...	...	☉ too faint at 16 ^h 25 ^m ; clouds interfere.
14	" 26	♂	8 25	8 38	548	541	99	3-6	2-4	0.40	29.40	55	4	...	...	Stopped by clouds.
15	" 27	♂	8 4	8 48	548	537	226	5-9	1-5	0.32	29.34	50	2	...	...	Stopped by clouds.
16	" 28	♂	8 10	8 55	540	522	280	5-2	0-9	0.42	29.51	57	4	...	...	Green very faint; rain-band strongly developed.
17	" 28	♂	15 30	16 10	584	575	197	0-8	4-6	0.38	29.58	54	1	...	...	Observations often interrupted by clouds.
18a	" 29	♂	15 25	15 53	585	574	161	0-3	2-8	0.40	29.63	56	1	...	...	Observations often interrupted by clouds.

TABLE I.—SUN AT LOW ALTITUDES—continued.

No.	Day of the Month.	Day of the Week.	Greenwich Mean Time at		Limits of Region Observed.		Number of Lines.	Apparent Altitude of the Sun at		Elastic Force of Water-Vapour.	Pressure of the Air.	Temperature in Fahr.	Transparency.	Wind.		Remarks.
			Begin-ning.	End.	Begin-ning.	End.		Begin-ning.	End.					Direction.	Velocity.	
18b	1887.	...	h. m.	h. m.	579	571	158	3°5	6'1	inch.	inch.	°	...	...	...	Clouds interfere.
19	July	1	8 10	8 22	533	527	76	5°1	3°8	0.48	29.41	63	...	...	...	Almost whole sky clouded.
20	"	2	15 46	15 57	581	577	78	2°1	3°1	0.42	29.40	58	...	...	...	Clouds interrupted once.
21	"	3	8 41	9 3	530	517	245	2°0	0°1	0.50	29.19	63	...	W.	9	Showery.
22	"	5	8 10	8 32	516	525	170	4°9	2°6	0.25	29.21	42	...	W.	...	Clouds near horizon.
23	"	5	15 47	16 35	576	560	351	1°8	6°7	0.21	29.21	38	...	W.	6	Clouds near horizon.
24	"	6	8 50	8 55	595	591	99	0°9	0°5	0.27	29.23	46	...	S.S.E.	5	Almost whole sky overcast.
25	"	9	8 51	8 53	590	589	20	0°6	0°5	0.39	28.98	52	...	S.E.	1	Clear for a few minutes.
26	"	10	8 44	8 47	590	589	48	1°2	0°9	0.38	28.73	54	...	S.	1	Clear for a few minutes.
27	"	10	15 30	16 37	574	560	310	-0°1	6°3	0.36	28.78	52	...	W.	5	Interrupted by clouds.
28	"	11	15 50	16 3	566	561	70	1°4	2°6	0.38	28.89	53	...	W.	3	Fog in the valley; stopped by clouds; $\alpha = 9$.
29	"	13	8 9	8 11	517	518	28	4°4	4°2	0.45	28.82	59	...	S.	5	Clear for a few minutes.
30	"	14	8 0	8 45	516	538	392	5°1	0°6	0.37	29.02	54	...	S.S.W.	1	Stopped by clouds; rain-band very strong.
31	"	14	15 36	16 35	575	563	224	0°0	5°6	0.31	29.11	49	...	S.	1	Stopped by clouds; 16 ^h 36 ^m $\alpha = 6$.
32	"	15	15 40	16 36	573	566	132	0°0	5°6	0.30	29.37	46	...	W.	6	Clouds near horizon.
33	"	17	7 50	8 31	526	540	217	6°0	1°6	0.27	29.45	45	...	N.N.W.	7	Interrupted and stopped by clouds.
34	"	20	8 1	8 39	535	543	122	4°4	0°5	0.39	29.44	55	...	N.N.E.	3	Clouds constantly interfering.
35	"	20	16 0	16 36	558	543	329	1°1	4°8	0.33	29.43	50	...	W.N.W.	2	
36	"	22	7 58	8 23	540	544	90	4°3	1°7	0.36	29.10	55	...	W.	7	Interrupted and stopped by clouds; 7 ^h 55 ^m $\alpha = 4$.
37a	"	24	7 50	8 10	542	551	184	4°9	2°7	0.32	28.87	51	...	W.	4	
37b	...	...	8 15	8 30	550	554	71	2°2	0°7	...	...	...	...	...	...	Spectrum faint.
38	"	24	16 15	16 55	571	565	105	1°9	6°2	0.28	28.90	47	...	W.	2	Through stratus; 16 ^h 56 ^m $\alpha = 5$.
39a	"	25	16 5	16 8	571	570	41	0°7	0°9	0.30	28.88	48	...	W.	1	Fog in the valley; spectrum faint.
39b	...	...	16 11	16 51	570	556	286	1°2	5°7	...	...	...	...	...	...
40a	"	27	7 49	7 58	547	551	80	4°4	3°4	0.40	29.23	57	...	W.	8	Interrupted and stopped by clouds; 7 ^h 44 ^m $\alpha = 8$.
40b	...	...	8 3	8 15	549	553	71	2°8	1°5	...	...	...	...	...	...
41	"	27	16 5	16 51	550	531	379	0°4	5°2	0.32	29.04	50	...	W.	4	Light faint at first; 17 ^h 0 ^m $\alpha = 5$.
42	"	29	7 39	8 16	550	564	271	5°1	1°1	0.39	28.91	58	...	S.W.	8	Interrupted and stopped by clouds; 7 ^h 34 ^m $\alpha = 5$.

TABLE I.—SUN AT LOW ALTITUDES—continued.

No.	Day of the Month.	Day of the Week.	Greenwich Mean Time at		Limits of Region Observed.		Number of Lines.	Apparent Altitude of the Sun at		Elastic Force of Water-Vapour.	Pressure of the Air.	Temperature in Fahr.	Transparency.	Wind.		Remarks.	
			Begin-ning.	End.	Begin-ning.	End.		Begin-ning.	End.					Direction.	Velocity.		
43	1887.																
July 29	h		h. m.	560	533	540	-0.1	5.5	0.34	29.07	51	2	S.W.	3		Stratus near horizon; 17 ^h 0 ^m $a=7$.	
" 31	h		16 12	17 2	543	527	0.3	5.8	0.32	29.34	48	2	W.	2		Fog in the valley; stratus.	
Aug. 2	h		7 45	8 4	561	572	3.6	1.6	0.30	29.43	52	4	W.	1		Stopped by clouds; 7 ^h 35 ^m $a=5$.	
" 2	h		16 33	17 0	544	532	2.0	5.2	0.30	29.50	47	2	W.	4		Fog in the valley; stratus.	
" 3	h		7 30	7 33	589	590	5.1	4.7	0.36	29.50	52	4	E.	6		Light faint.	
47a	"		7 40	8 12	565	582	3.0	0.5	...	...	...	...	...	...
47b	"		16 28	17 4	603	585	1.3	5.3	0.37	29.54	54	4	S.	2		Fog in the valley; light too faint in the green for observing.	
" 3	"																
49	Sept. 7	h	6 23	6 30	575	577	5.5	2.1	1.3	29.15	...	1	N.	1		Stopped by clouds.	
" 15	"	h	5 35	5 58	563	571	2.7	6.7	0.35	29.02	51	2	N.W.	1			
50	"																
1888.																	
June 16	h		8 17	8 50	527	518	2.05	4.3	1.2	29.31	...	1	N.	2		Splendid sunset; $b=7$.	
" 22	h		8 10	9 7	528	512	4.02	5.2	-0.1	29.52	46	4-1	N.	2		Observed till \odot completely down.	
" 23	h		8 7	9 7	518	506	3.24	5.5	0.0	29.52	49	1	N.	2		Observed till \odot completely down.	
" 24	h		8 24	9 7	511	496	3.16	3.8	0.0	29.54	50	1	N.N.E.	1		Observed till \odot completely down; light faint at last.	
"	h																
24	h		15 13	16 10	518	502	3.32	-0.3	4.8	29.42	52	2	Calm	...		Fog in the valley; splendid sunrise.	
"	h		8 11	8 42	504	496	1.85	5.1	2.1	0.38	29.32	53	4	S.E.	1		Blue very faint.
"	h		8 50	9 6	602	595	1.47	1.3	0.1	...	...	...	...	...
"	h		9 6	9 10	593	591	1.4	0.1	-0.2	...	...	...	...	...
"	h		15 20	15 30	595	592	7.0	0.1	0.9	0.42	29.28	58	2	S.	1		Darkest lines only.
57a	"	h	15 32	16 17	504	489	26.9	1.0	5.5	...	...	...	...	...
57b	"	h	8 8	8 32	496	486	14.6	5.4	2.9	0.39	29.12	54	2	E.	1		Fog in the valley; 16 ^h 18 ^m $a=6$, $b=7$.
58a	"	h	8 48	8 58	592	587	1.28	1.5	0.6	...	...	...	...	...
58b	"	h	15 36	15 50	490	486	4.9	1.5	2.7	0.35	29.07	50	4	Calm	...		Green too faint at sunrise.
59a	"	h	15 53	16 19	486	498	18.7	3.0	5.8	...	...	...	...	...
59b	"	h	15 43	16 19	486	498	18.7	3.0	5.8	...	...	...	...	...
"	h																
60	July 1	h	8 10	8 34	492	487	8.0	5.0	2.6	29.07	42	4	S.S.E.	3		Light very faint in blue; 8 ^h 9 ^m $b=7$.	
" 7	h		15 43	15 57	496	502	11.0	1.2	2.5	29.14	46	1	N.W.	1		Whole sky almost overcast with clouds.	
" 18	h		8 0	8 30	486	496	16.8	4.6	1.5	0.43	29.01	57	3	N.	1		Green blue very faint at last; 7 ^h 50 ^m $b=7$.
"	"																Observations continued in red.
63	"	h	15 59	16 39	496	508	27.3	1.1	5.3	0.40	29.06	54	3	N.W.	1		Fog in the valley.

TABLE I.—SUN AT LOW ALTITUDES—*continued*.

No.	Day of the Month.	Day of the Week.	Greenwich Mean Time at		Limits of Region Observed.		Number of Lines.	Apparent Altitude of the Sun at		Elastic Force of Water-Vapour.	Pressure of the Air.	Temperature in Fahr.	Transparency.	Wind.		Remarks.
			Begin-ning.	End.	Begin-ning.	End.		Begin-ning.	End.					Direction.	Velocity.	
64	1888. July 19	♂	h m. 16 4	h m. 16 34	502	512	230	1° 4	4° 6	inch. 0·42	inch. 29·07	57	2	N.W.	2	At sunrise blue-green very faint; red observed; 16 ^h 43 ^m <i>b</i> = 7.
65	" 20	♂	8 0	8 20	496	502	127	4·3	2·2	0·40	29·03	58	4	S.S.E.	2	Stopped by clouds.
66	" 20	♂	15 57	16 38	502	518	285	0·6	4·9	0·38	28·99	52	3	S.	1	Dense fog in the valley; the E. horizon only clear; 16 ^h 40 ^m <i>b</i> = 7.
67	" 31	♂	16 18	16 41	496	510	171	0·8	3·2	0·26	29·14	44	1	W.N.W.	4	Clear in the E.; stopped by clouds.
68a	Aug. 1	♂	16 15	16 27	498	505	93	0·3	1·5	0·30	29·26	46	1	N.W.	1	E. horizon only clear.
68b	" 7	...	16 32	17 0	510	518	143	2·0	5·2	0·30	...	...	...	...	...	Stratus.
69	" 7	♂	16 27	16 35	496	501	70	0·2	1·0	0·33	29·02	50	3	S.	1	7 ^h 10 ^m <i>b</i> = 7.
70	" 15	♂	7 12	7 40	496	504	198	4·1	0·8	0·27	29·39	44	3	N.	5	Spectrum faint at last.
71	" 18	♂	7 17	7 36	503	512	180	2·6	0·5	0·27	29·40	45	2	S.E.	2	Clouds interfere and stop observing.
72	Sept. 17	♂	5 48	6 12	508	514	105	4·1	1·0	0·37	29·41	53	4	N.	2	Stratus; light very faint in last part.
73	" 20	♂	5 40	5 59	509	519	213	4·0	1·5	0·36	29·50	52	4	S.S.E.	2	Light very faint at first.
74a	" 22	♂	5 35	5 50	486	496	150	3·8	1·9	0·44	29·36	56	4	S.	1	Light very faint; stopped by clouds.
74b	" 22	...	5 50	5 57	585	587	48	1·9	1·0	...	...	...	...	...	...
75	" 23	♂	5 30	5 47	486	493	87	4·2	2·0	0·43	29·32	57	5	S.	1	
76	1889. May 8	♂	7 5	7 30	577	581	100	7·0	4·0	...	28·97	...	...	S.	1	Stopped by clouds.
77	" 27	♂	8 15	8 25	576	580	50	2·5	1·6	0·27	28·90	44	1	S.E.	4	Fine sunset.
78	June 4	♂	8 13	8 50	576	586	248	3·8	0·3	0·37	29·50	55	2	W.	3	

TABLE IA.—SUN AT MEDIUM ALTITUDES.

No.	Day of the Month.	Day of the Week.	Greenwich Mean Time at		Limits of Region Observed.		Number of Lines.	Apparent Altitude of the Sun at		Elastic Force of Water-Vapour.	Pressure of the Air.	Temperature in Fahr.	Remarks.
			Beginning.	End.	Beginning.	End.		Beginning.	End.				
1	1887.												
2a	June 20	♂	H. M. 22 55	H. M. 23 50	602	584	319	53	56	near. 0.47	near. 29.60	65	a=4, b=4.
2b	July 1 $\frac{1}{2}$	♂	23 0	23 45	516	528	275	52	54	0.55	28.90	67	a=3.
2c	"	...	23 50	1 20	527	543	319	54	53	...	...	68	
3	"	...	1 30	1 45	542	546	77	52	51	...	...	68	
4	" 22	♂	0 25	0 45	561	553	181	53	53	0.58	29.07	70	a=3.
	Sept. 23	♂	1 30	3 15	590	566	646	30	21	0.35	29.55	53	a=3, b=4.
5	1888.												
6	June 2 $\frac{1}{2}$	♂	22 0	0 50	589	560	625	49	55	0.44	29.55	62	a=2.
7a	" 2 $\frac{1}{2}$	♂	22 30	0 30	518	496	556	52	56	0.28	29.33	61	a=3.
7b	July 19	♂	1 0	1 45	496	486	219	53	50	0.56	29.09	69	a=3, b=4.
7c	"	...	1 50	2 37	486	496	214	50	45	0.55	...	67	
8a	" 1 $\frac{1}{2}$	...	2 40	3 45	496	507	254	45	37	0.55	...	67	
8b	" 1 $\frac{1}{2}$	♂	22 50	23 35	510	518	212	50	53	0.62	29.03	71	a=4, b=3.
8c	"	...	23 50	1 50	541	532	414	53	50	0.38	...	70	
9	"	...	1 55	2 50	586	604	389	49	44	0.38	...	70	
10	Sept. 10	♂	23 0	23 40	562	552	263	36	37	0.40	29.30	58	a=3, b=4.
11a	" 17	♂	2 0	3 30	553	537	428	30	22	0.50	29.38	63	b=7.
11b	" 1 $\frac{1}{2}$	♂	23 45	2 0	538	517	576	34	39	0.42	29.54	57	a=4, b=4.
12a	" 1 $\frac{1}{2}$	...	2 10	3 15	560	573	297	29	22	0.38	...	54	
12b	" 1 $\frac{1}{2}$	♂	23 0	2 30	567	604	825	32	27	0.47	29.53	59	a=3, b=4.
13a	" 2 $\frac{1}{2}$	...	2 40	3 15	486	496	219	26	22	0.45	...	60	
13b	" 2 $\frac{1}{2}$	♂	23 50	1 25	495	518	630	33	31	0.64	29.36	72	a=3, b=4.
	"	...	1 30	2 50	518	533	387	30	24	0.62	...	71	

From these tables it appears that the spectrum has been observed on 79 occasions near the horizon, yielding a total of 17,782 observations. Since the work has been done in 44^h 54^m, each line required on the average 9 seconds. There are 32 sunrises and 47 sunsets, the former with 45 per cent. of the observed lines. The observations of the sun at medium altitudes amount to 8325, which have been determined in 29^h 7^m, thus allowing about 13 seconds for each line, or half as much again as in low sun. While the slit was as narrow in high sun as it could be made, it had to be opened more or less if the sun approached the horizon. Yet there are several series, especially in the less refrangible part of the spectrum, which have been obtained with a narrow slit down to the horizon.

5. THE REDUCTIONS.

The lines were read off from the strips to one-thousandth of a revolution of the recording wheel, by using a paper scale pasted on a piece of wood. One revolution covered 19 $\frac{3}{4}$ in. The marks made by the projecting nail on the recording wheel served as zero points for each revolution. With the exception of the observations obtained in 1887, this trying work was done twice over by JAMES M'PHERSON, the attendant at Dun Echt Observatory. From these records the wave-lengths are easily computed when the correction of the zero point has been determined from the standard lines.

Let C be the angle between the collimator and the viewing telescope, and x the angle between the collimator and the normal to the grating, positive on the side of the viewer, and let a be the distance in millimetres between the lines of the grating. Then we have for the spectrum of the n th order

$$\pm \frac{n\lambda}{a} = \sin(C-x) - \sin x.$$

The positive sign has to be chosen if the directly reflected beam of light falls between the collimator and the viewer or beyond the collimator, and the negative sign if it lies on the other side of the viewing telescope. In the first position the less refrangible part of the spectrum precedes the more refrangible rays when the grating is turned by the recording apparatus. Let x_1 correspond to this position (I) of the grating, and x_2 to the other (II), and let the dispersions be Δ_1 and Δ_2 as defined by

$$\Delta = \frac{dC}{d\lambda},$$

then we have

$$\Delta_1 = \frac{n}{a} \frac{1}{\cos(C-x_1)} = \frac{n}{a} \frac{1}{\cos x_2}; \quad \Delta_2 = -\frac{n}{a} \frac{1}{\cos(C-x_2)} = -\frac{n}{a} \frac{1}{\cos x_1},$$

and since $x_2 > x_1$, we have, disregarding the sign,

$$\Delta_1 > \Delta_2.*$$

* Compare HASSELBERG, *Untersuchungen über das Absorptionsspectrum des Jodgases*. St Petersburg, 1889.

From the constant of the grating $\alpha = 0.0017592$ mm. and $C = 25^\circ$, we find for the second spectrum if $\lambda = 5500 \text{ \AA.U.}$

$$x_1 = -6^\circ.2; \quad x_2 = 31^\circ.2; \quad \Delta_1 = 1.16 \Delta_2.$$

Suppose the rays from the edges of the slit enclose the angle $2s$ before diffraction, and let the angles be $2\sigma_1$ and $2\sigma_2$ after diffraction. Then

$$\frac{\sigma_1}{s} = \frac{d(C-x_1)}{dx_1} = \frac{\cos x_1}{\cos x_2}, \quad \frac{\sigma_2}{s} = \frac{d(C-x_2)}{dx_2} = \frac{\cos x_2}{\cos x_1}$$

$$\sigma_1 > s > \sigma_2.$$

This shows that the angular value of the slit remains unaltered if the collimator serves also as viewing telescope. Further, we see that the angular value of the slit in spectrum I, which gives the greater dispersion, has increased. The separation of close lines depends both on the dispersion and on the apparent size of the slit; we must therefore compare $\frac{\Delta_1}{\sigma_1}$ and $\frac{\Delta_2}{\sigma}$.

$$\frac{\Delta_1}{\sigma_1} = \frac{n}{a} \frac{1}{s} \frac{1}{\cos x_1}; \quad \frac{\Delta_2}{\sigma_2} = \frac{n}{a} \frac{1}{s} \frac{1}{\cos x_2},$$

therefore

$$\frac{\Delta_1}{\sigma_1} < \frac{\Delta_2}{\sigma_2},$$

which means that although the dispersion Δ_1 is greater on side I than on side II, the separating power is less in the first position.

In the special case for $\lambda = 5500 \text{ \AA.U.}$, it is

$$\frac{\Delta_2}{\sigma_2} = 1.16 \frac{\Delta_1}{\sigma_1}.$$

In this investigation one important point has not been taken into consideration at all, viz., the intensity of the light. It would require special experiments to find the intensity of the diffracted rays for the several positions of the grating with regard to the direction of the incident light. But we may compute the direct loss of light incurred by our spectroscop. The breadth of the ruled surface of the grating allows the same amount of light to be received from the collimator in both second spectra. After diffraction the horizontal diameter of the beam of light becomes

$$d_1 = \frac{\cos x_2}{\cos x_1} 4 \text{ in. and } d_2 = \frac{\cos x_1}{\cos x_2} 4 \text{ in.,}$$

or for $\lambda = 5500 \text{ \AA.U.}$,

$$d_1 = 3.44 \text{ in. ; } d_2 = 4.65 \text{ in.}$$

The aperture of the viewing telescope being 4 in., the second position of the grating entails a loss of light of about 15 per cent.

After all, it is difficult to say which of the two positions is the better for observing. But the formulæ leave no doubt that it is most advantageous to have the viewing telescope as close to the collimator as possible.

After this digression we return to the first formula, which we shall write

$$\sin\left(\frac{C}{2} - x\right) = \pm \frac{n\lambda}{2a \cos \frac{C}{2}} \text{ or } \pm \frac{n\lambda}{a2} \sec \frac{C}{2}.$$

Instead of x we introduce the angular motion of the zero point of the recording wheel. Let r be the number of revolutions of the recording wheel required to turn the grating from the position $x = 0$ to $x = x$, hence

$$x = -\frac{1296000''}{180 \frac{150}{15} \frac{140}{15}} r = [1.8872957]'' r,$$

thus giving a simple relation between r and λ .

A table was computed for the second spectrum giving λ with r as argument, the interval being one-tenth of a revolution of the recording wheel. On account of the relation

$$x_2 = C - x_1 \text{ or } r_2 = c - r_1,$$

one table suffices for both positions of the grating. The following is an abstract of the table employed:—

$\pm r.$	λ in Å.U.	1. Diff.	$\pm r.$	λ in Å.U.	1. Diff.	$\pm r.$	λ in Å.U.	1. Diff.
- 380	6055.92	60.16	- 310	5633.05	60.73	- 240	5206.33	61.27
- 370	5995.76	60.24	- 300	5572.32	60.80	- 230	5145.06	61.33
- 360	5935.52	60.33	- 290	5511.52	60.89	- 220	5083.73	61.40
- 350	5875.19	60.41	- 280	5450.63	60.96	- 210	5022.33	61.47
- 340	5814.78	60.49	- 270	5389.67	61.04	- 200	4960.86	61.54
- 330	5754.29	60.58	- 260	5328.63	61.11	- 190	4899.32	61.61
- 320	5693.71	60.66	- 250	5267.52	61.19	- 180	4837.71	
- 310	5633.05		- 240	5206.33				

All the standard lines were first expressed in terms of r , and then compared, in every series of observations, with the observed revolutions of the recording wheel. Had the apparatus been perfect, the differences between calculated and observed quantities would have been constant for the same set, the difference being the correction of the zero point, after allowing for which the foregoing table would have supplied the wave-lengths by interpolation. Owing, however, to irregularities in the mechanism, changes of temperature, &c., the zero point changed usually by a few hundredths of a revolution from line to line. So long as these changes were moderate in quantity it was easy to allow for them by a simple graphic process, but in certain positions of the worm-wheel the corrections changed very rapidly. The reducing curve then became so steep as no longer to

permit of accurate interpolation. When this happened we introduced another table, computed from the original one by altering all the first differences by the same quantity. This quantity was selected so that the first and last standard lines of the series gave the same correction. Of course " r " had again to be interpolated from this auxiliary table for the standard lines, and the whole process repeated. The curve could then be readily drawn. Geometrically the ordinates of the new curve are equal to the differences of the ordinates of the first curve and of a straight line drawn through the first and last points, or, in other words, the second table eliminates the progressive error in the motion of the apparatus.

The standard lines are those published by Professor H. A. ROWLAND, in his essay "*On the Relative Wave-lengths of the Lines of the Solar Spectrum*."* To these were added fifteen lines, principally between c and F , which were reduced from the memoir entitled "*Bestimmung der Wellenlängen von 300 Linien im Sonnenspectrum*,"† by Drs MÜLLER and KEMPF, and from ÅNGSTRÖM's *Recherches sur le Spectre solaire*. Twenty-two lines between b and F which were determined by Messrs ROWLAND and MÜLLER-KEMPF, gave the constant difference -0.19 Å.U., the probable error of one difference being ± 0.04 . To the same region forty-seven comparisons between wave-lengths determined by ROWLAND and ÅNGSTRÖM were made, and the differences combined by a curve. The probable error of one difference amounted to ± 0.07 Å.U. ÅNGSTRÖM's measures, however, were only combined with those of MÜLLER-KEMPF with regard to their weights when there was no doubt left that the wave-lengths referred to the same line.

The reduction of the bulk of observations was carried on in three columns; one column contained the readings, the second the corrections of the zero point as taken from the curve, and the third the wave-lengths, which were interpolated from the table with the difference of the values of the two preceding columns.

All the wave-lengths were then compiled, and the corresponding lines identified. This turned out to be a most difficult task in those regions where many faint lines of the same intensity stood close together and were occasionally wanting. In such cases special drawings were prepared and the most probable identifications adopted. There was not so much difficulty experienced with faint lines in the neighbourhood of darker ones. Neighbouring lines of different intensities were invariably combined line for line with others of corresponding blackness, although other combinations might have brought the wave-lengths to a closer agreement. Very often close double lines were found not to have been separated when the sun was close to the horizon or the faintness of the light had necessitated a wider opening of the slit.

The adopted values of the wave-lengths are the means of all the observations made, as well at medium altitudes of the sun as near the horizon. In the case of double lines, which had not always been resolved, the mean of the middle was first computed and then corrected by the average distance between the lines. The fainter lines having, as a rule,

* *American Journal of Science*, vol. xxxiii., March 1887.

† *Publicationen des Astrophysikalischen Observatoriums zu Potsdam*, Fünfter Band, Potsdam, 1886.

been observed on fewer occasions, it was found inadmissible to take the mean values of the wave-lengths before the single determinations had been corrected for systematic deviations derived from the darker lines.

As the observations of the standard lines were reduced with the others, the wave-lengths thus obtained should not deviate far from the standard values adopted. However, we must not forget that the curve was drawn as regularly as possible, and therefore at places where two or more standard lines lie close together discrepancies must occur in the several determinations of the wave-lengths of the standard lines. In the following table we give a comparison of the wave-lengths determined by Professor ROWLAND and by Drs MÜLLER and KEMPF with the mean of our final values. The Potsdam wave-lengths, which served as standards, are marked by a star in the column MK-B. Double lines have a *d* affixed.

TABLE II.

Final Wave-Lengths.	R - B	MK - B	Final Wave-Lengths.	R - B	MK - B	Final Wave-Lengths.	R - B	MK - B
6024.22	-1	+16	5848.36	...	+16*	5657.99	+3	...
6021.94	+1	...	5831.81	...	+15*	5655.70 ⁴	-6	...
6020.23 ^d	+5	...	5816.50	0	+18	5645.76	-1	...
6016.81	-3	...	5809.35	+1	...	5644.31	...	} + 5
6013.68	0	+15	5806.89	...	+16*	5644.13	...	
6008.71	-1	...	5798.36	-3	...	5641.58	+1	...
6003.17	0	+16	5791.14	0	+16	5638.39	...	+19
5987.20	+1	+20	5788.09	-2	...	5634.02	...	+18
5984.90 ¹	+8	...	5784.02	-1	...	5624.70	0	+ 5
5976.94	-1	+17	5782.30	-2	...	5624.18	0	...
5975.51	0	...	5780.72	...	+18	5615.82	-1	} +22
5965.97	...	+15	5775.24	-1	+12	5615.44	+1	
5958.45	...	+10	5772.28	+2	...	5603.03 ^d	-1	+12
5956.86	-1	...	5763.15	0	+ 8	5594.87	...	} + 6
5955.10	+1	...	5754.82	0	+ 8	5594.66 ⁵	...	
5951.68	+3	...	5753.29	-1	...	5588.92	-1	...
5948.67	+1	+26	5752.21	-2	...	5586.90	...	+14
5946.14	-1	...	5748.12	...	+ 7	5582.12	0	...
5934.82	-1	+17	5741.97	+2	...	5578.82	...	+19
5930.33	+1	...	5731.92	-1	+15	5576.22	0	...
5919.83	-4	...	5718.00	...	+13	5572.98	...	+16
5916.42	-1	...	5715.25	-1	...	5569.76	+1	...
5914.32 ^d	0	+15	5709.71	-1	} +12	5565.83	...	+16
5905.81	+1	...	5709.55	+1		5555.05	-1	+12
5901.62	+1	...	5701.71	0	...	5544.07	0	...
5898.33	0	...	5698.57 ^d	...	+13	5543.34	0	+10
5896.08	0	+17	5688.38	-1	+13	5534.98	+1	...
5893.08 ²	-5	...	5682.84 ³	+5	} +17	5528.56	0	+12
5890.12	0	+11	5682.41	...		5514.57 ^d	...	+18
5889.78	+2	...	5679.21	-3	...	5513.12	0	...
5883.98 ^d	-1	+21	5675.59	0	+17	5506.92	0	...
5862.51	0	+15	5662.68	0	...	5501.58	+3	+21
5859.73	+1	...	5659.04	...	} +13	5497.68	-2	+15
5857.61	0	+19	5658.82	...		5487.88	...	+19
5853.85	-1	...	5658.65	...		5477.05	-1	...

¹ Telluric companion.² Telluric companion.³ Telluric companion.⁴ Another line to the violet side.⁵ Another line to the violet side.

Final Wave-Lengths.	R - B	MK - B	Final Wave-Lengths.	R - B	MK - B	Final Wave-Lengths.	R - B	MK - B
5476.87 ^{d1}	...	+10	5255.01	...	+31	5090.88	+2	+24
5466.51	+1	...	5253.58	-2	...	5084.20	...	+19
5463.44	-2	} +12	5250.75	+1	} +31	5083.47	-1	...
5463.11	-2		5250.33	0		5076.43	...	+19*
5462.59	+8	...	5242.60 ^s	...	+15	5068.88	0	...
5455.68 ^d	0	+12	5233.02	+3	+19	5065.30	...	} +24
5447.04	+1	+16	5229.98	-3	...	5065.12	...	
5434.65	+1	+16	5227.31	...	} +33	5064.73	+4	} +24
5429.86	...	+16	5226.98	...		5060.19	+0	
5424.21	-1	...	5226.67	...	...	5051.74	...	+11
5415.32	+2	+20	5225.62	0	...	5049.94	0	+11
5405.91	0	+15	5217.52	-3	...	5041.80 ^d	...	+16*
5400.60 ²	...	+23	5215.27	+1	+29	5041.00 ^d	...	+24*
5397.26	+1	+19	5210.48	+1	...	5036.04	-1	+18
5393.27	+3	+30	5208.59 ^d	...	+18	5027.27	...	+24*
5389.62	-1	+21	5204.62	+3	...	5020.14	0	...
5383.49	+1	+19	5202.46	-4	+15	5018.47 ^d	...	+18
5379.71	-1	...	5198.81	+1	...	5014.36	-1	...
5371.63 ³	-1	+11	5193.07	0	...	5012.13 ⁶	...	+33
5370.09	0	...	5192.44	...	+23	5007.34	+3	+24
5367.62	-2	+17	5191.55	...	+21	5006.26	-2	} +23
5362.93 ^d	+4	+22	5188.89 ^d	0	...	5005.85	-1	
5361.76	-1	...	5183.73	0	+20	4999.64	-1	+16
5353.52	+1	+19	5173.83	+1	...	4994.23	+2	...
5345.99	...	+17	5172.78	+1	+6	4991.27 ^d	...	+17*
5341.22	...	+14	5171.73	-2	...	4985.53 ^d	...	+21
5333.04 ⁴	0	+12	5169.10 ^d	-1	...	4981.85	-1	...
5328.61	...	} +17	5167.51 ^d	-1	+16	4980.32	-3	+20
5328.34	...		5165.54	-2	...	4978.75	-4	...
5328.06	...	...	5162.39	+10	+21	4973.25	+4	+15
5324.32	-1	+17	5159.18	-1	+22	4966.21	...	+15*
5316.79 ^d	+1	+22	5155.90	-4	...	4957.54 ^d	...	+16*
5307.49	-1	+17	5154.17	-1	...	4950.26	...	+17*
5302.43	...	+17	5150.94	+2	...	4942.65	...	+17*
5300.86	-2	...	5148.25 ^d	...	+19	4934.20	-2	+17
5298.90	...	} +13	5146.62	-1	...	4924.90	-1	...
5298.57	...		5142.97 ^d	+2	...	4924.04	+1	+21
5298.34	...		5141.81	+4	...	4920.63	0	+16
5298.06	...		5139.44 ^d	+3	+28	4919.12 ⁷	-1	+8
5296.76	+4	...	5133.82	-1	+18	4907.85	+2	...
5288.68	-4	+17	5127.47	0	...	4903.42	-1	+21
5283.75	0	+18	5126.32	-1	...	4900.31	-7	...
5281.89	+2	+26	5125.26 ^d	...	+22	4900.05	-1	...
5276.20	-6	} +22	5121.74	-1	...	4891.68	...	+10
5275.89	...		5115.50	0	+29	4890.87	+1	+23
5273.37 ^d	+1	...	5110.48	+2	...	4885.38 ^d	...	+19*
5270.43 ^d	0	+12	5109.76	0	...	4878.30	...	+19*
5269.66	-1	+24	5107.63 ^d	...	+22	4871.41	...	+19*
5265.73 ^d	...	+24	5105.67	-1	...	4861.42	+1	+22
5262.36	...	} +25	5098.72 ^d	...	+19	4859.86	0	...
5262.28	...		5097.10	} (-3 (+5)	...			
5261.82	-1		5096.94		...			

¹ Another line to the violet side.² Companion to the red side.³ Companion to the violet side.⁴ Companion to the violet side.⁵ Probably Rowland's 5241.60.⁶ Double line to the red side.⁷ Three lines to the violet side.

The intensity of the lines adopted for medium sun is the mean of the estimations made near the meridian; yet if the mean fell between two classes of the intensity scale, the low sun observations were consulted. As to the fainter lines the mean of the intensity had often to be corrected in accordance with the definition of our classes of intensity. Thus a faint line which had only once been seen was considered equal 1, except when it stood near a dark line, or was a component of a close double line. Further, if a line of intensity "3" at high sun had frequently been overlooked in low sun, we assumed it to be of intensity "2." Moreover, a line of intensity "2" was entered as "3" when never missed either in high or low altitudes of the sun.

Before the intensity of the telluric lines can be treated of, it is necessary to show how the absorption at different altitudes may be expressed in units of that in the zenith.

6. ABSORPTION AT DIFFERENT ALTITUDES.

This problem has been solved in its simplest form by LAPLACE. Supposing the absorption to increase with the first power of the density, he finds the absorption in our atmosphere, for any zenith-distance, proportional to the refraction divided by the sine of the zenith-distance. Yet M. JANSSEN* has shown that, for certain bands in the absorption spectrum of oxygen, the same absorption is produced in columns of oxygen of different lengths, if these are inversely proportional to the squares of the densities.

This discovery induces us to develop the problem generally; the more so, as one of these remarkable oxygen bands falls within the region of our work.

Let s be the uniform density of a layer of atmosphere bounded by spheres of the radii r and $r + dr$; and let ν' be the angle between the curve of light and the radius r . Suppose the absorption to be proportional to the $(n + 1)$ th power of the density; then we have

$$dF = \frac{dr}{\cos \nu'} \rho^{n+1} \quad . \quad . \quad . \quad . \quad . \quad . \quad (1);$$

where F denotes the length of a column of atmosphere of the density 1, which produces the same absorption.

Assuming BESSEL's hypothesis† respecting the decrease of density, we have

$$\rho = \rho_0 e^{-\beta s} \text{ and } s = 1 - \frac{a}{r} \quad . \quad . \quad . \quad . \quad . \quad . \quad (2).$$

in which ρ_0 designates the density at the surface of the earth, β a constant ($= 745.747$), and a the radius of the earth.

Now suppose that μ and μ_0 are respectively the indices of refraction in the layer of air

* *Vierteljahrsschrift der Astronomischen Gesellschaft*, 25 Jahrgang, Erstes Heft, Leipzig, 1890.

† BESSEL, *Fundamenta astronomiæ* . . . Regiomonti, 1818, Sectio iv.

under consideration and in the air at the earth's surface, Z the angle between the curve of light and the radius α , then

$$r\mu \sin \nu' = \alpha\mu_0 \sin Z \quad . \quad . \quad . \quad . \quad . \quad (3).$$

Combining these formulæ we have

$$dF = a\rho_0^{n+1} \frac{\mu}{(1-s)^2\mu_0} \frac{-1}{(n+1)\beta} \sqrt{\frac{de^{-(n+1)\beta s}}{\cos^2 Z - \left(1 - \frac{\mu^2}{\mu_0^2}\right) + (2s-s^2)\sin^2 Z}} \quad . \quad . \quad . \quad (4)$$

a form similar to LAPLACE's differential equation of astronomical refraction.* We integrate this equation at first for large Z , following almost the same course as LAPLACE has chosen for $n=0$. We introduce with him the constant of refraction defined by

$$2\alpha = \frac{\mu_0^2 - 1}{\mu_0^2},$$

and consider that

$$\frac{\mu^2 - 1}{\mu_0^2 - 1} = \frac{\rho}{\rho_0},$$

hence and by (2)

$$1 - \frac{\mu^2}{\mu_0^2} = 2\alpha(1 - e^{-\beta s}) \quad . \quad . \quad . \quad . \quad . \quad (5).$$

$\frac{1}{(1-s)^2} \frac{\mu}{\mu_0}$ changes from 1 at the earth's surface to 1.025 at a height of 50 miles. We may therefore develope (4) into a series according to powers of s . The first term becomes after integrating

$$F_0 = a\rho_0^{n+1} \frac{-1}{(n+1)\beta} \int \sqrt{\frac{de^{-(n+1)\beta s}}{\cos^2 Z + 2\sin^2 Z \left[s - \frac{\alpha}{\sin^2 Z}(1 - e^{-\beta s})\right]}}.$$

Denote

$$s - \frac{\alpha}{\sin^2 Z}(1 - e^{-\beta s}) = x$$

and

$$y = x + \frac{\alpha}{\sin^2 Z} \quad . \quad . \quad . \quad . \quad . \quad (6).$$

LAGRANGE's formula for Reversion gives

$$e^{-(n+1)\beta s} = e^{-(n+1)\beta y} + \frac{\alpha}{\sin^2 Z}(n+1)\beta e^{-(n+2)\beta y} + \dots \frac{1}{(m-1)!} \left(\frac{\alpha}{\sin^2 Z}\right)^{m-1} (n+m)^{m-2} (n+1)\beta^{m-1} e^{-(n+m)\beta y} + \dots$$

Hence the m th term of F_0 becomes

$$F_{0,m} = a\rho_0^{n+1} \frac{1}{(m-1)!} \left[\frac{(n+m)\alpha\beta}{\sin^2 Z}\right]^{m-1} e^{-(n+m)\frac{\alpha\beta}{\sin^2 Z}} \int \frac{e^{-(n+m)\beta x} dx}{\sqrt{\cos^2 Z + 2\sin^2 Z \cdot x}}.$$

* LAPLACE, *Traité de mécanique céleste*, Tome iv. livre x. p. 246. Paris, 1805.

The integration must extend from $x = 0$ to $x = s_1 - \frac{\alpha}{\sin^2 Z}(1 - e^{-\beta s_1})$, where s_1 corresponds to the upper limit of the atmosphere. But since the value of the function which has to be integrated is very small for the upper limit, the value of the integral will not be altered if this limit be supposed to be ∞ . LAPLACE defines (*loc. cit.*, p. 250)

$$\psi(r) = e^{T^2} \int_T^\infty e^{-t^2} dt \quad \text{if} \quad T = \sqrt{r} \frac{\beta}{2} \cotg Z,$$

or

$$\int_0^\infty \frac{e^{-r\beta x} dx}{\sqrt{\cos^2 Z + 2x \sin^2 Z}} = \frac{1}{\sin Z} \sqrt{\frac{2}{\beta}} \sqrt{\frac{1}{r}} \psi(r).$$

We arrive therefore at the result :

$$F_0 = \frac{1}{\sin Z} \frac{\alpha}{\beta} \rho_0^{n+1} \sqrt{2\beta} \left\{ e^{-(n+1) \frac{\alpha\beta}{\sin^2 Z}} \frac{\psi(n+1)}{\sqrt{n+1}} + \left[(n+2) \frac{\alpha\beta}{\sin^2 Z} \right] e^{-(n+2) \frac{\alpha\beta}{\sin^2 Z}} \frac{\psi(n+2)}{\sqrt{n+2}} + \dots \right\}, \dots (7)$$

and the general term within the bracket becomes

$$\frac{1}{(m-1)!} \left[(n+m) \frac{\alpha\beta}{\sin^2 Z} \right]^{m-1} e^{-(n+m) \frac{\alpha\beta}{\sin^2 Z}} \frac{\psi(n+m)}{\sqrt{n+m}}.$$

The next largest term in the series into which $F(4)$ has been developed arises from the second term in $(1-s)^{-2}$. At the same time $\frac{\mu}{\mu_0}$ may be taken into account. By (5) and (6) we have

$$\frac{\mu}{\mu_0} \frac{1}{(1-s)^2} - 1 = \frac{2\alpha}{\sin^2 Z} - \alpha - \left[\frac{2\alpha}{\sin^2 Z} - \alpha \right] e^{-\beta s} + 2x.$$

When we substitute this expression in $dF(4)$, and write (7)

$$F_0 = \frac{C}{\sin Z} \Psi(n+1).$$

the correction depending on α becomes

$$\frac{C}{\sin Z} \left[\frac{2\alpha}{\sin^2 Z} - \alpha \right] \left[\Psi(n+1) - \Psi(n+2) \right] \quad . \quad . \quad . \quad (8).$$

α being less than 1 minute of arc, this correction is of no consequence. The part multiplied by $2x$ may be also reduced to ψ functions. We find that this term can be taken into account if we replace in $F_0(7)$

$$\frac{\psi(n+m)}{\sqrt{n+m}} \quad \text{by} \quad \frac{\psi(n+m)}{\sqrt{n+m}} \left[1 - \cotg^2 Z + \frac{1}{(n+m)\beta} \right] + \frac{\cotg Z}{(n+m)\sqrt{2\beta}} \quad . \quad . \quad (9).$$

Since Z has been supposed to be large and $\beta = 745.747$ in BESSEL'S hypothesis, the correction is very small indeed. This holds also for smaller values of Z , because $\frac{\cotg Z}{(n+m)\sqrt{2}\beta}$ makes the first term* in $-\cotg^2 Z \frac{\psi(n+m)}{\sqrt{n+m}}$ vanish.

For small values of Z we can developpe dF (4) according to powers of $tg^2 Z$. Neglecting all terms multiplied by s^3 and α^2 we obtain

$$F = \frac{1}{\cos Z} \frac{\alpha \rho_0^{n+1}}{\beta^{n+1}} \left\{ 1 + \frac{2}{(n+1)\beta} + \dots - tg^2 Z \left(\frac{1}{(n+1)\beta} + \frac{4}{(n+1)^2 \beta^2} - \frac{\alpha}{n+2} \right) \right. \\ \left. + tg^4 Z \left(\frac{3}{(n+1)^2 \beta^2} - \frac{3\alpha}{\beta} \frac{2n+3}{(n+1)(n+2)} \right) - \dots \right\} \quad (10).$$

For the zenith the formula becomes

$$F = \frac{\alpha}{\beta} \frac{\rho_0^{n+1}}{n+1} \left\{ 1 + \frac{2}{(n+1)\beta} + \dots \right\} \quad (11).$$

With BESSEL'S values of $\frac{\alpha}{\beta}$ and β we find for the oxygen of our atmosphere

$$F = 5572 \text{ feet if } n \text{ be equal } 0,$$

$$F = 579 \text{ feet if } n \text{ be equal } 1;$$

or, in words, the absorption produced by the oxygen of our atmosphere in the zenith is the same as that of a column 5572 feet in length of oxygen under a pressure of 1 atmosphere, if the absorption be proportional to the density; and of 579 feet, if it be proportional to the square of the density. M. JANSSEN finds 1660 and 172 mètres respectively, by employing a coefficient which RAMONT had computed from the heights of mountains determined by barometric and trigonometric measurements.†

The formulæ (7), (8), (9), (10) enable us to compute the absorption in any zenith-distance, but for our purpose we may dispense with the corrections given in (8) and (9).

For $n=0$ they admit of great simplification. This special value makes the expression within the bracket of (7) identical with that in LAPLACE'S and BESSEL'S formula of refraction. Hence we obtain

$$F_1 = \frac{1}{\sin Z} \frac{\alpha}{\beta} \rho_0 \frac{1-\alpha}{\alpha} \delta Z,$$

in which δZ denotes the astronomical refraction, or in units of F in the zenith (see (11))

$$f_1 = \frac{1-\alpha}{\alpha} \frac{\delta Z}{\sin Z} \quad (12).$$

This result might have been immediately deduced from the fundamental equations.

* LAPLACE, *ibid.*, No. 5.

† LAPLACE, *Traité de mécanique céleste*, Tome iv. livre x. chapitre iv.

For small Z (10) gives

$$f_1 = \frac{1}{\cos^2 Z} \left[1 - tg^2 Z \left(\frac{1}{\beta} - \frac{a}{2} \right) + tg^4 Z \left(\frac{3}{\beta^2} - \frac{9}{2} \frac{a}{\beta} \right) \dots \right] \quad (12a).$$

Supposing $n=1$, (7) gives for large Z , if $f_2=1$ corresponds to the zenith

$$f_2 = \frac{2\sqrt{2}\beta}{\sin Z} \left\{ e^{\frac{-2a\beta}{\sin^2 Z}} \frac{\psi(2)}{\sqrt{2}} + \frac{1}{1!} \left(\frac{3a\beta}{\sin^2 Z} \right) e^{\frac{-3a\beta}{\sin^2 Z}} \frac{\psi(3)}{\sqrt{3}} + \frac{1}{2!} \left(\frac{4a\beta}{\sin^2 Z} \right)^2 e^{\frac{-4a\beta}{\sin^2 Z}} \frac{\psi(4)}{\sqrt{4}} + \dots \right\} \quad (13),$$

and for smaller Z

$$f_2 = \frac{1}{\cos Z} \left[1 - tg^2 Z \left(\frac{1}{2\beta} - \frac{a}{3} \right) + tg^4 Z \left(\frac{3}{4\beta^2} - \frac{5}{2} \frac{a}{\beta} \right) \dots \right] \quad (13a),$$

which may be used up to $Z=85^\circ$.

If BESSEL's constants be introduced, f refers to a barometric pressure of 29.6 inches and about 50° Fahrenheit. In the case of $n=0$ any change of pressure and temperature is easily taken into account by employing BESSEL's tables of refraction. From these a table was computed which gave f_1 and its corrections for any barometer and thermometer readings. The interval of the argument "Apparent Zenith-Distance" was taken at 0.1 between $Z=90^\circ$ and $Z=83^\circ$.

The ψ functions in (13) were interpolated from BESSEL's tables in the *Fundamenta Astronomiæ*. The following is an abstract of our tables:—

Apparent Zenith-Distance.	Absorption proportional to the Density.		Absorption proportional to the Square of the Density.	
	f_1	F_1 in Miles.	f_2	F_2 in Miles.
0°	1.0	1.1	1.0	0.12
20	1.1	1.2	1.1	0.13
40	1.3	1.4	1.3	0.15
60	2.0	2.2	2.0	0.23
80	5.6	6.2	5.7	0.66
83	7.7	8.5	7.9	0.9
84	8.8	9.8	9.1	1.0
85	10.2	11.3	10.7	1.2
86	12.1	13.4	13.1	1.5
87	14.8	16.4	16.5	1.9
88	18.9	21.0	22.0	2.5
89	25.4	28.2	32.1	3.7
90	36.4	40.4	53.7	6.2

F gives the length in miles of a column of oxygen under a pressure of 29.6 inches at 50° Fahrenheit, which would produce the same effect as the oxygen of our atmosphere.

To assign to every line the corresponding value of f , the zenith distance was

computed from the observed Greenwich mean time. Let t be the hour angle of the sun, e the equation of time, l the longitude, and T the observed Greenwich mean time, then

$$t = T - l - e.$$

A table was prepared which gave the apparent zenith-distance with the two arguments, hour angle t and the sun's declination. When the values of f had been interpolated from these tables for every observed Greenwich mean time, they were entered as ordinates on cross-lined paper, the abscissæ being the current numbers of the lines to which they belong. A curve was then drawn through the points and the number of the line read off, for which the numerical value of f was a whole number. Close to the horizon, however, where f alters rapidly, it was necessary to secure more points of the curve by taking f from the table with several intermediate values of the zenith-distance.

7. THE PROBABLE ERROR OF THE RESULTS.

The complexity of the recording apparatus did not entitle us to expect any great accuracy in observations which were at some distance from the standard lines. It is true the working of the train of wheels had been examined under a high magnifying power of a microscope, before the work was undertaken. But although the wheels appeared to move regularly, when the fastest of the set was turned steadily, there was still the chance of periodic errors being produced by the form of the teeth.

It will be remembered that the bracket which carried the second wheel and the two pinions could be pulled out of position to permit a quick motion of the grating. This quick motion was used before every set of observations, in order to bring the required region of the spectrum into the field of view. Therefore all the errors emanating from irregularities of these wheels have the character of accidental errors. With the first wheel, the endless screw, and the worm-wheel it was different. The grating had a fixed position in relation to the worm-wheel, so that every line was observed almost in the same position of these three parts. Yet the great number of standard lines acted favourably. One revolution of the screw covered about 90 standard lines on an average, thus rendering harmless all the periodic errors in the screw and the form of the teeth of the worm-wheel. But the first wheel, which is on the same axis as the screw, turns about a tooth and a half for the mean interval between the standard lines. Any irregularities in the form of these teeth must lead to systematic error, which cannot be eliminated by merely multiplying the observations. It was not until 1889 that the grating was frequently altered in position with reference to the worm-wheel. Hence it was of importance to observe the second spectrum on both sides of the normal of the grating. It is true that, as already pointed out, the observations on one side preponderate, but those on the other side are sufficiently numerous to test the magnitude of the errors arising from the source under consideration. Moreover, the recording wheel worked in only one direction, while the lines travelled in opposite directions through the field of view on the

two positions of the grating. Therefore any personal error in bringing the lines to the cross wires would be eliminated if it depended on the direction of the motion.

In order to form an idea of the working of the apparatus 142 lines with 1583 single observations were selected, which lay about half-way between standard lines, and were distributed over the whole length of the spectrum. They gave as the probable error of a single observation

$$r = \pm 0.056 \text{ \AA.U.}$$

This value corresponds to $\frac{1}{3}$ th inch on the recording paper, to $\frac{1}{237}$ th inch on the circumference of the first wheel, and to $\frac{1}{90,000}$ th inch on the circumference of the worm-wheel. Every line having been observed on an average eleven times, the probable error of the wave-length of any well-observed line lying half-way between two standard lines amounts to

$$r = \pm 0.019 \text{ \AA.U.}$$

It would have occupied too much time to repeat the same computation for all the lines. We therefore chose an entirely different way. In the course of the computations we had deduced the means of the wave-lengths for every line, as well from the high sun observations, as from those of the low sun in both positions of the grating. There are thus three series of results belonging to the same lines.

Let s_1 and s_2 designate the values given in two sets of results, and m the true value. The average error η of one value is then :

$$\eta_1 = \pm \frac{[s_1 - m]}{n}; \quad \eta_2 = \pm \frac{[s_2 - m]}{n}$$

if n is the number of values in each set, and $[\]$ stands for the sum irrespective of the signs.

Let s_1 be the mean of p , and s_2 of q observations, and suppose all the observations equally accurate.

$$[s_1 - m] \sqrt{p} - [s_2 - m] \sqrt{q} = 0.$$

Further

$$[s_1 - m] + [s_2 - m] = [s_2 - s_1]$$

when the true value m is supposed to lie between s_1 and s_2 .

This granted, the average error of one value resting on $p + q$ observations becomes :

$$\eta = \pm \frac{\sqrt{pq}}{\sqrt{p+q} (\sqrt{p} + \sqrt{q})} \frac{[s_2 - s_1]}{n}.$$

The factor being symmetrical with respect to p and q , the same formula will hold good if p and q be interchanged for any pair of values.

The probable error follows by the known relation

$$r = 0.845\eta.$$

In using this formula we are well aware that neither the condition of equal accuracy, nor that of equality in the number of observations, is strictly fulfilled. Comparing the

wave-lengths of 2395 different lines obtained on one side of the normal with those found on the other side, we find the average difference

$$\frac{[s_2 - s_1]}{n} = 0.065 \text{ \AA.U.}$$

The probable error of one wave-length, which is the mean of all low sun observations, then becomes for $p = q$

$$r = \pm 0.019 \text{ \AA.U.}$$

One series, however, contains on an average twice as many observations, hence $p = 2q$ and

$$r = \pm 0.018 \text{ \AA.U.}$$

which nearly holds for the mean of six observations of the same line in low sun.

The same comparisons give on an average a systematic difference of 0.007 \AA.U.

We next compared the wave-lengths which result from all the low sun observations with those derived from high sun. They were divided into two classes, one of which comprised the faint lines of intensity 1 to 3, and the other the darker lines. 1710 faint lines show an average difference of 0.074 \AA.U. and $+ 0.007$ systematic difference, whereas 1215 well-defined lines give respectively 0.048 \AA.U. and $+ 0.001 \text{ \AA.U.}$ Supposing the low sun observations to be twice as numerous as those made at medium altitudes, we find the probable error of one definite wave-length

$$r = \pm 0.021 \text{ \AA.U. for intensity } < 4$$

$$r = \pm 0.014 \text{ \AA.U. for intensity } \geq 4.$$

There is an increase of 1 in the last decimal, if the mean of the observations in low and high sun are considered equally accurate. The greater probable error of the fainter lines is sufficiently explained by the smaller number of observations on which each wave-length rests, and the greater difficulty in perceiving them.

From the preceding examination we gather that there is no systematic difference either between the observations on opposite sides of the normal or between those made at medium altitudes and near the horizon. The probable error of one definite wave-length may be considered to amount on an average to $\pm 0.02 \text{ \AA.U.}$, if the line has been observed about six times. There will be lines, of course, which may turn out to deviate considerably more than this from the true value, in spite of having been frequently observed. But this will not surprise anybody who has ever compared the difference of two independent series of results with the probable errors as given by their authors.

The probable error is not so small as to render it worth while to correct the morning and evening observations for the displacement of the lines due to the rotation of the earth. For the latitude of Dun Echt the maximum effect is about 0.005 \AA.U. The displacement produced by the eccentricity of the earth's orbit can also be neglected, although it amounts to about 0.01 \AA.U. at the time of the equinoxes.

The probable error of the estimations of intensity of blackness was derived from those regions where no telluric lines were found. High and low sun observations were treated separately. The number of instances was counted in which the estimated intensity was the same as the final mean value expressed in whole numbers. The same was done for all the observations that deviated ± 1 , ± 2 , &c., classes from the average. The results are found in the following table:—

TABLE III.

Region of Spectrum, λ in 10^{-6} mm.	High Sun.			Low Sun.		
	566-552	538-511	497-486	566-552	538-511	497-486
Number of single observations,	830	1844	710	1501	2855	1006
Number of observations in 100 of intensity equal mean	71.5	71.6	72.8	63.8	61.7	61.0
" " " equal mean ± 1	28.0	27.9	26.6	34.6	36.6	36.5
" " " equal mean ± 2	0.5	0.5	0.6	1.5	1.5	2.1
" " " equal mean ± 3	...	...	...	0.1	0.2	0.4
Probable error of one estimation of intensity,	± 0.25	± 0.25	± 0.24	± 0.32	± 0.33	± 0.35

If it is borne in mind that the intensity-scale progresses by whole numbers, it is evident that the high sun estimations are as accurate as the scale allows. The low sun estimations are a little inferior to them in point of accuracy, as would be expected from the great variations in the intensity of the continuous spectrum.

We further compared the mean intensity as observed in low sun with that in high sun observations. All the lines which were darker in low sun than in high sun were counted, and the average difference between their intensities computed. The same was repeated with those which appeared feebler in low sun, and with those of equal intensities at both altitudes. The lines were divided into two classes, one comprising those fainter than 8, and the other the darker lines. Close double lines were excluded unless they had been separated on all occasions. The spectrum was divided into zones to show the changes in the regions where telluric lines are numerous.

TABLE IV.

DIFFERENCE OF INTENSITIES OF LOW AND HIGH SUN OBSERVATIONS.

Region of Spectrum, λ in 10^{-6} mm.		Number of lines < 8 .		n	Δi	n	Δi	n	Δi	Number of lines > 8 .		n	Δi	n	Δi	n	Δi
Regions of telluric lines.	566-552	322	30	+0.5	30	0	40	-0.5	26	40	+0.3	10	0	50	-0.5		
	535-524	258	34	+0.6	33	0	33	-0.5	38	32	+0.5	27	0	41	-0.7		
	524-512	246	33	+0.5	35	0	31	-0.5	61	54	+0.4	15	0	31	-0.6		
	500-486	231	18	+0.4	27	0	55	-0.6	50	40	+0.6	20	0	40	-0.5		
	602-590	291	82	+2.6	8	0	10	-1.1	10	...	...	40	0	60	-1.6
	590-578	361	69	+1.7	12	0	19	-0.8	4	25	+0.1	...	...	75	-0.4
	578-566	328	72	+1.8	17	0	11	-0.6	19	16	+0.4	16	0	68	-0.7		
	552-535	409	48	+1.0	20	0	32	-0.6	42	33	+0.5	14	0	52	-0.6		
	512-500	258	56	+1.5	15	0	29	-0.7	53	43	+0.6	25	0	32	-0.6		

In this table n is the number of lines in 100 that show an average difference Δi between the means of the intensities in low and in high sun. The first part of the table, in which there are no telluric lines, proves that the same scale of intensity applies to both low and high sun. Only in the regions of blue-green have the lines been estimated too faint near the horizon. In the regions of telluric lines, especially in the less refrangible part, where many dark lines spring up in low altitudes, the solar lines are estimated much too faint in a low sun. The reason for this may be traced to the effect of contrast. This difference, however, simply emphasizes the lines produced by atmospheric absorption.

8. THE TELLURIC LINES.

A great many of the telluric lines could be designated immediately, while others presented much difficulty. The faint lines of the two lowest classes of intensity naturally gave the most trouble; at high altitudes they were easily overlooked in the strong light of the continuous spectrum, while near the horizon they might be easy objects under favourable conditions of the sky. In these instances we were guided in our decision by the behaviour of other faint lines of undoubted solar origin.

In order to avoid mistakes this part of the work was repeated several times. Of course, in a region where many telluric lines occur, there is a tendency to ascribe lines to atmospheric absorption which in other places would pass as solar. For this reason the sheets on which the observations were entered were taken at random, when being examined respecting the origin of the lines.

Due regard was also paid to the mass of air the light had to pass through. Throughout we endeavoured to reduce the intensity of the telluric lines to a uniform depth of atmosphere, at least in the same spectral region. In the yellow they correspond to about 89° , and in the green to $88^\circ.3$ zenith-distance for an average amount of water-vapour.

With few exceptions all the telluric lines thus picked out were found to be arranged in three bands, the first with 678 lines stretching from $\lambda = 6020$ to 5666 \AA.U. , the second from $\lambda = 5530$ to 5386 \AA.U. , with 106 lines, and the third from $\lambda = 5111$ to 4981 \AA.U. , with 116 lines.

One would think that telluric lines which are of equal intensity in the same part of the spectrum at medium altitudes of the sun would behave alike, if the absorption be increased. This, however, does not happen as a rule.

In the following table the horizontal rows show the number of telluric lines of a given intensity in any part of the spectrum at medium altitudes, while the vertical column in which the number stands indicates the intensity of the same lines, when seen near the horizon. *E.g.*, from the second row of the table we see that with high sun there are 14 lines in $\lambda = 602$ to 584 of an intensity = 1, which assume an intensity of 6 near the horizon. Lines that are not visible in a medium sun are ranged in the row of intensity = 0.

TABLE V.

Region of Spectrum, λ in 10^{-6} mm.	Intensity at Medium Altitudes.	Intensity near Horizon.												
		2	3	4	5	6	7	8	9	10	11	12	13	14
602 to 584	0	3	9	14	13	8	...	5	...	...	...	...	...	1
	1	1	4	17	11	14	5	4	...	...	...	...	...	...
	2	...	6	18	20	22	17	14	4	1	...	...	...	...
	3	...	...	2	4	6	7	27	13	5	1	...	...	...
	4	...	...	...	1	2	1	4	14	18	9	2	...	...
	5	...	...	...	...	1	...	1	3	10	11	7	...	...
	6	...	...	...	...	...	...	...	...	1	2	7	...	...
	7	...	...	...	...	...	...	...	...	1	2	1	...	...
	8	...	...	...	...	...	...	...	...	1	1	...	...	...
584 to 578	0	3	8	9	3	...	...	...	...	...	...	...	...	...
	1	4	7	14	5	...	1	...	...	...	...	...	...	...
	2	...	7	29	4	2	...	...	...	...	...	...	...	...
	3	...	...	4	3	2	...	...	...	...	...	...	...	...
	4	...	...	...	1	...	...	1	...	...	...	...	...	...
	5	...	...	...	...	...	...	...	...	...	...	...	...	...
578 to 572	0	4	5	1	1	3	...	...	...	...	...	...	...	...
	1	4	16	10	4	...	3	...	2	1	...	...	...	...
	2	...	6	12	8	6	6	5	4	2	1	...	...	...
	3	...	...	6	1	...	...	2	1	...	...	...	...	...
	4	...	...	...	...	...	...	...	...	...	...	...	...	...
	5	...	...	...	...	...	2	...	...	...	...	...	...	...
	6	...	...	...	...	...	...	...	...	...	...	...	...	...
572 to 566	0	...	4	6	1	2	1	2	...	...	...	...	...	...
	1	1	5	7	5	2	...	2	...	...	...	...	...	...
	2	...	4	7	6	1	1	5	2	2	1	...	...	...
	3	...	...	...	2	...	...	1	2	1	...	...	...	...
	4	...	...	...	...	...	...	1	...	1	...	...	...	...
	5	...	...	...	...	...	...	...	...	...	...	...	...	...
553 to 538	0	3	5	6	1	...	1	...	...	...	...	...	...	...
	1	...	9	7	3	1	1	...	...	...	...	...	...	...
	2	...	11	18	8	5	4	1	...	...	...	...	...	...
	3	...	...	1	6	1	1	2	1	...	...	...	...	...
	4	...	...	...	...	3	3	2	...	...	...	...	...	...
511 to 498	0	...	2	4	6	3	1	1	1	...	...	...	...	...
	1	...	5	6	5	2	1	1	...	...	...	...	...	...
	2	...	5	9	12	9	3	1	1	...	...	...	...	...
	3	...	...	4	7	6	1	5	...	1	...	...	...	...
	4	...	...	...	1	...	...	2	1	...	...	...	...	...
	5	...	...	...	...	...	1	2	...	...	...	...	...	...
	6	...	...	...	...	...	...	1	1	...	...	...	...	...
	7	...	...	...	...	...	...	...	1	...	...	...	...	...
	8	...	...	...	...	...	...	...	...	1	1	...	...	...
	9	...	...	...	...	...	...	...	...	...	2	...	...	...

At a glance it is apparent, that lines of equal intensity at medium altitudes increase differently in blackness as the sun approaches the horizon. If to each class of intensity at medium altitude we ascribe that intensity near the horizon, which is shown by the maximum number of lines in the preceding table, we obtain the values entered in the following table, where two numbers are given whenever the lines are clustered about two maxima:—

TABLE VI.

Intensity at Medium Altitudes.	Intensity near Horizon.						
	Wave-Length 602 to 584.	Wave-Length 584 to 578.	Wave-Length 578 to 572.		Wave-Length 572 to 566.		Wave-Length 553 to 538.
0	4.5	3.5	2.5	6	3.5	6	3.5
1	5	4	3.5	7	4	7	3.5
2	6	4	4	8	4.5	8	4
3	8	5	4	...	...	9	...
4	9.5	...	...	...	...	...	...
5	11	...	...	...	...	...	...
6	12	...	...	...	...	...	...

From the fact that every class of intensity has a range of ± 0.5 we shall show, that, for some of the regions, the values given in this table explain the different behaviour of lines of the same intensity at medium altitudes as exhibited in the Table V.

REGION $\lambda = 6020$ to 5840 .—Since intensity “3” for instance ranges from intensity 2.5 to 3.5, the preceding table shows that lines between 2.5 to 3.5 at medium altitudes give an intensity between 7 and 9 near the horizon. This range further increases to 6.5 and 9.5 on account of the extent of each class of intensity. Without, therefore, admitting any error in the estimations of intensity, we find thus, that lines of intensity “3” at medium altitudes may increase near the horizon to any intensity between 6.5 and 9.5. According to Table V., at least 47 lines out of 65 fulfil this condition. But there are errors in the adopted intensities which will increase this range considerably. We have to bear in mind that the single estimations of intensity of the telluric lines vary with the altitude of the sun, and in this region, as we may anticipate, with the amount of water-vapour, and that the adopted intensities are chosen to correspond to a uniform altitude of the sun and an average amount of water-vapour. These reductions entail, of course, a considerably larger error than is met with for the solar lines (comp. Table III.). If it be permissible, therefore, to ascribe to every class of intensity a range of ± 1 instead of ± 0.5 in high sun as well as in low sun, we find, by analogous reasoning, that lines of adopted intensity “3” at high sun should develop near the horizon into lines of intensity 5 to 10.5, with the restriction that the number of lines of each class within this range increases towards the middle of the range. With this extension of our scale there are but 3 lines left out of 65, of which the intensity at low sun falls beyond this range. Two of these three alter but one class of intensity near the horizon, and one as much as eight classes. With regard to

the former it may be supposed that they are solar lines on which fainter telluric lines are superposed. Also, the great change in intensity of the one line may be accounted for by the table. By comparing the intensities of many close double lines with the intensities observed when they were not separated, we deduced that two close faint lines combined appeared hardly one class of intensity darker than the components, while two close dark lines produced the effect of a line two classes darker in intensity than its components. In this particular case the line "3" ought to consist at least of 4 lines of intensity "2," in order to present at low sun the appearance of a line of intensity 11. If the probability of this explanation is not conceded, one is obliged to assume that the absorption produced by one and the same medium in the same part of the spectrum need not necessarily obey the same law. Treating all the other classes of intensity in the same way, we find amongst 376 telluric lines, 23 superposed on solar lines and 12 close multiple lines. These numbers will increase if the range of each class be diminished.

We have to draw attention to one particular telluric line, which, invisible at medium altitudes of the sun, comes into existence as one of the broadest lines of the spectrum, on the *less* refrangible side of D_2 , when the sun is near the horizon. At an altitude of about 6° it appears just as broad and of the same intensity as its great solar companion. Besides the observations given below, we found the D_2 -line double on 12 occasions from June 14, 1887, to August 15, 1888, the sun being at an average altitude of 6 degrees. On July 19, 1888, this appearance was confirmed in the third spectrum under a higher magnifying power of the viewing telescope. Further to the less refrangible side, another line of the intensity "4" was observed close to it on three of these days. When the sun approached the horizon both lines broadened and formed one dark band with D_2 . Now D_2 is one of those broad solar lines whose intensity of blackness is below that of a telluric line of the same breadth. If, therefore, the telluric companion at a certain altitude showed the same intensity and breadth as D_2 , we might explain its appearance by supposing the telluric line produced by a set of very close atmospheric lines of less intensity.

In the next region, $\lambda = 5840$ to 5780 , we meet with faint telluric lines of different behaviour. In a high sun they are hardly perceptible, while near the horizon their intensity is increased only two or three classes of the scale. The changes in their intensity may be explained by Table VI. in the same manner as before. This band appears to be continued in the following region, $\lambda = 5780$ to 5720 , although there are some lines to be found which suffer a much greater absorption. On account of the small changes in the intensity of most of the lines it seems improbable that the lines which alter up to nine classes of intensity are produced by bands of lines. We rather believe them to be due to the action of another medium. Under this supposition we represent the changes of intensity, as exhibited by Table V., by two sets of intensities in Table VI.

Both classes of lines are continued within the region $\lambda = 5720$ to 5660 ; the number of the faint telluric lines has however decreased, while the darker ones are still as numerous as before.

About the two isolated bands, $\lambda = 5538$ to 5386 and $\lambda = 5111$ to 4981 , we could not arrive at a satisfactory conclusion. Certainly, most of the lines can be brought into agreement with the values given in the table on p. 93, but some would still remain liable to a far greater absorption. Perhaps the values given in that table for the intensity at low sun may have to be increased, and many further coincidences of telluric and solar lines admitted.

From the foregoing examination we come to the conclusion that the telluric lines from $\lambda = 6020$ to 5660 can be arranged in three bands, and that all the lines of the same band are probably due to the same absorptive medium.

There is no doubt left by our observations that most of the lines of the first band, $\lambda = 6020$ to 5840 , originate in a variable constituent of our atmosphere. That this constituent is water-vapour was established long ago by M. JANSSEN. The band is universally known as the rain-band. Our observations ascribe also the darker lines of the third band, $\lambda = 5780$ to 5660 , to the absorption of a variable element, whereas the origin of the group of faint lines which form the second band and overlap the third cannot be deduced from our observations alone.

On the refrangible side of the rain-band BREWSTER's¹ map contains a very dark band, which he calls δ , and which is very probably identical with our third band. He gives the following description of it:—" . . . it is one of the most characteristic features of the prismatic image of the light that has passed through a long space of air. It is discernible in the diffuse light of a dull day at any hour; it is that which Professor W. A. MILLER observed manifesting itself on the occasion of a thunder shower,² and it becomes evident in the direct solar rays when the luminary is several degrees above the horizon: . . . and when the sun is just setting, it becomes a broad space of almost total darkness. It appears to cover a larger amount of the image in the direction of E , as it deepens in shade. . . . There seems to be a difference in the visibility of these bands at different times, . . . thus on October 29, 1837, at Allerly, near Melrose, at the instant of sunset the luminous sky gave a spectrum in which $C6$ ($= \alpha$), though distinctly seen, was not black, nor was D , nor δ , while the line B was *very broad* and deep . . . and until the twilight had gone, the forementioned bands, usually so prominent, did not appear either black or white. On October 31, again, the atmospheric lines were not so dark as usual, while the rays beyond $C10$ ($=$ rain-band) had evidently suffered a considerable absorption, . . . but that the phenomena did not depend on either the absence or presence of humidity in the atmosphere, is evident from the fact that on the earlier date there was a keen frost, while on the later day the weather was wet, the thermometer being 38° F. . . . That moisture has some influence in the production of these bands, is shown by the effect of a fog on the solar radiations; thus on November 20, 1858, at 10 o'clock A.M., at London, the sun loomed red through a mist, and a prismatic analysis of its light showed α and B with extreme distinctness, and the characteristic C (6), δ , and η ."

¹ *Phil. Trans.*, vol. 150, 1860, p. 154, London, 1861.

² *Phil. Mag.*, August 1845, p. 85.

Considering that there is a strong water-vapour band close to the oxygen band *B*, Sir DAVID BREWSTER's description appears to us consistent with the assumption of water-vapour being the cause of the δ -band. Also, his observations on October 31 are not adverse to this hypothesis, because the atmospheric lines, which did not appear so dark as usual, include, besides δ , other water-vapour bands in the red end of the spectrum. That at the same time the rain-band had suffered a considerable absorption cannot be considered an argument against this view, if we compare the number of dark lines in the rain-band and δ -band in Table V. BREWSTER's description as well as our interpretation are apparently in opposition to the observations of ÅNGSTRÖM,¹ who says:—"Outre les trois groupes de raies situés près de *A*, *B* et α , il existe, à gauche de *D*, une bande d'absorption, toujours visible dans le spectre du ciel pur. Cette bande s'étend de 5681 à 5812 à peu près, et, d'après BREWSTER, je la désignerai dans la suite par la lettre δ . Dès que cette bande commence à se montrer dans le spectre solaire, on peut la résoudre en raies très-fines; mais au coucher du soleil, les raies, en se joignant, forment une bande obscure et continue. Or, puisque l'apparence de cette bande ne change pas avec les circonstances desquelles dépend l'intensité des raies d'absorption dues à la vapeur d'eau, l'origine en doit être attribuée à une cause toute différente. . . . Pour expliquer l'origine des bandes *A*, *B*, α et δ , qui sont très-constantes et ne dépendent pas sensiblement des variations de la température de l'air, il faut recourir à d'autres corps gazeux moins variables en tension que la vapeur d'eau." We can only reconcile ÅNGSTRÖM's view with BREWSTER's description and our own observations by supposing the fainter lines within the δ band to be produced by dry-gas absorption. Certainly these closely set lines present a sufficiently striking appearance, if viewed in a spectroscope like Ångström's, as may be concluded from the extent he gives to the δ -band towards the red. Besides, little water-vapour would suffice to make the region from $\lambda = 5710$ to 5680, which contains so many conspicuous solar lines, appear dark in a low sun.

This hypothesis is supported by some experiments that M. JANSSEN² has made on the absorption produced by oxygen. By employing tubes of different lengths filled with oxygen under different pressures, M. JANSSEN discovered that several absorption bands begin to appear in a tube 60 mètres in length charged with oxygen under a pressure of 6 atmospheres, and that the same effect is produced if the length of the tube be altered inversely as the square of the density. Thus he finds that the oxygen of one of these tubes is equivalent to a column of oxygen 2160 mètres long under the pressure of 1 atmosphere. But since the oxygen of our atmosphere in the zenith equals only 172 mètres at normal pressure, M. JANSSEN concludes that the absence of these bands in the solar spectrum at considerable altitudes of the sun is fully explained. The figures given in Chapter 6 prove that at zenith-distances larger than 86° the band should be visible in a spectroscope of the power M. JANSSEN employed. Most of our observations fulfil this con-

¹ *Recherches sur le spectre solaire*, p. 40.

² *Vierteljahrsschrift der astronomischen Gesellschaft*, 25 Jahrg., 1 Heft. Leipzig, 1890.

dition, some of them referring to a column of oxygen even three times as long as M. JANSSEN demands. There are, however, many faint telluric lines within the space $\lambda = 580$ to 572 which are visible at medium altitudes, when the atmosphere traversed equals only one-fifth of the length M. JANSSEN considers essential for their visibility. We are inclined to believe this to be due to the excellent optical appliances at our disposal, as shown by the great number of faint lines now observed for the first time.

However, there still remain numerous faint lines between this band and the rain-band, which, although of the same order of intensity as those of M. JANSSEN's oxygen-band, could hardly be grouped with them. Nor could they belong to the rain-band, a few dark lines excepted. Before beginning this work we were struck by a relation between the oscillation frequencies of the head lines of the groups A , B and a and of the region under consideration, which Professor PIAZZI SMYTH named in his maps *Region of "Low Sun Band" of Thin and Closely-set Telluric Dry-Gas Lines*. If we suppose the relation between the oscillation frequencies of A , B and a not to be accidental, we should expect an oxygen-band to end at $\lambda = 5788$ Å.U., or very near to the place where M. JANSSEN's band begins. This supposed oxygen band could not be identical with the latter, because, according to M. JANSSEN, the A , B and a groups increase proportionally to the first power of the density. Now our observations give a band of closely-set lines, which ends at $\lambda = 5788$, and which does not at all present the general aspect of the water-vapour bands. It still remains an open question whether this is the result of a fortuitous coincidence, or is due to some unknown law.

The two isolated groups of lines from $\lambda = 5538$ to 5386 and from 5111 to 4981 are produced by a variable element of our atmosphere. We conclude this from the behaviour of the darker lines only.

We have now to draw attention to a remarkable relation among the oscillation frequencies which correspond to the middle of the water-vapour groups. Attributing the two isolated groups of lines in the green and green-blue to the absorption of water-vapour, we obtain the following values of $\frac{1}{\lambda}$, each being the mean of $\frac{1}{\lambda}$ of the first and last prominent lines of each band. The values of the inverted wave-lengths of the water-vapour bands in the red end of the spectrum have been taken from Professor SMYTH's maps and my own observations in 1889.

	$\frac{1}{\lambda}$	No. of Band.
a ,	1380	1
Water-vapour group near B ,	(1434)	2
" " " near C ,	1533	3
Rain-band,	1684	4
δ -band,	(1748)	5
Water-vapour group $\lambda = 5538$ to 5386 (ξ),	1833	6
" " " $\lambda = 5111$ to 4981 (i),	1973	7

The inverted wave-lengths of the first, third, fourth, sixth, and seventh bands form very

nearly an arithmetical progression which could easily be made perfect without moving appreciably from the middle of each band. The first, third, and fifth of this series are the strongest in their respective parts of the spectrum. It will be interesting to see if the water-vapour bands beyond *F* fit into the series given above. Possibly they may also give some information about the water-vapour group near *B* and the δ -band.¹

Outside the groups mentioned but few telluric lines have been picked out, although the work has been done without knowing where telluric lines would occur. In fact, previous maps were only consulted after our charts were drawn.

We close this chapter by alluding to the faintness of the more refrangible part of the spectrum in the low sun. According to our observations this dulling of the continuous spectrum is independent of the intensities of the water-vapour lines between *b* and *F*, but varies with the transparency of the air. We therefore conclude that its variable part is produced by condensed water-vapour.

CATALOGUE OF LINES.²

The first column contains the oscillation frequencies which are identified with the reciprocal values of the wave-lengths. The wave-lengths are given in the fourth column in ÅNGSTRÖM'S units, of which there are 10 millions in a millimetre. The second column gives the adopted intensities of blackness of the solar and telluric lines as they would appear at medium altitudes of the sun for an average amount of water-vapour (elastic force of vapour = 0.5 inch). The third column shows the intensities of the telluric lines only, when the sun is at an apparent altitude of 1° to 2°. Unless both components of double lines were measured repeatedly, the line has been entered as single with the letter *d* affixed to the intensity. The letter *b* means band. It stands either between two lines which form the borders of the band or it is affixed to the intensity, in order to show that the line is broader than its intensity alone would lead one to expect. The intensity of the light between two lines is signified by the letter *i* before the figure giving the intensity. Lines which have been only once observed are considered to be doubtful and are marked therefore with ?, unless they are of the lowest intensity (1). The same notations are employed with the telluric lines in column 3. In this column the sign ? is intended to show that the telluric character of the line is open to some doubt, whereas the same notation enclosed in brackets is chosen to express the bare possibility that the line is telluric.

The columns from 5 onwards comprise the original observations of intensity in full, without any corrections whatever,—first those made at medium altitudes, and then those at low altitudes of the sun. Each column is headed by the number of the series, which ranges from 1 to 13 in high sun, and from 1 to 73 in low sun. They enable the reader to find

¹ M. THOLLON'S maps, which we have just received (see Postscript), give water-vapour lines in the α -group, the middle of the band being in $\frac{1}{\lambda} = 1586$. Each of the first three bands of the series is thus followed by a group of lines which are fainter than the bands themselves.

² The Catalogue begins on p. 48.

the time and meteorological notes by the Tables I. and IA. The second line of figures in the heading gives the elastic force of vapour in units of 0.01 inch, while the third line shows the column of atmosphere (f_1) traversed by the light in units of that in the zenith (*comp.* p. 86); f_2 may be interpolated from the table on p. 86 with argument f_1 . The notations d , b , i have the same meaning as above. B and E indicate the beginning and end of a series.

Although the printing of the single observations of intensity demands much additional space, we trust that this will be compensated by the advantage they will afford in later investigations. They may serve as a check on the values adopted, and enable spectroscopists to consult the intensities of lines suspected to be of telluric origin.

Table VII., on p. 100, may give an idea of the distribution of the lines with regard to their intensity in different parts of the spectrum.

THE MAPS.¹

The maps are the graphical reproduction of the first three columns of the Catalogue, and they are only intended to facilitate the identification of the lines with those given in other maps. The main object of our work was the identification of the telluric lines, which could only be done efficaciously when observing the sun close to the horizon. Rapid observing was necessary; we therefore dispensed with noting the definition of the edges of lines and the various degrees of paleness in lines of the same breadth, &c.

Of the two spectra the top one refers to the second column of the Catalogue, and the lower one to the third column. The scale is in terms of oscillation frequencies ($\frac{1}{\lambda}$) but for the convenience of comparing with other maps the positions of the full wave-lengths expressed in 10^{-6} mm. are marked by a dot.

The intensities of the lines are represented by the breadth of the lines only, with the exception of the two lowest classes of the scale, which are distinguished from intensity 3 by the length of the lines. In choosing the breadth for the different classes we were guided by the distance of close double lines. The notes below the spectra are a reproduction of those given in the Catalogue. Lines of possibly telluric origin are not mapped in the lower spectrum but their intensity is stated below the telluric spectrum. Double lines which have been once separated are mapped as single, and their distance is stated at the foot of the line in units of the distance between the lines of the scale; thus $d.3$ stands for a double line whose components are 0.3 of the interval of the lines of the scale apart.

POSTSCRIPT.

This memoir was on the point of being presented to the Royal Society of Edinburgh when we received the third volume of the *Nice Observations*,² with the late M. THOLLON'S

¹ The maps have been reproduced by photo-lithography, and are about one-fourth of the size of the original drawings. It will be noticed that the faintest lines are far from continuous in the lithographs, but as it was found impracticable to make good this defect without altering the breadth of the lines, they are left untouched.

² Paris, 1890.

TABLE VII.—DISTRIBUTION OF LINES WITH REGARD TO THEIR INTENSITY IN THE DIFFERENT PARTS OF THE SPECTRUM.

Portion of spectrum, λ in $\mu\mu$.	603 to 486		603 to 584		584 to 566		566 to 553		553 to 539		539 to 525		525 to 515		515 to 497		497 to 486	
	sol. + tell.	tell.	sol. + tell.	tell.	sol. + tell.	tell.	sol. + tell.	tell.	sol. + tell.	tell.	sol. + tell.	tell.	sol. + tell.	tell.	sol. + tell.	tell.	sol. + tell.	tell.
Total number of lines,	3637	...	574	...	613	...	396	...	447	...	428	...	328	...	574	...	277	...
Number of lines per cent. for each class of intensity when sun at medium altitudes.	0	4.1	9.8	9.8	8.7	8.7	0.3	0.3	3.6	3.6	0.7	0.7	...	...	3.1	3.1	0.4	0.4
	1	13.2	5.4	15.0	23.0	15.3	12.6	...	13.4	4.7	11.0	1.6	8.5	...	9.1	3.5	5.8	...
	2	30.5	8.7	32.1	40.0	19.7	37.9	0.3	28.6	10.5	28.5	1.2	25.3	...	21.1	6.9	27.1	...
	3	17.5	3.6	15.3	9.6	3.9	19.1	...	18.2	2.7	23.1	1.0	21.4	...	19.7	4.1	18.1	0.7
	4	10.3	1.9	10.0	5.7	0.7	8.9	...	13.0	1.8	9.6	...	13.7	...	13.8	0.7	9.3	...
	5	7.0	1.1	8.3	4.0	0.3	5.8	...	5.6	0.4	7.0	...	9.2	...	9.0	0.7	8.3	...
	6	4.7	0.4	3.1	1.7	0.5	5.3	...	6.3	...	6.1	...	3.6	...	3.7	0.4	9.3	...
	7	4.1	0.2	2.8	2.6	0.2	4.0	...	3.6	...	2.8	...	4.3	...	5.4	0.2	9.8	...
	8	4.2	0.1	2.3	2.3	...	2.3	...	2.7	...	5.9	...	6.4	...	7.8	0.4	5.4	...
	9	2.3	0.03	0.7	1.3	...	2.5	...	1.6	...	2.6	...	3.4	...	4.9	0.2	2.2	...
	10	1.3	...	0.2	...	...	0.8	...	2.5	...	1.6	...	3.3	...	1.7	...	1.5	...
	11	0.5	...	...	...	...	0.5	...	0.7	...	0.9	...	0.3	...	0.7	...	1.8	...
	12	0.2	...	0.2	...	...	...	...	0.2	...	0.2	...	0.6	...	...	...	0.7	...
	13	0.03	...	...	...	...	...	...	...	...	...	...	...	...	...	...	0.3	...
	14	0.03	...	0.2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
	0 to 14	100	25.5	100	66.2	100	49.3	100	0.6	100	23.7	100	4.5	100	100	20.2	100	1.1

The development of the spectroscope may also be traced in this Table. ÅNGSTRÖM'S maps (1868) contain the lines from intensity 5 upwards, Professor VOGEL (1880) and M. FRIEZE (1882) have added those of intensity 4, while Professor PIAZZI SMYTH (1884) goes down to the 3rd class of our intensity scale.

work on the solar spectrum. It comprises the whole region from *A* to *b*, and gives the solar lines as well as the water-vapour and dry-gas lines. M. THOLLON has observed (in the years 1883 to 1887?) not only the positions and intensities of the lines but also their breadth in various altitudes of the sun. They are reduced to four states. The first refers to a zenith-distance of the sun of 80° when the air contains little water-vapour; the second and third correspond to a zenith-distance of 60° when the air is either almost saturated with water-vapour or very dry the fourth gives the solar lines only. The charts are drawn by M. THOLLON, and are really a work of art.

As the observations are not reduced to wave-lengths we could not compare the positions of the lines with our own, but to judge from the maps the agreement appears to be very close in all the parts compared. M. THOLLON finds the same groups of water-vapour lines as we have given above. There are, however, some telluric lines which our observations do not attribute to atmospheric absorption, as for instance lines between $\lambda = 5295$ and 5292 \AA.U.

As to detail, we must say that the ROWLAND grating, combined with the large collimator and viewing telescope, has proved its superiority over a prismatic train. M. THOLLON employed a spectroscope with a set of bisulphide of carbon prisms. The telluric lines are also more numerous in our observations. This we are inclined to attribute to the great depth of atmosphere in which our observations were obtained. This is shown by the following summary :—

Portion of the Spectrum.	Number of Solar and Telluric Lines.		Number of Telluric Lines.		
	Thollon.	Becker.	Thollon. ¹	Becker.	
6020-5840	456	574	326	376	Rain-band Supposed oxygen band Water-vapour band δ .
5840-5780 }	370	613	{ 23	{ 109	
5780-5720 }			{ 66	{ 117	
5720-5660 }			{ 44	{ 76	
5660-5530	246	396	1	2	Water-vapour band ζ .
5530-5390	314	447	46	106	
5390-5250	328	428	9	19	
5250-5167	178	272	...	...

¹ On p. A15, *loc. cit.*, there is a table of water-vapour lines in which the figures do not agree with those given above. M. Thollon gives 107 telluric lines more than we counted from the book. We reproduce his summary :—

Longueurs d'ondes.	Nombre de raies telluriques.	Mixtes.
0.597-0.585	319	72
0.578-0.567	118	15
0.548-0.542	40	18

CATALOGUE OF LINES.

Oscillation Frequency.	Mean Intensity.		λ	High Sun.			Low Sun.					
	☉ at Medium Altitudes.	Telluric Lines on the Horizon.		1	8c	12a	1	2	4	6a	48	56b
				47	58	47	48	53	59	31	37	38
				1.2	1.4	2.2	27	10	9	9	23	23
165997	10	...	6024.22	B 9	E 9	E 9	E 10	B 10	B 9	B 9	B 10	B 11
166012	1	...	3.66	...	...	2	...	...	...	...	...	...
023	2	...	3.26	1	2	2	...	...	...	...	2	...
040	2	...	2.66	1	2	2	...	...	1	...	3	3
060	9	...	1.94	8	9	9	8	8	8	8	9	9
070	2	...	1.55	1	...	2	...	...	...	...	...	...
088	2	...	0.91	1	2d	2	...	...	1	...	2	...
104	9	(10?)	0.33	8	8	8	} 9	10	{ 8	8	} 9	{ 10
110	8	...	6020.13	7	8	8							6	8	6
129	2	...	6019.43	1	2	2	...	...	...	...	...	...
134	2	7	9.25	1	2	2	7	4	5	3	6	6
149	1	...	8.71	...	2	1	...	...	...	...	...	...
156	3	...	8.45	3	3	3	3	...	3	3	2	...
176	2	...	7.71	1	2	2	...	...	2	...	2	...
179	1	...	7.62	1	...	...	...	...	...	...	...	...
187	1	...	7.31	...	2	...	...	...	...	...	...	...
201	8	...	6.81	9	8	9	6	7	8	8	8	8
208	...	6?	6.56	...	...	...	6	...	2	...	...	...
222	2	8	6.06	3	2	3	9	} 8	{ 5	4	8 ^b	8
227	3	9	5.88	4	2	3	9						5	3	8^{b}	9
238	1	8?	5.48	2	2	...	...	...	4	3	...	8
245	1	6?	5.22	1	...	2	4	2	3	3	4	6
261	2	4	4.64	...	2	2	...	...	1	...	3	4
278	1	4	4.03	1	1	2	...	...	1	...	3	4
287	8	...	3.68	9	8	8	7	8	8	8	6	8
294	2	...	3.43	1	2	...	...	...	...	...	...	3
305	2	...	3.04	...	...	2	...	...	...	...	...	3
308	2	6	2.93	2	2	2	4	...	4	3	4	6
323	5	...	2.41	5	5	5	...	1	4	5	3	4
329	...	5	2.17	...	...	...	...	...	3	...	3	4
339	...	5	1.83	...	...	...	3	1	...	...	b	5
345	2	5	1.58	...	2	2	3	...	3	...	3	5
357	2	5	1.18	...	2	2	...	...	...	...	2	5
365	1	...	0.87	...	2	...	...	...	...	...	...	...
380	2	...	0.32	...	...	1	...	...	2	...	...	...
387	2	4	6010.09	...	2	2	4	...	2	...	...	...
402	2	9	6009.53	2	2	2	8	5	6	5	6	9
405	1	5	9.43	...	...	2	...	...	...	...	5	4
425	8	...	8.71	8	8	8	8	8	8	8	7	8
431	...	5?	8.50	...	...	...	...	...	...	...	...	5
441	7d	...	8.12	7	7	7	8	7	7	5	6	6d
458	5	...	7.52	5	5	5	4	4	4	5	4	5
467	1	5	7.20	...	1	2	5	...	3	3	4	5
478	2	4?	6.81	2	2	...	4	...	...	...	...	...
490	2	...	6.37	3	2	2	...	...	...	...	3	...
498	1	5	6.08	...	...	2	4	...	3	2	4	5
509	5	...	5.68	6	5	5	5	4	5	5	4	6
527	1	5	5.03	...	...	2	5	...	4	...	5	6
533	2	8	4.82	3	2	2	6	...	6	4	5	8
546	...	4	4.33	...	...	...	...	...	...	...	5	3
557	2	8	3.96	3	2	3	5	4	5	3	...	8
166566	1	...	6003.61	...	...	2	...	...	...	...	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.					
	☉ at Medium Altitudes.	Telluric Lines on the Horizon.		1	8c	12a	1	2	4	6a	48	56b
				47 1·2	58 1·4	47 2·2	48 23	53 11	59 9	31 9	37 20	38 25
166579	9	...	6003·17	9	8	8	7	7	8	8	7	10
590	3	8	2·78	3	3	2	6	5	5	4	7	8
600	2	...	2·41	...	6	2	...	...	...	...	...	...
605	2	7	2·22	1	2	2	4	...	4	3	5	7
620	1	6	1·68	1	...	2	5	3	4	4	5	6
628	2	5	1·39	1	2	2	4	...	4	3	...	5
636	1	...	1·10	2	...	...	...	...	...	...	2	...
647	2	...	0·72	2	3	2	...	...	...	2	...	...
657	2	7	6000·34	3	2	2	6	4	5	4	6	7
671	4	11	5999·83	5	4	4	9	9	8	6	10	12
672	2?	...	9·80	...	...	...	...	...	...	2	...	...
685	3	...	9·35	3	3	3	...	1	1	3	3	3
691	2	...	9·14	1	} 3d	{ 2	...	...	...	...	...	...
696	2	...	8·95	1			...	...	...	...	...	...
702	2	(3?)	8·73	1	...	...	...	...	...	...	3	...
712	2	6d	8·37	1	2	2	5	3	5	3	5	5d
...	...	i2	...	...	...	...	...	...	...	...	...	i2
724	7	...	7·94	7	7	6	4	3	6	6	5	5
730	4	...	7·71	3	4	4	...	...	...	...	...	i3
738	4	10	7·43	4	4	4	9	8	7	6	9	10
755	5	...	6·82	6	5	5	4	1	4	5	4	4
759	...	5	6·67	...	...	...	4	...	3	...	6	} 5
763	...	5	6·53	...	...	...	4	...	1	...	4	
776	3	...	6·08	2	3	3	...	...	...	2	2	...
790	2	...	5·56	...	3	...	...	...	1	...	...	3
795	1	5	5·39	1	...	2	4	...	1	2	3	4
805	1	...	5·02	...	2	...	...	...	...	...	...	...
813	4	11	4·74	4	4	4	9	9	8	6	9	11
831	2	6	4·08	1	...	3	4	2	4	3	4	6
839	2	5	3·81	...	2	2	4	...	...	...	4	5
855	3	8d {	3·27	} 3	3	3	{ 6	} 4	6	4	6	8
870	2	...	3·17									
884	4	...	2·68	...	2	2	...	...	...	...	2	...
889	4	} 11d {	2·17	5	4	4	6	} 9	8	6	9	11
901	5		2·01	4	4	4	6					
916	4	...	1·58	6	5	5	4	3	4	6	4	5
924	3	11	1·03	5	4	4	8	8	8	6	8	11
931	3	10	0·74	3	3	3	8	2	6	5	6	10
931	1	6	5990·50	...	2	...	6	2	...	...	4	6
949	2	...	5989·86	1	2	2	...	...	...	...	1	...
961	4	11	9·44	4	3	4	8	8	7	7	8	11
971	1	4	9·06	...	...	2	3	...	1	...	2	3
981	4	10d {	8·75	} 4	3	4	{ 6	} 8	7	6	7	10
166993	2	8	8·67									
167014	3	...	8·27	2	2	3	7	5	5	5	5	8
023	8	11?	7·51	...	3	2	...	...	2	...	3	3
044	2	...	7·20	9	8	8	9	10	9	8	9	11
050	2	...	6·45	1	...	3	...	...	...	...	2	...
060	2	4	6·25	1	2	2	4	...	2	1	3	3
167074	2	5	5·86	...	2	2	...	...	3	2	4	5
167074	4	10	5985·37	3	4	5	9	8	8	7	9	11

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.							
	at Medium Altitudes.	Telluric Lines on the Horizon.		1	8c	12a	1	2	3a	4	5a	6a	48	56b
				47 1'2	58 1'4	47 2'2	48 20	53 13	53 7	59 10	25 11	31 10	37 18	38 28
167084	...	8	5985.00	...	...	...	9	8	...	{ 6	}...	8	6	{ 7
087	8	...	4.90	9	8	8				{ 6				{ 7
101	3	7	4.41	3	2	3	5	...	...	4	...	3	5	6
106	2	6	4.24	...	2	3	...	...	...	4	...	...	...	5
116	8	...	3.87	8	8	8	4	3	...	7	...	8	6	6
125	2	7	3.55	1	2	2	4	4	...	3	...	2	4	6
140	2	6	3.00	2	3	2	3	...	...	4	...	3	4	5
155	2	5	2.47	2	3	2	...	...	...	2	...	3	3	4
164	2	8	2.15	2	2	...	5	4	...	4	...	3	5	8
171	2	7	1.89	...	2	2	5	...	...	4	...	3	4	7
185	3	9	1.40	3	3	3	7	4	...	7	...	5	6	8
197	1	4	0.96	1	2	...	...	...	...	4	...	2	4	4
204	1	6	0.70	...	...	2	4	...	...	5	...	3	4	6
215	3	8	5980.31	2	3	3	6	4	...	6	...	5	6	8
226	...	4?	5979.93	...	...	...	...	...	...	...	...	...	2	4
232	2	...	9.70	1	2	2	...	...	...	...	...	1	...	...
243	...	5	9.33	...	...	...	4	1	...	...	...	...	3	5
250	2	6	9.08	1	2	2	4	...	...	...	...	2	4	6
262	5	...	8.64	5	5	5	...	...	...	...	...	6	3	3
275	1	6	8.18	...	...	2	5	...	E	...	E	...	4	5
282	4	12	7.94	5	4	4	9	10	7	9	6	7	10	12
...	...	23	...	...	...	...	...	...	...	...	...	...	...	23
293	3	8	7.55	3	3	3	5	...	4	6	2	4	7	8
...	...	23	...	...	...	...	...	...	...	...	...	...	...	23
304	5	12	7.14	5	5	5	11	12	7	9	8	8	11	12
310	7	10?	6.94	7	8	7	...	...	6	6	...	8	7	11
318	3	8	6.66	5	3	3	5	4	6	...	4	6	7	8
335	2	7	6.04	3	2	2	4	...	2	6	2	4	6	7
343	1	...	5.76	...	...	2	...	...	...	...	...	...	...	...
350	6	...	5.51	7	6	6	...	...	6	6	...	8	5	5
356	5	12	5.27	6	5	5	9	11	8	9	9	8	11	12
371	1	...	4.75	...	...	2	...	...	...	...	...	...	...	...
381	3	8	4.40	2	3	3	7	2	4	6	4	5	6	8
400	2	4	3.72	1	2	2	...	...	...	...	...	...	3	4
421	1	6	2.95	1	...	2	...	2	...	3	...	3	5	6
426	...	3?	2.77	...	...	...	...	...	...	3	...	...	...	...
428	2	5	2.71	1	2	2	...	...	2	3	3	2	4	5
441	2	...	2.25	...	2	1	...	...	...	...	...	...	3	...
457	2	...	1.68	...	2	...	...	...	...	...	...	...	...	...
461	5	11	1.53	6	5	5	8	10	8	9	8	8	11	11
465	2	...	1.40	...	...	3	...	...	...	...	...	...	...	...
480	2	{ 5 }	0.87	...	{ 2	2	{ ...	...	...	...	...	...	...	...
485	2		0.70	{ 3	{ 2	2		2	4	3	3	4	5	
493	1		0.41	...	2	2		...	...	...	...	...	...
497	5	10	5970.24	6	5	5	8	9	7	8	7	7	8	10
509	3	...	5969.83	2	3	2	...	...	...	...	...	...	3	3
525	4	10	9.24	5	4	4	8	7	7	8	6	7	8	10
542	...	4?	8.64	...	...	...	...	...	...	...	...	4	...	...
547	3	12	8.49	{ 7	{ 3	2	8	10	8	12	9	7	11	12
551	5	...	8.32		{ 5	6	...	...	...	...	...	...	4	25
564	5	11	7.87	6	5	5	7	{ 10	{ 7	{ 12	8	{ 8	9	{ 12
167570	4	10	5967.66	4	4	4	7		{ 6		{ 6	{ 6	6		6

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.												
	\odot at Medium Altitudes.	Telluric Lines on the Horizon.		1	8c	12a	1	2	3a	4	5a	6a	8	24	48	56b	57a		
				47	58	47	48	58	58	59	25	31	34	27	37	38	42		
				1·2	1·4	2·1	18	14	8	11	12	10	21	26	17	32	34		
167578	3	7	5967·39	3	3	3	6	...	4	6	3	4	...	...	6	7	...	
583	...	3?	7·18	...	...	...	...	...	...	...	...	...	...	...	3	...	...
594	5	10	6·81	5	5	5	8	7	7	8	7	7	...	...	8	10	...	
606	3	10d	6·42	} 4	3	3	8	...	6	7	6	{ 4	...	...	} 7	10	...	
617	5	...	6·33																
633	2	4	5·97	6	5	5	5	...	5	5	4	4	...	...	5	5	...	
643	3	8	5·40	...	2	2	...	...	...	4	...	1	...	...	4	4	...	
651	2	...	5·05	3	3	3	7	4	5	6	5	5	...	...	6	9	...	
673	1	4	4·77	...	...	2	...	...	...	...	...	...	...	...	2	...	...
681	2	5	3·98	...	...	2	...	...	...	1	...	...	...	...	3	4	...	
692	2	4	3·71	...	2	2	...	...	...	...	2	...	...	...	2	5	...	
698	2	...	3·30	1	2	2	...	...	...	1	...	...	...	...	3	4	...	
711	4	10	3·09	...	2	2	...	...	...	...	...	...	...	...	...	...	...
719	1	6	2·65	4	4	4	7	7	6	8	6	5	...	...	8	10	...	
732	1	5	2·35	...	2	1	4	...	2	4	4	3	...	...	4	6	...	
740	3	8	1·89	...	...	1	...	...	...	...	...	...	...	...	3	5	...	
762	2	(3?)	1·59	3	3	3	6	6	5	6	5	5	...	...	6	8	...	
774	...	2?	0·82	...	3	2	...	...	...	...	...	...	...	...	2	3	...	
782	3	9	0·38	...	...	...	...	...	...	...	...	...	...	...	2	...	...
790	2	5	5960·13	3	3	3	6	7	5	7	5	6	...	...	8	9	...	
802	2	6	5959·84	2	3	2	4	...	...	...	2	...	...	...	2	5	...	
809	2	6	9·39	2	2	2	5	...	3	6	3	4	...	...	5	6	...	
814	...	8	9·14	...	2	2	...	...	...	...	...	4	...	...	...	6	...	
818	5	12	8·98	...	...	...	...	...	2	...	...	...	...	...	5	8	...	
829	5d	12	8·85	7	5	5	9	14	8	12	8	8	...	...	9	12	...	
841	5	12	8·48	} 7	{ 4	} 5	9	E	8	12	8	8	...	...	9	12	...	
843	...	4?	8·42																
859	2	{ 5	8·02	7	5	5	9	...	8	12	8	8	...	...	9	12	...	
862	2		7·95	...	...	...	...	...	...	...	...	...	...	...	4	...	...
874	7	...	7·37	{ ...	2d	{ 2	} 4	...	2	3	2	3	...	...	4	5	...	
876	...	8?	7·27																
884	4	9	6·86	8	7	7	...	...	{ 6	} 8	8	9	...	...	8	9	...	
901	2	6	6·76	{ 6										
916	1	...	6·50	4	4	4	8	...	7	8	7	6	...	...	8	9	...	
923	5	11	5·90	1	3	3	4	...	2	5	...	3	...	...	4	5	...	
937	2	6	5·37	...	...	2	...	...	...	...	...	...	...	...	...	...	...
950	2	...	5·10	6	5	5	9	...	8	9	8	8	...	...	10	11	...	
958	...	3?	4·61	...	2	2	4	...	1	4	2	2	...	...	4	4	...	
965	2	8	4·14	...	2	2	...	...	...	...	...	...	...	...	2	...	...
975	6	...	3·88	...	...	...	...	...	...	...	...	...	...	...	3	...	...
985	7	...	3·61	3	2	2	4	...	4	7	3	5	...	...	5	8	...	
167988	...	8	3·28	6	6	5	3	...	4	...	3	5	B	...	4	3	...		
168000	2	...	2·91	7	7	7	6	...	...	...	...	...	...	...	...	...	...
020	5	10	2·81	...	...	...	6	...	6	8	7	8	9	...	5d	8d	...	
025	2	8	2·40	...	2	...	...	...	...	...	...	...	...	...	2	...	B	
037	3	9	1·68	5	5	4	6	...	6	9	7	7	8	...	8	10	9		
042	...	4?	1·50	1	3	2	5	...	4	9	...	3	...	...	5	8	4	
053	4	10	1·05	3	3	3	4	...	4	8	4	5	8	B	6	9	8		
168057	2	8	0·91	...	...	...	4	...	...	...	...	...	...	...	...	...	...
			0·49	4	4	4	5	...	4	8	5	6	...	6	6	10	8		
			5950·35	2	3	3	5	...	4	6	...	5	...	6	5	E	15		

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.													
	\odot at Medium Altitudes.	Telluric Lines on the Horizon.		1	8c	12a	1	3a	4	5a	5b	6a	6b	8	24	48	56c	57a	58b	
				47	58	47	48	53	59	25	25	31	27	34	27	37	38	42	39	
				1·2	1·4	2·1	15	9	13	14	7	12	21	20	27	14	37	29	21	
168481	2	7	5935·38	...	2	2	4	5	6	3	...	5	...	6	7	5	...	7	...	
490	2?	...	5·07	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...
497	7	...	4·82	9	7	7	5	7	7	6	...	8	...	6	7	6	...	7	...	
511	2	9	4·32	3	2	3	4	4	7	4	...	4	...	8	8	5	...	9	...	
516	...	4	4·14	...	...	...	...	3	...	...	...	...	...	...	5	3	...	3	...
523	3	7	3·91	4	3	3	3	4	6	4	...	3	...	8	6	4	...	7	...	
533	2	...	3·57	...	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...
544	1	5	3·16	...	...	1	3	...	...	...	...	3	...	...	5	3	...	6	...
550	5	11	2·96	6	5	5	8	8	10	8	...	8	...	9	10	10	...	11	...	
563	1	23	2·51	...	...	1	...	...	...	...	...	...	...	...	...	...	...	23	...
569	6	12	2·28	7	6	6	10	9	10	9	...	9	...	10	11	11	...	12	...	
574	1	3	2·13	...	2	...	...	4	...	3	...	...	...	...	...	...	...	...	...
585	1	...	1·74	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...
601	3	8	1·17	3	3	2	5	4	6	4	...	5	...	6	8	5	...	8	...	
612	2	8	0·77	2	3	2	5	4	6	...	...	5	...	6	8	5	...	8	...
625	8	...	0·33	9	8	8	5	6	6	6	...	8	...	6	8	6	...	8	...	
629	2	...	5930·19	...	...	...	1	3	...	...	...	...	...	...	...	...	...	...	...
638	6	...	5929·85	6	6	6	4	4	...	4	...	6	...	...	6	5	...	5	...
646	1	6	9·57	1	...	2	3	3	...	...	...	4	...	...	6	4	...	5	...
655	2	9	9·25	2	2	3	4	4	...	...	...	5	...	...	8	6	...	9	...
663	3	9	8·99	3	3	3	4	4	...	7	4	...	5	...	6	...	7	6	...	
671	...	4	8·69	...	...	...	...	...	...	...	...	...	...	...	4	2	...	...	...
677	5	11a {	8·53	6	5	5	8	6	...	...	...	...	...	...	...	...	...	...	...
691	6	...	8·43	7	6	6	4	5	...	4	5	...	8	...	10	10	11	...	11	...
695	...	6	8·01	...	...	...	...	...	...	...	...	6	...	5	4	5	...	4	...
704	1	...	7·86	...	...	...	...	...	...	...	...	...	...	...	5	...	...	6	...
721	2	5	7·54	...	...	2	...	...	...	...	...	...	...	...	...	2	...	...	...
727	2	8	6·94	1	2	2	4	3	6	4	...	2	...	...	4	3	...	4	...
740	1	4	6·74	1	2	2	6	6	6	4	...	3	...	6	7	5	...	8	...	
753	1	4	6·29	...	...	1	1	...	...	...	...	1	...	...	4	3	...	4	...
771	5	12	5·82	...	1b	1	1	E	...	B	...	4	3	B	4	...
777	1	6	5·19	5	5	5	8	7	10	9	6	9	12	11	12	10	14	12	...	
...	...	23	4·96	...	2	...	4	2	...	...	5	3	6	...	4	3	...	6	...
791	6	12	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	23	...
...	...	23	4·49	6	6	6	8	8	9	8	7	9	12	11	11	10	14	12	...	
805	5	11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	23	...
810	5	11	3·98	6	5	5	8	8	...	...	...	9	10	...	10	10	...	11	...
822	3	7	3·82	6	5	5	8	8	...	...	...	9	10	...	10	10	...	11	...
828	3	...	3·39	3	3	3	5	4	4	4	3	4	5	4	7	5	5	7	...	
837	3	...	3·20	3	...	3	...	...	...	...	3	...	...	...	...	...	...	...	...
837	3	9	2·87	4	3	3	5	6	...	...	6	5	8	...	9	6	...	...	...
843	4	10	2·66	5	4	5	6	7	...	...	6	7	9	...	8	8	...	...	...
847	4	8	2·54	5	4	6	6	6	...	...	6	5	7	...	8	4	...	...	...
855	5	...	2·24	5	5	4	2	3	...	3	2	4	4	...	4	4	...	...	...
867	3	7	1·83	4	3	3	5	...	5	4	2	5	7	4	6	5	...	...	...
881	3	6a {	1·39	3	3	3	4	4	...	...	2	5	6	4	6	5	...	...	...
898	4	10	1·25	5	4	4	7	6	8	6	6	8	9	8	10	9	...	...	...
911	2	6	0·73	...	2	3	3	...	...	...	...	5	6	4	6	4	...	...	...
918	2?	...	0·29	...	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...
924	6	12	5920·03	...	...	2	...	...	...	...	...	...	...	...	...	...	...	B	...
...	...	...	5919·83	7	6	6	10	9	10	9	8	9	12	11	12	11	14	11	12
168941	5	12	5919·22	7	5	5	10	9	10	9	8	9	12	11	12	11	14	11	12	

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.														
	at Medium Altitudes.	Telluric Lines on the Horizon.		1	8c	12a	1	3a	4	5a	5b	6a	6b	8	11a	24	48	56c	57a	58b	
				47	58	47	48	53	59	25	25	31	27	34	30	27	37	38	42	39	
				1·2	1·4	2·1	13	9	15	16	7	13	22	19	26	29	13	38	25	21	
168943	3?	...	5919·15	...	...	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...
958	4	12	8·62	{ 7	{ 4	4	10	9	10	9	8	9	12	11	...	10	10	14	11	12	
963	5	...	8·45	...	5	5	...	...	5	...	...	...	...	...	...	...	...	E	...	...
974	2	7	8·08	3	2	2	4	4	...	4	2	4	5	4	...	7	5	...	...	5
978	2	...	7·93	...	...	2	...	...	...	...	...	...	...	...	...	...	3	...	...	...
989	3	8	7·53	4	3	3	5	5	6	5	4	6	8	5	...	7	5	...	...	6
168996	...	5	7·29	...	...	...	1	...	...	...	...	3	4	...	...	4	3	...	...	3
169006	2	6	6·93	...	3	2	2	...	...	...	...	4	4	...	...	{ 4	4	...	...	6
011	2	7	6·77	...	3	2	5	4	{ 8	{ 4	3	5	6	{ 5	...	{ 7	5	...	...	6
021	7	...	6·42	7	6	7	4	4	6	4	3	6	5	5	...	6	4	...	...	6
027	2	6	6·21	...	2	2	4	4	...	...	3	5	5	...	...	6	4	...	...	4
040	4	9	5·77	5	4	4	7	6	{ 10	9	{ 5	7	8	{ 10	...	{ 9	7	{ 10	...	{ 8	
047	4	9	5·52	5	4	4	8	6	...	...	{ 5	7	8	...	...	{ 9	7	...	...	{ 8
060	4	9	5·06	5	4	4	7	6	8	6	5	7	8	6	...	9	8	...	...	9
072	1	4	4·64	...	...	1	...	...	...	...	...	1	...	...	...	4	3	...	...	3
079	8	...	4·38	{ 10	{ 8	8	{ 9	8	9	9	9	9	10	9	...	10	9	...	...	10
083	8	...	4·27	...	{ 8	8	...	...	...	...	...	...	...	...	...	...	...	...	...	...
093	1	4	3·92	...	...	1	...	...	...	4	...	...	3	...	...	4	3	...	...	...
105	2	...	3·50	...	2	2	...	...	...	...	...	...	...	...	...	3	2	...	...	...
115	4	10	3·15	4	5	5	8	7	9	8	6	8	9	9	...	10	9	10	...	9	
124	3	8	2·82	3	{ 3	3	{ 5	5	{ 9	8	4	{ 5	6	{ 9	...	{ 8	6	{ 10	...	{ 6	
127	3	8	2·70	3	...	...	{ 5	5	...	...	...	{ 5	5	...	...	{ 8	5	...	...	{ 6
143	2	7	2·15	2	{ 3d	2d	{ 4	4	{ 7	{ 7	{ 4	{ 6	{ 6	{ 7	...	{ 7	5	...	...	6
148	2	7	1·99	2	...	...	{ 4	4	...	...	...	{ 6	{ 6	...	...	{ 7	5	...	...	6
160	2	5	1·56	1	2	2	4	...	...	...	...	{ 4	{ 4	{ 4	...	{ 5	4	...	...	4
167	...	5	1·33	...	...	...	3	{ 3	...	4	...	{ 4	{ 4	{ 4	...	{ 5	4	...	...	4
175	...	3?	1·05	...	...	...	...	...	...	...	...	...	...	...	B	...	3	...	...	...
178	4	{ 11d	0·95	{ 6	{ 4	4	7	{ 8	10	10	6	8	10	10	11	11	9	14	...	11	
180	3	...	0·87	...	{ 3	3	7	...	...	...	...	...	...	...	...	...	...	...	...	...
182	...	4	0·79	...	...	...	3	...	...	...	...	4	...	...	...	...	...	...	...	...
196	...	3?	0·32	...	...	...	3	...	...	...	...	...	...	...	...	27	23	...	...	23
198	4	11d	0·25	4	4	4	7	7	10	10	6	6d	9	10	11	9	7	14	...	10	
203	6	...	5910·08	6	5	5	5	6	E	...	6	6	8	...	...	6	5	E	...	5
217	3d	7	5909·57	1	3d	3	4	4	...	4	4	5	7	4	4	7	5	...	...	6
229	5	10	9·14	5	5	5	8	8	...	9	6	8	9	9	9	9	9	...	...	9
238	1	3	8·85	...	...	1	...	...	...	...	4	...	...	...	...	...	2	...	...	...
252	4	9	8·36	4	4	4	7	6	...	7	5	6	8	8	9	9	7	...	...	8
262	5	9	7·98	5	5	5	5	6	...	7	5	6	8	8	8	9	7	...	...	8
274	3	8	7·58	...	...	3	5	6	...	{ 8	{ 4	5	8	...	9	9	E	{ 6	...	6
279	4	8	7·42	4	4	4	6	6	...	...	{ 5	6	8	...	...	{ 6	...	...	...	7
286	...	6	7·16	...	...	...	3	4	...	...	...	3	6	5	6	...	4	...	...	5
292	5	...	6·95	5	5	5	3	4	...	...	3	3	...	...	...	...	...	...	...	4
304	2	6	6·53	2	3	2	4	...	...	4	3	{ 3	4	{ 5	4	...	5d	...	...	{ 6
308	2	6	6·38	2	3	2	4	{ 4	...	...	...	{ 3	4	...	...	...	...	...	...	{ 6
318	2?	...	6·04	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
325	7	...	5·81	8	6	8	4	5	...	4	6	7	6	5	4	...	6	...	...	8
328	...	5	5·68	...	...	...	4	5	...	...	...	...	...	...	...	...	...	...	...	22
335	3	9	5·46	3	3	3	7	6	...	8	5	5	8	8	9	...	7	...	...	8
341	1	7	5·25	...	...	2	6	6	...	...	5	6	7	...	...	...	6	...	...	7
349	3	5	4·97	2	3	3	1	1	...	...	...	2	4	...	...	...	3	...	...	4
169362	3	5	5904·53	4	2	2	2	2	...	...	...	3	4	...	...	...	3	...	...	4

Osc. Freq.	Mean Intensity.		λ	High Sun.					Low Sun.																
	at Medium Altitudes.	Telluric Lines on the Horizon.		1	4	5	8c	12a	1*	1	3a	3b	5a	5b	6a	6b	8	11a	25	26	47a	48	58b	74b	
				47	30	44	58	47	38	48	53	53	25	25	31	27	34	30	...	38	36	37	39	44	
				1-2	2-0	1-3	1-4	2-1	11	12	10	6	19	8	14	25	18	25	28	24	10	12	23	25	
169372	3	8	5904.16	} 2	3d	{ 3	...	4	}	4	{ 6	}	7	8	9	...	B	...	5	7d	...
376	3	8	4.04																						
380	4	7	3.87	4	4	...	5	4	...	6	5	4	7	...	8	9	...	6	...	4	6	...
387	2	9	3.64																						
396	3	(4?)	3.34	4	2	3	4	4	5	4	...	2	3	...
408	2	5	2.90																						
413	...	4	2.73	2	3	4	5	4	...	4	3	...
419	4	5	2.53																						
427	3	10	2.25	{ 4	{ 3	3	...	3	1	...	3	5	...	3	5	5	...	4	4	...
430	3	8	2.13																						
439	2?	...	1.82	2
445	7	12	1.62																						
...	...	25	...	8	6	8	...	8	8	...	10	7	10	12	11	11	...	10	...	10	12	...	
450	3	9	1.43																						
461	3	8	1.07	4	3	3	...	7	5	6	6	9	9	...	6	7	...	
474	2	7	0.60																						
485	6	11	0.22	7	5	6	...	8	8	...	10	{ 7	9	{ 14	11	11	10	{ 11	...	11	{ 14	...	
490	5	10	5900.06																						
503	4	...	5899.60	4	3	4	4	5	3	4	...	2	5	...	
509	5	...	9.39																						
515	4	10	9.17	4	4	5	...	7	6	...	8	4	8	9	8	8	8	10	...	8	9	...	
522	1	6	8.94																						
533	2	6	8.56	2	2	...	3	4	4	5	6	...	5	6	...	
540	7	11	8.33																						
546	2	6	8.10	3	4	{ 3	...	4	...	{ 5	6	{ 5	...	5	{ 6	...	4	{ 5	...	
552	...	6	7.90																						
561	4	9	7.58	4	3	4	...	6	5	6	7	5	7	7	7	9	...	6	8	...	
566	3	...	7.42																						
571	...	6	7.22	3	3	3	5	4	4	...	6	E	4	5	E	...	
578	4	10	6.97																						
586	...	4b	6.72	4	3	4	...	7	6	...	8	6	8	10	9	9	10	7	...	7	9	10
590	4	11	6.58																						
596	...	5b	6.37	12	11	12	12	12	11	11	10	12	10	12	12	11	9	9	8	5	10	11	11	10	
604	12	...	6.08																						
610	2	5	5.89	...	3	3	3	4	4	...	5	1	2	5	...	
617	...	1b	5.64																						
628	3	10	5.26	4	3	{ 2d	{ 3	3	6	7	7	5	{ 7	{ 5	6	{ 8	5	9	9	{ 9	6	5	8	...	
632	3	10	5.11																						
644	1	5	4.71	4	2	3	...	3	2	...	4	5	6	7	4b	4	5	3	3	4	...		
649	4	9	4.51																						
657	2	...	4.25	...	2	2	3	2	...	2	2	
668	...	4?	3.88																						
672	4	10	3.72	4	4	3	4	5	6	7	2	6	6	5	8	8	8	8	9	10	7	6	9	...	
678	1	4	3.52																						
686	4	9	3.24	4	4	...	3	4	6	5	5	6	7	5	7	8	8	5	9	9	9	6	6	8	...
691	7	...	3.08																						
696	4	6	2.88	4	3	4	4	4	4	5	5	6	...	5	7	8	5	{ 4b	4b	{ 5	3	3	4	...	
705	5	10	2.59																						
710	1	(3?)	2.40	...	1	3	9	10	10	8	8	10	...
719	2	4?	2.09																						
725	5	11	1.87	6	5	4	5	5	6	7	8	6	{ 8	{ 6	9	10	{ 11	10	11	{ 10	8	9	11	...	
169729	4	10	5891.73																						

Osc. Freq.	Mean Intensity.		λ	High Sun.					Low Sun.												
	O at Medium Altitudes.	Telluric Lines on the Horizon.		1	4	5	8c	12a	1	3a	5b	6a	6b	8	11a	48	58b	74b			
				47 1·2	30 2·0	44 1·3	58 1·4	47 2·1	48 10	53 12	25 11	31 17	27 30	34 16	30 21	37 11	39 27	44 24			
170075	4	9	5879·77	4	3	3	4	4	6	9	{ 3 6	6 6	10	9	9	{ 7 7	{ 11	...			
078	4	9	9·64	4	3	3	4	4	6												
084	2	...	9·46	...	2	...	...	...	...	...	...	...	...	...	...	3	...	...	
090	1	7	9·24	1	2	2	2	2	4	4	3	5	6	4	4	5	7	...			
100	2	...	8·90	...	2	...	2	...	...	...	B	...	...	...	...	3	...	...	
107	2	...	8·64	...	b	2	...	2	...	...	...	...	...	...	1	3	...	...	
119	2	...	8·24	...	2	2	...	2	...	...	...	...	...	...	...	3	...	...	
128	4	...	7·92	4	4	5	5	4	2	2	...	...	...	...	...	3	...	...	
136	1	6	7·66	1	3	...	...	...	3	5	{ 3 4	6 6	4 4	4 4	4 4	4 4	{ 5d	...
142	2	6	7·43	...	2	2	2	2	3												
149	1	4	7·21	...	...	...	2	2	...	2	...	4	...	...	...	4	...	...	
154	...	3	7·04	...	...	...	...	...	...	...	...	3	3	...	3	3	...	...	
166	3	...	6·62	3	{ 4	{ 3 3	{ 3d 3	{ 3 3	7	7	...	8	9	8	9	7	9	...			
171	3	9	6·44	2																	
177	3	9	6·22	3	4	3	4	4	6	7	...	8	9	8	9	6	9	...			
192	3	9	5·71	3	4	2	4	...	{ 4 4	7	...	8	9	8	9	7	9	...			
197	1	5	5·55	...	...	2	...	...	{ 4 4	...	...	5	...	...	...	4	...	...	
206	3	5	5·24	3	3	2	3	3	4	4	...	5	5	4	4	5	5	E			
221	2	4d {	4·77 4·68	{ 1	2	2	2	2	2	4	...	3	4	3	3	{ 4 3	...	{ 4			
231	1	4	4·37	...	...	...	...	2	...	...	...	4	...	...	...	3	...	...	
238	1	...	4·13	...	...	...	...	...	...	...	...	...	...	...	...	2	...	...	
241	2	5	4·02	...	3	...	3	...	2	4	...	3	5	3	3	4	4	7			
250	2	7	3·71	1	3	3d	3	3	5	5	...	6	7	5	5	5	6	7			
260	5	6	3·37	5	4	5	5	4	2	5	...	5	6	4	4	4d	5	7			
276	1	...	2·82	1	2	1	...	2	...	...	...	...	...	...	...	2	...	...	
289	1d	5	2·37	...	1d	...	2	...	2	4	...	4	5	4	3	4	4b	4			
297	1	4	2·09	...	...	...	...	2	2	...	...	3	4	3	2	...	...	...
304	1	4	1·85	...	1	1	2	1	...	...	...	3	4	...	...	3	...	...	
318	3	9	1·38	4	3	2	3	3	4	6	...	6	5	7	7	5	9	9			
321	...	5	1·26	...	...	...	...	...	4	...	...	5	...	...	...	3	...	i2
337	3	9	0·73	4	3	2	3	3	6	6	...	7	8	7	7	5	9	9			
349	1	...	5870·31	...	2	1	...	1	...	...	...	...	...	...	...	2	...	...	
360	3	6	5869·94	3	2	...	{ 3 3	{ 2	{ 3 3	{ 5	...	{ 5 5	{ 6	5	5	{ 4 3	{ 5	7			
363	3	6	9·82	3	2	{ 2d	{ 3 3	{ 2	{ 3 3	{ 5	...	{ 5 5	{ 6	5	5	{ 4 3	{ 5	7			
375	2	...	9·39	1	2	2	2	2	...	...	...	...	...	...	...	2	...	3
390	2	7	8·89	1	2	2	2	2	4	5	...	5	7	5	5	4	5	7			
405	2	...	8·37	...	2	2	2	2	...	...	...	...	...	...	...	3	...	3
416	2	...	7·99	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...
424	5	9	7·71	7	5	5	5	5	6	7	...	8	9	7	7	7	7	9			
427	2	...	7·62	...	...	...	...	...	2	...	...	...	...	...	...	...	E	...
439	3	...	7·20	3	2	2b	3	3	...	...	...	...	...	...	2	2	...	3
446	2	...	6·94	...	2	...	...	2	...	...	...	...	...	...	...	...	...	...
457	7	...	6·58	8	6	7	6	7	6	5	...	5	6	6	6	6	...	7			
465	2	4	6·31	...	3	3	...	...	...	...	...	4	4	3	...	4	...	i3
477	2	7	5·90	1	2	2	...	...	2	6	...	{ 4 5	6 6	5 5	5 5	5 5	...	7	
484	2	7	5·66	...	2	...	2	2	3												
488	3	...	5·52	...	2	...	2	2	2	...	...	4	...	...	...	3	...	...	
506	1	4	4·90	...	1	1	2	2	...	...	...	3	...	3	2	3	...	4
518	3	...	4·49	{ 3	{ 3	2	{ 3	3	{ ...	...	...	...	...	...	...	...	...	...
170521	3	6	5864·38	{ 3	{ 3	2	{ 3	3	{ 3	2	...	5	6	4	3	4	...	5			

Osc. Freq.	Mean Intensity.		λ	High Sun.					Low Sun.											
	at Medium Altitudes.	Telluric Lines on the Horizon.		1	4	5	8c	12a	1	3a	6a	6b	7	8	11a	18a	48	74b	78	
				47	80	44	58	47	48	53	31	27	37	34	30	40	37	44	37	
				1.2	2.1	1.3	1.4	2.0	9	13	20	33	8	15	19	32	10	22	31	
170531	2	...	5864.05	2	2	1	3	2	...	...	...	...	...	1	...	...	2	2	...
545	2	...	3.56	...	2	2	...	2	...	...	...	...	...	...	...	...	2	...	...
550	1	4	3.37	...	2	1	2	2	...	...	...	...	4	...	2	...	3	3	...
556	...	4	3.18	...	...	...	...	...	...	...	...	...	4	...	1	...	3	3	...
564	2	...	2.92	...	2	2	2	2	...	...	...	...	...	...	...	...	2	...	...
573	2	...	2.58	...	2	...	...	...	...	...	...	...	B	...	...	...	...	...	...
575	8	...	2.51	8	8	8	8	8	7	6	8	9	8	7	8	...	7	8	...	
582	2	...	2.27	...	2	1	...	...	...	...	...	...	...	...	...	...	...	...	...
594	2	5	1.86	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
597	2	6	1.77	3	3	2	3	2	4	4	6	6	4	6	5	...	5	7	...	
604	1	...	1.52	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
612	3	...	1.26	4	3	3	4	3	2	...	3	...	3	4	3	...	3	3	...	
617	1	...	1.08	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
630	2	...	0.63	...	2	2	2	2	1	...	...	...	...	...	...	...	2	3	...
642	2	...	5860.21	2	2	2	2	2	...	...	...	...	...	...	...	...	...	3	...
651	1	...	5859.91	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	E
656	8	10	9.73	8	8	7	8	8	8	8	9	10	8	9	9	...	9	10	12	
665	3	...	9.42	...	2	2	3	2	...	...	...	E	...	...	3d	...	3	...	...
676	...	3	9.04	...	...	...	...	...	2	...	...	...	3	3	...	...	3	...	4b
680	4	...	8.91	4	4	4	4	4	3	...	4	...	4	3	...	...	4	...	...
685	1	...	8.75	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
693	3	...	8.48	...	3	3	2	3	...	...	...	...	...	...	...	...	2	...	...
700	2	...	8.24	...	2	...	...	2	...	...	...	...	...	...	...	...	...	...	...
709	6	...	7.92	6	6	6	6	6	4	5	...	...	6	7	7	...	7	7	...
718	9	...	7.61	8	9	10	9	10	8	8	9	...	9	9	9	...	8	10	12	
732	2	4?	7.13	...	2	1	B	2	...	...	E	...	...	...	...	E	4	...	...
745	2	...	6.69	...	2	1	...	1	...	...	...	...	...	...	...	...	...	...	...
750	2	...	6.52	...	2	...	...	...	...	...	...	...	...	3	...	...	...	...	...
754	2?	...	6.38	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
759	6	...	6.21	7	5	6	...	6	4	5	...	...	5	4	5	...	5	...	...
766	2	...	5.98	...	2	3	...	1	...	...	...	...	...	...	...	...	...	...	...
775	2	...	5.64	...	2	3	...	1	...	...	...	...	...	...	...	...	...	...	...
787	5	...	5.24	6	4	5	...	5	3	...	...	...	4	4	3	...	5	...	...
795	2	5	4.97	...	...	2	...	2	3	5	...	...	4	4	3	...	4	...	...
808	2	4	4.52	3	2	3	...	2	...	...	...	...	3	...	...	...	4	...	...
815	2	...	4.28	...	2	2	...	2	...	...	...	...	...	...	...	...	...	...	...
828	7	...	3.85	5	8	8	...	8	6	6	...	...	7	8	6	...	8	...	...
833	2	...	3.68	...	3	2	...	...	...	...	...	...	...	...	...	...	...	...	...
840	3	(4?)	3.43	2	3	3	...	...	...	...	...	...	...	...	...	...	4	...	...
844	2	(4?)	3.29	...	3	...	...	1	1	...	...	...	3	2	1	...	4	...	...
856	2	...	2.88	...	2	2	...	2	...	...	...	...	...	...	...	...	...	...	...
870	6	...	2.39	6	7	6	...	7	5	4	...	...	6	6	6	...	...	...	...
874	2	...	2.27	...	3	2	...	...	...	...	...	...	...	...	...	...	...	...	...
881	2	...	2.01	...	...	2	...	...	...	...	...	...	...	...	...	B	3	...	...
896	3	8	1.52	3	2	3	...	3	3	...	...	...	4	5	5	8	5	8	...
901	...	3	1.34	...	...	...	...	...	...	...	...	...	3	...	b	...	3	...	...
911	1d	8	1.05	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
			0.97	...	1	1	...	2	3	5	...	...	3	5	4	8	5	6	...
921	1	...	0.67	...	2	...	...	...	...	...	...	...	...	...	...	...	B	...	...
930	2	...	0.36	1	2	2	...	2	...	...	...	...	...	...	...	...	...	...	...
170936	1	...	5850.15	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.									
	O at Medium Altitudes.	Telluric Lines on the Horizon.		1	4	5	12a	1	3a	7	8	11a	11b	13b	17	18a	78
				47 1·2	30 2·1	44 1·3	47 2·0	48 9	53 14	37 9	34 15	30 18	30 11	36 17	38 28	40 32	37 31
170943	3	5	5849·89	3	3	3	3	2	1	3	2	2	...	...	...	4	...
954	1	...	9·53	...	...	...	2	...	...	...	...	...	...	...	...	...	...
964	2	...	9·20	1	2	3	2	{ 1	...	3	...	...	...	...	...	...	...
967	2	...	9·07	1	2	3	2	{ 2	...	...	...	2	...	...	...	...	...
975	1	5	8·82	...	2	...	...	...	...	2	2	2	...	...	...	4	...
988	7	...	8·36	8	7	6	6	5	3	7	5	5	...	...	...	4	...
170998	1	...	8·01	...	2	1	...	...	...	...	...	...	...	...	...	...	...
171003	2	...	7·86	...	2	...	...	...	...	2	...	2	...	...	...	...	...
011	2	...	7·57	...	2	2	...	...	...	...	...	...	...	...	...	...	...
021	5	...	7·22	6	4	5	5	4	2	5	4	3	...	...	...	4	...
039	1	...	6·63	E	2	1	...	B	...	...	...	...	...	...	...	...	...
048	2	...	6·31	...	2	2	2	...	...	...	...	...	...	...	...	...	...
054	2	(4?)	6·09	...	2	...	2	...	...	...	4	...	...	...	B	...	...
064	1	8	5·76	...	2	...	...	...	3	5	4	3	...	...	8	7	5
071	3	...	5·51	...	2	2	3	...	B	...	...	...	...	...	...	3	...
082	2	(4?)	5·15	...	2	...	2	...	...	1	...	...	...	...	4	...	...
091	2	...	4·85	...	2	1	2	...	...	...	...	...	...	...	...	...	...
104	1	...	4·39	...	...	...	2	...	...	...	...	...	...	...	...	...	...
116	2	3	4·00	...	2	...	2	...	...	...	...	1	...	...	3b	3	...
134	2	...	3·38	...	...	2	2	...	...	...	...	...	...	...	...	...	...
149	2	6	2·87	...	2	...	2	...	...	4	3	3	...	...	6	6	5
156	2	5	2·63	...	2	...	...	...	...	...	3	...	...	...	...	...	5
166	2	3?	2·29	...	...	...	2	...	...	...	...	...	...	...	3	2	...
181	1	...	1·76	...	...	...	2	...	...	...	...	...	...	...	...	...	...
194	1	4	1·33	...	2	1	...	...	...	2	3	...	...	...	4	...	4
203	1	6	1·02	...	2	1	2	...	...	3	3	3	...	...	6	6	4
220	2	...	5840·43	...	2	1	2	...	...	...	...	...	...	...	...	...	...
238	2	4	5839·84	...	2	2	...	...	...	2	3	...	...	...	4	...	...
241	1	...	9·73	...	2	...	...	...	...	...	...	...	...	...	...	...	...
244	2	5	9·61	...	2	2	2	...	...	2	3	3	...	...	5	5	4
256	2	...	9·22	...	2	...	2	...	...	...	...	...	...	...	...	...	...
265	3	4	8·90	...	3	...	3	...	...	3	3	...	...	...	4	...	...
273	3	6	8·64	...	3	1	5	...	...	3	3	3	...	...	6	...	...
279	2	4	8·44	...	2	3	2	...	...	...	...	3	...	...	4	...	...
286	2	...	8·20	...	2	3	...	...	...	2	...	...	...	...	...	2	...
296	4	...	7·86	...	3	4	4	...	...	...	2	...	...	...	4	...	...
307	1	4	7·46	...	1	1	1	...	...	...	...	...	...	...	4	4	...
323	2	...	6·93	...	1	2	2	...	...	...	...	...	...	...	4	...	...
332	1	4	6·62	...	1	...	...	...	...	...	...	...	...	...	2	2	4
344	2	...	6·20	...	1	2	2	...	...	...	...	...	...	...	2	...	...
356	3	5	5·80	...	3	3	3	...	...	3	4	3	...	...	5	4	4
362	3	...	5·60	...	3	3	3	...	...	3	...	2	...	...	...	...	b
372	4	...	5·27	...	4	4	4	...	...	4	4	3	...	...	4	3	4
386	2	4?	4·78	...	2	1	2	...	...	...	...	...	...	...	4	...	...
394	2	...	4·51	...	...	2	...	...	...	...	...	...	B	B	...	...	...
403	4	8	4·20	...	5	4	5	...	...	6	7	6	6	6	8	8	6
415	1	...	3·80	...	...	1	...	...	...	...	...	...	...	...	...	...	...
424	1	4	3·51	...	...	1	2	...	...	2	3	1	2	...	4	3	3b
437	1	...	3·06	...	...	1	...	...	...	...	...	...	...	...	...	...	...
449	2	4d	2·64	...	2	2	2	...	...	2	3	2	2	3	4d	3	3b
171455	1	...	5832·45	...	...	...	2	...	...	...	...	...	...	...	...	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.											
	☉ at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	12a	7	8	11b	13a	13b	17	18a	20	47b	76	78	
				30 2·2	44 1·3	47 2·0	37 10	34 13	30 10	36 21	36 16	38 20	40 26	42 18	36 30	...	37 12	37 22
171981	2	...	5814·60	2	1	2	...	...	...	...	...	...	1	...	...	...	2
991	2	...	4·27	2	...	3	} 1	1	3	...	...	3	...	...	...	...	4
171996	2	...	4·08	3	2	4
172006	2	4	3·74	2	2	2	2	2	...	3	...	3	2	...	...	...	4
025	2	4	3·13	2	2	2	2	2	3	6	2	4	3	...	3 ^b	...	4	
028	2	...	3·02	2	...	...	...	...	...	...	...	...	...	...	...	...	2
036	2	3	2·75	...	...	2	...	2	...	3	...	4	2	...	...	...	3
044	2	...	2·46	2	2	...	2	...	2	...	...	...	...	...	...	...	2
055	3	...	2·11	2	4	3	3	3	3	...	2	4	1	...	...	...	3
062	2	...	1·85	3	2	1	...	...	...	...	...	...	...	...	...	...	3
070	1	3	1·61	2	1	...	1	2	...	...	...	3	2	...	...	...	3
077	...	2?	1·35	...	...	...	...	...	...	...	...	...	...	...	...	...	2
088	3d	...	1·04	2	} 4d	...	...	...	...	...	...	...	...	...	...	...	3
			0·92	3		3	1	2	2	...	2	3	2 ^b	3
101	2	...	0·54	2	2	1	2	...	...	...	...	...	...	...	...	...	2
111	2	...	5810·19	2	2	3	...	2	...	...	...	2	...	...	...	...	2
119	...	3	5809·94	...	...	...	...	...	...	...	...	3	...	...	...	...	3
126	1	4	9·70	2	...	2	...	2	3	...	2	4	4	B	3	...	4	
136	7	...	9·35	7	8	7	7	8	6	8	7	7	8	8	7	...	9	
145	2	4	9·07	2	2	2	2	3	1	...	...	4	...	...	...	...	3
152	...	3	8·84	...	...	...	...	...	...	...	...	2	...	2	2	...	2
159	2	...	8·58	2	1	2	...	...	...	...	...	...	...	...	...	...	2
174	3	...	8·08	2	3	3	3	3	3	3	3	3	3	3	2	...	2	
180	2	4	7·86	3	...	...	...	3	3	...	...	4	...	3	6	...	...
186	2	...	7·68	3	...	...	...	...	...	...	...	...	...	...	2	...	2
194	2	...	7·40	2	...	...	3	...	...	...	...	...	...	...	...	...	3
197	2	...	7·29	2	2	2	...	...	...	...	...	...	...	...	...	...	3
209	7	...	6·89	7	7	7	8	8	6	6	5	8	8	8	8	...	8	
212	...	4?	6·79	...	...	...	...	...	...	...	...	...	...	...	...	...	4
223	1	4	6·44	2	...	1	3	4	3	3	3	4	4	4	4	...	4	
232	1	3	6·14	6	...	...	3	...	...	...	...	3	...	4	...	...	3
240	4d	...	5·91	} 2	5	4	3	4	4	3	3	4	4	5	4	...	{ 4 4	
			5·77	
249	1	...	5·56	2	...	...	...	...	...	...	...	...	...	...	...	...	...
255	7	...	5·34	6	7	7	7	7	6	6	6	8	8	8	8	...	8	
261	2	3	5·14	2	...	...	2	...	...	...	1	3	...	...	...	...	3
265	2	...	4·99	2	2	...	...	...	...	...	...	...	...	...	...	...	...
274	2	...	4·72	2	...	...	...	...	...	...	...	...	...	...	...	...	...
276	5	...	4·64	4	5	5	5	5	4	5	4	5	5	6	5	...	5	
283	4	...	4·41	3	4	4	4	...	2	...	6	3	...	3	...	...	4
290	5	...	4·18	4	5	5	5	5	4	5	4	5	5	6	5	...	5	
293	...	3?	4·07	...	...	...	...	...	...	...	...	...	...	...	...	E	3
302	2	...	3·78	1	1	2	...	...	...	...	...	...	...	...	...	2	2
308	1	5	3·57	...	...	2	3	3	3	...	3	4	4	4	2	2	5
312	2	...	3·43	2	...	...	...	...	...	...	...	...	...	...	...	2	2
320	1	3	3·16	...	1	...	...	1	...	...	...	3	3	3	...	2	4
327	1	4	2·91	} ...	...	2	3	3	3	2 ^b	3	4	4	4	2	{ 2 2	4
332	1	4	2·74		4
339	2	3?	2·53	2	1	...	...	...	...	...	...	...	...	...	...	...	3
343	1	3	2·40	2	...	...	...	...	...	...	...	3	...	...	...	2	3
172354	2	3?	5802·03	2	1	2	...	...	...	...	...	...	1	2	2	2	3

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.														
	at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	12a	7	8	11b	13a	13b	17	18a	18b	20	47b	76	77	78		
				30	44	47	37	34	30	36	36	38	40	40	42	36	...	27	37		
				2.3	1.3	2.0	10	12	10	21	15	18	24	13	17	28	12	21	19		
172361	2	...	5801.79	2	...	...	...	...	...	...	...	...	...	...	...	...	2	...	3
373	2	4	1.39	2	2	2	3	...	2	...	3	...	...	...	...	...	2	...	4
383	2	5	1.04	2	...	2	3	2	...	3	3	5	5	...	5	3 _b	2	...	5		
391	1	5	0.78	...	2	...	4	2	3	...	3	5	5	...	5	3 _b	2	...	5		
398	2	...	0.55	2	1	...	...	...	...	...	3	...	...	...	...	...	2	...	1
409	...	3	0.17	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	4
414	2	4	5800.01	2	2	2	3	...	2	3	3	...	...	...	...	...	3	...	4
422	2	...	5799.72	2	...	...	...	...	...	...	...	...	...	...	...	...	3	...	2
429	1	5	9.49	...	1	2	2	...	...	...	...	4	5	...	4	...	...	...	3
436	2	(3?)	9.25	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
440	1	...	9.11	...	1d	2	...	1	2	...	...	...	...	...	...	2	3	...	1
454	1	4d	8.66	...	...	...	...	...	...	...	...	2	4	4	...	3	...	...	3
			8.61	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
463	6	9	8.36	6	6	6	7	7	7	7	8	8	8	...	9	8	8	...	9		
466	...	4	8.24	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
472	6	9	8.03	6	6	6	7	7	6	7	8	8	8	...	8	8	7	...	9		
480	2	4	7.77	2	1	2	2	...	2	...	3	3	3	...	...	...	2	...	4
487	...	3	7.53	...	...	...	...	...	...	...	...	...	...	...	3	...	2	...	3
493	1	2	7.32	1	...	...	...	...	...	...	...	...	...	...	...	...	2	...	3
503	2	4	6.99	2	3	2	...	2	2	3 _b	3	3	3	...	...	...	2	...	4
513	...	4	6.65	...	...	...	3	...	...	...	3	...	4	...	3	...	2	...	4
522	4d	(4?)	6.42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
			6.28	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
530	1	4	6.10	...	2	...	...	3	3	...	...	4	...	...	...	...	...	...	3
540	1	3	5.77	2	...	...	...	...	...	...	2	...	2	...	...	...	...	...	3
547	1	2	5.51	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	3
553	2	3	5.31	2	...	2	...	...	1	...	2	3	...	...	...	...	...	...	2
565	1	2	4.93	2	...	...	...	...	...	2	...	...	...	...	...	...	1	...	3
571	...	2	4.71	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	3
577	2	4	4.51	2	2	2	3	...	3	...	2	4	3	...	4	...	2	E	3		
589	6	...	4.12	7	7	5	...	...	...	...	...	...	...	...	...	...	...	...	...
592	...	5	4.02	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
597	1	...	3.83	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...
602	1	4	3.67	2	1	...	4	4	3	...	3	4	4	...	4	4	1	...	4		
607	1	...	3.50	...	1	...	...	...	...	...	...	...	...	...	...	...	2	...	...
614	6	...	3.26	5	7	6	6	7	6	7	6	5	8	...	8	6	6	6	7		
620	...	3	3.06	...	...	...	2	...	1	...	2	3	...	...	...	3	...	...	3
625	2	...	2.89	1	...	2	...	...	...	...	...	...	...	...	...	...	...	...	2
634	2	...	2.60	2	2	2	...	...	...	...	...	...	...	...	...	...	1	...	2
645	2	4d	2.30	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
			2.15	...	...	2	4	2	3	4	...	...	...	...	5	...	5	3d	2
657	2	4	1.84	2	2	...	2	...	...	...	3	3	...	...	...	...	2	4	...
662	3	...	1.66	...	3	3	...	...	...	...	...	...	...	...	...	...	3	...	3
667	1	3	1.48	1	...	2	2	2	2	3	3	3	3	B	3	3	2	...	3		
678	9	...	1.14	10	9	9	8	9	9	9	9	8	8	8	8	8	11	10	10		
681	...	4	1.01	...	...	...	3	...	...	...	2	4	...	5	...	3	...	...	2
686	2	...	0.87	2	2	...	...	...	...	...	...	...	3	...	...	...	3	...	3
702	3	5	0.33	3	3	3	4	3	3	3	3	4	4	4	4	4	3	4	5		
710	2	4	5790.05	2	2	2	4	3	2	...	3	4	4	4	4	4	2	4	4		
718	...	2	5789.80	...	...	...	...	...	...	...	1	...	...	...	...	...	...	...	3
172724	2	...	5789.58	2	2	2	...	...	...	...	...	...	...	...	...	...	2	...	3

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.													
	at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	12a	7	8	11b	13a	13b	17	18a	18b	20	47b	76	77	78	
				30	44	47	37	34	30	36	36	38	40	40	42	36	...	27	37	
				2.3	1.3	2.0	11	11	10	20	14	16	22	13	16	27	10	20	16	
172731	...	5	5789.35	...	...	...	4	3	2	3	3	4	5	4	5	4	3	5	5
741	2	5	9.03	2	2	2	3	3		b		4		4		4	2	5	4	
747	2	4d	8.87	b																
			8.76	2		3	2	3	2	3										
762	1	4	8.31	2	...	...	...	...	...	...	2	4	3	2	4	3	1	...	3
769	7d	...	8.09	7	8	7	7	7	5	6	7	5	6	7	7	6	8	7d	7	
778	1	...	7.76	2	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
782	1	2i	7.63	2	1	...	...	...	...	...	3	...	...	...	2	...	2	...	2
789	2	6	7.41	2	2	2	3	3	3	4	4	4	4	4	4	5	2	3	4	
795	3	5	7.19	3	3	3	4	3	3	...	...	4	4	4	7b	...	2	3	4
806	1	3d	6.91	2	...	...	1	...	2	...	2	...	3	3	3	3	2	...	2
			6.76	2	...	...	...	...	...	...	...	...	3	...	...	...	2	...	2
813	2	...	6.60	2	2	2	...	...	...	...	...	...	3	...	...	...	2	3	2
821	2	...	6.34	2	...	2	...	...	...	...	...	...	...	...	...	...	2	...	2
828	4	...	6.09	4	3	3	4	3	3	4	3	4	5	3	4	...	3	...	3	
834	5	...	5.90	5																
837	4	...	5.80	4	5	4	5	5	5	6	5	5	7	5	5	4	2	5	6	
			5.44	5																
849	6d	...	5.38	5	6	6	6	6	5	6	6	7	5	5	8	4	6	5	7	
			5.12	5	5	5	5	5	4	5	5	5	5	4	6	3	5	5	6	
866	5	...	4.83	5	5	5	5	4	4	5	5	5	5	4	5	3	5	5	6	
873	2	...	4.60	2	...	2	...	...	1	2	...	...	...	...	...	...	2	...	3
880	2	...	4.35	2	2	2	...	...	...	2	...	...	1	...	...	...	2	...	3
885	2	...	4.18	2	...	...	...	...	...	...	...	...	...	...	...	...	2	...	2
890	7	...	4.02	7	7	6	5	6	6	6	6	7	7	6	8	5	7	7	7	
897	3	...	3.79	2	2	...	...	...	1	...	...	...	...	4	...	...	2	...	3
901	2i	...	3.67	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
904	2	...	3.55	2	...	2	...	...	...	...	...	...	1	...	2	...	2	...	3
913	7	...	3.25	7	6	5	5	6	6	6	6	7	7	6	8	6	6	7	7	
921	2	...	2.98	2	2	2	...	...	...	...	...	...	2	...	...	...	2	...	2
925	2i	...	2.85	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
931	1	4	2.67	2	...	2	...	...	1	3	2	4	3	3	3	2	1	4	2
942	8d	...	2.30	10	8	8	8	7	8	9	8	8	8	8	8	8	8d	9	9	
949	...	4	2.05	...	...	...											
952	4	...	1.94	4	5	4	5	4	3	5	3	4	4	6	5	3d	5	4d	5	
963	2	...	1.59	2	...	...	...	...	...	...	...	...	...	...	2	2	1	...	2
969	4	...	1.38	4	4	4	4	4	3	2	3	4	4	4	4	...	4	...	4	
974	1	...	1.21	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...
981	5	...	0.97	4	4	5	4	5	4	3	4	5	5	6	4	...	4	...	5	
			0.78																	
989	5d	...	0.66	5	5	6	5	5	4	4	4	5	5	6	5	3b	4	6b	6	
			0.47	4	4	5	4	4	3	4	3	4	4	5	4	...	4	...	5	
172996	4	...	5780.34	2	...	...	4	4	...	4	2	4	4b	5	5	4	3	6	4
173000	1	5	5779.76	2	2d	3	1	3b	2	E	2b	3	4b	3	3	4	2	4	3	
018	3	...	9.50	2		3	1													
025	2	4	9.42	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
028	1	...	9.16	1	2	2	...	...	...	...	...	...	...	...	...	...	2	...	2
036	2	...	8.96	...	...	...	...	...	...	...	...	2	...	...	...	...	2	...	2
041	2	...	8.62	5	5	5	5	5	5	...	5	5	5	5	5	3	5	5	5	
052	5d	...	8.40	1	...	...	...	...	...	...	...	...	...	...	...	3	...	...	1
058	1	...																		
173067	1	3	5778.11	1	...	2		3b	2	...	2	...	...	2	...	3	2	...	2

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.												
	O at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	12a	7	8	11b	13b	17	18a	18b	20	47b	49	76	77	78
				30	44	47	37	34	30	36	38	40	40	42	36	...	...	27	37
				2.4	1.3	1.9	11	10	10	13	15	19	12	14	25	23	8	18	14
173075	1	3	5777.83	1	1	...	...	...	...	2	3b	...	...	2	...	...	2	2	2
085	2	...	7.49	1	...	2	...	...	...	...	...	2	...	...	...	...	2	...	2
095	2	...	7.16	1	1	...	...	...	...	...	...	...	...	...	...	...	2	2	2
106	2	...	6.82	1	1	2	2	...	...	...	...	...	...	...	...	...	2	...	2
113	...	6	6.56	...	...	...	2	4	3	4	4	6	5	7	5	...	2	5	3
121	2	4	6.31	1	2	2	...	b	b	b	b	...	...	...	b	...	2	b	3
124	...	6	6.19	...	2	...	2	4	3	4	6	6	5	7	6	...	2	5	3
136	1	3	5.82	1	2	2	...	1	...	2	...	2	3	3	3	...	2	...	2
142	...	3	5.60	...	...	...	...	...	...	...	3	...	...	...	...	...	2	3	2
153	8	...	5.24	9	8	7	8	8	8	8	8	8	8	8	7	...	7	9	8
160	2	...	5.00	2	2	...	...	...	...	...	...	...	...	...	...	B	...	...	2
171	2	4	4.65	2	...	2	3	3	3	3	4	...	3	4	3	...	...	3	3
179	3	4?	4.38	2	3	3	2	3b	b	...	...	4	4	b	3	...	...	b	3
186	3	4?	4.15	3	3	3	3	3	3	3	4	...	...	4	...	...	...	3	3
190	1	...	4.01	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
196	2	3	3.79	2	2	2	2	3	...	...	4	...	2	3	3	...	...	...	2
210	2	7	3.34	2	...	2	5	4	...	3	3	...	5	7	7	...	...	...	4
215	2	7	3.16	2	2	...	5	4	...	3	3	4	8	5	7	...	...	...	5
224	...	4?	2.88	...	...	...	...	...	...	...	4	...	...	...	E	...	...	...	...
227	2	8	2.77	2	2	2	6	5	4	4	5	8	6	7	8	4	...	6	5
232	2?	...	2.59	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
242	7	...	2.28	8	7	7	7	7	7	6	7	8	7	6	5	7	...	7	8
246	4?	...	2.15	...	...	...	...	...	...	...	4	...	...	E	...	...	...	...	...
256	2	7	1.81	2	3	3	4	4	3	3	5	8	...	5b	...	5	4	...	5
259	...	5	1.70	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	4
264	2	6	1.53	2	...	2	4	3	...	3	4	7	4	...	5	4	...	5	4
270	2	...	1.33	2	2	...	...	...	...	...	...	...	...	...	...	...	...	...	1
277	1	...	1.11	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
283	1	2	0.89	...	...	2	...	...	...	...	3	...	2	...	...	2	...	...	2
298	1	7	0.41	1	...	2	4	4	3	4	5	7	4	...	5	4	...	4	5
301	1	4	5770.31	2	1	...	...	...	...	...	...	...	...	...	...	...	...	4	2
311	2	...	5769.98	1	...	2	...	...	...	...	...	...	...	...	2	2	...	...	2
322	1	7	9.60	1	...	...	5	4	3	4	6	7	5	...	5	4	...	5	5
329	2	6	9.38	2	2	3	4	3	...	3	4	6	4	...	5	4	...	5	4
336	1	...	9.13	1	...	2	...	...	...	...	...	...	...	...	...	...	...	...	2
342	1	...	8.94	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	2
349	...	3	8.71	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
354	2	5	8.55	2	2	...	4	3	2	3	4	5	4	...	4	...	...	...	3
363	2	...	8.25	1	...	2	...	...	...	...	2	...	...	...	...	...	...	...	2
375	1	3	7.84	...	1	2	...	...	...	...	2	...	2	...	2	2	...	...	3
382	1	...	7.60	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
391	2	8	7.32	2	1	2	7	6	4	5	6	8	7	...	8	5	...	4	6
396	...	3	7.13	...	...	...	1	...	...	...	3	...	...	...	3	3	...	...	3
403	1	...	6.90	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
416	2	6	6.47	2	3	4	5	5	3	4	6	5	6	...	6	5	...	2b	5
428	1	3	6.08	1	1	2	...	...	...	...	3	...	3	...	3	...	...	...	3
434	...	2?	5.88	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
439	1	2	5.70	1	1	...	...	...	...	...	...	...	...	...	...	2	...	...	3
456	1	2	5.14	1	1	2	...	...	...	...	2	...	2	...	...	...	...	2	3
465	1	2	4.84	...	1	...	...	...	...	...	...	...	...	...	...	2	...	...	3
173476	1	4	5764.48	1	...	2	...	...	...	...	3	4	2	...	2	2	...	3b	3

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.													
	O at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	12a	7	8	9	11b	13b	17	18a	18b	23	47b	49	77	78	
				30	44	47	37	34	37	30	36	38	40	40	21	36	...	27	37	
				2.4	1.3	1.9	12	10	8	9	12	12	18	11	20	24	22	17	12	
173486	2	(3?)	5764.15	1	1	2	...	...	B	...	...	...	2	B	...	2	...	2
501	2	{ 8	3.64	2	1	2	} 8	6	5	3	6	{ 7	8	6	7	9d	{ 4	{ 6		
504			3.55	...	...	...											
516	9	...	3.15	10	9	9	7	9	9	9	9	8	9	9	8	9	9	9		
520	4	...	3.01	3	4	5	3	...	...	...	3	5	...	...	5	...	2	...
528	1	3	2.76	1	...	...	...	...	...	...	3	...	...	...	...	3	3	B
534	5	...	2.55	4	5	5	4	5	5	4	5	5	4	5	6	} 3b	{ 5	...		
538	3	...	2.41	3	3	4	...	...	...	...	3	...	...	...	...	
550	2	...	2.02	2	2	...	...	...	...	...	2	...	...	...	...	1	...	...
558	3	8	1.75	3	3	3	6	7	5	4	5	5	6	6	7	8	5	...		
570	2	3	1.36	2	2	1	1	E	...	...	2	2	3	...	...	3	...	...
582	6	...	0.97	6	5	6	6	...	} 6	{ 4	6	6	6	6	6	3	7	...		
589	2	...	0.74	2	3	...	...	...									
597	5	...	0.48	5	4	5	6	...	} 4	{ 4	4	5	10	6	5	5	5	...		
606	2	...	5760.17	2	1	2	...	...										
620	3	(4?)	5759.72	2	3	4	4	...	3	2	3	4	1	4	3	3	4	...		
626	3	...	9.51	3	3	4	...	...	...	...	...	...	...	...	...	...	...	...
630	1	5	9.39	2	...	...	4	...	3	2	3	4	5	4	4	5	4	...
640	2	5	9.04	2	2	2	4	...	3	...	3	4	5	4	4	5	4	...		
654	2	4	8.59	1	2	2	3	...	2	...	2	3	3	3	3	4	3	...		
669	2	3	8.08	1	2	2	2	...	...	...	2	2	3	3	3	3	2	...
682	2	3?	7.65	1	2	2	1	...	1	...	...	3	3	2	...	...	1	...
689	...	3	7.41	...	...	...	...	...	...	...	...	...	2	2	3	...	...	...
697	1	5	7.16	2	...	...	3	...	...	...	3	4	6	4	4	3	3	...
704	6	...	6.93	5	6	5	6	...	6	5	6	7	6	6	7	4	5	...		
711	1	3	6.68	2	...	...	3	...	...	...	...	...	2	...	3	...	...	...
719	2	...	6.43	2	2	2	...	...	...	...	...	3	...	2	...	2	1	...
729	1	...	6.09	...	2	...	...	...	...	...	...	...	...	...	2	...	...	...
735	1	5	5.91	2	...	...	4	...	3	...	3	5	5	4	4	4	3	...
743	2	5	5.64	2	...	2	4	...	3	...	3	5	5	4	4	4	3	...		
752	2	...	5.34	2	3	1	...	...	1	...	...	...	...	...	...	...	2	...
760	2	...	5.07	...	...	...	...	...	...	...	...	...	...	...	...	...	2	...
767	8	...	4.82	9	8	8	9	...	8	8	9	8	8	8	8	8	8	...		
776	3	...	4.55	3	3	3	...	...	...	...	...	...	...	...	2	...	3	...
781	2	9	4.37	3	2	3	8	...	7	4	6	7	7	7	6	9	6	...		
788	2	5	4.13	2	2	...	...	...	...	...	...	...	...	3	3	4	3	...
798	6d	{	3.82	7	} 6	5d	6	...	7	4	6	7	3	6	7	4	5	...		
806	1		3	3.77															7	
814	8	...	3.55	2	...	...	...	...	...	...	...	...	...	...	3	...	2	...
			3.29	8	8	8	7	...	8	8	8	8	...	...	8	8	7	...
818	3	8	3.13	3	3	4	6	...	6	...	5	6	} 8d	{ 6	6	8	6	...		
832	2	3	2.68	2	2	2	3	...	...	E	3	E						
839	1	...	2.44	2	...	...	...	...	...	...	...	...	...	...	...	...	...	...
846	7	...	2.21	8	7	7	6	...	8	...	7	...	} 7	{ 6	7	6	7	...		
853	2	6	1.99	2	2	...	4	...	5	...	4	...								
855	1	...	1.91	...	2	...	...	...	...	...	...	...	...	...	...	...	B	...
865	1	...	1.59	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
879	2	...	1.13	...	1	2	2	...	...	...	...	...	...	2	2	...	...	...
891	2	4	0.74	...	2	2	3	...	3	...	3	...	4	3	4	4	...	...
896	...	3?	0.56	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...
173910	2	...	5750.09	2	1	2	...	...	...	...	...	...	...	2	3	...	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.									
	O at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	11b	12a	7	9	13b	18a	18b	23	27	31	47b	
				30 2.4	44 1.3	38 2.6	47 1.9	37 18	37 9	36 11	40 16	40 10	21 18	36 36	31 35	36 22	
173929	2	4d	5749.49	2	2	...	2	2	2	2	4d	2d	3	...	...	3b
942	2	...	9.05	2	2	...	2	...	...	...	...	1	...	...	...	...
957	5	...	8.56	5	5	...	5	6	6	6	5	7	6	...	...	4
970	5	7	8.12	5	5	...	5	7	7	6	8	7	7	...	...	6
979	5	7	7.83	5	5	...	5	7	7	6	8	7	7	...	...	5
173990	1	3	7.45	2	1	...	2	3	1	2	2	2	3	...	...	3
174003	1	3	7.02	2	1	...	...	3	1	3	3	3	3	...	...	3
014	1	3	6.67	2	1	...	2	...	1	2	3	3	3	...	...	2
028	1	...	6.20	1	...	...	...	...	...	...	...	...	3	...	B	...
037	2	10	5.92	4	2	...	3	9	8	8	8	9	8	...	8	11	
046	1	...	5.59	1	...	...	...	...	...	...	...	...	...	...	...	...
051	1	4	5.44	2	1	...	...	3	...	...	...	3	3	...	5	3b
063	1	9	5.05	3	1	...	3	8	6b	7	7	6	7d	...	8	11	
066	1	...	4.94	...	1	...	...	...	...	...	...	...	...	...	...	...
083	1	3	4.37	2	1	...	2	...	...	...	...	...	3	...	...	3
091	...	2?	4.11	...	...	...	...	...	...	...	...	2	...	...	...	...
097	2	5	3.94	2	2	...	2	5	3	3	7	4d	4b	{	4	5	
108	2	6d	3.58	...	2	...	2	5b	3	3							
123	3	...	3.08	3	3	...	3	...	3	3	...	3	4	...	...	...
134	1	4	2.72	2	1	...	...	4	3	3	4	3	4	...	...	4
146	1	10	2.30	3	1	...	2	7	6	6	8	7	7	...	6	10	
156	6	...	1.97	6	6	...	6	6	6	6	6	6	6	...	7	5	
163	2	...	1.74	2	2	...	...	...	...	...	E	...	...	...	...	...
171	2	4?	1.49	2	2	...	2	...	...	...	...	2	2	...	4	...
183	2	4	1.10	2	2	...	2	...	1	2	...	2	3	...	4	3	
192	1	...	0.80	...	...	...	2	...	...	...	...	...	...	...	...	...
210	2	4	5740.19	3	2	...	3	...	3	3	...	2d	3	...	4	3	
220	2	...	5739.86	3	2	...	...	...	...	...	...	...	...	...	...	3
228	3	4?	9.59	...	2	...	3	...	3	2	...	2	4	...	...	...
242	1	4	9.14	2	1	...	2	...	3	2	...	...	4	...	4	4
260	3	4	8.57	3	3	...	2	4b	{	3	2	...	3	4	...	{	
268	2	5	8.30	4	2	...	4			4	4	...	4	5	B		
282	2	11	7.82	4	...	...	4	9	8	9	...	8	8	10	9	11
293	2d	5 {	7.53	2	3	...	...	...	1	2	...	2	3	5	4	...
			7.38	3		3	3	...	3	4	5	4	3
302	2	5	7.16	...	...	...	4	...	3	3	...	3	4	5	4	...
315	2	...	6.75	2	1	...	2	...	1	...	...	3	3	...	...	...
323	1	4	6.49	2	...	...	2	...	...	2	...	3	3	4	4	3
327	1	...	6.35	3	...	...	...	...	...	...	...	...	...	...	...	...
339	...	3	5.96	...	...	...	...	...	...	...	...	...	2	3	3	...
346	2d	9	5.74	2	3	...	3d	7	7	5	...	7	7	8	9	7	
362	2	4	5.20	3	2	...	2	...	...	...	...	2	2	...	4	...
378	1	4	4.66	2	...	...	3	...	3	3	...	3	3	4	3	3
392	1	...	4.21	2	1	...	...	...	...	...	...	...	2	...	...	...
404	1	7	3.80	2	...	...	2	...	4	3	...	4	4	7	6	4
423	2d	8 {	3.27	2	2	...	2	6	5	{	3	4	{	6	6	8	
			3.11			...	2	...	...						
436	1	4	2.77	...	...	...	2	...	...	...	...	4	2	3	4	...
446	4	...	2.45	3	4	...	4	...	5	3	...	5	5	3	4	...	
453	1	...	2.20	...	...	E	2	...	...	...	...	...	...	...	...	...
174462	8	...	5731.92	8	8	8	7	6	8	8	...	8	8	7	6	5	

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.									
	\odot at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	11b	12a	7	9	13b	13b	23	27	31	32	47b	
				30	44	38	47	37	37	36	40	21	36	31	30	36	
				2.5	1.2	2.6	1.9	14	9	10	9	15	34	32	36	20	
174476	2	4	5731.46	3	2	...	3	...	3	3	4	4	3	3	...	3b	
489	2	4	1.02	3	2	...	3	...	3	3	4	4	4	3	...		
502	1	...	0.61	...	1	...	...	...	...	...	...	...	...	B	...	...
512	1	5	5730.27	2	...	...	2	...	2	...	3	2	5	4	5	...
522	2	9	5729.95	3	2	...	...	10	{ 6	5	8	6	8	10	9	12
527	2	9	9.78	3	2	...	3										
541	2	4?	9.30	2	2	...	2	...	...	...	...	4	...	...	...	...
553	2	7	8.92	3	2	...	2	6	5	4	5	5	7	7	6	5	
563	2	7	8.58	3	2	...	2	6	5	4	5	5	7	7	6	5	
582	1	3	7.95	2	3	...	...	4	...	...	2	3	3	3	3	...
588	3	(4?)	7.76	3	...	...	3	4	4	3	4	4	...	...	...	...
596	2	...	7.50	2	...	...	...	...	...	...	...	...	...	...	...	...
606	7	10	7.18	7	7	6	6	10	7	6	7	7	8	12	9	11d	
612	3	9	6.98	3	3	4	3	8	7	6	8	7	8				
618	...	6	6.79	...	...	...	...	6	4	3	...	4	...	...	6	...
628	2	...	6.45	...	...	2	...	...	...	3	...	...	...	...	...	...
637	1	3	6.16	2	...	1	1	1	2	2	3	{ 3	{ 3	3	2	3	
642	1	3	6.00	2	1	...	1										
651	2	...	5.71	2	...	2	1	...	...	...	...	...	...	...	...	...
661	2	...	5.39	2	1	2	1	1	2	2	2	2	2	...	...	...
682	1	3	4.70	2	...	...	...	2	3	3	3	3	3	...	...	...
687	3	(4?)	4.54	3	2	3	2	...	...	...	...	4	...	...	...	...
699	1	9	4.12	2	...	3	...	8	...	4	7	7	8	9	9	9	
706	2	...	3.91	2	2	3	2	...	...	...	...	...	...	...	...	...
711	1	4	3.74	...	2	...	2	2	...	1	3	3	4	4	3	3	
723	2	...	3.34	2	1	2	...	...	...	...	...	3	...	...	...	...
734	...	2?	2.98	...	...	...	...	...	...	...	...	3	1	...	...	...
740	2	...	2.79	2	1	2	2	...	...	...	...	...	...	...	...	...
754	2	6	2.34	3	...	3	3	6	5	3	4	4	6	5	5	4	
762	2	10	2.07	3	...	3	3	9	7	5	7	7	9	10	10	10	
766	1	4	1.92	...	2	...	...	4	3	3	4	...	4	...	...	...
782	2	...	1.40	2	...	2	2	...	2	...	...	...	2	...	...	...
793	3	5	1.05	3	3	4	4	5	5	4	5	5	5	4	5	4	
800	3	...	0.83	...	...	3	4	...	...	...	...	...	...	...	...	...
810	2	8	5720.51	3	2	...	2	8	6	5	6	6	8	8	7	7	
827	2	5	5719.94	2	2	3	3	...	...	3	4	4	5	...	...	3
833	2	11	9.75	3	...	4	3	10	8	6	8	7	9	11	9	10	
851	2	8	9.15	2	2	3	3	8	7	5	6	5	8	8	6	7	
856	1	...	8.98	3	...	...	...	...	...	...	...	...	...	...	...	...
865	1	...	8.70	2	...	...	...	...	...	...	...	...	...	...	...	...
871	2	4	8.51	3	2	2	2	3	2	2	3	3	3	4	2	2	
878	1	...	8.26	1	...	...	...	...	...	...	...	...	...	...	...	2
886	8	...	8.00	9	8	7	8	8	8	8	8	8	7	8	8	6	
897	2	9	7.65	3	2	4	2	9	7	7	7	7	9	9	8	8	
904	2	...	7.42	2	...	...	...	...	...	...	...	...	...	...	...	3
913	2	4	7.13	2	2	2	...	2	...	...	2	3	4	3	3	3
928	3	...	6.64	2	2	3	3	2	3	2	3	3	3	...	...	2
933	3?	...	6.47	...	3	...	...	...	...	...	...	...	...	...	...	...
943	2	(3?)	6.16	2	1	2	2	...	...	...	...	3	3	...	2	2
952	1	3	5.87	2	2	1	...	2	2	2	2	...	3	3	2	2	
174962	2	...	5715.54	2	...	...	2	...	...	...	...	...	2	...	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
	O at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	11b	12a	7	9	13b	18b	23	27	31	32	38	39a	45	47b	50																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
				30	44	38	47	37	37	36	40	21	36	31	30	28	30	30	36	35																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
				2.6	1.2	2.5	1.9	15	10	10	9	14	28	29	25	11	27	21	16	12																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
174971	8	...	5715.25	9	8	8	8	9	8	9	8	8	7	7	8	...	...	E	6	7	...																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
980	2	...	4.93	...	2	3	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
174988	4	...	4.69	4	3	5	3	...	3	2	2	3	3	3	2	...	B	...	2	...	...																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
175001	4d	8	4.27	3	4	...	5	9	8	6	7	7	9	9	8	...	9	6	8	...	...																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
			4.21	4																		

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.															
	\odot at Meridian Altitudes.	Telluric Lines on the Horizon.		4	5	11b	12a	7	9	13b	23	27	31	32	38	39a	39b	45	47b	50			
				30	44	38	47	37	37	36	21	36	31	30	28	30	30	30	36	35			
				2.7	1.2	2.4	1.9	16	11	9	13	20	25	23	11	26	23	18	16	12			
175399	5	...	5701.30	6	5	5	5	5	6	5	5	5	4	5	4	5	...	4	5	4			
411	2	9	0.90	5	2	4	3	9	8	6	6	8	8	8	5	10	...	8	9	9			
415	...	3?	0.78	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3	...	...	
424	4	...	0.48	4	5	4d	4d	4	{	4	4d	5	4	3	3	4d	3	...	3	3	3		
426	4	...	0.39	4																	
433	1	2?	5700.17	...	...	...	2	...	...	...	...	...	...	...	...	...	...	2	2	2
446	3	...	5699.74	2	3b	{	3	...	3	...	3	3	2	3	2	3	B	4	3	2			
453	4	10	9.52	4				4	9	8	7	7	8	9	8	6	10	10	8	9	10		
465	1	3	9.14	...	...	1	...	...	...	...	1	...	...	3	...	3	...	3	...	
471	...	6	8.93	...	...	...	...	7	5	3	4	6	6	5	...	7	6	4	6	5
477	5	(5?)	{	8.75	4	6	4	5	6	5	3	{	4	4	5	5	4	5	5	{	4	4	4
482				8.60																			
486				8.46																			
491	2	10	8.31	3	...	...	...	9	8	4	5	8	9	9	5	10	9	8	8	9
495	4	...	8.16	3	4	4	3	...	4	2	4	4	3	...	3	...	...	3	3	3	
504	...	4d	7.92	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
515	1	4	7.79	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
521	2	(3?)	7.51	2	1	2	2d	3	3	2	3	4	4	4	3	E	4	3	3	3			
527	1	...	7.31	...	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
532	1	8	7.14	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
532	1	8	6.96	3	1	...	2d	{	7	6	4	5	5	8	7	4	...	7	5	6	7		
544	1	4	6.58	2	...	3	3	3	3	4d	3	3	2	3		
555	4	...	6.22	3	4	3	4	...	5	4	5	3	...	...	...	...	...	4	3	...
560	3	8d	6.06	3	...	3	3	7	5	4	5	6	8	7	5	...	8d	6	7	8			
572	1	3	5.65	1	...	2	...	3	...	...	2	3	3	2	2	...	3	2	2	2	
582	2	...	5.35	1	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...
588	6	...	5.13	7	6	6	6	5	7	6	6	7	6	5	5	...	5	5	5	5			
595	4	...	4.92	4	4	5	5	4	6	3	5	5	4	4	4	...	4	4	4	4			
606	1	...	4.56	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
613	1	6	4.34	3	1	2	3	6	5	3	4	5	6	5	3	...	5	4	5	4			
627	8	...	3.89	8	7	8	8	6	9	8	7	8	{	7	7d	5	{	7	{	5	5		
631	...	8	3.76	...	...	...	...	6												
635	1	...	3.64	...	1	...	...	...												
643	2	4	3.38	2	...	2	2	3	2	...	3	4	4	3	4	2	3	3		
654	1	...	3.02	1	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...
657	2	8	2.91	2	2	3	2	7	5	4	5	6	8	6	4	...	8	5	5	5			
668	2	10	2.57	5	2	4	5	9	8	8	7	8	9	9	6	...	9	9	9	10			
674	1	4	2.35	...	...	2	...	...	...	...	...	3	...	...	2	...	...	3	4	...
692	3	...	1.79	2	...	3	3	...	...	...	2	3	...	...	...	...	...	3	3	2
697	6	...	1.63	6	6	5	6	7	6	7	6	7	5	5	6	...	5	6	6	5			
707	2	...	1.29	2	2	...	2	3	...	2	3	...	{	3	3d	1		
714	2	...	1.05	2	2	...	2	...	...	...	...								
722	...	4	0.81	...	...	...	...	...	...	...	3	...								
728	6	10	0.62	6	6	6	7	9	9	8	9	8	9	8	8	...	9	9	8	10			
734	...	8	0.42	...	...	...	1	8	5	3	4	6	8	6	4	...	7	5	6	7
745	...	5	5690.07	...	...	2	...	4	4	2	3	4	4	4	2	...	5	3	3	4	
755	3	9	5689.74	3	4	{	4	{	8	7	5	6	7	4	7	5	...	8	5	7	9		
760	3	...	9.58	3	4	{	4	{	...	...	3	3	3	...	...	...	2	3	4	...
772	1	4	9.20	2	1	2	1	4	3	2	3	4	...	4	3	...	4	3	4	3			
786	2	6	8.74	3	2	3	3	6	5	4	4	6	5	6	4	...	6	4	5	5			
175797	9	...	5688.38	10	9	9	9	9	9	9	9	9	9	9	8	...	9	8	8	9			

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.													
	at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	11b	12a	7	9	13b	23	27	31	32	38	39b	45	47b	50		
				30	44	38	47	37	37	36	21	36	31	30	28	30	30	36	35		
				2·7	1·2	2·4	1·9	18	12	8	11	13	11	21	10	20	16	15	10		
175800	3	...	5688·28	...	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...
815	2	5	7·80	...	...	3	...	...	4	3	3	3	...	...	4	6	4	5	5
819	3	10	7·66	5	3	4	4	9	8	6	7	7	8	9	7	9	8	9	10		
828	1	...	7·38	...	...	...	...	...	...	...	...	...	...	...	...	1	...	...	...
833	2	...	7·21	2	...	2	...	1	...	...	2	2	2	...	...	3	...	...	3
839	3	...	7·03	2	3	3	3	...	3	...	3	3	2	3	3	2	3	2	3		
848	7	...	6·72	8	7	7	7	6	8	8	8	8	7	7	7	7	8	8	7		
855	3	5	6·49	3	3	4	4	5	4	{ 3	4	4	4	5	4d	{ 5	{ 5	4d	{ 5		
859	4	(5 ?)	6·38	3	4			4	4											4	4
871	1	5	5·97	2	1	2	...	4	4	3	3	4	4	4	3	5	4	3	4		
878	1	...	5·76	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1	...
883	2	8	5·61	3	...	3	2	8	6	5	5	5	6	6	6	7	6	7	8		
885	...	4 ?	5·55	...	...	...	...	...	...	...	...	...	...	...	...	4	...	...	...
893	2	5	5·28	2	2	2	2	5	4	3	4	4	4	4	3	4	4	3	5		
903	2	...	4·96	1	...	2	2	...	...	...	...	...	...	...	...	...	...	2	2
912	7	...	4·66	8	7	6	7	7	8	8	7	7	8	6	8	7	7	6	8		
921	6	...	4·37	6	6	5	6	5	7	6	6	6	6	5	6	5	5	5	5		
931	3	9	4·05	4	2	4d	3	9	8	7	7	7	8	8	8	8	8	8	10		
942	3	...	3·69	2	2	3	3	3	2	2	3	3	3	3	3	3	2	3	3		
955	2	...	3·26	2	2	2	3	...	2	...	...	2	3	...	3	2	2	2	3
964	...	6	2·98	...	...	...	...	6	3	...	...	3	...	5	3	5	4	5	5
968	8d	...	2·84	9	8	8d	8	8	9	9	9	8	9	8	9	8	8	8	9		
971	3	...	2·74	3	...	4	4	...	...	...	...	...	...	...	...	...	...	...	...
982	7	...	2·41	7	6	6	6	8	7	8	7	7	7	7	6	7	7	7	9		
175995	2	8	1·97	3	...	3	2	8	5	6	5	6	6	6	5	8	7	7	9		
176002	...	3	1·74	...	...	...	...	2	2	...	...	1	...	...	...	...	2	2	3
014	2	...	1·36	2	2	2	2	...	...	...	3	2	2	2	...	2	1	1	2
020	2	...	1·16	2	2	...	...	...	...	...	...	...	...	...	...	2	2	...	3
026	1	5	0·98	...	...	2	2	5	4	2	3	4	3	4	3	4	3	4	5
035	2	...	0·68	...	...	3	...	...	...	1	...	...	...	...	...	...	...	2	2
042	3	...	0·45	3	3	3	3	...	4	3	4	4	4	3	...	3	2	3	4		
053	2	5	5680·10	2	2	2	3	5	4	3	3	4	4	4	2	4	3	4	5		
063	2	5	5679·79	2	2	...	...	5	4	3	4	4	4	4	2	4	4	4	5
073	2	...	9·48	...	...	2	...	...	...	...	...	...	...	...	...	3	...	2	...
081	8	...	9·21	8	8	7	7	7	8	9	8	8	8	8	8	7	8	7	8		
094	2	...	8·79	1	...	2	...	...	3	...	...	2	2	...	3	...	1	...	...
101	3	...	8·56	2	2	3	3	...	3	2	3	3	3	2	...	2	3	2	3		
110	2	...	8·27	...	3	1	...	...	...	...	...	...	...	...	...	...	...	...	...
124	3	...	7·83	2	3	3	3	2	...	3	4	3	3	...	3	3	4	3	3		
127	1	...	7·71	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
138	2	...	7·36	...	2	1	...	...	...	...	...	...	...	...	...	...	1	2	2
147	1	...	7·07	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...
151	2	8	6·94	2	2	3	2	8	5	4	4	5	5	7	4	6	6	5	7		
163	2	...	6·56	...	2	2	2	1	...	3	3	2	...	3	2	2	2	2	2		
183	2	...	5·90	2	2	2	1	...	...	2	3	3	2	2	...	2	2	3	2
193	8	...	5·59	7	8	7	7	7	8	7	8	7	8	8	8	8	8	7	8		
202	2	...	5·32	1	...	...	B	...	...	E	3	3	2	...	1	...	...	...	...
218	1	4	4·79	1	1	2	...	3	3	...	...	3	3	4	3	4	...	2	3
227	...	4	4·49	...	...	...	{	3	{ 4	{	2	4	4	4b	3	{ 4	{ 3	4	{ 4
229	1	4	4·42	1	...	2															
176238	1	5	5674·15	...	1	2	...	5	3	...	2	3	3	3	...	4	3	4	4		

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.												
	at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	11b	7	9	23	27	28	31	32	38	39b	45	47b	50	
				30	44	38	37	37	21	36	38	31	30	28	30	30	36	35	
				2.8	1.2	2.3	20	13	11	12	21	10	11	9	17	14	13	10	
176257	2	...	5673.54	1	1	2	...	1	2	1	...	2	...	3	2	1	1	2	
264	2	...	3.30	1	...	2	...	...	...	1	...	...	...	3	2	...	...	2
275	2	...	2.95	1	2	...	...	...	2	...	...	...	...	...	...	2	2	...
282	2	...	2.71	...	2	...	...	...	2	...	...	...	...	2	2	...	2	2
294	2	...	2.34	1	...	2	...	...	3	...	...	...	...	...	...	...	...	...
302	...	4	2.07	...	...	...	...	3	...	4	...	...	...	...	...	3	3	3
307	3	...	1.93	3	3	4	...	3	4	4	...	4	...	3	4	4	3	3	
318	2	4	1.58	2	2	3	3	3	4	3	...	3	4	3	4	3	2	3	
337	5	...	0.97	4	5	5	4	4	5	5	...	5	4	4	4	5	4	4	
351	2	5	0.50	2	1	3	4	3	3	3	...	3	...	3	4	3	3	4	
358	1	...	0.27	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
365	4	...	5670.06	4	4	4	4	4	5	4	...	4	5	5	4	4	3	5	
372	4	...	5669.84	4	4	4	4	4	5	4	...	4	5	5	4	4	3	5	
380	2	...	9.56	...	...	2	...	...	...	...	...	...	...	...	...	...	2	2
393	6	...	9.15	6	6	5	6	7	6	6	...	5	5	5	6	7	5	7	
407	...	3	8.70	...	...	...	...	...	...	2	...	...	3	...	3	...	1	...
414	3	...	8.49	2	3	3	...	2	3	3	...	3	3	3	2	3	2	3	
422	2	...	8.22	1	2	2	...	...	...	...	...	...	...	...	...	...	...	3
431	1	3	7.94	...	1	...	3	2	...	...	...	...	...	2	2	2	3	2
440	7	...	7.63	8	8	7	7	7	7	7	...	7	6	6	6	7	5	6	
451	5	...	7.29	5	5	5	5	6	5	6	...	6	5	5	5	6	4	5	
457	2	...	7.10	...	...	...	...	...	...	...	...	...	...	...	3	...	...	2
466	5d	...	6.84	4	5	5	5	5	5	6	...	4	5	5	5	6	4	5	
479	2	...	6.79	4	...	...	...	...	...	2	...	2	...	2	...	1	1	2
490	2	4	6.03	2	2	3	4	3	3	3	...	3	4	3	4	3	3	4	
501	6	...	5.68	5	6	6	6	7	6	7	...	8	6	7	6	6	5	7	
515	2	...	5.25	2	2	2	...	...	3	3	...	2	3	3	2	1	2	2
532	3	...	4.69	2	3	3	...	2	3	3	...	3	3	3	2	3	2	3	
539	2	...	4.48	...	...	...	...	...	...	...	...	...	...	...	...	2	...	3
549	7	...	4.15	7	7	6	6	7	7	7	...	8	7	7	6	6	5	7	
556	2	...	3.93	2	...	...	...	...	...	3	...	...	...	3	...	...	...	...
565	2	...	3.63	2	1	...	...	...	...	...	...	3	...	3	1	2	3	2
573	2	...	3.38	1	...	2	...	...	...	...	...	...	...	2	...	2	...	2
582	7	...	3.09	6	7	6	7	8	7	7	...	8	8	6	6	6	5	6	
585	2?	...	2.99	...	...	...	...	...	...	...	B	...	...	...	...	...	...	2
595	9	...	2.68	9	9	8	8	9	9	8	8	9	9	8	8	8	8	8	
607	4	...	2.31	4	4	4	4	4	4	4	4	5	4	4	5	4	4	4	
610	1	...	2.21	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
619	2	...	1.92	2	...	2	...	...	...	...	...	...	...	3	...	1	3	2
631	5	...	1.53	4	5	5	4	5	5	5	5	5	...	4	5	4	4	4	
641	2	...	1.22	1	...	2	...	...	...	2	...	4	...	...	...	1	2	2
648	4	...	0.96	3	4	4	4	4	5	4	4	4	...	4	4	4	5	4	
654	4	...	0.78	3	4	4	4	4	4	4	4	4	...	4	4	4	5	4	
659	4	...	0.61	3	4	4	4	4	4	4	4	4	...	4	4	4	5	4	
673	3	...	5660.17	2	2	2	...	...	3	2	3	2	...	2	2	2	2	3
687	5	...	5659.73	4	4	5	4	5	5	4	5	5	...	4	4	5	4	4	
700	2	...	9.33	2	...	2	...	...	...	...	1	...	...	...	...	2	2	3
708	9	...	9.04	10	9	8	...	9	9	8	8	8	...	8	8	7	7	7	
715	5	...	8.82	3	6	5	...	6b	5	5	5	5	...	7	5b	4	4	5	
176721	6	...	5658.65	5	6	6	6	5	5	6	5	5	7	5	5	6	5	6	

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.											
	at Medium Altitudes.	Telluric Lines on the Horizon.		4	5	11b	7	9	23	27	28	31	32	38	39b	45	47b	50	
				30	44	38	37	37	21	36	38	31	30	28	30	30	36	35	
				2.8	1.2	2.2	22	14	10	10	21	10	9	8	15	14	12	9	
176727	4	...	5658.46	4	5	5	5	4	5	4	4	4	5	5	4	4	4	4	
733	1	...	8.27	...	...	...	...	...	...	2	2	...	...	...	...	...	...	7
741	8	...	7.99	8	7	8	7	8	8	7	8	8	8	8	8	8	8	8	
754	3	...	7.58	E	2	3	2	1	3	3	2	2	E	E	3	2	B	3	
766	2	...	7.20	...	...	...	...	...	...	...	...	...	...	...	2	2	...	2
776	2	...	6.89	...	2	2	...	...	...	2	2	...	...	...	...	b	...	1b
792	2	...	6.37	...	2	2	...	...	1	2	...	...	...	...	1	...	...	...
799	1	...	6.13	...	...	2	...	...	...	...	...	...	...	...	...	2	...	1
813	7	...	5.70	...	8	7	7	8	8	6	7	7	...	...	7	8	...	7
823	6	...	5.38	...	6	6	6	7	7	6	5	6	...	...	6	7	...	7
829	4	...	5.18	...	4	4	...	4	4	4	3	4	...	...	4	3	...	4
841	4	...	4.79	...	4b	{ 4	}	3	4b	{ 4	4	}	4d	...	4b	{ 4	}	4	
844	4	...	4.70
851	1	...	4.47	...	...	...	...	...	...	...	...	...	...	...	...	...	...	1
864	6	...	4.08	...	6	6	6	7	6	7	5	6	...	...	6	6	...	6
872	3	...	3.82	...	2	...	...	...	3	3	...	...	...	...	3	...	...	...
884	2	...	3.42	...	...	2	...	...	...	2	2	...	...	...	...	2	...	2
892	2	...	3.16	...	2	...	...	...	...	3	1	...	...	...	...	...	...	2
899	2	...	2.94	...	...	2	...	...	2	...	...	...	...	...	2	2	...	2
912	6	...	2.54	...	5	5	6	7	6	5	5	5	...	...	6	6	...	5
922	2	...	2.23	...	2	1	...	...	...	...	...	...	...	...	...	...	...	3
928	2	(3?)	2.01	...	...	...	...	...	...	3	1	...	...	...	...	...	...	2
938	5	...	1.71	...	5	5	4	6	6	5	5	5	...	...	5	5	...	5
943	2	...	1.55	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
953	2	...	1.21	...	2	...	...	...	...	...	2	...	...	...	...	2	...	2
962	6	...	0.93	...	6	6	6	7	7	5	5	7	...	...	6	6	...	6
970	2	...	0.67	...	3	1	...	...	...	3	2	...	...	...	...	2	...	2
977	2?	...	0.45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
986	5	...	5650.18	...	5	6	5	6	5	5	4	6	...	...	5	6	...	6
176994	5	...	5649.91	...	5	6	5	6	5	5	4	6	...	...	5	6	...	6
177004	3	...	9.60	...	3	3	4	3	4	4	2	4	...	...	3	2	...	3
013	4	...	9.29	...	3	4	...	3	4	4	3	3	...	...	3	3	...	3
029	4	...	8.78	...	3	4	...	3	4	4	3	4	...	...	3	3	...	4
039	3	...	8.48	...	3	3	...	1	3	4	2	2	...	...	3	2	...	3
053	3	...	8.02	...	2	2	...	1	2	3	3	2	...	...	2	3	...	3
066	2	...	7.61	...	...	2	...	...	...	3	...	...	...	...	2	...	...	...
074	4	...	7.37	...	4	4	...	4	5	4	4	4	...	...	4	4	...	4
084	1	...	7.03	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2
090	4	...	6.85	...	3	4	...	3	4	4	3	3	...	...	4	3	...	4
103	2	...	6.42	...	}	2	3	...	2	2	2	2	...	...	2	2	...	{ 2
107	2	...	6.30
118	4	...	5.95	...	4	4	...	3	4	4	2	3	...	...	3	3	...	4
124	6	...	5.76	...	6	6	6b	6	6	6	5	6	...	...	5	6	...	6
139	3	...	5.30	...	}	2	3	...	2	{ 3	}	3	...	...	3d	3	...	{ 2
145	3	...	5.10
157	2	...	4.71	...	1	3	...	...	...	...	...	...	...	...	...	...	...	2
165	2	...	4.47	...	...	2	...	...	3	...	...	...	...	...	...	2	...	...
170	6	...	4.31	...	7	5	}	6	{ 6	6	5	6	}	...	6d	{ 6	...	5	
175	5	...	4.13	...	5	5													...
191	3	...	3.62	...	2	3	...	...	3	2	3	2	...	...	2	2	...	3
177197	2?	...	5643.44	...	...	...	...	...	...	...	...	...	...	...	...	...	...	2

Osc. Freq.	Mean Intensity.		λ	High Sun.		Low Sun.									
	at Medium Altitudes.	Telluric Lines on the Horizon.		5	11b	7	9	23	27	28	31	39b	42	45	50
				44	38	37	37	21	36	38	31	30	39	30	35
				1·2	2·1	25	15	9	10	19	9	13	23	14	8
177204	4	...	5643·22	4	5	...	4	5	5	4	4	4	...	4	3
214	3	...	2·91	3	4	...	3	4	4	3	3	3	...	3	3
225	3	...	2·55	2	3	...	3	3	3	2	2	3	...	2	3
227	3	...	2·49	...	...	...	...	...	2	...	...	...	E	...	...
242	5	...	2·01	5	5	4	6	5	6	4	5	5	5	5	4
255	8	...	1·58	8	7	7	8	8	8	7	8	8	8	8	8
270	6d	...	1·11	6	6	5	7	6	7	5d	6d	6	5	5	6
279	2	...	0·82	...	1	...	...	...	2	...	...	2	...	3	2
292	5	...	0·43	4	5	...	5	5	5	5	4	5	3	4	5
297	3	...	5640·27	...	...	...	...	...	...	...	...	...	...	3	...
308	2	...	5639·90	1	2	...	...	1	...	...	2	...	2	...	2
313	1	...	9·74	...	...	...	...	...	...	...	...	...	...	...	2
322	3	...	9·47	3	3	...	...	3	4	2	3	3	3	3	2
336	2	...	9·01	...	...	...	...	...	...	2	...	...	...	...	3
341	3	...	8·86	3	3	...	4	4	4	3	3	3	3	3	2
356	8	...	8·39	9	8	...	9	8	9	8	8	8	8	7	8
360	2	...	8·26	...	...	...	...	...	...	...	...	...	...	4	1
366	1	...	8·07	...	...	...	...	...	...	...	2	...	...	...	...
373	3	...	7·85	...	2	...	...	3	3	...	2	2	2	3	3
382	7	...	7·55	6	7	...	6	7	7	5	6	5	5	6	6
390	6	...	7·30	6	6	...	6	6	6	5	5	5	5	5	5
405	5	...	6·82	5	5	...	5	6	5	4	5	5	4	4	4
420	3	...	6·36	3	3	...	3	3	3	...	3	3	3	3	3
433	6	...	5·93	6	6	...	7	6	6	5	6	6	5	6	5
447	2	...	5·48	1	3	...	...	2	3	...	...	3	2	...	2
455	3d	...	5·22	2d	3	...	1	2	3	...	2	3	2	2	2
474	2	...	4·62	2	2	...	...	b	...	...	b	2	2	2	2
482	2	(2?)	4·37	...	...	...	...	2	2	...	1	...	2	...	2
493	8	...	4·02	7	8	...	8	8	8	8	8	8	8	7	7
496	3	...	3·93	...	...	...	...	...	...	...	...	...	...	3	B
512	2	...	3·43	2	3	...	...	...	...	...	...	...	2	...	...
518	2	(2?)	3·23	...	...	...	...	2	2	...	1	2	2	2	...
538	2	...	2·59	2	2	...	...	2	2	...	2	2	2	2	...
559	3	...	1·94	...	3d	4d	...	3	{ 4 }	3	...	2	{ 3 }	3	...
562	3	...	1·84	...	...	...	...	...	...	...	...	...	...	...	...
576	2	...	1·38	2	...	3	...	...	2	...	E	...	2d	...	...
580	2	...	1·27	2	...	...	...	...	...	...	...	...	...	...	...
588	2	(2?)	1·02	...	...	...	...	2	...	...	...	2	2	2	...
608	2	...	0·39	2	2	...	...	2	2	...	...	2	2	...	...
618	1	...	5630·06	1	...	...	...	...	1	...	...	2	2	1b	...
636	1	...	5629·49	1	3	...	...	...	1	...	...	...	...	...	...
645	2	...	9·22	...	3	...	...	3	2	...	...	1	2	1	...
659	4	...	8·77	4	4	...	4	5	4	...	...	4	4	4	...
667	4	...	8·50	4	4	...	4	5	4	...	...	4	4	4	...
679	2	...	8·12	2	2	...	...	3	3	...	...	...	...	3	...
689	5	...	7·80	4	5	...	5	5	5	...	...	5	...	4	...
693	4	...	7·67	3	4	...	4	3	3	...	...	3	...	4	...
709	2	...	7·17	2	2	...	...	2	3	...	...	2	2	3	...
718	2	...	6·88	2	3	...	...	2	3	...	...	2	2	2	...
740	2	...	6·19	2	3	...	...	2	2	...	...	1	2	2	...
177752	4d	...	5·87 5625·77	{ 4 }	{ 4 }	...	{ 5 }	5	5	5	...	5	4	4	...

Osc. Freq.	Mean Intensity.		λ	High Sun.					Low Sun.							
	at Medium Altitudes.	Telluric Lines on the Horizon.		3	5	8b	9	11b	9	10	23	27	28	39b	42	45
				58 1.3	44 1.2	58 1.3	40 1.7	38 2.0	37 16	39 9	21 9	36 9	38 16	30 12	39 20	30 14
177763	6	...	5625.46	...	6	...	...	6	6	...	6	6	...	6	5	6
771	2	...	5.20	...	1	...	...	...	...	...	...	...	...	...	...	3
777	2	...	5.01	...	1	...	...	2	...	...	3	2	...	3	...	2
787	9	...	4.70	...	9	...	...	9	10	...	9	10	9	9	9	8
790	4?	...	4.61	...	...	...	...	...	...	...	...	...	...	...	...	4
804	7	...	4.18	...	6	...	...	7	8	...	6	7	...	6	6	6
818	2	...	3.72	...	2	...	...	3	...	...	3	1	...	2	2	2
837	3	...	3.12	...	3	...	...	4	2	...	3	3	...	3	3	3
842	3	...	2.96	...	...	...	...	3	...	...	...	...	...	...	3	3
859	3	...	2.42	...	2	...	...	3	2	...	3	3	...	3	2	3
879	3	...	1.80	...	2	...	...	4	3	...	3	4	...	3	3	3
889	3	...	1.47	...	2	...	...	3	2	...	3	3	...	3	3	2
899	1	...	1.18	...	...	...	...	2	...	...	...	...	...	...	...	...
916	5d	...	0.64	...	5	...	...	5d	6	...	6	6	5	6	5	5d
930	3	...	5620.20	...	3	...	...	3	2	...	4	4	...	4	3	3
943	6	...	5619.77	...	5	...	...	6	6	...	6	6	5	6	5	5
952	2	...	9.48	...	2	...	...	3	...	...	3	3	...	3	...	...
957	2	...	9.33	...	...	...	...	2	...	...	...	...	...	...	3	2
973	7	...	8.82	...	6	...	...	7	7	...	6	7	6	7	6	6
982	1	...	8.55	...	1	...	...	...	...	...	...	...	...	...	...	...
177994	3	...	8.16	...	2	...	...	3	3	...	3	3	...	3b	3	...
178001	3	...	7.96	...	2	...	...	3	3	...	...	...	...		4	3
019	5	...	7.38	}	5	...	...	{ 5 }	7	...	5d	6	5	5	5d	5
021	5	...	7.31			...	...			...	
036	2	...	6.83	...	1	...	...	2	...	...	2	2	...	2	2	2
050	2	...	6.41	...	1	E	...	2	...	...	2	2	...	2	2	2
062	3	...	6.01	B	...	5	B	2	...	B	...	...	...	...	4	2
068	11d	...	5.82	10	11	12	11	10	12	10	10	10	10	11	9	10d
072	4	...	5.69	...	...	5	2i	...	...	...	...	...	...	...	4	...
080	7	...	5.44	8	7	8	8	7	8	7	7	7	6	6	7	7
088	2	...	5.20	...	...	...	2	2	...	...	...	...	...	...	...	2
098	6	...	4.89	7	6	6	6	6	7	7	6	6	5	5	5	5
113	4	...	4.41	5	3	5	3	4	4	4	4	4	E	4	4	4
121	1	...	4.15	...	...	...	2	...	...	...	...	...	...	...	...	B
131	3	...	3.83	2	2	3	3	3	...	...	2	3	...	2	2	...
146	2	...	3.37	...	2	...	2	...	...	...	...	3	...	...	2	...
157	2	...	3.04	...	2	3	2	3	...	...	...	...	...	...	...	...
170	2	...	2.62	2	...	...	2	3	...	...	...	...	...	...	...	...
175	3	...	2.45	3	2	3d	3	...	2	2	3	3	...	2	2	...
189	2	...	2.00	...	...	...	2	3	...	...	...	...	...	...	...	...
196	3	...	1.79	3	2	3	3	3	3	...	3	3	...	...	...	...
205	4	...	1.50	4	3	4	4	4	3	3	4	3	...	3	3	...
218	1	...	1.10	...	...	...	1	...	...	...	...	...	...	...	...	...
224	2	...	0.90	2	1	2	2	3	2	...	...	2	...	...	...	...
242	3	...	0.36	3	2	3	3	3	2	...	3	3	...	2	3	...
252	3	...	5610.04	3	2	3	3	...	...	...	3	3	...	...	...	...
261	2	...	5609.74	...	...	3	2	3	2	...	1	...	...	...	2	...
275	1	...	9.32	...	...	...	2	...	...	...	...	2	...	...	...	...
281	4	...	9.11	4	3	4	4	4	3	4	4	4	...	3	3	...
295	1	...	8.67	...	...	...	2	...	...	...	...	...	...	...	...	...
178305	3d {	...	8.42	} 3	2	3	{ 3 3 }	3	...	...	3	3	...	2	2	...
	...	5608.30														

Osc. Freq.	Mean Intensity.		λ	High Sun.					Low Sun.								
	at Medium Altitudes.	Telluric Lines on the Horizon.		3	5	8b	9	11b	7	9	10	23	27	39b	42	43	
				58 1.3	44 1.2	58 1.3	40 1.7	38 2.0	37 26	37 17	39 9	21 8	36 8	30 11	39 18	34 37	
178322	4	...	5607.82	4	3	4	5	4	...	3	4	4	4	4	4	...	
329	2	...	7.60	...	...	...	2	...	...	...	...	...	...	...	...	...
341	3	...	7.24	3	2d	2	3	3	...	1	...	3	3	3	2	...	
347	2	...	7.06	...	...	...	2	...	...	...	...	...	...	...	...	...
359	2	...	6.67	...	...	2	2	2	...	...	...	...	...	...	2	...
374	3	...	6.19	3	2	3	3	3	...	...	...	3	3	2	...	...
380	3	...	6.02	...	2	...	3	3	...	...	...	...	...	...	...	...
393	2	...	5.60	...	1	...	2	3	...	...	...	...	2	...	...	...
408	3	...	5.14	2	2	3	3	2	...	...	...	3	2	2	2	...
422	2	...	4.70	...	2	2	2	2	...	...	...	...	...	...	...	...
432	2	...	4.38	2	...	...	2	2	...	...	...	...	2	...	1	...
446	4	...	3.93	5	4	4	4	4	...	4	5	5	5	4	4	...	
454	1	...	3.68	...	...	...	2	...	...	...	...	...	...	...	...	...
462	2	...	3.42	...	...	...	2	2	...	...	...	...	...	...	...	B
472	9	...	3.12	9	9	10	10	9	14	9	9	9	9	9	9	10d	
478	9	...	2.94	9	9	10	10	9		9	9	9	9	9	9		
485	2	...	2.70	3	E	...	2	B	...	...	...	E	E	2	...	...
494	1	...	2.44	...	...	1	1	...	...	...	...	...	...	...	...	...
501	2	...	2.22	...	...	2	2	...	...	...	...	...	...	...	2	...
509	3	...	1.96	4	...	3	4	...	...	3	3	...	...	3	3	3
525	9	...	1.46	9	...	9	9	...	9	9	9	...	...	9	9	6
532	3	...	1.23	1	...	2	4	...	...	...	...	...	...	...	...	...
541	2	...	0.95	1	...	...	3	...	...	...	...	...	...	...	...	...
545	2	...	0.84	...	...	...	3	...	...	...	...	...	...	3b	2	...
558	5	...	0.44	5	...	5	6	...	6	5	6	...	...	5	5	5d
565	5	...	5600.20	5	...	5	6	...		5	6	...	...	5	5	
576	2	...	5599.86	2b	...	2	2	...	...	...	...	...	...	3	...	...
578	2	...	9.78			...	2	...	...	...	...	...	...	...	...	...
590	2	...	9.42			2	2	3	2	3
602	2	...	9.05			...	2	3	2	...
614	9	...	8.67	8	...	9	9	...	11	9	8	...	...	9	8	8d
621	8	...	8.45	7	...	8	8	...		8	7	...	...	8	8	
635	2	...	8.00	3	...	2	2	...	...	...	...	...	...	2	...	...
641	2	...	7.81	3	...	...	...	...	...	...	...	...	...	...	...	...
647	2	...	7.63	2	...	2	2	...	...	...	...	...	...	...	2	...
659	2	...	7.24	2	...	2	2	...	...	...	...	...	...	2	2	1
675	1	...	6.74	...	...	...	2	...	...	...	...	...	...	...	...	...
686	2	...	6.42	2	...	2	2	...	...	...	...	...	...	2	2	...
692	1	...	6.21	1	...	...	2	...	...	...	...	...	...	...	2	...
707	1	...	5.75	1	...	...	2	...	...	...	...	...	...	...	1	...
724	2	...	5.22	3	...	2	3	...	...	...	1	...	...	2	3	...
735	7	...	4.87	7	...	7	7	...	11	8	6	...	...	7	7	9
742	9	...	4.66	9	...	9	10	...		9	8	...	...	9	9	
754	2	...	4.27	...	...	2	...	...	...	...	...	...	...	2	3	...
765	6	...	3.94	6	...	6	6	...	6	7	6	...	...	5	5	5
775	1	...	3.62	...	...	...	1	...	...	...	...	...	...	...	...	...
780	2	...	3.46	3	...	2	2	...	...	...	...	...	...	2	2	...
791	2	...	3.12	...	...	...	2	...	...	...	...	...	...	...	...	3
800	3	...	2.84	3	...	2	2	...	...	3	1	...	...	3	3	...
813	7	...	2.45	7	...	6	7	...	7	7	8	...	...	7	7	7
178816	6	...	5592.36	6	...	6	6	...		5	5	...	...	5	7	

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.						
	O at Medium Altitudes.	Telluric Lines on the Horizon.		3	8b	9	7	9	10	35	39b	42	43
				58 1·3	58 1·3	40 1·7	37 27	37 18	39 9	33 24	30 10	39 16	34 35
178825	2	...	5592·05	2	...	2	...	...	...	...	...	...	...
840	3	...	1·60	3	2	3	...	...	3	...	3	2	3
848	2	...	1·36	...	3	2	...	...	...	...	...	...	...
860	3	...	0·96	} 3d	3d	{ 3	} ...	3	4	...	{ 4 4	} 3	3
863	3	...	0·88										
873	1	...	0·56	...	...	1	...	...	...	...	...	...	...
882	8	...	0·27	8	8	8	9	9	9	...	8	8	8
890	4	...	5590·02	4	4	4	...	3	3	...	4	4	...
898	1	...	5589·79	...	...	2	...	...	...	...	...	...	...
905	5	...	9·56	5	5	5	...	4	5	...	5	5	4
919	2	...	9·12	...	...	2	...	...	...	...	...	2	...
925	10	...	8·92	9	10	11	10	10	10	...	10	10	9
936	2	...	8·60	...	...	2	...	...	...	...	...	...	...
945	1	...	8·31	2	1	2	...	...	...	...	...	1	...
955	6	...	8·01	6	6	5	6	7	6	...	6	6	5
964	5	...	7·71	5	6	5	6	6	5	...	5	5	4
973	1	...	7·44	...	...	2	...	...	...	...	2	...	...
982	3	...	7·16	...	...	2	...	...	...	...	...	4	...
178990	11	...	6·90	11	12	12	11	12	10	...	11	11	11
179003	2	...	6·49	3	3	2	...	...	...	...	2	2	...
014	1	...	6·15	...	...	2	...	...	...	...	...	...	...
022	2	...	5·90	2	3	2	...	...	...	...	2	2	2
043	3	...	5·25	2	3	2	4	...	2	...	3	2	3
055	6	...	4·89	6	6	5	5	6	6	...	6	5	5
062	2	...	4·65	...	...	2	...	...	...	...	...	2	...
078	3	...	4·17	3	3	3	...	...	2	...	3	3	2
092	2	...	3·71	2	2	2	...	1	...	...	2	2	...
101	1	...	3·44	...	...	2	...	...	...	...	...	...	...
111	2	...	3·12	3	2	2	...	1	1	...	2	2	2
118	2	...	2·92	3	2	2	...	...	...	...	...	...	...
135	2	...	2·38	2	2	2	...	...	...	B	...	2	...
144	9	...	2·12	8	8	10	9	9	9	8	9	10	9
146	2	...	2·05	...	...	2	...	...	...	...	...	...	...
160	1	...	1·59	...	...	...	...	...	...	...	2	2	...
171	2	...	1·26	2	2	2	...	...	...	1	...	...	2
190	2	...	0·68	2	2	2	...	...	...	2	2	2	...
198	2	...	5580·42	...	2	2	...	...	...	...	...	...	...
212	2	...	5579·99	...	2	2	...	...	...	...	...	2	2
229	3	...	9·47	4	3	3	...	3	3	3	3	3	2
234	1	...	9·29	...	...	2	...	...	...	...	...	...	...
249	7	...	8·82	8	7	7	7	8	7	6	7	7	7
257	2	...	8·58	2	...	2	...	3	...	...	1	...	...
267	2	...	8·26	...	2d	2	...	...	...	2	...	2d	...
285	1	...	7·72	1	2	...	...	...	...	...	...	2	...
294	3	...	7·42	2	2	2	...	...	2	3	2	3	...
303	4	...	7·14	3	3	4	...	4	3	...	4	4	4
313	2	...	6·83	...	2	2	...	...	...	...	...	...	...
319	1	...	6·64	...	...	2	...	...	...	...	...	...	...
333	9	...	6·22	9	9	10	11	10	9	9	9	10	9
344	2	...	5·88	1	2	2	...	4	...	1	...	...	...
179355	...	3	5575·53	...	...	...	...	...	...	2	...	2	3

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.							
	at Medium Altitudes, ☉	Telluric Lines on the Horizon.		8	86	9	7	9	10	35	39b	42	43	
				58 1·3	58 1·3	40 1·7	37 30	37 19	39 10	33 24	30 9	39 15	34 33	
179365	2	...	5575·21	2	2	2	...	...	...	...	2	...	...
370	2	...	5·07	...	2	2	...	...	...	...	...	2	...
388	3	...	4·50	2	3	2	...	2	2	2	2	2	2	
405	1	...	3·98	...	...	2d	...	...	...	...	...	...	...
412	3	...	3·75	2	3	2	...	2	3	3	2	2	3	
427	6	...	3·29	6	6	6	7	7	5	7	6	7	6	
437	10	...	2·98	10	10	12	12	10	9	10	9	11	10	
444	4	...	2·78	...	...	...	...	5	...	2	4	...	...
459	2	...	2·31	2	3	2	...	...	1	...	2	2	...
466	2	...	2·09	2	...	2	...	...	...	...	...	...	...
474	2	...	1·83	2	...	2	...	...	...	2	...	...	...
486	2	...	1·48	...	2	2	...	...	1	...	2	2	2
492	1	...	1·29	...	2	...	...	...	...	...	...	2	...
506	2	...	0·85	2	...	2	...	...	2	...	2	...	...
514	3	...	0·58	2	2	2	...	...	2	3	2	2	3
524	2	...	0·30	...	2	3	...	...	...	...	...	2	...
530	1	...	5570·11	...	...	2	...	...	...	...	...	...	...
541	10	...	5569·76	10	10	11	10	10	9	9	10	10	10	
556	1	...	9·29	...	...	1	...	...	...	...	2	2	...
564	3	...	9·06	3	3	4	...	2	3	3	3	3	3	
574	2	...	8·75	...	...	3	...	...	...	...	2	...	...
585	2	...	8·40	3	2	2	...	...	2	...	2	...	...
591	2	...	8·22	...	...	3	...	2	...	...	2	3	...
600	3	...	7·92	3	2	3	...	3	2	3	2	3	2	
612	7	...	7·56	7	7	7	6	8	8	7	5	7	7	
615	4	...	7·46	4	4	4	...	...	...	...	4	4	...
627	2	...	7·08	...	...	3	...	...	...	...	...	...	...
633	3	...	6·92	3	3	4	...	2	3	3	3	4	3	
648	2	...	6·43	...	...	3	...	...	...	...	...	...	...
656	4	...	6·20	4	4	5	4	4	4	4	4	5	...	
668	8	...	5·83	8	8	7	8	9	8	8	8	9	9	
674	4	...	5·62	4	4	4	...	4	4	3	4	4	...	
685	1	...	5·30	...	...	2	...	...	...	...	...	...	...
693	2	...	5·06	1	2	2	...	...	2	2	2	2	2
707	2	...	4·61	...	2	2	...	...	2	1	2	2	2
715	2d	...	4·40	2	...	2	...	...	...	2	2	...	...
			4·35	2	...	...	...	...	...	...	...	...	...
722	2	...	4·15	2	2	1	...	...	...	...	...	1	...
735	8	...	3·73	9	8	9	8	9	9	8	8	9	7	
744	2	...	3·48	2	...	2	...	...	...	2	3	...	...
753	2	...	3·20	...	...	2	...	...	...	...	2	2	2
758	2	...	3·04	...	...	...	...	...	...	...	...	2	...
764	7	...	2·84	7	7	7	7	7	7	7	6	8	6	
777	2	...	2·45	2	3	2	...	...	...	...	E	...	...
782	2	...	2·28	3	...	3	...	...	2	3	...	2	...
797	2	...	1·83	2	2	3	...	2	2	...	...	2	2
812	3	...	1·37	3	3	3	...	2	3	3	...	3	2	
823	1	...	1·02	...	...	2	...	...	...	...	...	...	...
828	2	...	0·87	2	2	2	...	...	...	2	...	2	...
845	7	...	0·36	7	7	7	6	7	7	6	...	8	6	
179856	2	...	5560·02	2	2	3	...	...	...	...	...	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.									
	O at Medium Altitudes.	Telluric Lines on the Horizon.		3	85	9	10	7	9	10	12	35	37b	40b	42	43	
																	58	58	40	50	37	37	39	46	33	32	40	39	34
				1.3	1.3	1.6	2.0	35	22	11	10	20	26	21	11	30	
180475	3	...	5540.94	3	3	2	...	...	1	3d	1	3	...	...	3	3
487	2	...	0.57	2	3	2	...	...	...	...	3	...	...	...	2	3
504	2	...	5540.03	2	...	2	...	...	...	...	...	...	...	...	...	...
509	3	...	5539.89	4	3	3	...	...	3	4	2	4	...	...	3	3
526	5	...	9.38	5	4	5	...	...	4	5	4	5	...	...	5	4
535	1	...	9.09	2	...	1	...	...	...	...	...	2	...	...	...	...
548	6	...	8.68	8	6	6	...	6	6	6	5	7	...	...	6	6
556	1	...	8.45	2	...	1	...	...	...	...	...	2	...	...	...	...
571	5	...	7.99	5	{ 5 }	5	...	6	5	5d	4d	5d	...	...	5d	6
574	5	...	7.89			
584	1	...	7.60	...	...	1	...	...	...	...	...	...	...	...	...	...
596	3	...	7.23	4	2	3	...	...	...	2	2	3	...	...	3	2
611	3	...	6.75	4	3	3	...	...	...	2	3	4	...	...	3	...
621	2	...	6.44	...	...	3	...	...	...	2	...	3	...	...	...	3
629	3	...	6.21	3	2	3	...	...	...	2	3	4	E	...	2	3
645	5	...	5.72	5	5	5	...	8	9	8d	9	{ 5 }	8d	...	{ 5 }	8d	
650	8	...	5.58	7	8	8	...					{ 7 }		...	{ 8 }		
658	3	...	5.33	3	...	3	...	...	...	...	...	3	...	...	...	...
669	7	...	4.98	7	7	6	...	7	7	7	7	7	5	...	7	7	
675	4	...	4.80	3	3	4	...	...	...	...	...	4	...	...	4	...
688	3	...	4.41	3	3	2	...	...	...	1	3	3	3	...	2	3
692	3?	...	4.29	...	...	3	...	...	...	...	...	...	...	...	...	...
711	3	...	3.71	2	3	2	...	...	3	1	3	3	3	...	4	3
716	2	...	3.53	2	...	2	...	...	...	...	...	...	...	...	b	...
734	4	...	3.00	4	4	5d	...	7	7	7d	8	{ 3 }	6d	...	{ 4 }	7	
738	6	...	2.86	5	6			{ 6 }	...		{ 6 }
756	3	...	2.32	2	3	2	...	...	4b	2b	4d	{ 3 }	3b	...	{ 5 }	...
761	4	...	2.15	4	4	4	...					{ 4 }		...	{ 3 }	...	{ 4 }	...	{ 5 }	4
772	2	...	1.82	1	...	2	...	...	...	...	...	3	...	...	...	...
783	2	...	1.49	2	2	2	...	...	...	...	...	2	...	...	2	...
798	4	...	1.02	4	4	3	...	...	3	3	4	4	3	...	4	4d
808	4	...	0.73	4	4	4	...	...	3	3	4	3	3b	...	4	
816	2?	...	0.47	...	...	3	...	...	...	...	...	...	...	...	...	...
823	2	...	5530.28	3	3	2	...	...	...	1	3	...	...	...	3	...
834	2	3?	5529.92	...	...	3	...	...	2	...	...	3	...	...	3	2
843	2	...	9.65	...	...	2	B	...	3	...	...	1	...	...	...	...
854	3	...	9.32	3	4	4	3	...	3	3	3	3	...	...	3	...
862	3	...	9.07	3	4	4	3	...	...	3	...	3	3	E	3	2
879	12	...	8.56	12	11	12	11	14	12	11	11	12	12	12	12	12	
892	1	...	8.15	E	...	...	1	E	...	...	...	...	...	...	...	...
898	2	...	7.97	...	2b	2	2	...	...	...	...	1	...	...	...	...
910	2	...	7.61	...	...	2b	1	...	...	...	...	2	4	2	1	1
920	1	...	7.30	...	...	2	1	...	...	...	...	2	...	...	...	...
929	8	...	7.02	...	8	8	8	...	9	8	8	8	9	8	8	8	
938	2	...	6.76	...	...	3	2	...	...	...	...	...	...	...	...	...
949	3	...	6.41	...	2	3	2	...	...	1	2	3	...	2	3	2
956	1	...	6.19	...	...	...	...	...	...	...	...	...	...	1	...	...
970	3	...	5.77	...	...	4	2	...	...	...	...	...	...	...	...	...
973	7	...	5.69	...	7	7	7	...	7	7	7	7	8	7	7	7	
180986	4	...	5.29	...	4	4	4	...	4	4	3	4	4	3	4	4	
181000	1	...	5524.87	...	...	E	2	...	...	...	...	...	...	...	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.		Low Sun.									
	at Medium Altitudes.	Telluric Lines on the Horizon.		8b	10	9	10	12	35	37b	40a	40b	42	43	
				58 1·3	50 2·0	37 23	39 12	46 10	33 18	32 21	40 13	40 20	39 11	34 28	
181005	2	...	5524·71	2	2	...	2	...	3	...	...	3	2	3
018	2	...	4·30	...	2	...	...	...	...	...	...	3	2	...
025	3	...	4·11	3	3	3	3	4	4	4	...	2	3	3	
034	1	...	3·82	...	2	...	...	...	2	...	...	...	...	...
041	3	...	3·60	...	2	...	...	...	...	...	...	3	...	3
048	3	...	3·40	3	3	3	3	3	4	4	...	2	3	3	
061	1	3	3·03	...	2	...	...	4	...	...	...	...	...	3
074	7	...	2·61	7	7	7	7	7	7	6	...	6	6	6	
082	2	...	2·36	...	2	...	...	...	2	2	...	...	...	3
103	3	...	1·73	3	2	4	2	3	3	3	...	2	3	3	
114	3	...	1·38	3	3	b	{	3	3	3	...	2	3	3	
124	3	...	1·07	3	3			3	3	3	3	...	3	3	3
138	3	...	0·66	3	3			3	...	4	3	...	3	3	3
152	1	3	5520·23	...	2	...	...	...	3	...	...	2	b	2
161	2	(3½)	5519·95	2	...	...	...	2	2	...	...	...	3	...
169	5	...	9·71	5	5	4	5	5	5	4	...	5	5	6	
179	1	4	9·41	...	2	...	...	...	...	3	...	...	...	4
196	2	...	8·89	2	2	2	1	2	2	1	...	2	2	...	
207	2	...	8·55	2	...	...	b	b	2	b	...	...	2	3
217	2	...	8·24	3	2	...	1	2	2	1	...	2	2	3	
237	4d	...	7·63	4	4d	4	4	4	5	4	...	4	4	3	
252	4	...	7·17	4	4	4	5	5	4	5	4	...	4	3	
260	5	...	6·93	4	5	6	6	6	6	6	...	5	6	5	
263	5	...	6·84	4	5						...				
275	2	3	6·49	2	2						...				
288	1	3	6·09	...	2	...	1	...	4	3	...	3	2	2	
297	3	...	5·80	3	3	...	2	3	4	3	...	3	2	4	
307	1	4	5·52	...	1	...	3	...	...	...	...	...	...	4
315	1	...	5·26	...	2	...	...	...	...	...	...	...	...	...
322	3	...	5·04	2	2	...	2	3	3d	3	...	3	3	3	
326	2	...	4·94	...	2	...	...	...	...	...	...	...	...	...
335	6	...	4·67	6	6	8	6	7	7	7	...	5	6	6	
341	6	...	4·47	6	6	8	6	7	7	7	...	5	6	6	
360	2	4	3·91	2	2	4	3	2	4	3	...	3	...	4d	
366	2	...	3·70	2	2	...	...	...	...	3	...	1	...	...
375	2	...	3·44	...	2	...	...	...	...	...	...	...	2	...
386	8	...	3·12	5	8	9	9	9	9	8	...	8	7	7	
388	4	...	3·04	4	...	...	...	...	...	3	...	...	4	...
401	6	...	2·66	6	6	8	7	7	6	5	...	5	6	6	
405	3	...	2·53	4	2i	...	...	...	...	3	...	4	...	...
410	6	...	2·38	6	5	7	7	7	6	5	...	5	6	6	
416	2	...	2·19	...	3	...	...	...	...	...	...	...	...	...
426	3	...	1·90	3	3	2	1	2	3	3	...	4	1	4	
436	2	...	1·59	3	2	...	...	...	...	...	...	...	...	...
443	2	5	1·37	2	3	4	3	2	4	4	...	4	2	5	
462	5	...	0·81	4	5	7	5d	5d	{	5	5d	5d	{	4	
465	5	...	0·72	4	5										
477	1	...	0·35	1	1										
484	6	...	0·13	5	6	8	7	6	{	7	E	{	5	8	
487	6	...	5510·03	5	6										
181500	2	4	5509·64	...	3	2	3	3	4d	3	2	3	2	4	

Osc. Freq.	Mean Intensity.		λ	High Sun.		Low Sun.											
	O at Medium Altitudes.	Telluric Lines on the Horizon.		8b	10	9	10	12	35	37a	37b	40a	40b	41	42	43	
				58	50	37	39	46	33	32	32	40	40	32	39	34	
				1·3	2·1	25	13	12	15	15	18	13	17	30	10	24	
181510	2	...	5509·34	3	2	...	...	...	...	...	...	...	...	...	...	...
517	...	2	9·11	...	...	...	...	1	3	...	2	2	2	...	...	...
530	4	...	8·73	4	5	4	4	5	5	...	4	4	4	...	4	} 6d	
537	4	...	8·53	4	5	4	4	5	5	...	4	4	4	...	4		
557	3	...	7·91	2	2	...	1	3	3	...	3	...	3	...	3	} 3 ^b	
565	2	(3?)	7·67	1 ^b	2	...	...	...	3	...	3	1	3	...	3	
584	3?	...	7·08	...	...	...	...	...	...	E	3	...	...	...	...	...
590	10	...	6·92	9	10	10	10	10	10	12	9	10	10	...	10	10	
601	2	(3?)	6·57	...	2	...	...	...	3	...	3	...	2	...	B	3
611	1	...	6·28	...	2	...	...	...	...	...	...	...	...	...	...	...
619	7	...	6·03	7	7	7	7	7 ^b	8	8	6	7	6	...	...	8
623	3?	...	5·91	...	3	...	...	...	...	...	...	...	...	...	...	...
633	2	...	5·60	2	2	...	...	...	2	...	2	...	...	...	...	...
641	2	4	5·37	2	2	...	...	3	3	3	2	2	3	...	...	4
655	1	...	4·90	...	...	...	...	...	...	...	...	2	2	...	...	...
668	4	...	4·55	4	4	...	3	3	4	3	3	3	3	...	...	4
675	3	...	4·33	3	3	...	2	...	3	...	...	3	3	...	...	...
683	4	...	4·08	4	4	3	3	3	4	3	3	3	3	...	...	4
691	2?	...	3·84	...	...	...	...	2	...	...	...	...	...	...	...	...
697	3	...	3·66	2	3	...	2	...	3	2	3	2	3	...	...	3
707	4	...	3·37	4	...	...	...	...	3	...	...	...	4	...	...	...
712	7	...	3·21	6	7	7	7	8 ^b	7	5	6	6	6	...	...	8
717	5	...	3·05	4	5	...	2	...	...	4	5	4	5	...	...	...
729	1	...	2·68	...	...	...	...	...	...	...	2	...	...	...	...	...
733	2	...	2·58	1	2	...	...	...	3	...	2	1	2	...	...	2
745	4	...	2·20	3	5	4	4	3	5	4	4	4	4	...	...	4
752	...	3?	2·00	...	...	...	...	2	3	...	3	1	2	...	...	...
766	9	...	1·58	9	10	10	10	9	10	9	8	9	10	...	...	10
780	1	...	1·14	...	2	...	...	...	...	...	B	...	...	...	...	...
790	2	...	0·85	2	2	...	...	...	3	2	...	2	2	...	...	3
804	2	3	0·44	2	2	1	...	...	4	2	...	2	2	...	...	3
818	1	...	5500·00	...	...	...	2	...	...	...	...	...	...	...	...	...
828	1	3	5499·70	...	2	3	3	...	3	...	...	...	2	...	...	3
838	...	3	9·39	...	...	b	...	...	3	2	...	2	3	...	...	3
850	2	4	9·05	2	2	3	3	...	4	2	...	3	3	...	...	4
866	...	3	8·56	...	...	...	...	...	3	2	...	...	2	...	...	...
876	2	...	8·27	2	2	...	...	...	...	...	...	2	2	...	...	3
887	2?	...	7·93	...	2	...	...	...	...	...	...	...	...	B	...	...
895	10	...	7·68	9	10	10	11	11	11	10	...	10	10	9	...	11	
899	4?	...	7·56	4	...	...	...	...	...	...	...	...	B	...	...	...
909	1	...	7·27	...	1	...	...	...	...	...	...	...	...	...	...	...
918	2	5	6·98	...	3	4	3	3	5	3	...	4	...	4	...	4	
929	4	...	6·65	4	4	...	2	2	4	3	...	3	...	...	...	3
940	...	3	6·33	...	...	...	...	...	3	2	...	...	...	...	...	3
947	1	...	6·13	...	2	...	...	...	1	...	...	...	...	...	...	...
958	2	...	5·78	2	2	...	3	2	2	...	...	...	...	...	...	2
962	...	4	5·65	...	...	} 3	4	...	{ 3	2	...	2	...	} 4d	...	3d
967	3	...	5·51	2	2					3	3	...	3		...		
975	1	...	5·25	...	...	...	...	...	...	...	1	...	...	...	...	...
984	4	...	4·99	4	5	4	...	3	4	4	...	4	...	...	...	4
181997	5	...	5494·60	5	5	5	5	4	6	5	...	6	...	5	...	6	

Osc. Freq.	Mean Intensity.		λ	High Sun.		Low Sun.									
	O at Medium Altitudes.	Telluric Lines on the Horizon.		8b	10	9	10	12	14	15	35	37a	40a	41	43
				58	50	87	39	46	40	32	33	32	40	32	34
				1·3	2·3	31	15	14	13	9	13	13	11	28	19
182517	2	4	5478·93	2	2	4	2	1	...	...	4	3	2	2	3
529	7d	...	8·58	5d	7	5	6	6	...	...	8	5	5	6	7
538	2	7	8·32	...	2	5	4	4	...	...	6	4	4	6	7
553	6	...	7·87	5	6	5	5	6	...	...	7	5	5	6	7d
559	3	...	7·69	2	3	...	...	3	...	...	4	3	3	...	3
577	4?	...	7·14	...	...	...	...	...	B	B	...	4	...	...	...
580	10	...	7·05	9	10	9	11	10	9	10	11	9	8	9	10
592	8	...	6·69	8	9	8	9	9	8	8	9	8	8	8	8
603	7	...	6·37	6	8	8	9	9	8	8	8	8	7	8	8
606	5	...	6·28	5	5	...	...	...	...	...	...	...	B	...	...
617	2	...	5·93	3	2	...	...	...	...	...	3	...	...	2	...
626	2	...	5·68	3	2	...	2	2	...	...	3	2	...	2	2
635	...	2	5·41	...	...	...	b	3	...	...	...	...	...	2	2
646	2	...	5·08	2	2	...	2	3	...	...	2	...	...	...	...
654	2	...	4·82	...	2	...	...	...	...	...	...	...	...	2	3
663	2	...	4·55	...	2	...	...	...	...	3	...	...	...	...	3
672	3	...	4·30	3	3	...	3	3	...	3	3	2	...	2	2
682	8	...	4·01	8	9	8	9	8	8	8	8	8	...	8	7
697	3	5	3·54	3	3	5	3	4	3	3	4	4	...	4	4
707	5	...	3·25	4	5	5	4	5	4	5	5	5	...	4	5
722	6	...	2·79	6	7	5	5	6	6	7	6	6	...	4	6
733	2	...	2·46	3	1	...	...	2	...	...	3	...	...	3	3
745	3	...	2·12	3	2	...	...	...	1	2	3	3	...	3	3
758	1	...	1·72	...	1	...	2	2	...	2	...	...	...	...	...
772	3	...	1·31	3	3	...	2	3	3	2	4	3	...	3	3
777	1	...	1·16	...	1	...	...	...	...	3	...	...	...	...	...
788	6	...	0·82	5	7	6	8	8	8	6b	8	6	...	6	7
791	6	...	0·72	5											
804	2	8	0·35	...	3	9	7d	7	6	5	7	5	...	7	7
808	5	...	5470·22	5	5										
819	2	...	5469·90	1	2	...	...	...	...	2	3	2	...	1	...
830	2	...	9·56	3	2	...	1d	3	2	3	4	3	...	2	3d
836	3	...	9·38	4	3										
847	2	...	9·06	2	2	...	...	...	2	2	3	2	...	2	...
861	1	...	8·63	...	...	...	...	...	...	...	2	...	...	...	...
869	3	...	8·40	3	3	1b	2d	3	2	3	4	...	...	3	...
876	4	...	8·18	4	4	...	...	...	...	4	3	3	...	3	3
888	3	...	7·83	3	2	...	...	3	2	2	3	...	...	3	3
899	2	...	7·49	3	2	...	...	...	2	2	3	2	...	...	2
911	6	...	7·13	6	7	4	4	6	6	7	6	4	...	5	4d
919	2	6	6·90	...	3										
932	9	...	6·51	9	9	8	8	8	8	8	8	8	...	8	12
944	2	3	6·17	2	1	...	2	...	1	2	3	2	...	3	3
953	2	...	5·88	2	2	...	...	...	...	...	2	...	...	...	...
967	2	5	5·47	3	2	5	3	4	5	3	4	4	...	4	4
976	3	6	5·21	3	3	5	4	4	5	4	5	5	...	5	5
988	2	(3?)	4·84	2	2	...	1	...	...	2	3	2	...	3	2
182996	2	...	4·59	...	2	...	...	...	...	...	...	...	...	...	...
183001	6	...	4·46	6	6	5	6	6	6	6	7	6	...	5	6
013	4	...	4·11	3	4	...	2	3	2	4	4	3	...	3	3
183018	3	...	5463·93	...	4	...	...	...	...	...	3	...	...	2	...

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.									
	O at Medium Altitudes.	Telluric Lines on the Horizon.		2c	8b	10	9	10	12	14	15	35	37a	41	43	
				55	58	50	37	39	46	40	32	33	32	32	34	
				1·3	1·3	2·3	34	17	15	14	9	12	12	25	17	
183035	9	...	5463·44	...	8	9	8	8	9	9	9	10	8	9	8	
046	8	...	3·11	...	8	9	8	8	9	8	8	9	8	8	8	
063	7	(7?)	2·59	...	6	7	...	8	8	8	7	8	7	8	8	
077	2	5	2·18	...	2	3	...	3	3	3	4	5	4	4	5	
084	2	...	1·98	...	2	2	...	...	...	...	...	...	...	...	...
094	6	...	1·68	...	6	6	...	4	4	4	5	5	5	4	5	
105	1	...	1·35	...	1	...	...	...	...	...	...	2	...	1	...
117	4	...	1·00	...	4	4	...	3	3	4	1	4	3	3	4	
126	4	...	0·71	...	4	4	...	3	b	...	3	4b	3	3	4	
132	4	...	0·53	...	4	4	...	...	3	4	3	2	3	3	...
144	1	...	5460·20	...	...	...	...	...	...	...	...	1	...	...	...
155	3	...	5459·86	...	3	2	...	...	2	2	3	3	...	2	2
166	...	7	9·54	...	...	...	...	6	6	7	6	8	{ 5 }	7	7
169	4	...	9·44	...	4	4	...	...	...	...	...	...	{ 4 }	...	...
182	2	(3?)	9·05	...	...	2	...	...	1	...	2	3	...	2	3
195	2	5	8·65	...	3	2	...	4	4	5	4	5	3	5	5	
208	2	...	8·26	...	2	2	...	...	...	...	...	3	2	2	2
230	4	7	7·62	...	4	4	...	9	5	6	5	7	4	6	6	
239	2	4	7·34	...	3	2	...	4	3	3	3	4	3	3	4	
265	4	8	6·58	E	4	4	...	5	6	8	6	7	4	8	7	
270	4	...	6·42	2	4	4	...	...	...	4	...	3	3	3	...
292	10	...	5·76	10	11	10	...	...	{ 9 }	...	{ 11 }	10	8	10	{ 12 }
298	9	...	5·59	10	9	10	...	12	{ 8 }	{ 12 }	{ 9 }	10	8	10	...	
309	2	4	5·28	...	2	2	E	1	3	2	3	4	4	3	4	
328	4	...	4·70	3	4	5	...	3	3	3	4	4	4	3	4	
345	3	...	4·21	...	...	...	...	3	2	2	4	3	3	3	4
347	3	...	4·13	...	4d	4	...	...	...	...	...	3	2	2	3
356	3	...	3·87	2	3	3	...	...	...	...	...	3	2	4	4
374	4	...	3·33	3	3	4	...	4	4	3	4	4	4	3	4	
386	4	...	2·98	4	3	4	...	3	4	3	4	4	4	3	4	
401	1	3	2·54	...	...	2	...	...	3	...	...	3	...	3	3
410	4	...	2·26	4	...	4	...	3	b	...	{ 3d }	4	3	3	{ 4 }	
418	3	...	2·02	2	3	3	...	3	3	...	{ 4 }	3	3	3	...	
430	1	...	1·67	...	...	2	...	...	...	...	...	1	...	1	...
444	2	4	1·26	2	2	3	...	3	3	3	4	4	3	3	4	
455	3	...	0·94	3	3	4	...	...	3	...	4	4	3	3	4
472	1	4	0·43	...	...	2	...	...	2	3	4	3	2	3	4
484	2	...	5450·07	2	1d	...	...	2	...	...	...	1	...	...	3
501	1	5	5449·57	...	...	3	...	4	5	6	5	5	4	5	5
515	2	4	9·16	2	2	2	...	4	4	5	{ 4 }	4d	4	4d	5	
518	4	...	9·07	4	4	4	...	4	4	3	5	4	5	4	4	
535	4	...	8·54	4	4	4	...	6	5	7	6	6	4	5	6	
546	2	6	8·22	2	2	3	...	...	...	...	4	2	...	2	...
564	2	...	7·70	1	2	2	...	...	...	...	4	2	...	2	...
586	11	...	7·04	10	11	11	...	10	10	10	12	11	9	11	11	
597	8	...	6·72	8	8	8	...	7	8	8	9	8	7	7	8	
613	1	3	6·25	...	...	2	...	...	2	1	3	3	2	2	3
621	2	...	6·00	2	2b	2	...	...	...	...	...	3	...	...	2
629	2	...	5·75	...	...	2	...	...	...	...	2	...	2	2	...
638	1	...	5·49	1d	...	...	...	...	...	...	1	...	...	...	...
183649	9	...	5445·17	8	9	9	...	10	9	9	10	10	8	9	9	

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.													
	\odot at Medium Altitudes.	Telluric Lines on the Horizon.		2c	8b	10	10	12	14	15	34	35	36	37a	41	43	44	46		
55	58	50	39	46	40	32	39	33	36	32	32	34	32	30						
1.3	1.3	2.4	20	17	15	13	30	11	20	11	22	15	32	19						
183654	3	...	5445.01	...	...	2	...	...	...	...	...	...	...	4	...	...	...	...
664	4	...	4.72	4	4	3	...	3	3	4	...	3	...	3	3	4	...	...
681	2	4	4.23	2	2	2	3b	...	...	4	...	3	...	3	2	4	...	...
699	3	...	3.68	3	3	3	...	3	3	4	...	4	...	3	3	4	...	...
703	3	...	3.56	3	3	...	...	...	...	4	...	4	...	3	3	4	...	...
720	3d	...	3.06	2	3	3	...	...	...	3	...	2d	...	...	2	3	...	...
735	3?	...	2.61	...	...	...	...	...	...	3	...	...	...	...	...	...	...	...
739	4	7	2.51	3	4	4	6	5d	6	4	...	6	...	5	6d	7	...	...
743	4	...	2.39	3	4	4	...	...	...	4	...	6	...	5	6d	7	...	...
756	2	...	2.01	2	...	2	...	...	...	3	...	2	...	2	2	2	...	...
773	6	...	1.51	5	6	7	5	6	6	6	...	6	...	5	5	6	...	...
780	2	...	1.30	...	...	2	...	...	...	3	...	2	...	3	...	...	...	...
797	3	...	0.79	3	3	2	...	...	1	3	...	3	...	2	2	3	...	...
816	2	...	5440.22	2	3	...	...	...	...	...	...	...	...	...	2	...	...	...
827	1	3	5439.91	...	...	2	...	2	2	3	...	3	...	3	2	3	...	...
836	2	...	9.62	...	...	2	...	...	...	2	...	2	E	...	...	2	...	...
856	2	5d	9.06	2	3	2	4	4	5	5	...	5	4	4	4	5	...	...
			8.99	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
877	2	4	8.43	2	3	2	...	3	3	3	...	4	...	2	3	4	...	...
886	2	4	8.16	1	3	2	3	3	3	3	...	4	4	b	3	4	...	...
893	1	...	7.93	...	...	2	...	...	...	...	...	...	...	2	...	...	...	...
909	2	...	7.46	...	...	...	...	...	1	2	...	...	...	...	...	...	...	...
913	4	6	7.36	4	4	5	7	5	7	5	...	8	6	4	3	6b	7	...		
917	4	6	7.23	4	4	4	7	7	7	6	...	7	6	4	5	6	...	...
933	6	...	6.76	5	5	6	7	7	7	6	...	7	6	4	5	6	...	...
943	6	...	6.47	5	5	6	7	7	7	6	...	7	6	4	5	6	...	...
958	7	...	6.03	6	6	8	7	7	7	7	...	8	6	5	6	7	...	...
967	2	7	5.76	2	1	3	7	7	7	6	...	7	6	4	5	6	...	...
976	...	3?	5.49	...	...	...	...	...	...	3	...	...	...	...	...	3	...	...
982	3	...	5.31	3	3	3	...	...	...	4	...	...	2	...	...	2	...	B
183995	1	6	4.92	...	...	2	6	4	5	4	...	4	5	3	4	4	...	4
184005	10	...	4.65	9	10	10	10	10	10	10	...	10	9	10	10	11	...	8		
015	2	...	4.33	...	2	2	...	...	...	3	...	E	...	...	...	2	...	3
025	2	4	4.04	3	2	2	4	3b	3	4	...	...	3	2	3	3	...	...
031	2	...	3.87	3	2	2	...	...	...	3	...	...	...	...	...	...	...	...
040	2	...	3.61	3	2	...	...	...	2	2	...	...	3	2	2	3	...	...
			3.14	8	8	7	7	7	8	8	...	...	8	4	7	7	...	6
057	8d	...	3.06	...	...	...	...	...	...	...	...	...	...	3	...	...	...	...
			2.67	7	6	6	5	6	6	7	...	...	8	4	6	6	...	5
072	6d	...	2.63	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
			...	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
077	1	...	2.52	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...
087	2	...	2.20	...	2	2	...	...	...	3	...	...	3	...	2	2	...	...
100	3	5	1.82	3	2	3	5	4b	6	5	...	...	5	4	5	5	...	5d
108	3	5	1.60	3	3b	3	b	...	...	...	...	...	...	...	...	...	...	...
120	1	3	1.25	...	...	2	5	...	...	2	...	...	2	...	2	4	...	...
133	2	...	0.87	1	2	2	...	...	...	...	...	...	3	...	...	3	...	...
147	3	4	0.46	3	3	3	4	2	3	4	...	...	3	4	4	4	...	3
162	6	...	5430.00	5	5	6	...	...	...	7	E	...	6	6	...	...	B	...
167	10	...	5429.86	10	11	10	12	12	10	10	11	...	9	9	11	11	10	12		
175	7	...	9.61	6	7	7	...	8	8	7	...	...	8	7	9	7	5	...
184187	3	...	5429.26	3	3	3	...	...	...	4	...	...	1	2	2	4	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.																								
	O at Medium Altitudes.	Telluric Lines on the Horizon.		2b	2c	8b	10	10	12	14	15	34	36	37a	41	43	44	46														
				55	55	58	50	39	46	40	32	39	36	32	32	34	32	30														
				1·3	1·3	1·3	2·5	22	19	16	15	30	$\left\{ \frac{17}{12} \right\}$	10	19	15	32	18														
184200	3	$\left. \begin{array}{l} 7d \\ 5d \end{array} \right\}$	5428·88	...	3	3	2	$\left. \begin{array}{l} 5 \\ 5 \end{array} \right\}$	4	5	$\left\{ \begin{array}{l} 5 \\ 5 \end{array} \right\}$	$\left. \begin{array}{l} 5 \\ 4 \end{array} \right\}$	5	5	4	5	7	3														
204	3		8·78	3	3														
210	2		8·59	...	2	2	2														
227	3	$\left. \begin{array}{l} 5d \\ 5d \end{array} \right\}$	8·09	...	3	3	2	$\left. \begin{array}{l} 3 \\ 4 \end{array} \right\}$	3	2	$\left\{ \begin{array}{l} 3 \\ 4 \end{array} \right\}$	$\left. \begin{array}{l} 4 \\ 4 \end{array} \right\}$	4	3	3	3	3	3														
234	3		7·89	...	2	2	3															
247	2		7·49	...	2	2			
258	2	$5d$	7·17	...	3	...	2	4	4	$4d$	$4b$	$\left\{ \begin{array}{l} 4 \\ 3 \end{array} \right\}$	$\left. \begin{array}{l} 4 \\ 3 \end{array} \right\}$	$3d$	3	$3d$	$\left. \begin{array}{l} 3d \\ 4b \end{array} \right\}$	$3d$														
269	3	(3?)	6·85	3	3												b	2	3	...				
284	3	(3?)	6·42	...	3	2	3												1	3	2	2	2	...				
299	2	3	5·96	...	2	...	2	4	3	2	3	...	3	2	2	3	2	2														
318	6	...	5·41	...	6	6	6												5	5	6	7	...	6	7	6	7	4	4			
329	1	4	5·09	E	1												4	...	3	2	...	3			
339	6d	...	4·78	6	6	5	6	5	5	6	7	4	5	6	6	7	$4d$	4														
345	2?	...	4·63	...	...	...	2	...	...	...	...	...	...	...	...	...	...	...			
359	10	...	4·21	10	11	10	11	10	10	9	10	10	10	10	10	10	11	10														
364	4	...	4·06	...	...	B	4	...	...	5	4	...	...	...	4	...	...	3					
377	...	3	3·66	...	...	...	...	...	...	...	3	2	4	3	...	3	1	...							
383	3	...	3·48	3	3	...	2	...	4	...	...	...	...	2	2	3	...	...												
399	3	$9d$	3·06	$\left. \begin{array}{l} 3 \\ 3 \end{array} \right\}$	3	...	4	8	6	$\left\{ \begin{array}{l} 6 \\ 6 \end{array} \right\}$	$\left. \begin{array}{l} 7 \\ 7 \end{array} \right\}$	9	6	5	7	6	8	6														
			2·98															
410	2	...	2·70	3	...	...	2	...	...	...	2	...	3	...	...	2	...	...												
416	2	...	2·51	3	3	...	...	...	...	...	...	...	...	2	...	2	...	3						
427	4	...	2·21	6	4	...	4	2	$\left. \begin{array}{l} 4 \\ 4 \end{array} \right\}$	$3d$	$\left\{ \begin{array}{l} 4 \\ 4 \end{array} \right\}$	3	3	3	3	4	3	...														
435	4	...	1·95	4	4	...	4					
450	2	...	1·52	2	3	...	2					
457	5	$7d$	1·31	5	5	...	5	$6b$	7	7	8	7	6	$5d$	6	7	7	7														
467	4	...	1·01	4	4	...	5	...	...	...	4	...	4	3	4	4	...	...												
478	2	7	0·71	2	3	...	4	...	6	5	5	7	4	4	4	4	7	3														
485	6	$\left. \begin{array}{l} (8?) \\ (8?) \end{array} \right\}$	0·49	6	6	...	6	$\left. \begin{array}{l} 7 \\ 7 \end{array} \right\}$	8	7	$8d$	8	8	$\left\{ \begin{array}{l} 5 \\ 5 \end{array} \right\}$	$7d$	8	7	7														
488	6		5420·41	6	6	...	6															
502	3	...	5419·99	$\left. \begin{array}{l} 3 \\ 3 \end{array} \right\}$	3	...	4	...	...	...	2	...	1	B	$\left\{ \begin{array}{l} 3 \\ 3 \end{array} \right\}$	2	$\left. \begin{array}{l} 3 \\ 3 \end{array} \right\}$	2											
507	3	...	9·84																
519	3	8	9·49																3	2	...	4	8	7	7	6	8	4	...	5	6	7
526	3	...	9·29	3	2	...	4	2	...	3	...	1	2														
533	3?	...	9·08	...	...	...	3	...	...	...	...	...	...	...	...	...	...	...			
540	7	...	8·89	7	6	...	8	...	7	6	6	4	6	...	6	7	5	5														
542	4?	...	8·83	...	B	...	...	...	...	...	...	...	4	...	...	...	...	...									
555	2	5	8·43	...	...	...	3	...	5	5	4	4	4	...	4	4	5	5											
562	3	...	8·23	$\left. \begin{array}{l} 3d \\ 3d \end{array} \right\}$	...	...	3	$\left. \begin{array}{l} 6 \\ 5 \end{array} \right\}$	...	5	...	4	4	3	...	3	4	4											
568	3	5	8·07																
577	2	...	7·80	3	...	...	...	...	...	...	...	...	1	...	...	2	...	...												
591	1	5	7·39	...	...	...	2	$\left. \begin{array}{l} 7 \\ 7 \end{array} \right\}$	$6d$	...	$\left\{ \begin{array}{l} 4 \\ 7 \end{array} \right\}$	$\left. \begin{array}{l} 4b \\ 4b \end{array} \right\}$	5	$\left\{ \dots \right\}$	2	3	5	$\left. \begin{array}{l} 6d \\ 6d \end{array} \right\}$										
600	6	...	7·13	5	6																
615	2	4	6·68	2	2												2	...	3	...	3	3	...				
622	...	4	6·47	...	...	...	...	...	...	...	...	...	4	...	...	...	...	...									
630	2	6	6·25	$2b$	...	...	2	6	4	...	5	4	5	...	4	4	6	3												
650	1	4	5·66	...	...	...	2	...	5	...	3	...	3	...	3	3	4	...											
661	10	...	5·32	10	...	...	10	10	10	...	10	9	9	...	10	11	10	9												
666	...	4	5·18	...	...	...	...	...	...	...	5	4	...	...	4	...	...	...											
677	1	4	4·86	...	...	...	2	...	...	...	4	...	...	...	2	2	3	...					
184689	3	8	5414·50	3	...	...	4	8	7	...	8	7	4	...	5	5	8	5												

Osc. Freq.	Mean Intensity.		λ	High Sun.		Low Sun.									
	\odot at Medium Altitudes.	Telluric Lines on the Horizon.		2b	10	10	12	15	34	36	41	43	44	46	
				55	50	39	46	32	39	36	32	34	32	30	
				1·3	2·6	24	22	17	28	12	16	13	28	17	
184698	5	7	5414·23	5	5	7	7	7	6	4	5	5	7	4	
711	4	...	3·87	...	4	...	...	4	...	3	4	4	4	3
730	4	8d	3·30	4	4	7	8	8	7d	4	5	5	7	5	
736	1	...	3·14	...	...	...	...	...	...	...	...	1	...	...
740	4	7	3·00	4	4	...	7	6	...	4	4	4	5	4	
751	1	...	2·69	...	1	...	...	...	...	...	...	...	...	...
763	2	7	2·34	3d	2	7	5	5	...	4	5	4	5	4	
772	2	...	2·07	...	2	...	...	...	...	...	...	2	1	...
777	1	5	1·92	...	2	...	...	5	4	4	4	3	5	4
795	5	...	1·40	5	5	...	...	5	...	5	5	4	4	4
806	9	...	1·09	9	10	10	9	10	8	9	10	10	9	9	
822	3	(3 ?)	0·61	2	2	...	...	3	3	2	3	3	1	2
841	10	...	5410·06	9	10	11	10	10	10	9	10	10	9	10	
850	3	5	5409·80	3	4	5	...	5	...	3	5	5	4b	4	
867	7	...	9·30	6	7	...	...	6	4	8	6	7	6	4
873	3	...	9·13	2	3	...	...	...	...	...	...	...	4	...
878	...	5	8·98	...	...	...	...	5	...	2	4	4	4	3
898	2	6	8·40	2	3	} 6	...	{ 5	}	{ 3	4	5	5	} 5d	
904	2	6	8·20	2	3										{ 6	}	{ 5	}	{ 3	4	5	5
920	5	...	7·75	4	5	} 6	...	{ 6	}	{ 4	4	5	4	} 5d	
927	6d	...	7·55	5d	6										} 6
937	1	4	7·25	...	2	...	...	3	4	2	2	3	3	...
946	6d	...	6·97	5	6	6	...	7	6d	5	5	5	6	5	
956	1	...	6·68	...	...	...	...	1	...	...	...	...	...	...
964	4	...	6·47	3	3	3	...	4	4	3	4	4	4	3	
983	11	...	5·91	10	11	11	11	11	10	9	11	12	10	11	
987	6?	...	5·78	...	...	...	...	...	...	6	...	...	...	...
184995	5	...	5·54	6	5	7	...	6	4	5	6	6	4	4	
185006	4	...	5·22	4	4	...	...	4	3	2	4	3	4	4
021	4	...	4·79	3	4	...	...	4	...	2	4	4	4	3
037	10d	...	4·35	} 10	11	10	11	11	9	{ 8	}	11	11	10	9
048	7	...	4·32												
059	3	...	3·67	2	3	...	...	3	...	...	2	2	3	...
075	3	...	3·22	2	3	...	...	3	...	2	2	2	3	...
086	4	...	2·90	4	4	...	...	3	3	3	3	3	3	3
102	2	4	2·43	...	3	...	...	3	4	...	3	...	3	3
110	5	...	2·19	4	5	...	...	5	5	4	4	5	5	4
119	2	...	1·94	...	2	...	...	...	...	...	2	...	3	...
126	1	...	1·72	...	...	...	...	...	...	...	...	...	2	...
137	5	...	1·40	5	5	6	...	5	4	4	5	5	4	4	
145	1	...	1·17	...	2	...	...	...	...	...	...	...	...	...
160	5	...	0·75	6	5	} 10	9	10	8	8	{ 4	}	9	10	9
165	9	...	0·60	8	11										
174	1	...	0·32	...	2	...	...	...	...	B	...	...	2	...
183	1	3	5400·07	1	...	...	...	3	...	...	2	8	3	2
199	6	...	5399·60	6	6	7	...	6	4	...	...	5	4	5
212	1	...	9·21	...	2	...	...	...	...	...	...	...	2	...
218	2	...	9·03	3	2	...	...	2	...	...	...	3	2	2
231	...	4	8·66	...	...	...	...	4	...	...	3	3	4	...
185236	2?	...	5398·50	...	...	...	...	...	...	...	...	2	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.											
	O at Medium Altitudes.	Telluric Lines on the Horizon.		2b	10	11a	10	12	15	16	30	33	34	41	43	44	46	
				55	50	42	39	46	32	42	37	27	39	32	34	32	30	
				1·3	2·6	1·8	26	23	19	10	28	20	$\left\{ \begin{smallmatrix} 28 \\ 17 \end{smallmatrix} \right\}$	14	12	24	15	
185240	7	...	5398·41	7	8	...	8	8	8	...	...	...	5	6	6	8	6
250	1	7	8·12	...	2	...	...	...	3	...	...	...	6	3	3	4	...
262	4	...	7·76	4	5	...	...	...	4	B	...	E	3	4	4	4	3
279	11	...	7·26	11	12	...	11	11	10	10	...	12	9	11	11	12	10	
284	4	...	7·10	...	...	...	...	...	...	...	...	...	...	4	...	...	4
298	2	...	6·70	2	3	...	...	...	...	2	...	...	...	3	2	2	...
309	3	...	6·39	3	4	...	...	...	3	3	...	3	...	3	2	2	2
315	2	...	6·20	...	...	...	...	...	...	3	...	...	...	...	...	...	2
327	3	...	5·86	3	2	...	...	...	3	...	...	2	...	3	2	3	1
341	2	...	5·47	2	2	...	...	...	...	...	...	...	...	...	...	...	...
346	5	...	5·32	4	5	...	...	...	5	5	...	5	...	5	5	4	3
364	8	...	4·79	9	9	...	8	8	8	8	...	8	6	8	7	8	8	
374	2	...	4·50	...	...	...	...	...	...	...	...	...	...	2	...	2	...
381	3	...	4·31	2	2	...	...	...	2	1	...	3	...	2	2	3	2
394	2d	...	3·93	3d	2	...	...	...	1	...	...	...	...	...	2	1	...
411	3?	...	3·42	3	...	...	...	...	...	...	...	...	...	...	...	...	...
416	10	...	3·27	11	10	...	10	11	10	9	...	10	8	10	8	10	9	
429	2	...	2·91	2	2	...	...	...	3	2	...	...	...	2	...	2	2
431	1	...	2·83	2	...	...	...	...	...	...	...	...	...	...	...	...	...
444	4	...	2·46	3	3	...	...	...	4	4	...	4	4	4	4	4	3
453	2	...	2·21	2	3	...	...	...	2	2	...	...	...	3	2	2	...
468	6	...	1·76	6	5	...	9	8	6	6	...	5	6d	5	5	5	...	
474	7	...	1·60	7	6	...	...	...	7	7	...	8	...	6	7	6	8
484	2	(3?)	1·31	...	1	...	...	...	...	...	...	...	...	2	2	3	...
497	2	(3?)	0·93	1	1	...	...	...	2	...	...	3	...	...	3	...	...
505	5	...	0·70	4	5	...	...	...	...	...	...	...	...	...	...	...	...
510	4	...	0·54	3	4	...	8	6	4	3	...	5	3b	5	5	4	5d	
523	2	...	5390·16	...	3	...	...	...	2	...	...	...	...	4	3	4	...
529	4	...	5389·99	3	3	...	...	...	3	3	...	4	3	4	3	3	3
542	8	...	9·62	8	8	...	8	8	9	8	...	8	8	9	9	8	8	
553	3	...	9·30	2	2	...	...	...	2	2	...	2	3	3	3	2	...
567	2	...	8·89	2	2	...	...	...	...	...	...	...	...	...	...	...	...
576	3	...	8·62	3	3	...	...	...	...	...	...	...	...	...	...	...	...
581	4	...	8·47	4	4	...	...	...	3d	3	...	5	...	3	3	2	4d
596	2	...	8·05	1	2	...	...	...	...	...	...	...	...	4	4	3	...
610	5d	...	7·63	5	5	...	...	...	4d	5	...	5	3	5	5	4	4
629	5	...	7·10	5	5	...	...	...	4	5	...	5	4	5	5	4	4
642	1	...	6·72	...	2	...	...	...	...	...	...	...	...	...	...	...	...
650	6	...	6·48	6	6	...	...	...	5	5	...	6	4	5	5	6	4
666	1	5	6·02	...	2	...	...	...	3	3	...	...	4	2	3	4	3
676	3	...	5·73	3	2	...	...	...	...	2	...	2	3	2	3	3	...
692	2	...	5·25	2	2	...	...	...	...	...	...	2	2	...	2	...	...
708	2	...	4·81	2	2	...	...	...	...	2	...	2	2	...	2	...	...
727	2	...	4·26	2	2	...	...	...	...	...	...	2	2	...	2	...	2
737	2	...	3·97	...	...	B	...	...	...	...	...	...	...	2	2	2	2
753	10	...	3·49	9	10	10	12	12	10	10	E	2	2	...	...	2	1
770	3	(3?)	3·01	...	...	...	E	...	2	...	12	10	10	11	11	10	12
779	1	...	2·74	2	2	...	...	...	...	...	...	3	3	2	2	3	3
792	5	...	2·35	4	5	5	...	5	4	5	4	...	...	...	...	...	...
809	4	...	1·87	3	4	2	...	...	2	3	...	3	4	4	4	3	3
185820	3	...	5381·54	2	3	...	...	...	...	...	...	2	3	3	3	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.										
	O at Medium Altitudes.	Telluric Lines on the Horizon.		2b	10	11a	12	15	16	30	33	34	41	43	44	46	
				55 1·3	50 2·7	42 1·8	46 25	32 21	42 10	37 27	27 16	39 12	32 13	34 11	32 21	30 13	
185836	7	...	5381·10	6	7	7	6	7	7	8	7	7	8	8	7	7	
845	3	...	0·83	3	3	...	...	...	...	...	...	3	3	2	2	1
859	4d	...	5380·41	4	5	4	...	5	4d	5	4	4	5d	5	5	3	
875	2	...	5379·95	2	...	...	...	...	...	...	...	3	...	3	...	...
884	8	...	9·71	7	8	8	6	7	8	8	7	6	8	7	7	6	
900	2d	...	9·30	2	2	3	...	1	1	...	...	...	2	2	2	3
914	2	...	9·20														
931	3	...	8·83	2	2	2	...	...	...	...	2	1	2	...	1	...
947	2	...	8·34	2	2	3	...	1	2	...	3	2	2	2	2	3	
			7·88	2	...	...	...	...	...	...	...	...	...	...	2	3
953	7	...	7·70	6	7	7	6	7	6	7	7	5	7	7	7	6	
969	2	...	7·25	3	2	2	...	E	...	...	...	...	2	3	2	...
978	4	...	6·98	4	4	5	4	...	4	4	4	4	4	4	3	...	
185991	2	...	6·59	2	3	...	...	...	2	...	...	...	2	2	2	...
186006	3	...	6·16	2	3	2	...	...	...	...	2	2	2	2	2	2
016	1	...	5·88	...	2	...	...	...	...	...	...	...	...	...	...	...
032	3	...	5·43	2	2	...	...	...	...	...	2	2	2	2	2	2
043	2	...	5·09	...	...	...	...	...	...	...	...	...	2	2	2	...
052	2	...	4·85	2	2	...	...	...	...	...	...	...	...	...	1	2
062	2	...	4·55	2	...	...	...	...	...	...	2	1	2	...	2	...
072	2	...	4·25	2	2	2	...	...	...	...	...	1	2	...	1	...
084	2?	...	3·92	...	...	...	...	...	...	...	...	...	...	...	...	2
087	8	...	3·84	7	8	8	8	...	8	6	7	5	8	8	8	8	
103	2	...	3·38	...	...	...	E	...	...	...	...	...	2	2	1	2
114	3	...	3·05	3	1	1	...	...	...	2	2	2	2	2	...	2b
132	2	...	2·52	3	1	1	...	...	...	...	2	...	...	...	2	2
150	2	...	2·02	2	1	2	...	...	3	...	...	...	...	...	2	3
163	11	...	1·63	9	12	12	...	...	11	12	12	10	13	11	12	12
170	6	...	1·44	5	7	5	...	...	7	...	5	4	7	6	5	6
186	2	...	0·98	2	E	2	...	...	3	2	...	...	2	2	2	3
195	1	...	0·71	...	...	...	...	...	...	...	...	...	...	2	1	...
205	3	...	0·41	3	...	3	...	...	3	2	2	...	3	3	3	3
217	9	...	5370·09	9	...	10	...	...	9	9	10	8	9	9	9	10
231	6	...	5369·67	6	...	6	...	...	6	5	5	5	5	6	6	6
243	2	...	9·33	...	...	2	...	...	...	...	...	2	2	2	...	...
253	2	...	9·04	...	...	3	...	...	...	...	...	...	2	3	3	3
264	3	...	8·73	2	...	3	...	...	2	3	2	2	2	3	3	3
272	3	...	8·50	3	...	2	...	...	...	...	3	2	3	3	2	...
280	2	...	8·27	3	...	...	...	...	...	3	...	2	...	...	2	2
294	3	(3?)	7·85	...	...	...	...	...	...	...	...	4	2	...	2	...
302	9	...	7·62	9	...	10	...	...	9	10	10	8	10	9	6	9
306	3?	...	7·52	...	...	...	...	...	...	...	...	3	...	...	...	...
326	2	(3?)	6·95	...	...	2	...	...	3	2	2	2	2	3	2b	2
337	2	...	6·63	3	...	2	...	...	...	...	2	...	2	3	...	...
344	3	...	6·42	3	...	...	...	...	3	...	2	2	2	3	2	3
360	2	...	5·97	...	...	2	...	...	...	2	...	...	...	3	1	2
376	8	...	5·51	7	...	8	...	...	8	8	8	7	6	8	8	7
385	2?	...	5·23	...	...	...	...	...	...	...	...	...	...	...	...	2
393	9	...	5·01	9	...	9	...	...	9	9	9	8	9	9	9	9
410	2	...	4·53	2	...	2	...	...	2	2	...	...	2	3	2	2
186425	2	(3?)	5364·09	2	...	2	...	...	...	3	2	2	2	3	2	2

Osc. Freq.	Mean Intensity.		λ	High Sun.		Low Sun.							
	at Medium Altitudes.	Telluric Lines on the Horizon.		2b	11a	16	30	33	34	41	43	44	46
				55 1·3	42 1·8	42 11	37 25	27 15	39 11	32 12	34 11	32 19	30 12
186428	1	...	5363·99	...	...	...	...	...	2	...	...	...	...
444	2	...	3·53	} 2	3	2b	3	2	1	2d	{ 2 3	} 2	...
449	2	...	3·40										
459	2	...	3·10	1	...	...	...	...	4	...	...	...	...
463	8	...	2·99	7	7	} 8	9	8d	8	{ 8 6	9 5	} 9	9
468	6	...	2·86	7	6								
486	3	4	2·32	2	3	2	4d	3	2	3	3	2	3
506	6	...	1·76	6	6	5	6	6	5	6	6	6	6
512	4	...	1·60	4	4	...	...	...	3	3	4	...	...
530	2	3	1·08	1	2	2	2	1	1	2	3	2	2
549	...	2?	5360·51	...	...	...	...	...	...	2	3	2	...
569	...	2?	5359·95	...	...	...	2	...	1	...	...	2	2
580	2	...	9·62	2	2	...	...	...	...	3	3	...	...
593	3	...	9·26	3	3	3	3	3	3	3	3	3	3
605	2	...	8·92	2	...	...	...	...	...	2	2	2	...
617	1	...	8·58	...	2	...	...	...	...	...	1	...	...
629	3	...	8·22	4	3	3	3	3	3	3	3	3	3
651	2	...	7·60	...	2	2	...	...	...	2	...	...	...
664	3	...	7·21	3	3	...	...	2	2	3	2	2	2
671	2	...	7·01	3	...	...	...	...	1	...	...	...	...
686	1	...	6·58	...	2	...	...	...	...	...	...	...	2
695	2	...	6·32	...	2	...	...	...	...	2	2	...	...
713	3	...	5·81	3	3	2	2	1	2	2	2	3	3
725	1	...	5·46	...	2	...	...	...	...	2	...	...	...
744	2	...	4·93	2	2	...	...	...	...	...	2	...	3
759	1	...	4·50	...	2	...	...	...	1	...	...	...	...
773	2	3d	4·10	2	2	...	3	...	...	2	2d	...	3
788	4	...	3·66	4	4	4	...	...	4	6	4	4	5
793	8	...	3·52	8	9	8	9	10	7	7	8	8	8
809	2	(3?)	3·07	...	2	...	...	...	B	3	2	2	3
820	2	...	2·75	1	2	...	...	...	...	2	2	...	2
839	5	...	2·20	5	5	5	5	5	...	5	5	5	5
852	1	3	1·82	...	1	...	...	...	...	3	3	2	3
871	...	4	1·28	...	...	...	...	...	...	3	4	3	3
879	4	...	1·06	4	4	4	4	3	...	2	3	4	4
889	2	...	0·76	...	1	...	...	...	...	...	...	3	...
898	3	4?	0·52	3	3	3	4	3	...	3	4	4	2
907	1	...	5350·25	...	2	...	...	...	...	...	...	...	...
917	6	...	5349·96	6	5	7	7	7	...	6	6	5	5
928	8	...	9·64	8	8	8	8	8	...	8	9	8	8
943	1	4	9·23	...	2	2	...	...	...	3	2	4	3
953	3	4?	8·93	2	3	2	4	2	...	3	2	4	3
969	9	...	8·48	9	9	8	9	9	...	9	9	9	9
978	2	...	8·21	...	2	...	...	...	...	3	2	...	...
989	3	...	7·91	2	3	2	2	...	...	3	2	3	2
186999	2	(3?)	7·62	2	2	...	3	2	...	...	...	3	2
187012	2	...	7·25	...	2	...	...	...	...	2	2	2	2
025	3	...	6·89	3	3	...	3	3	...	2	...	...	...
031	4	...	6·71	4	5	4	4	4	...	4	4	4	4
049	3	...	6·20	3	3	3	3	3	...	3	3	4	3
187056	9	...	5345·99	10	9	9	9	8	...	9	9	9	9

Osc. Freq.	Mean Intensity.		λ	High Sun.		Low Sun.						
	O at Medium Altitudes.	Telluric Lines on the Horizon.		2b	11a	16	30	33	41	43	44	46
				55	42	42	37	27	32	34	32	30
				1.2	1.8	12	23	14	11	10	17	11
187066	3	...	5345.72	...	...	3	...	3	2	2	...	...
077	2	...	5.40	1	2	...	...	...	...	2	...	2
093	3	...	4.93	3	3	3	3	3	3	3	3	3
103	3	...	4.66	3	3	3	3	3	3	3	3	2
112	1	...	4.39	...	2	...	...	...	...	...	...	...
123	3	...	4.08	2	2	...	2	3	2	2	2	2
138	8	...	3.66	8	8	7	7	7	8	7	7	8
147	2	...	3.38	...	...	...	...	...	2	2	2	2
164	5	...	2.91	5	5	6	5	5	6	5	6	6
180	3	...	2.45	3	3	3	...	...	3	2	3	3
188	3	(3 ?)	2.21	2	...	...	3	3	2	3	3	...
207	3	...	1.68	4	3	...	2	...	2	...	3	...
223	11	...	1.22	10	12	11	10	11d	11	10	11	11
242	4	...	0.67	3	4	4	4	3	3	4	4	3
251	2	(3 ?)	0.42	...	...	...	3	...	...	...	3	...
258	2	...	0.22	2	...	...	...	...	...	...	2	...
262	10	...	5340.11	10	10	9	10	11	9	9	9	9
281	3	...	5339.56	3	3	3	3	...	3	3	3	...
288	3	...	9.38	3	...	...	...	2	2	3	2	3
294	1	...	9.20	...	...	...	...	...	...	...	2	...
300	1	...	9.04	...	2	...	...	...	...	...	2	...
307	2	...	8.82	...	...	...	...	...	2	3	2	2
320	4d	...	8.46	4	4	4	4	3	4	4	3d	4
339	6	...	7.93	5	6	5	6	7	6	5	5	6
344	2 ?	...	7.79	...	...	...	...	...	...	...	2	...
356	3	...	7.44	3	3	2	...	1	3	3	2	3
371	8	...	7.00	8	8	8	8	8	8	7	8	8
389	3	...	6.48	3	...	2	3	2	2	3	2	3
398	2	...	6.23	3	2	...	...	...	2	3	...	...
410	2	...	5.90	3	...	...	...	...	2	...	...	2
422	3	...	5.55	3	2	2	2	2	2	3	2	2
441	6	...	5.01	6	6	6	5	6	7	6	5	6
463	3	...	4.38	3	3	3	3	2	3	3	3	3
478	2	...	3.95	...	...	...	3	...	...	...	...	...
484	3	...	3.79	3	3	3	3	3	3	3	3	3
496	2	...	3.44	2	2	2	3	3	2	...	...	2
510	8	...	3.04	7	8	8	8	7	8	8	8	8
520	6	...	2.76	6	6	6	5	6	6	6	6	6
534	2	...	2.37	...	2	...	...	1	3	3	3	2
542	1	...	2.13	...	...	...	1	...	3	...	...	...
554	2	...	1.80	...	2	2	...	...	3	3	...	...
562	4	...	1.57	5	5	4	4	4	4	4	4	4
583	2	...	0.97	...	2	2	...	...	3	3	...	...
594	3	...	0.67	2	3	2b	2d	2	2	3	2	2
602	2	...	0.45	...	2			
614	6	...	0.11	6	6	7	6	5	7	6	6	7
617	3	...	5330.01	...	...	...	...	...	...	...	...	3b
621	5	...	5329.89	5	5	6	5	5	6	5	5	5
630	2	...	9.65	...	2	2	...	3	...	...	...	3
646	7	...	9.18	7	8	8	7	7	7	7	7	7
187656	3 ?	...	5328.91	...	...	3	...	...	...	...	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.					
	O at Medium Altitudes.	Telluric Lines on the Horizon.		2b	11a	18b	16	19	21	30	33	44
				55 1.2	42 1.9	62 2.4	42 14	48 11	50 18	37 19	27 11	32 13
188257	3	...	5311.88	3	3	...	} 2d	3	{ ...	2	...	} 2
263	3	...	1.71	3	2	3		...	{ ...	2	3	
281	1	...	1.20	...	1	2	...	...	...	...	...	2
296	4	...	0.80	4	3	4	3	} 3d	{ ...	3	3	3
306	3	...	5310.50	3	1	3	2		{ ...	2	...	3
326	2	...	5309.95	3	2	2	...	2	...	1b	1	...
346	2	...	9.38	2	3	3	2	...	...	...	...	...
366	2	...	8.80	2	2	2	3	...	...	3	...	2
377	5	...	8.50	5	6	5	5	5	...	5	5	5
390	1	...	8.14	...	...	2	...	...	...	...	...	...
396	3	...	7.97	1	2	2	3	2	...	2	1	3
413	8	...	7.49	8	9	9	8	9	...	8	8	8
418	4	...	7.34	4	4	5	...	...	...	...	3	...
437	2	...	6.82	...	2	2	...	...	...	...	...	...
447	3	...	6.52	2	2	2	2	...	...	2	2	2
468	6	...	5.95	5	6	6	5	7	...	5	4	5
481	2	...	5.59	...	2	1	3	...	...	2	...	3
493	2	...	5.24	2	3	2	...	1	...	...	...	2
502	1	...	4.98	...	...	2	...	...	...	...	...	...
509	2	...	4.78	1	3	2	3	1	...	2	...	2
526	4	...	4.30	4	5	4	3	5	...	3	3	4
538	3	...	3.98	3	3	3	2	3	...	2	...	3
550	2	...	3.62	...	2	2	...	...	...	...	...	...
558	3	...	3.40	2	3	3	2	3	...	2	3	3
572	2	...	3.02	...	1	3	2	...	...	...	...	3
584	2?	...	2.67	2	...	...	...	...	...	...	...	...
593	10	...	2.43	9	10	10	9	10	...	9	10	9
609	3	...	1.98	3	3	3	2	2	...	3	3	3
625	2	...	1.51	...	2	3	2	2	...	...	3	...
639	4	...	1.12	4	4	4	4	4	...	4	4	4
649	7	...	0.86	8	8	7	6	8	...	6	8	7
661	3	...	0.52	3	2	1	2	2	...	...	4	3
676	5d	...	5300.09	5	5	6	5	4d	...	4	7	5
695	3	...	5299.56	3	2	2	2	2	...	3	4	3
709	2	...	9.16	...	3	1	...	...	B	...	...	...
718	6d	{	8.95	} 6	6d	5	5	7	6	5	{ 4?	} 6
			8.85									
730	6	...	8.57	7	6	5	6	8	7	6	6	7
738	8	...	8.34	8	8	8	8	9	9	8	8	8
748	7	...	8.06	8	7	7	7	7	8	7	7	7
757	2	...	7.81	...	...	2	3	...	...	...	...	2
770	7	...	7.44	7	7	7	7	8	8	7	7	7
775	4	...	7.32	3	4	4	...	3	...	4	3	3
786	2	...	6.99	...	1	...	2	...	...	...	4	...
795	8	...	6.76	8	9	9	8	8	8	8	8	8
803	2	...	6.53	...	2	...	...	2	1	...	1	3
815	3	...	6.18	2	3	3	2	2	...	3	...	3
827	4	...	5.84	4	4	4	3	4	4	4	3	4
843	6	...	5.40	5	6	6	4	5	5	5	5	5
855	2	...	5.06	1	2	2	...	2	2	...	...	3
188872	4	...	5294.60	4	5	5	3	4	4	4	4	4

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.							
	O at Medium Altitudes.	Telluric Lines on the Horizon.		2a	2b	11a	13b	16	19	21	30	33	44	52	
				55	55	42	62	42	48	50	37	27	32	29	
				1·2	1·2	1·9	2·3	16	12	18	17	10	11	10	
188883	1	...	5294·28	...	...	2	...	...	...	...	...	...	1	...
892	6d	...	4·03	...	5	6	6	4	5d	7	5	5	5	...	
908	2	...	3·58	...	...	3	2	2	2	...	...	...	2	...
921	4	...	3·23	}	4d	{	4	4	{	4	{	3d	3	4	
926	4	...	3·08												4
940	6	...	2·68	...	5	6	6	4b	6	7	5	4	7	...	
956	2	...	2·24	...	2	2	2	...	...	2	1	...	2	...
967	1	...	1·93	...	...	...	2	...	...	...	...	...	...	...
983	2	...	1·47	...	3	3	2	3	...	...	...	...	...	...
188993	1	...	1·20	...	...	2	...	...	...	...	...	...	2	...
189005	3	...	0·88	...	3	3	3	3b	...	3	2	...	2d	...	
017	2	4	0·52	...	...	2	2	3	...	4	2	...	...	...
031	1	...	5290·15	...	...	2	...	...	...	...	...	...	...	...
038	3	...	5289·93	...	2	2	2	2	...	3	2	2	2	...	
053	2	...	9·51	}	2	3	{	2	}	2	3	...	2d	...	
060	2	...	9·32												2
073	2	...	8·95	...	...	2	...	3	...	2	...	...	2	...
083	8	...	8·68	...	7	8	8	8	9	9	7	7	8	...	
088	3	...	8·53	...	...	...	3	...	...	...	...	3	...	...
105	1	...	8·06	...	...	1	...	...	...	...	...	...	...	...
107	3	5	8·00	...	2	3	3	4	...	5	3	...	3	...	
118	2	...	7·69	...	2	2	3	...	...	...	...	2	2	...
131	4	...	7·34	...	3	5	3	3	...	4	3	3	4	...	
151	3	...	6·77	...	2	3	2	3	...	...	1	2	3	...
168	2	...	6·32	...	2	2	2	3	...	...	...	...	2	...
177	2	...	6·05	...	...	2	...	3	...	...	...	...	...	...
188	3d	...	5·74	...	3	2	3	2	...	2	2d	2	3	...	
207	6	...	5·23	...	5	6	5	5	...	7	5	5	5	...	
215	1	...	4·99	...	2	1	2	...	...	...	...	...	1	...
223	5	...	4·76	...	4	4	5	5	...	6	4	4	5	...	
232	4	...	4·53	...	4	4	5	4	...	5	4	4	5	...	
244	7	...	4·19	...	6	7	7	6	...	8	6	7	7	B	
260	10	...	3·75	...	9	10	10	9	}	10	9	9	9	}	
266	5	(7 ?)	3·58	E	4	4	6	7							6	5	5	7	7	9
281	3	...	3·16	2	3	2	4	3	...	...	2	...	2	5
293	2	...	2·82	...	...	2	4	...	...	...	...	...	2	...
304	4	...	2·51	4	5	4	5	4	...	5	4	4	4	4	
311	2	...	2·32	...	...	3	...	...	...	...	...	...	...	...
326	9	...	1·89	}	9	9	{	10	}	9	9	9	9	{	
330	5	...	1·78												5
341	3	...	1·49	}	3d	3d	3	{	3	}	3	3	3	3	
344	3	...	1·40												3
353	1	...	1·13	2	1	2	
369	4	...	0·69	3	4	5	4	3	...	4	4	4	4	4	
378	7	...	0·45	7	7	7	6d	6	...	8	7	7	7	7	
388	3	...	5280·17	3	3	3	3	3	...	4	3	3	3	3	
397	4	...	5279·92	4	4	4	4	3	...	4	4	4	3	4	
401	2	...	9·80	1	2	2	...	...	...	...	...	...	...	...
416	2	...	9·40	2	...	3	...	...	...	...	...	...	2	1
428	3	...	9·06	2	2	3	2	2	...	3	}	3	{	3	
189437	3	...	5278·79	3	3	3	3	4					3

Osc. Freq.	Mean Intensity.		λ	High Sun.				Low Sun.										
	O at Medium Altitudes.	Telluric Lines on the Horizon.		2 α	2 β	11 α	13 β	16	19	21	30	33	44	51	52			
				55	55	42	62	42	48	50	37	27	32	...	29			
				1.2	1.2	1.9	2.3	18	12	19	16	9	10	11	10			
189455	3	...	5278.30	3	}	3	{	3	2	...	4	3	3	3	...	2		
462	3	...	8.10	2													2	2
486	3	...	7.45	3	3	3	2	...	...	...	4	...	2	3	...	2	
495	1	3	7.19	...	...	2	...	3	...	3	2	...	3	...	3	3	
501	3	...	7.01	3	2	2	2	...	...	...	1	2 β	3	...	2	2	
514	1	...	6.66	...	...	...	2	...	...	...	...	...	...	...	...	2	
527	3	...	6.29	...	...	...	...	...	...	5	...	2	...	...	...	...
530	9	...	6.20	8	8	9	9	9	9	10	9	8	9	...	9	9		
542	7	...	5.89	7	6	7	7	8	8	8	7	7	8	...	7	7		
549	2	...	5.69	...	...	1	...	...	...	...	...	...	3	...	1	1	
559	6	(7 ?)	5.40	7	5	6	5	}	8	8	7	8	{	7	6	...	6	
564	5	...	5.28	7	4	4	5											5	8	7	8	{	5	4	...	4
570	6	(7 ?)	5.11	7	5	6	5	8	7	7	8	7	7	6	...	6	6	
585	3	...	4.67	3	3	4	3	4	...	3	3	3	3	4	...	3	3	
594	3	...	4.43	3	...	4	3	...	...	3	3	3	3	4	...	3	3
602	3 ?	...	4.20	...	...	...	...	...	...	...	...	...	4	...	...	...	...
610	2	...	3.98	2	3	2	2	...	...	3	2	...	2	...	2	...	2
614	1	...	3.86	...	...	...	...	...	...	...	...	...	...	...	...	1	1
628	9	...	3.48	9	8	8	9	10	}	11 α	{	9	9	9	8	...	9	
636	9	...	3.26	9	9	8	9	10										9
649	2	...	2.90	1	...	2	2	...	...	2	...	...	2	...	...	1	1
664	4	...	2.48	}	3	4	3	4	{	4	...	{	4	{	5	...	3	
669	4	...	2.35															4
678	5	...	2.10	4	5	5	5	5	4	...	5	4	4	5	...	4	4	
691	2	...	1.74	1	...	3	2	...	...	3	1	2	2	...	2	...	2
705	4	...	1.34	4	4	5	4	4	...	5	4	4	4	...	5	...	5	
713	5	...	1.13	4	...	5	4	4	...	6	4	4	5	...	5	...	5	
722	2 ?	...	0.86	...	...	...	...	...	...	...	...	...	2	B	...	...	...
737	10	...	0.46	10	9	11	10	}	10	9	12	{	10	8	10	9	10	
739	10	...	0.39	10	9	11	10											10
753	3	...	5270.00	...	...	2	...	4	...	5	...	...	...	...	...	...	2
766	12	...	5269.66	12	11	12	12	11	12	12	12	12	11	12	12	11	11	
775	3	...	9.40	...	B	2	...	...	E	5	...	...	...	E	3	3	3
791	2	...	8.95	...	...	3	2	...	...	...	...	...	...	...	2	2	2
803	5	...	8.62	5	...	5	5	}	4 α	...	{	6	5	5	...	4	4	
811	5	...	8.39	5	...	5	5											5
825	2	...	8.00	...	...	2	2	...	...	...	...	...	...	...	2	2	2
834	2	...	7.76	3	...	3	2	...	...	...	1	2	...	2	...	2	...
849	4	...	7.35	4	...	5	4	3	...	5	4	4	...	4	5	5	5	
856	2	...	7.15	2	...	3	...	...	...	...	...	...	...	...	2	2	2
874	10	...	6.66	10	...	10	10	10	...	10	11	10	...	10	10	10	10	
881	4	...	6.46	4	...	5	...	...	...	6	...	...	...	...	3	3	3
896	5	...	6.05	5	...	5	5	...	...	4	5	5	...	4	5	5	5
904	8	...	5.81	8	...	8	8	8	}	9	{	8	8	8	...	8	8	
910	8	...	5.66	8	...	8	8	8										8
926	4	...	5.22	4	...	5	4	...	...	4	4	B	...	4	5	5	5
937	5	...	4.91	5	...	6	5	3	...	6	5	...	...	...	6	6	6
947	2	...	4.62	...	...	3	1	...	...	...	...	...	...	...	2	2	2
956	8	...	4.37	}	10	{	...	8	7	{	9	...	9	10	8	8
958	8	...	4.31															
189970	5	...	5263.98	5	...	5	5	...	...	5	5	...	...	...	4	5	5

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.				
	O at Medium Altitudes.	Telluric Lines on the Horizon.		2a	11a	13b	16	21	30	51	52
				55 1.2	42 1.9	62 2.2	42 20	50 22	37 15	... 12	29 11
189975	3	...	5263.84	...	3	4	...	...	...	...	...
984	3	...	3.61	...	...	3	...	...	...	...	3
189988	9	...	3.48	9	9	9	9	9	10	8	8
190004	4	...	3.05	4	4	4	4	3	4	3	4
012	3	...	2.83	3	3	3	...	2	3	2	3
029	8	...	2.36	9	9	7	9	8	10	8 6	8 6
032	6	...	2.28	5	5	7					
041	3?	...	2.02	...	3	...					
048	8	...	1.82	9	8	8	9	8	9	8	8
053	2	...	1.68	...	...	...	...	...	...	2	3
066	2	...	1.33	...	2	2	...	2	...	2	2
074	1	...	1.12	...	...	...	...	...	...	2	...
082	3	...	0.90	3	3	3	...	3	3d	3 3	2
086	3	...	0.79	3		...	...	...
095	5	...	0.54	6	5	6	4b	5	5	4	5
111	3	...	5260.09	2	3	3	...	2	3	3	3
129	3	...	5259.60	3	3	3	...	3	4	3	3
150	3	...	9.00	3	3	3	...	3	4	3	3
170	2	...	8.46	2	2	3	...	2	3	2	2
181	1	...	8.16	...	...	...	...	...	...	2	1
193	5	...	7.81	5	5	5	4	5	5	5	5
203	2	...	7.53	3	2	...	...	...	...	3	2
218	5	...	7.13	5	5	5	4	5	5	5	5
231	2	...	6.76	3	1	...	...	2	...	1	2
241	2	...	6.50	...	...	2	...	...	...	2	2
249	2	...	6.26	2	2	2	...	...	...	...	2
262	5	...	5.92	7	4d	5 5	5 5	5d	5 5	4	5 5
265	5	...	5.82								
273	3	...	5.60	...	3	2	...	...	...	...	5
279	5	...	5.45	5	5	6	...	5	4	5	6
288	5	...	5.19	5	4	5	...	4	4	5	5
295	9	...	5.01	8	9	8	10	9	9	8	9
307	2	...	4.66	...	2	2	...	3	...	2	2
323	1	...	4.23	...	2	...	...	...	...	...	2
330	3	...	4.04	3	3	3	...	3	3	3	3
337	2	...	3.84	...	2	2	...	...	...	...	...
346	8	...	3.58	8	8	8	8	8	8	8	...
355	2	...	3.35	...	1	...	...	2	...	3	...
362	5	...	3.14	5	5	5	7	4	4	4	5
375	2	...	2.80	...	2	2	...	...	...	2	2
387	2	...	2.46	3	2	...	...	3	2	2	2
396	5	...	2.21	5	5	5	...	4	5	5	5
401	6	...	2.06	6	6	7	7	6	6	6	6
416	2	4?	1.66	2	2	3	...	4	2	2	3
421	1	3	1.52	...	...	2	3	3	...	2	2
442	3	...	0.94	2	2	2	...	3	2	3	2
449	8	...	0.75	9	9	8	9	8	8	8	9
458	3?	...	0.51	...	...	...	...	3	...	...	...
464	7	...	0.33	8	7	7	8	7	8	7	7
472	1	...	5250.11	...	2	...	...	...	...	...	2
190483	4	...	5249.81	3	4	3	3	4	4	4	4

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.					
	Cat Medium Altitudes.	Telluric Lines on the Horizon.		2a	11a	13b	16	21	22	30	51	52
				55 1·2	42 1·9	62 2·2	42 22	50 24	25 17	37 14	...	29 13
190490	4	...	5249·61	3	4	3	...	4	...	4	4	4
503	5	...	9·27	} 6d	{ 5	6	} 4	5	...	5	{ 5	6
508	4	...	9·12									
521	1	...	8·76	...	1	2	...	...	...	...	...	2
531	4	...	8·49	3	3	3	4	4	...	4	4	3
548	4	...	8·03	4	4	3	3	4	...	4	4	4
559	8	...	7·71	8	8	8	9	8	...	8	8	8
569	3	...	7·44	3	3	3	...	3	...	...	4	3
577	8	...	7·21	8	7	7	9	7	...	8	7	7
588	4	...	6·93	3	3	4	6	3	...	3	3	4
594	3	...	6·74	3	...	...	...	...	...	...	...	...
612	2	...	6·26	...	2	2	...	...	...	...	...	3
623	3	...	5·95	2	3	...	3	} 3d	{	...	2	3
630	3	...	5·77	3	3	2	3	2	3
648	3	...	5·28	...	3	2	3	3	...	3	2	2
666	2	...	4·76	} 3	3	...	...	3	...	2d	2	{ 2
672	2	...	4·62									
681	2	...	4·35	...	2	2	...	...	...	...	...	...
693	2	...	4·04	...	...	...	...	3	...	...	1	...
697	7	...	3·92	7	7	7	6	8	...	8	7	8
711	4	...	3·55	4	4	4	...	5	...	4	4	4
719	4	...	3·32	4	4	4	5	4	...	4	4	4
734	2	...	2·90	...	2	1	...	...	E	...	2	1
745	9d	...	2·68	} 9	9	9	9	9	9	{ 5	} 9	9
			2·52									
759	4	...	2·21	4	4	4	} 4	4	4	4	3	{ 4
763	3	...	2·10	4	3	2						
780	3	...	1·64	3	3	3	...	4	...	3	3	2
803	3	...	1·02	3	3	3	...	4	...	3	3	2
817	3	...	0·61	} 4	3	4	6	4	4	3	{ 3	2
823	3	...	5240·47									
841	8d	...	5239·97	8	7	8	7d	7	8	7	7	8
853	2	...	9·64	1	2	2	...	2	3	...	2	1
873	4	...	9·09	4	4	4	3	3	5	4	4	4
884	4	...	8·77	4	4	4	...	4	5	3	4	4
896	2	...	8·45	1	2	2	...	...	3	...	2	2
906	1	...	8·18	...	...	...	...	...	...	...	2	...
914	3	...	7·95	2	3	2	3	3	3	2	3	2
931	8	...	7·48	7	7	8	8	8	7	7	8	8
941	2	...	7·21	1	1	2	...	...	2	1	2	2
949	2	...	7·00	...	...	...	...	...	3	...	2	...
957	3	...	6·78	3	3	2	3	2	3	...	3	1
968	4	...	6·48	3	...	4	...	...	4	2	...	5
974	6	...	6·32	6	6	6	5	6	6	5	7	6
983	2	...	6·08	...	2	2	...	...	4	...	...	2
190998	4	...	5·67	...	5	5	...	...	...	...	3	...
191003	8	...	5·53	7	8	8	9	8	7	7	9	8
011	5	...	5·30	4	5	4	...	6	6	5	4	4
021	1	...	5·04	...	2	...	...	...	...	...	...	...
032	8	...	4·72	7	8	8	8	8	7	7	9	7
191046	3	...	5234·35	3	3	3	...	3	3	2	3	2

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.					
	\odot at Medium Altitudes.	Telluric Lines on the Horizon.		2a	11a	13b	16	21	22	30	51	52
				55 1.2	42 2.0	62 2.2	42 25	50 26	25 16	37 13	...	29 14
191059	1	...	5233.98	...	...	...	...	...	...	1	...	2
069	2	...	3.71	2	2	2	...	3	...	...	2	2
076	1	...	3.51	...	...	...	...	...	...	...	...	2
094	11	...	3.02	11	12	12	11	10	10	11	12	11
100	4	...	2.85	...	4	...	...	...	...	...	...	5
109	3	...	2.61	2	4	3	3	4	3	3	2	3
125	2	...	2.17	...	3	2	...	...	...	...	...	2
139	3 _b	...	1.80	2 _b	3	2	...	3b	3	3	3	2
149	3 _b	...	1.51	3 _b	3	3	...		4	3	3	3
163	1	...	1.14	...	2	...	...	...	...	...	...	2
171	2	...	0.91	...	3	2	...	...	3	...	2	3
182	3	...	0.63	3	2	3	...	...	...	3	3	...
194	5	...	5230.30	4	5	5	...	4	6	5	3	5
205	9	...	5229.98	8	10	9	8	9	8	8	7	8
209	3 _?	...	9.89	...	...	...	...	...	...	...	...	3
225	1	...	9.45	...	1	2	...	...	...	...	2	1
231	2	...	9.29	3	2	}	...	3	3	2	2	2d
239	2	...	9.05	3	2		...	...	...	...	...	...
250	1	...	8.77	...	2	2	...	...	...	...	...	1
260	7	...	8.48	6	7	7	6b	7	7	6	7	7
269	4	...	8.24	4	4	4	...	4	4	4	4	5
283	3	...	7.87	2	3	3	...	3	...	...	3	3
293	2	...	7.59	...	...	...	...	2	...	...	3	...
303	10	...	7.31	10	10	10	14	10	10	10	10	11
315	9	...	6.98	8	9	9	8	9	9	9	9	10
326	8	...	6.67	8	8	8	E	8	8	8	8	9
338	2	...	6.36	2	...	...	...	...	2	...	3	...
343	3	...	6.21	2	3	3	...	3	3	3	3	3
354	3	...	5.91	2	3	3	...	3	3	3	2	3
365	7	...	5.62	7	8	8	...	5	7	7	7	8
375	1	...	5.34	...	...	...	...	...	...	...	...	1
384	6	...	5.11	}	6	6	...	}	4	}	6	6
387	7	...	5.02		6	8	...		6		6	7d	6	6
398	5	...	4.71	4	5	5	...	6	5	4	4	5
407	6	...	4.48	5	6	6	...	6	6	5	5	6
417	3	...	4.19	3	4	3	...	2	3	3	2	3
422	1	...	4.06	2	...	...	...	...	...	...	...	...
425	2	...	3.98	2	...	2	...	...	...	...	...	...
434	4d	...	3.74	4	5	4	...	5	4d	4	4	4
449	6	...	3.33	5	6	6	...	6	6	5	5	5
460	2	...	3.03	...	2	2	...	2	...	...	...	2
468	5	...	2.79	4	5	5	...	5	5	4	5	4
479	5	...	2.50	4	5	5	...	6	5	4	5	4
493	2	...	2.13	...	2	2	...	3	...	...	2	2
502	5	...	1.88	4	5	6	...	6	5	5	6	5
513	3	...	1.57	3	3	2	...	...	3	...	2	2
528	5	...	1.18	4	5	5	...	5	4	}	5	5
533	4	...	1.04	4	4	5	...	4	4		5	4
544	1	...	0.73	...	2	...	...	...	...	...	2	1
557	5	...	0.39	5	5	5	...	5	5	4	5	5
191565	4	...	5220.17	4	4	4	...	4	4	4	4	4

Obs. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.				
	\odot at Medium Altitudes.	Telluric Lines on the Horizon.		2a	11a	13b	21	22	30	51	52
				55 1·3	42 2·0	62 2·1	50 28	25 14	37 12	... 18	29 16
191578	5	...	5219·81	5	5	5	5	6	4	5	5
586	1	...	9·58	...	2	...	...	...	...	...	2
600	3	...	9·20	...	3	9·20	3	2d	2	3	2
609	2	...	8·97	2	3	2	...	...	...	3	2
621	2	...	8·64	...	...	3	...	...	...	3	2
633	7	...	8·32	6	6	6	7	6	6	7	8
644	7	...	8·00	6	6	6	7	6	6	7	8
651	1	...	7·82	...	1	...	...	...	...	...	...
662	9d	...	7·61 7·43	5 7	9	9	9	8	9	9	9
677	2	...	7·11	1	2	2	...	2	...	3	2
688	3	...	6·80	...	3	...	...	...	...	...	...
695	5	...	6·62	6	5	5	5	5	4	5	6
704	8	...	6·39	7	9	9	8	8	8	9	9
724	2	...	5·84	3	1	2	...	...	...	...	2
731	4	...	5·63	3	4	3	4	3	3d	4	4
745	9	...	5·27	8	9	10	8	9	8	9	9
760	2?	...	4·84	...	...	2	...	...	...	...	...
765	4	...	4·71	4	4	5	4	4	4	3	4
780	4	...	4·31	4	4	5	4	4	4	3	4
791	3	...	4·01	3	3	3	3	3	3	3	3
800	2?	...	3·77	...	...	...	...	...	...	3	...
807	3	...	3·58	3	4	4	3	3	3	2	4
811	3	...	3·48								
820	2	...	3·23	...	...	3	...	...	...	2	4
830	2	...	2·96	...	2	...	...	...	...	...	3
834	4	...	2·83	4	4	5	4	4	4	4	4
851	4d	...	2·38	4	4	4	4	4d	4	3	4
868	2	...	1·92	...	2	2	3	...	...	...	2
879	6	...	1·63	5	6	7	5	6	5	7	6
890	3	...	1·31	3	3	3	3	3	3	4	3
903	4	...	0·97	4	3	4	4	4	3	5	4
914	3?	...	0·66	3	...	...	...	...	...	...	...
921	8	...	0·48	7	8	8	8	8	7	10	9
929	3	...	5210·27	...	3	...	2	...	...	...	4
940	3	...	5209·95	3	2	3	3	4	3	3	3
944	1	...	9·85	...	...	...	...	...	...	...	2
957	2d	...	9·51	...	2	2	2	2	...	3	2d
969	2	...	9·17	2	...	...	2	...	3	3	...
987	9	...	8·69	9	9	9	12	9	9	12	10
191994	10	...	8·49	9	10	10	12	10	9	12	10
192006	2	...	8·17	3	...	3	...	...	...	...	...
011	4	...	8·03	4	4	5	4d	4	4	4	4
022	2	...	7·75	...	2	...	...	...	...	...	...
034	3	...	7·41	2	2	3	3b	2	2	3	2
045	1	...	7·13	2	...	...	...	...	...	...	2
056	3d	...	6·88 6·76	3	2	3	...	2	3	3	3
064	3	...	6·60								
075	6	...	6·29	7	4	6	6	6	5	...	5
192082	10	...	5206·12	9	10	11	11	8	9	10	10

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.					
	at Medium Altitudes.	Telluric Lines on the Horizon.		2 α	11 α	13 β	21	22	30	51	52	73
				55 1.3	42 2.0	62 2.1	50 29	25 13	37 11	...	29 18	36 22
192092	6	...	5205.83	5	6	6	6	5	6	4	5	...
108	2	4	5.40	...	2	2	...	...	2	4	2	...
119	2	4	5.12	3	2	2	4	2	2	4	2	...
132	2 $\frac{1}{2}$	...	4.77	...	...	...	...	...	...	...	2	...
137	10d	...	4.64	11	10	9 10	11	10	10	11	10	...
156	2	...	4.60									
171	3	...	4.10	...	2	...	...	...	...	1	2	...
171	3	...	3.71	2	3	2	2	2	1	3	2	...
181	2	...	3.42	...	...	2	...	6	...	...	...	...
195	3	...	3.06	2	3	2	3	2	1	3	2	...
217	10d	...	2.49	10	10	9 9	11	9	10	11	9	...
227	2	...	2.42									
227	2	...	2.19	1	3	2	...	3	2	...	2	...
250	2	...	1.57	2	3	2	...	...	...	...	3	...
261	4	...	1.26	4	4	3	3	4	3	3	4	...
269	2	...	1.04	...	2	2	3	3	...	...	1	...
287	6	...	0.55	5	6	6	4	6	5	5	6	...
297	5	...	5200.30	4	5	5	4	5	5	5	5	...
314	3	...	5199.84	4d	2	3	3b	3	3	3	3	...
319	2	...	9.68									
330	1	...	9.39	...	2	...	...	...	1	...	2	...
343	3	...	9.05	4	2	...	...	...	...	...	...	...
352	9	...	8.81	8	9	9	8	7	8	9	9	...
364	2	...	8.47	...	2	2	...	...	...	...	3	...
379	5	...	8.07	5	5	6	5	5	5	5	5	...
393	8	...	7.69	8	8	8	7	7	7	8	8	...
409	5	...	7.27	4	5	6	5	5	4	4	5	...
419	2	...	6.99	...	2	2	...	...	...	...	...	E
430	5	...	6.68	5	5	5	7d	5	5	6	5	}
435	5	...	6.55	5	5	5						
449	7	...	6.19	6	8	7	7	6	7	8	8	7
460	2	...	5.89	3	1	...	...	...	...	...	...	...
470	8	...	5.61	7	8	8	8	7	8	9	8	8
486	3	...	5.19	3	...	...	...	...	4	...	...	...
490	9	...	5.08	7	9	9	8	8	8	9	9	9
493	3	...	5.00	...	...	2	...	...	...	...	4	...
505	1	...	4.66	...	...	2	...	...	...	...	2	...
515	2	...	4.40	1	2	...	...	...	...	...	3	...
525	3	...	4.13	3	3	3	3	4	3	...	3	...
544	3	...	3.61	3	3	3	3	4	3	3	3	4b
549	3	...	3.47									
564	8	...	3.07	7	8	8	8	8	7	9	8	7
584	5	...	2.55	5	4	4	...	6	5	...	5	...
588	10	...	2.44	8	10	10	10	9	8	12	10	10
601	4	...	2.09	4	4	5	...	5	4	...	4	...
616	5	...	1.68	...	...	...	...	...	5	...	...	...
621	10	...	1.55	8	10	10	10	9	8	10	10	10
640	2	...	1.02	...	1	2	...	...	...	E	2	...
650	2	...	0.76	2b	2	2	...	...	...	...	2	4
662	2	...	0.44									
192673	2	...	5190.14	1	2	1	...	...	...	...	2	...

Osc. Freq.	Mean Intensity.		λ	High Sun.						Low Sun.									
	\odot at Medium Altitudes.	Telluric Lines on the Horizon.		2a	6	8a	11a	13a	13b	21	22	29	30	51	52	53	55	73	
				55 1.3	28 1.3	62 1.3	42 2.0	64 2.0	62 2.0	50 32	25 12	45 11	37 11	... 23	29 22	30 9	31 44	36 21	
192690	2	...	5189.68	...	...	...	2	...	2	...	2	...	...	2	...	...	...	4
701	2	...	9.38	...	...	...	2	...	2	...	...	...	...	2	...	...	...	...
716	8	...	8.98	8	...	...	8	...	9	...	...	...	8	...	...	...	...	...
723	8	...	8.80	8	...	...	8	...	9	11	{ 8	...	8	11	{ 9	...	...	10
735	2	...	8.47	...	...	...	2	...	2	...	...	2	2	...	1	...	...	...
750	7	...	8.08	7	...	...	5	...	8	7	6	...	7	...	7	...	...	5
754	2	...	7.95	...	...	...	...	...	...	...	2	...	...	...	3	...	...	...
766	2	...	7.63	...	...	...	...	...	3	...	3	...	...	...	...	...	...	...
772	3	...	7.47	2	...	...	3	...	...	...	3	...	3	...	3	...	...	3
783	2	...	7.17	2	...	...	2	...	2	...	...	...	...	...	3	...	...	...
800	4	...	6.71	4	...	...	4	...	4	6	4	...	4	...	4	...	...	4
808	3	...	6.50	3	...	...	3	...	2	...	3	...	4	...	3	...	...	...
821	2	...	6.15	...	...	...	...	...	...	...	...	...	3	...	...	...	...	...
825	7	...	6.05	7	...	...	8	...	8	8	6	...	6	...	8	...	...	5
841	2	...	5.61	...	...	...	2	...	2	...	2	...	...	...	1	...	...	...
857	2	...	5.20	1	...	...	2	...	2	...	2	...	3	...	2	...	...	...
863	1	...	5.04	...	B	E	...	E	...	...	2	...	...	...	...	...	...	...
875	5	...	4.71	5	5	5	5	5	6	6	6	...	5	...	7	...	...	...
883	5	...	4.48	5	5	5	5	5	6	6	6	...	5	...	7	...	...	...
900	3	...	4.04	...	...	1	4	3	3	...	...	...	...	...	B	B	...	...
887	12	...	4.39	11	12	12	12	12	12	12	12	...	12	14	13	12	14	14	
911			3.73																
936			3.07																
923	3?	...	3.43	...	...	...	3	...	B	...	...	...	...	E	...	...	...	...
944	2	...	2.85	...	...	...	2	...	...	...	2	...	...	...	2	...	...	...
959	2	...	2.44	1	2	2	2	3	...	...	3	...	...	...	3	2	...	...
979	4d	...	1.95	4	3	4d	3	4	...	...	4	...	3	...	4	{ 3	{ 3	{ 3
			1.88																
			1.43																
192999	5d	...	1.33	5	5	5	4	5	...	...	5	...	5	...	{ 5	4	5	5
193012	2	...	1.03	...	1	2	2	2	...	...	1	E	...	...	3	2	...	...
027	3	...	0.63	3	2	3d	{ 3	2	...	{ 3	2	3	...	3	{ 3	...	...	...
033	3	...	0.46																
043	7	...	5180.19	6	7	7	7	7	...	7	7	6	7	...	7	7	4	6	
055	2	...	5179.88	2	2	2	2	2	...	...	2	2	2	3	3	3	...	...
069	1	...	9.50	...	...	...	2	2	...	...	...	...	...	...	...	2	...	...
081	4	...	9.19	4	4	4	4	4	...	6b	{ 4	4	4	...	4	5	{ 3	{ 4	
091	5	...	8.91	5	5	5	5	5	...		{ 5	4	5	...	5	6			
103	2	...	8.57	2	2	2	2	3	...		2	1	2	...	1	3			
112	1	...	8.33	...	...	...	1	3	...	...	...	...	...	...	...	2	...	...
122	2	...	8.07	2	2	2	2	3	...	...	2	1	...	...	3	2	...	3
133	1	...	7.77	...	...	...	1	...	...	...	...	...	...	...	2	...	...	...
144	5	...	7.49	5	5	5	4	5	...	6	{ 5	4	5	...	5	6	{ 5	{ 5	
151	5	...	7.31	5	5	5	4	5	...		{ 5	4	5	...	6	6			
163	1	...	6.99	2
167	3	...	6.88	2	2	3	2	3	...	...	3	2	3	...	3	3	...	...
175	7	...	6.65	7	8	7	7	8	...	6	6	7	6	...	8	8	5	7	
191	4d	...	6.22	4	3	4d	3	3	...	...	4	3	3	...	3	3	...	3
203	2	...	5.90	2	2	2	2	...	...	...	...	...	...	...	...	2	...	...
215	2	...	5.59	...	...	...	2	...	...	...	...	...	...	...	3	3	...	...
193223	3	...	5175.36	3	3	3	3	3	...	...	3	3	2	...	3	...	...	3

Osc. Freq.	Mean Intensity.		λ	High Sun.					Low Sun.									
	C at Medium Altitudes.	Telluric Lines on the Horizon.		2a	6	8a	11a	13a	21	22	29	30	52	53	55	66	68b	73
				55 1·3	28 1·3	62 1·3	42 2·0	64 2·0	50 33	25 11	45 11	37 10	29 25	30 10	31 41	38 10	30 10	36 20
193237	2	...	5174·99	2	2	2	2	...	...	...	...	2	2	...	...	...	...
255	3	...	4·52	3	3	3	3	3	...	3	3	2	3	...	E	...	3	
271	1	...	4·08	...	...	...	2	...	...	...	...	...	...	...	...	...	...
280	8	...	3·83	5	8	7	8	7	8	7	7	7	9	9	...	7	7	
288	2?	...	3·62	...	...	...	2	...	...	...	...	...	...	...	...	E	...
302	12	...	3·25	10	12	11	11	12	14	11	11	10	13	12	14	12	14	
320			2·78															
340			2·23															
359	10	...	1·73	9	10	10	10	10	E	9	9	9	10	10	8	9	9	
367	2?	...	1·50	...	...	...	...	...	...	...	...	...	2	...	...	...	...
381	3	...	1·14	3	1	3	2	3	...	3	3	...	4	2	3	{	...	
391	6	...	0·88	6	6	5	5	6	...	6	5	5	5	6				
398	2	...	0·68	2	...	2	3	2	...	2	...	...	...	3	...	...	...
411	3	...	0·34	3 ^b	...	3	...	...	...	3	...	...	2	2	...	...	4
421	3	...	5170·08	3 ^b	2	3	2	3	...	...	...	2	3	...	...	...	3
427	2	...	5169·91	...	...	...	2	...	...	...	...	...	3	2	...	...	...
446	3	...	9·40	3	3	3	3	3	...	4	3	...	3	2	...	...	...
454	8	...	9·18	7	9	8	8	9	...	8	8	8	10	{	9	12	{	
460	8	...	9·03	7	9	8	8	9	...	8	8	8						
470	7	...	8·76	7	7	7	7	7	...	7	7	8	6	8	...	5	...	
486	4	...	8·33	4	4	4	3	3	...	4	3	3	3	3	...	...	3
504	4	...	7·85	4	4	3	4	3	...	4	...	...	3	3	...	...	...
500	10	...	7·95	8	11	9	9	11	...	10	10	9	11	{	10	14	{	
512			7·64															
522			7·38															
534	3?	...	7·04	B	...	...	3	...	...	B	B	B	...	...	...	...	...
535			7·02															
549			6·65															
558	9	...	6·41	...	8	9	9	9	...	...	...	...	8	9	8	9	9
569	2	...	6·11	...	1	...	E	...	...	...	...	...	2	2	...	...	...
579	1	...	5·84	...	...	...	...	...	...	...	...	...	2	...	...	...	...
591	8	...	5·54	...	8	8	...	8	...	...	...	...	6	8	6	8	7
595	3?	...	5·41	...	...	...	...	3	...	...	...	...	...	...	...	...	...
604	4	...	5·19	...	3 ^d	{	4	4	...	...	...	...	5	{	4	4	4 ^d
606	4	...	5·12	...					...	...	...	...
618	6	...	4·81	...	6	6	...	7	...	...	...	...	5	{	6	b	5
619	6	...	4·77	...					...	...	...	...
634	3	...	4·39	...	3	2	...	3	...	...	...	...	3	3	4	3	3
649	2	...	3·98	...	3	3	...	3	...	...	...	...	...	2	...	...	...
658	3	...	3·75	...	3	3	...	...	...	...	...	...	3	{	3	...	...
662	3	...	3·64	...	3	3	...	...	...	...	...	...	3	{	3	...	...
676	3	...	3·25	...	3	3	...	3	...	...	...	...	...	3	3 ^b	...	...
682	3	...	3·11	...	3	3	...	3	...	...	...	...	3	3	...	3	3
699	2	...	2·66	...	2	2	...	3	...	...	...	...	...	2	...	...	...
709	10	...	2·39	...	10	10	...	10	...	...	...	...	10	10	11	12	11
730	4	...	1·83	...	4	4	...	4	...	...	...	...	4	4 ^d	2	3	4
747	4	...	1·37	...	4	4	...	4	...	...	...	...	4	{	4	3	3
753	4	...	1·21	...	4	4	...	4	...	...	...	...	4	{	4		
759	3	...	1·04	...	3	2	...	4	...	...	...	...	3	3	3	3	4
781	3	...	0·45	...	3	{	3	3	...	...	...	...	3	4	3	3	5
193785	4	...	5160·35	...					...	...	...	...	3	4			

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.						
	O at Medium Altitudes.	Telluric Lines on the Horizon.		6	8 α	13 α	52	53	55	66	68b	73	
				28 1·3	62 1·3	64 2·0	29 29	30 12	31 36	38 11	30 11	36 18	
193796	2?	...	5160·06	...	...	...	3	...	...	...	...	...	...
806	3	...	5159·81	...	2	...	4	4	...	...	...	...	...
813	3	...	9·62	3	3	4	4	4	3	3	4	3	3
829	8	...	9·18	7	7	8	8	8	8	7	8	8	8
834	2?	...	9·04	...	...	...	...	2	...	...	...	...	...
849	4d	...	8·66	3	3d	4	4	4d	2	4	5	4	4
859	1	...	8·38	...	1	...	...	...	...	...	...	...	...
868	5	...	8·14	5	5	4	4	5	2	4	5	4	4
880	4	...	7·84	4	4	}	4	{	4	}	4	5	4
882	4	...	7·77	4	4								
898	4d	...	7·35	3d	4	4	4	3	...	4	4	4	4
918	5	...	6·82	5	5	5	5	}	6d	5	5	5	4
922	5	...	6·72	5	5	5	5						
933	2	...	6·43	2	3	2	...	1	...	...	...	...	...
943	3	...	6·15	3	3	3	3	3	...	4	...	...	...
953	8	...	5·90	8	8	7	7	8	7	8	8	8	8
960	4	...	5·70	3	3	3	4	3	...	5	4	4	4
977	7	...	5·26	7	6	7	6	7	6	7	7	7	7
193984	2	...	5·07	...	...	2	...	2	...	...	...	...	...
194006	5d	...	4·49	5d	4d	4d	5	5d	5	5	5	5	5
018	8	...	4·17	8	7	8	8	8	8	8	8	8	8
041	5	...	3·55	5	5	5	6	5	5b	4	5	5	5
051	7b	...	3·29	7b	7	7	6	6	5b	7	7	6	6
072	1	...	2·72	...	...	2	...	1	...	...	...	...	...
078	2	...	2·57	...	...	2	2	2	...	...	2	...	...
083	1	...	2·43	2	2	...	...	1	...	...	...	...	...
090	6	...	2·26	6	6	6	6	6	4	5	5	5	5
100	9	...	1·98	9	9	9	9	9	8	9	9	9	9
104	5?	...	1·89	...	...	5	...	...	...	...	...	...	...
116	2	...	1·57	2	2	2	3	1	...	...	1	...	...
127	1	...	1·27	...	2	2	...	1	...	...	...	...	...
139	9	...	0·94	9	9	9	9	9	9	9	9	9	9
148	3	...	0·72	3	3	3	...	3	...	...	...	...	...
167	4	...	5150·22	3	5	5	...	4	3	4	4	4	4
181	3	...	5149·85	3	4	3	...	3	...	3	3	3	3
192	2	...	9·53	2	3	2	...	2	1	...	...	...	...
206	4	...	9·16	3	4	4	...	4	4	3	4	3	3
217	3	...	8·87	3	4	3	...	3	...	3	4	...	...
221	3	...	8·78	3	4	3	...	3	...	...	4	3	3
237	8	...	8·36	8	8	8	9	9	8	8	7	8	8
245	8	...	8·14	8	8	8	9	9	6	8	7	8	8
257	3	...	7·83	3	3	3	...	3	...	...	2	2	2
266	6	...	7·58	6	6	6	4	6	...	5	5	5	5
278	4	...	7·27	4	4	4	4	3	4	4	4	3	3
290	3	...	6·95	3	3	4	3	3	3	...	3	3	3
297	2?	...	6·76	...	...	...	...	...	2	...	...	...	...
302	8	...	6·62	8	7	8	9	8	8	7	7	7	7
311	4	...	6·40	5	3	4	...	3	...	...	4	2	2
317	5	...	6·24	5	5	5	4	5	5	5	5	5	5
329	2	...	5·91	2	3	2	...	2	...	...	...	...	...
194341	5	...	5145·60	6	5	5	5	6	5	5	4	5	5

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.						
	☉ at Medium Altitudes.	Telluric Lines on the Horizon.		6	8a	13a	52	53	55	66	68b	72	73
				28 1·3	62 1·3	64 2·0	29 33	30 14	31 30	38 12	30 12	37 24	36 16
194356	7	...	5145·21	7	6	7	6	7	6	7	5	...	7
361	2	...	5·06	...	...	...	...	2	...	...	...	...	...
370	4	...	4·82	4	4	5	} 4	{ 4	} 3	4d	4d	...	4
374	3	...	4·72	3	4	4							
381	1	...	4·53	...	...	...	...	2	...	...	...	...	...
396	2	...	4·15	...	2	2	...	2	...	...	...	...	...
404	...	5d	3·94	...	...	...	5	} 5	{ 4	5d	4	...	} 4d
410	4	...	3·78	4	5	4	5						
424	2	...	3·40	2	3	2	...	2	...	...	2	...	...
438	8	...	3·04	9	8	8	} 9	{ 9	} 11d	{ 8	7	...	8
443	8	...	2·89	9	8	8							
455	9	...	2·57	10	9	9	9	{ 10	{ 11d	{ 9	8	...	9
473	2	(2?)	2·10	...	...	...	...		
484	8	...	1·81	9	8	8	8	9	10	8	8	...	9
486	1	...	1·76	...	...	...	...	1	...	...	...	...	...
503	4d	{	1·34	} 4	5	4	{	3	} 3	3	4	...	4
517	4		1·27										
538	3	...	0·94	4	5	4	...	4	3	3	4	...	4
547	2	...	0·38	2	2	3	...	2	2	2	2	...	3
563	4	...	5140·14	2	2	3	...	2	...	...	...	...	...
569	11	...	5139·71	5	...	4	...	3	...	...	...	E	...
579	11	...	9·56	11	10	10	} 12	{ 10	11	10	11	} 13	{ 12
600	3	...	9·31	11	10	10							
610	3	...	8·76	2	3	3	4b	3	3	3	2	...	...
620	3	...	8·48	2	3	3	...	3	3	...	2	...	2
639	4	...	8·22	2	3	3	...	3	...	3	...	...	2
647	8	...	7·72	...	4	3	...	4	...	...	...	...	...
660	8	...	7·51	8	9	8	9	9	9	8	8	} 10	{ 9
669	3	...	7·15	8	9	8	9	9	9	8	8		
681	3	...	6·92	3	3	2	...	3	...	...	2	...	...
681	1	...	6·60	...	...	2	...	...	...	...	...	...	...
693	3	...	6·30	3	3	4	...	3	...	4	4	...	3
698	4	...	6·15	4	4	5	...	4	3	5	5	...	4
714	3	...	5·75	} 4	4	{ 3	...	4	} 3	4	5	...	4
717	4	...	5·66										
735	3	...	5·17	3	3	3	...	3	3	3	3	...	3
751	4	...	4·75	4	3	3	...	5	} 3d	4	4	4b	4
755	4	...	4·66	4	3	3	...	4					
765	3	...	4·40	3	2	3	...	3	...	3	4	...	4
787	11	...	3·82	11	10	11	11	10	11	11	11	10b	12
795	4	...	3·60	4	2	2	...	3	...	...	6	...	...
810	2	...	3·20	...	1	2	...	2	...	...	2	...	2
822	5	...	2·88	5	5	5	4b	6	5	5	5	...	5
833	3d	...	2·59	3d	3	3	...	4	...	4	4	...	3
846	2	(3?)	2·25	...	...	...	...	2	3	...	...	...	...
860	7	...	1·89	6	7	6	8	7	6	6	6	} 9b	{ 6
872	8	...	1·58	8	8	7	8	8	8	8	8		
879	3	...	1·38	4	1	2	...	3	...	...	4	...	...
891	1	...	1·06	...	...	2	...	...	...	...	...	...	...
900	3	...	0·84	2	...	4	...	2	...	4	...	} 5b	{ 4
908	5	...	0·61	4	5	4	...	4	4b	5	4		
194916	5	...	5130·41	5	5	4	...	5	4	5b	5b	...	4

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.										
	at Medium Altitudes.	Telluric Lines on the Horizon.		6	8a	13a	52	53	55	64	66	68b	71	72	73		
				28	62	64	29	30	31	42	38	3	27	37	36		
				1·3	1·3	2·0	35	19	25	11	13	14	30	24	15		
194930	2	...	5130·04	2	...	2	...	2	...	...	...	...	...	...	...
942	7	...	5129·74	5	7	7	7	6	6	...	7	6	...	8	8		
952	7	...	9·47	7	7	7	b	8	7	...	7	7	...	b	8		
961	7	...	9·24	7	7	7	7	8	7	...	7	7	...	8	8		
976	1	...	8·83	...	...	...	...	2	...	...	...	...	...	...	...
986	3	...	8·57	3	3	3	...	3	...	...	3	2	...	...	2b
194999	3	...	8·24	} 3	{ 3	{ 4	{ ...	3	3	} 3	3	3	...	3b	3		
195002	3	...	8·16					3	3		3	3			3		
016	4	...	7·79	3	4	4	...	4	3	...	3	3	...	...	3
028	8	...	7·47	8	9	8	8	8	9	...	8	8	...	7	8		
047	3	...	6·96	2	3	2	...	2	3	...	2	3	...	...	2
054	2	...	6·77	2	3	2	...	...	...	...	2	...	...	...	2
072	8	...	6·32	8	7	8	8	7	9	...	9	7	...	7	7		
088	2	...	5·88	} 2	2	{ 2	...	} 2d	2	...	2	3	...	...	2
096	2	...	5·68														
110	7	...	5·32	8	6	7	} 11	{ 7	} 11	...	10	{ 6	...	} 10	{ 10		
114	8	(10 ?)	5·20	8	8	8											
133	4	...	4·70	4	5	4	E	4	4	...	4	4	...	3	5		
155	3	...	4·14	3	3	3	...	3	4	E	3	3	...	...	4
167	8	...	3·81	8	8	8	...	9	9	8	9	8	...	9	8		
177	3	...	3·56	3	3	3	...	2	...	4	4	3	...	...	...
187	5	...	3·30	4	5	5	...	6	4	5	5	5	...	...	5
196	2	...	3·05	1	3	...	...	...	...	...	...	...	...	...	...
203	4	...	2·87	4	4	4	...	4d	4	4	5	5	...	3	5		
218	2	...	2·47	2	2	2	...	3	...	...	...	...	...	b	...
222	2 ?	...	2·37	...	...	...	...	3	...	...	...	...	...	...	...
228	4	...	2·21	3	3	3	...	3	4	4	4	4	E	3	4		
246	9	...	1·74	9	9	9	...	9	10	8	9	8	9	9	9		
256	3	...	1·47	5	...	...	...	2	2	2	...	3	...	...	...
265	1	...	1·24	...	2	...	...	...	...	...	...	2	...	...	...
273	3	...	1·04	2	3	3	...	3	...	2	3	2	...	...	2
284	3	...	0·74	2	3	3	...	3	2	3	...	2	...	...	...
294	7d	...	5120·48	5	7	7	...	6	7	7	7	7	6	7d	6		
318	3	...	5119·86	2	3	3	...	3	3	3	...	3	...	...	3
333	2	...	9·45	3	3	2	...	3	...	...	...	...	...	...	...
344	5	...	9·17	4	5	5	...	4	4	5	5	5	3	4	4		
356	3	...	8·85	2	3	2	...	2	3	3	...	3	...	...	2
382	4	...	8·19	3	3	3	...	3	...	4	4	4	...	...	4
389	5	...	7·99	4	5	5	...	5	4d	5b	5	5	3	4	5		
406	2	...	7·55	...	2	2	...	2	...	...	...	...	...	...	...
419	2 ?	...	7·21	...	...	3	...	...	...	...	...	...	...	...	...
426	4	(5 ?)	7·02	3	4	3	...	3	3	4b	} 4b	{ 4b	...	5b	4b		
438	4	(5 ?)	6·72	3	4	2	...	3	3	4b			...	3	5b	4b	
459	1	...	6·16	...	1	2	...	...	...	...	...	...	...	...	...
471	5	...	5·85	4	5	5	...	6	5	5	5	6	...	...	4
484	8	...	5·50	8	8	8	...	8	9	8	8	8	8	8	8		
497	3	...	5·18	4	2	1	...	...	3	...	...	...	...	...	...
515	4	...	4·70	4	4	4	...	4	4	4	5	5	4	} 4b	{ 5		
526	4	...	4·40	4	4	4	...	4	4	4	5	5	...			{ 4b	{ 5
542	1	...	3·98	...	...	2	...	2	...	...	...	...	...
195555	5	...	5113·64	5	4	5	...	5	5	5	5	5	...	4	6		

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.											
	O at Medium Altitudes.	Telluric Lines on the Horizon.		6	8a	18a	53	54	55	64	66	67	68b	71	72	73		
				28 1·3	62 1·3	64 1·9	30 22	28 12	31 22	42 11	38 14	26 14	30 17	27 29	37 { $\frac{22}{14}$ }	36 14		
195570	4	...	5113·26	4	}	5d	5	5d	...	5	4d	5	...	5d	4	5	6	
572	4	...	3·20	4		2	2	2	...	...	2	...	...	3	...	...	3
592	2	...	2·68	2	2	2	2	...	...	2	...	...	3	...	...	4	3
603	3	...	2·41	3	3	3	3	...	2	3	3	...	3	...	...	4	3
623	3	...	1·88	3	3	3	2	...	2	3	...	...	...	...	...	3	4
628	3	...	1·74	3	3	3	2	...	...	3	3	...	4	...	...	3	4
639	3	...	1·45	3	3	3	2	...	...	...	...	...	2	...	...	...	4
650	1	4	1·16	...	1	...	2	...	2	3	3	...	3	4	}	4b	{	
665	4	...	0·78	4	4	4	4	B	2	3	4	...	3	...		4		4
676	10	...	0·48	10	9	10	10	10	10	9	10	...	9	10	10	10	9	
687	1	3	5110·20	2	...	...	3	3	2	...	4	...	2	...	...	...	...
704	8	...	5109·76	7	7	8	9	8	9	7	8	...	8	8	8	8	8	
712	2?	...	9·56	...	...	...	...	2	...	...	...	...	...	...	...	...	...
723	3	...	9·27	3	3	3	...	3	3	...	...	...	3	...	3	4	...
730	3	...	9·09	...	3	2	3	3	...	3	3	...	...	...	3	...	...
745	1	...	8·70	...	...	2	...	1	...	...	...	...	...	...	...	...	...
752	4	...	8·50	3	4	3	4	5	4	4	4	...	4	3	}	4d	{	
768	3	...	8·09	2	3	2	3	3	3
780	9	...	7·76	9	9	9	10	10	10	8	9	...	9	}	12d	12	{	
790	9	...	7·50	9	9	9	10	10	10	8	9	...	9	
799	2b?	...	7·27	2b	...	...	...	...	...	...	...	...	...	...	...	...	...
814	3	...	6·88	3	3	2	3	2	2	2	3	...	...	...	4	4	...
826	4	...	6·57	b	4	3	3	4	3	3	3	...	...	...	...	4	4
832	4	...	6·41	3	4	3	3	4	3	3	3	...	...	3	4	4	...
848	2	...	6·01	...	...	2	...	2	2	...	...	...	...	...	...	...	...
861	9	...	5·67	9	8	9	9	9	9	8	9	...	8	8	9	9	...	
863	5?	...	5·61	...	B	...	...	...	...	...	...	...	5	...	...	...	...
872	3	...	5·38	4	...	2	1	1	...	...	...	...	...	...	...	...	...
884	1	4d	5·07	...	...	2	1	1	...	2	...	...	...	3	3b	3d	...
904	6	...	4·55	5	...	6	5	6	5	4	5	...	...	4	6	6	...
915	5	...	4·25	5	...	5	5	6	4	4	}	6b	...	{	b	b	5	
920	5	...	4·13	5	...	5	5	6	4	4		4	6	5
932	2d	(3?)	3·86	}	2	...	2	3	3	...	3	{	4	3
946	2	...	3·45															
961	7	...	3·06	8	...	7	8	7	7	6	8	...	...	...	5	7	7
980	3	8	2·57	3	...	3	6	6	4	5	7	...	...	6	8	5	...
195992	2	...	2·26	...	...	...	...	2	...	3	...	...	...	...	...	...	...
196005	2	6	1·90	2	...	3	4	3	3	3	4	...	...	5	4	4	...
016	3d	...	1·62	3	...	3	3	2d	...	3	...	...	...	...	2	3	...
036	3	...	1·11	3	...	3	4	1	...	...	...	...	...	...	...	...	...
040	4	...	1·00	3	...	4	4	5	3	4	5	...	...	...	4	4	...
050	4	...	0·74	4	...	4	4	5	3	4	5	...	...	4	4	4	...
066	2	...	0·31	...	...	...	...	2	...	...	...	...	...	...	...	...	...
078	8	...	5100·02	8	...	8	9	9	8	7	9	...	8	8	8	7	...	
082	4	...	5099·92	...	...	3	...	5	...	...	...	...	5	...	...	4	...
089	1	...	9·71	...	...	2	1	2	...	...	...	...	...	...	...	...	...
100	7	...	9·43	7	...	7	8	8	6	6	6	...	...	}	7	7	6
110	6	...	9·17	6	...	7	6	7	6	5	6	E	7	6	...
125	9	...	8·79	9	...	8	10	9	10	7	}	10	8		{	8	9	8
196130	8	...	5098·65	8	...	8	10	9	6	7	

Osc. Freq.	Mean Intensity.		λ	High Sun.		Low Sun.								
	O at Medium Altitudes.	Telluric Lines on the Horizon.		6	13a	53	54	55	64	66	67	71	72	73
				28	64	30	28	31	42	38	26	27	37	36
				1.3	1.9	26	14	19	12	15	14	27	14	13
196141	1	...	5098.36	2	...	...	...	...	...	...	...	...	...	...
148	4	...	8.20	4	4	4	4	4	3	4	...	...	3	3
162	2	...	7.83	2	2	...	2	...	...	...	...	...	...	...
171	6	...	7.58	6	6	6	7	6	4	7	...	5	5	5
178	3	5	7.40	3	3	4	3	...	4	...	...	...	5	4
190	8	...	7.10	8	8	8	9	8	...	...	...	...	8	8
196	7	...	6.94	6	7	6	5	6	9	12	8	10	8	8
214	2	...	6.48	2	1	2	2	...	...	...	...	...	...	...
224	1	5	6.23	...	2	2	2	2	3	4	...	5	4	4
234	2	7	5.95	2	3	4	4	4	5	5	...	7	5	5
253	3	...	5.47	3	3	2	4	3	...	4	...	3	3	4
258	3	...	5.34	3	3	3	4	b	3	4	...	3	3	4
268	3	...	5.08	3	3	3	4	3	3	4	...	3	3	4
280	1	...	4.75	...	1	...	2	...	...	...	...	...	...	...
289	5	8	4.52	6	5	7	7	7	6	6	...	8	6	6
302	...	6	4.20	...	...	5	5	4	5	4d	...	6	5d	5
308	2	6	4.04	3	1	...	...	...	...	...	...	6	...	4
318	...	2	3.78	...	...	1	2	...	...	...	...	...	2	3
330	3	...	3.45	3	2	...	2	2	2	...	...	3	2	2
351	3	...	2.92	3	2	3	2	2	2	...	...	3	2	2
364	4	8	2.58	4	3	6	6	6	5	6	5	8	6	5
372	5	7	2.37	5	4	6	6	5	5	6	5	7	6	5
381	2	...	2.13	...	...	...	3	1	...	...	...	...	...	...
388	4	...	1.95	4	3	...	5	...	...	...	...	...	...	4
394	4	...	1.79	4	3	4	5	3	4b	4d	4	5	4	4
413	2	4	1.32	2	3	3	2d	2	2	...	2	4	2	3
430	9	...	0.88	9	9	10	10	9	9	9	9	9	9	9
451	2	4d	0.39	...	...	...	2	...	...	...	...	...	...	...
451	2	4d	5090.25	2	3	2	2	2b	2	3	3	4	3	B
467	2	4	5089.92	2	2	2	2	2	...	3	3	3	3	...
488	4	(4?)	9.36	3	3	3	3	3	3	4	3	4	4d	...
493	3	(4?)	9.23	3	3	...	3	...	...	...	3	4	4	...
501	5	...	9.04	6	4	5	5	4	4	4	4	4	5	...
510	2?	...	8.80	...	...	...	2	...	...	...	...	...	...	...
517	5	...	8.61	6	4	5	6	4	4	4	4	4	5	...
531	6	...	8.25	6	5	5	6	5	5	4	5	5	5	...
537	4	...	8.10	4	3	4	4	3	3	3	4	5	2	...
548	2	...	7.81	...	...	2	2	...	...	...	...	...	...	...
559	7	...	7.52	7	7	6	8	7	5	5	5	6	6	...
573	5	...	7.17	5	5	5	5	4	4	4	5	4	5	...
581	2?	...	6.97	...	...	...	2	...	...	...	...	...	...	...
589	2	6	6.75	2	2	5	5	4	5	5	5	6	5	...
603	5	...	6.40	5	4	5	5	4	4	5	4	6	5	...
610	...	6	6.21	...	...	4	4	3	4	4	4	6	5	...
620	2	...	5.95	1	2	...	...	2	...	...	...	...	...	...
634	4	...	5.60	5	4	3	3	...	...	...	...	4	4	...
642	2	4	5.39	3	1	...	5	3b	4	4d	3	4	4	...
653	...	3	5.11	...	...	...	...	...	...	...	...	3	2	...
663	3	...	4.85	3	2	...	2	...	...	...	...	...	2	...
671	2	5	4.64	3	2	4	4	3	4	4	4	5	4	...
196688	9	...	5084.20	10	8	9	10	9	8	8	8	8	9	...

Osc. Freq.	Mean Intensity.		λ	High Sun.		Low Sun.								
	O at Medium Altitudes.	Telluric Lines on the Horizon.		6	13a	53	54	55	63	64	66	67	71	72
				28	64	30	28	31	40	42	38	26	27	37
				1·3	1·9	30	15	17	9	13	17	15	24	12
196699	2	7	5083·91	3	2	6	5	5	...	5	7	5	7	5
706	2?	...	3·74	...	2	...	...	...	...	...	...	...	...	...
716	10	...	3·47	10	9	10	10	9	...	8	8	8	9	9
730	2	5	3·12	3	2	4	4b	4	...	4	4	3	5	3
739	2	...	2·88	...	2	...	...	...	...	...	...	...	...	2
755	8	...	2·45	8	7	9	9	8	...	6	7	7	7	7
762	2	...	2·27	...	...	...	...	...	...	...	...	3	...	1
775	3	...	1·94	3	3	3	3	3	...	1	2	2	2	2
786	3	...	1·66	3	2	3	3	3	...	1	...	3	2	2
803	8	...	1·22	8	8	9	9	8	...	7	7	7	8	6
808	4	...	1·09	4	4	4	4	3	...	...	...	5	...	3
824	8	...	0·69	8	8	9	9	8	...	7	6	7	7	6
830	5	8	0·53	5	5	7	6	6	...	6	5	6	7	5
848	7	...	5080·05	6	7	7	7	6	...	5	6	5	5	5
857	8	...	5079·84	8	8	9	9	8	...	6	...	7	6	6
862	1	7	9·70	1	...	6	4	5	E	5	...	8	5	4
877	9	...	9·32	9	9	10	10	9	8	9	9	9	11	8
886	9	...	9·07	9	9	9	10	9	8	8	9	9	11	8
906	3	6	8·57	3	2	4	4b	4	3	5	5	4	6	B
921	1	3	8·18	...	2	3	2	2	2	...	...	3	2	...
937	3?	...	7·77	...	...	3	...	...	...	...	...	...	...	...
945	3	7	7·57	3	3	6	5b	5	5	6	5	5	6	...
954	2	...	7·32	...	2	...	...	...	...	...	...	3	...	...
969	3	...	6·94	3	3	2	...	1	...	1	...	...	2	...
980	2	9	6·65	...	3	9	5	6	7	6	6	6	10	...
196989	9	...	6·43	9	9	9	9	7	8	7	8	8	10	...
197006	2	5	5·98	2	3	5	4	3	4	5	4	4	5	...
027	5d	...	5·45	5	5d	5	5b	4	4	5	4	4	4	...
049	10	...	4·87	10	10	10	11	9	8	9	9	9	9	...
053	4?	...	4·78	...	...	...	...	...	...	...	...	4	...	...
066	1	3?	4·43	...	2	2	3	1	...	...	...	...	...	...
087	3	4?	3·89	3	3	4	4	3	3	3	3	3	4b	...
097	4	...	3·63	4	3	...	4	3	3	3	...	3	...	...
118	6	7	3·09	5	6	...	8	7	7	7	8	7	8	...
127	7	...	2·87	7	7	10	8	7	7	7	8	7	8	...
138	1	...	2·60	...	...	...	1	...	...	...	...	...	...	...
144	6	...	2·44	5	6	...	7	7	6	6	4	4	7	...
151	8	...	2·26	8	8	9	8	8	7	7	6	7	7	...
158	...	4	2·06	...	...	4	3	...	...	...	4	4	...	...
164	2	...	1·92	2	2	...	...	...	...	...	...	...	...	...
175	5	...	1·64	5	5	...	6	3	4	4	5	4	5	...
184	1	5	1·40	...	2	...	4	3	3	4	5	4	...	...
192	2	5	1·21	1	2	...	3	2	3	3	...	4	5	...
211	2	...	0·71	1	2	...	2	...	...	...	...	...	2	...
225	...	5	0·35	...	...	4b	4	3	4	4b	5	5	5	...
233	4	...	0·15	4	3	...	b	b	...	...	...	...	...	...
237	3	5	5070·04	3	4	...	4	3	4	3	5	5	5	...
246	1	...	5069·80	...	2	...	...	...	...	...	...	...	...	...
257	3	4	9·53	3	3	4	4	3	4	4	3	3	...	...
267	3	5	9·26	3	3	...	4	3	4	5	4	5	4	...
197282	9	11?	5068·88	9	9	11	12	11	9	9	9	9	10	...

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.							
	\odot at Medium Altitudes.	Telluric Lines on the Horizon.		6	7c	13a	53	54	55	63	64	66	67	71
				28	55	64	30	28	31	40	42	38	26	27
				1·2	1·6	1·9	34	17	15	10	14	19	17	21
197299	4	5	5068·45	4	...	3	5	5	4	4	5	4	4	4
309	1	...	8·20	...	...	2	...	...	...	...	...	...	...	...
322	5d	...	7·87	6	...	5	5	6d	5b	5	5	4	4	4
332	1	...	7·59	2	...	...	...	2	...	...	...	...	...	...
344	8	11	7·29	8	...	8	11	11	9	8	9	10	9	10
351	2?	...	7·10	...	...	...	...	...	...	...	...	...	...	2
359	4	...	6·91	4	...	3	...	4	3	4	4	4	5	3
375	3	6	6·49	3	...	3	6	5	4	4	5	5	5	5
393	6	9	6·04	7	...	5	10	8	7	7	7	8	7	9
400	3	(3?)	5·85	...	E	...	...	2	...	...	1	...	4	...
422	8	...	5·30	9	7	7	10	10	8	8	7	10	6	8
429	9	...	5·12	9	9	9	10	11	9	9	9	10	9	9
444	8	...	4·73	9	8	8	8	10	8	8	8	8	7	8
468	3	...	4·11	2	3	2	...	2	2	3	3	2	2	3
482	1	4	3·74	2	...	2	3b	1	...	...	...	...	...	4
495	3	...	3·41	3	1	3d	...	3d	{ 3	{ 3	3	4	{ 3	4b
501	3	...	3·27	3	4		...		{ 3	{ 4		...	{ 3	
515	2	...	2·90	...	...	...	3b	...	...	...	...	...	2	...
533	2	(3?)	2·44	1	2	2	...	2	3	3	3	...	...	...
544	4	...	2·17	4	4	4	...	3	3	4	...	4	3	4b
559	3	...	1·78	3	3	3	3	2	2	3	2	...	2	3
568	1	...	1·56	...	1	2	...	...	...	...	...	...	...	...
582	2	6	1·18	2	2	2	5	4	3	5	6	6	4	6
592	1	...	0·92	...	...	...	...	...	...	...	...	...	3	1
607	2	5	0·56	...	2	2	...	2	2	2	2	...	...	5
621	8	10	5060·19	8	7	8	10	10	9	9	9	9	8	9
630	4	...	5059·95	3	4	4	E	4	...	...	...	...	5	...
645	1	3	9·58	...	...	2	...	...	2	2	3	3	...	3
666	3d	...	9·05	1d	3	2	...	3	2	2	3	3	2	3
681	4	...	8·66	4	4	3	...	3	2	2	...	...	2	...
694	2	6	8·32	...	3	2	...	5	5	4	6	7d	{ 5	6
703	5	...	8·09	5	5	5	...	6	5	4	5		{ 5	5
705	3?	...	8·03	...	3	...	...	...	...	...	...	...	...	...
719	...	9	7·69	...	...	...	...	7	7	5	8	9d	{ 6	9
723	5	...	7·58	4	5	5	...	5	5	5			{ 4	4
741	1	...	7·13	...	...	2	...	...	...	...	...	...	...	...
748	5	5	6·95	4	6	5	...	5	5	4d	5	4	3	4b
762	3	10	6·58	3	3	{ 3	...	7	5	5	8	10	6	9
768	2	5	6·44			{ 2	...	4	4	4	...	...	5	3
782	4	...	6·08	3b	5	4	...	4	4	4	4	4	4	3
798	2	...	5·66	2	3	2	...	2	...	...	...	...	...	2
813	2	4	5·28	2	2	2	...	2	3	2	3	4	3	3
834	6	...	4·73	7	6	6	...	8	6	7	5	5	5	6
843	...	4	4·52	...	...	...	...	4	1	...	...	...	4	...
850	2	...	4·33	...	2	2	...	...	...	...	...	...	...	...
866	3	6	3·92	3	3b	{ 3	...	5	3	4	5	5	5	6
877	3	5d	3·64	3		{ 3	...	4d	3	4	4	4	5	4	4
898	4	...	3·10	3	5	4	...	{ 5	3	{ 3	4	3	4	4
903	4	...	2·99	3		...	...	{ 4		{ 3		...	...	...
911	3	...	2·78	3	4	3	...	...	...	...	...	...	...	...
197921	1	6	5052·52	...	...	2	...	6	...	3	5	4	4	5

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.													
	Oat Medium Altitudes.	Telluric Lines on the Horizon.		6	7c	13a	54	55	56a	57b	63	64	65	66	67	68a	70	71		
				28 1·2	55 1·6	64 1·8	28 23	31 12	38 10	42 22	40 12	42 18	40 17	38 24	26 21	30 24	27 25	27 17		
198514	3	8	5037·43	4	3	3	8	6	6	6	6	6	...	7	7	8	8	7		
529	5d	...	7·12	5	4	{4	5	4	5	3	4	3	...	...	4	4	...	4
545	7	...	6·98	8	6	{5	8	7	7	{6d	{6	{6d	...	7	{5	5	{9	{6		
554	6	...	6·42	6	6	6	8	7	7	{6	{6	{6d	...	7	{5	6	{9	{6		
569	9	...	6·04	9	9	9	9	8	9	{8d	{7	{7	...	{9d	{7	6	{10	{7		
577	2	8	5·83	3	...	...	5	4	5	{8d	{5	{7	...	{9d	{7	6	{10	{7
592	9	...	5·46	9	8	9	10	9	9	9	9	9	...	9	10	9	10	7		
602	...	5	5·19	...	...	...	...	2	3	...	3	3	...	...	...	...	...	5
618	1	8	4·80	...	...	2	...	4	5	8	5	8	...	8	8	8	9	B
622	...	7	4·69	...	...	...	{5d	...	4	5	5	...	...	...	...	i4	...	...
631	2	5	4·45	...	3	2	4	3	4	b	4	5	...	{6	{5b	...	...	...
640	2	5	4·23	2	3	2	4	3	4	5	4	5	...	{6	{5b	5	5	...		
656	2	...	3·82	...	...	...	...	...	3	...	...	...	...	...	...	...	...	...
665	3	...	3·60	{2d	3	{3	...	...	3	...	3	...	...	...	{3b	...	4	...
682	2	5	3·17	2	2	3	3	3	4	4	4	4	...	5	{4d	{4	b	...		
696	5	...	2·80	5	4	5	5	5	5	5	5	6	...	6	{5	4	...	...
710	3	...	2·47	2	3	2	2	2	2	3	4	...	...	...	...	...	...	...
726	4	...	2·04	5	4	4	5	4	5	4	3	5	...	4	3	4	4	...		
735	2	...	1·83	3	...	3	...	...	...	...	...	...	...	...	3	...	...	...
754	2	6	1·34	...	...	3	4	2	3	...	4	...	...	...	...	4	...	...
761	8	...	1·16	8	8	8	9	8	8	8	7	8b	...	8b	7	8	8b	...		
771	5	...	0·92	5	5	4	4	3	3	4	4	...	...	...	5	4	...	...
787	1	4	0·52	1	...	2	...	...	2	...	...	...	...	...	4	...	...	...
800	3	...	0·18	...	...	{3	...	...	...	...	...	...	...	...	...	...	...	...
802	3	...	5030·12	{3d	4	{3	4	3	3	...	4	...	...	...	4	...	...	...
814	...	8	5029·82	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
821	7	...	9·64	7	6	7	8	9	{6	{8	{7	{8b	...	8	{7	8	{8b	...		
834	2	...	9·32	...	...	...	...	2	{5	{8	{6	...	2	...	{6	5	...	...
847	2	6	8·98	2	2	3	5	3	4	5	4	6	...	{5b	{5	6	7	...		
858	1	6	8·72	...	...	2	4	3	4	5	4	6	...	{5b	{5	6	5	...
874	7	...	8·30	7	7	8	9	8	9	8	7	8	...	5	6	7	6	...		
889	6	...	7·92	6	6	7	6	6	7	7	6	6	...	5	5	6	5	...		
908	5	...	7·46	4	5	5	4	5	5	...	5	1	...	...	...	...	...	...
915	10	...	7·27	10	9	10	11	10	10	9	9	9	...	10	8	10	10	...		
932	1	...	6·85	...	...	2	2	2	...	...	...	...	...	...	...	...	...	...
944	2	...	6·55	1	2	2	...	...	2	...	2d	3b	...	...	...	...	...	...
955	...	6	6·26	...	...	...	2	2	4	4	3	4	...	5	...	4	5	...
968	3	6	5·94	2	3	3	2	2	4	...	3	4	...	b	...	4	b	...		
978	7	...	5·67	7	7	7	6	6	7	5	6	5	...	5	...	4	5	...		
986	4	...	5·47	3	4	4	...	2	3	...	3	...	...	...	...	...	...	...
198993	4	...	5·30	3	4	4	...	2	3	...	3	3	...	...	...	...	...	...
199004	7	...	5·03	7	8	8	6	7	7	7	7	6	...	6	...	5	6	...		
013	2	6	4·81	3	...	...	...	...	3	...	3	5b	...	5b	...	5	...	...
029	3	6	4·39	4	4	3	{3b	{2	3	3	3	5b	...	5b	...	5	5	...		
044	2	...	4·02	3	...	2	...	3	...	3	...	...	...	...	...	...	...	...
063	5	...	3·54	5	5	5	5	4	5	5	4	4	...	5	...	5	{5b	...		
075	5	...	3·24	5	5	5	6	4	5	4	4	4	...	...	...	5	...	...
087	7	...	2·92	8	7	7	9	8	7	7	7	6	...	7	...	7	7	...		
098	1	...	2·65	...	...	2	...	...	...	...	...	E	...	...	...	...	...	...
199111	8	...	5022·33	9	8	8	11	9	9	8	8	7	8	8	...	8	8	...		

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.														
	at Medium Altitudes.	Telluric Lines on the Horizon.		6	7c	13a	54	55	56a	57b	61	63	64	65	66	67	68a	69	70		
				28	55	64	28	31	38	42	23	40	42	40	38	26	30	33	27		
	\odot			1-2	1-5	1-8	26	11	12	19	16	14	21	17	28	23	27	25	22		
199123	4	...	5022-03	4	4	3	5	3	3	3	...	3	4	4	...	...	...	...	4
136	7	...	1-70	5	7	7	7	7	7	7	...	7	5	7	5	...	5d	...	7		
152	2	...	1-30	2	1	3	3	...	2	...	...	3	...	...	...	...	...	...	...
165	4	...	0-97	3	3	4	4d	{	3	3	...	4	3b	3	4	{	3	...	4		
176	4	...	0-69	2	3	4														{	3
185	2?	...	0-45	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	3
198	8	...	5020-14	8	7	8	8	8	9	8	...	7	7	7	5	...	5	...	7		
210	3	...	5019-82	3	3	4	...	2	3	...	...	3	...	...	...	...	...	...	...
224	...	4	9-49	...	...	...	4	{	3	3b	4	...	3	4b	2	{	5	...	4
233	3	4	9-26	3	3	3	{													4	{
257	...	5?	8-65	...	...	...	...	...	...	...	E	...	...	{	11b	...	...	...	5
261	9	11	8-55	9	9	9	...	12	11
268	8	...	8-38	6	8	8	{	13	{	8	8	{	11	10	{	8	{	10	11b	{	10
283	1	5	8-00	1															
296	8	...	7-67	8	8	8	8	...	8	8	7	8	...	8	...	...	7	...	9
313	2	5	7-23	...	2	2	4	...	2	...	...	4	...	3	...	...	...	...	5
321	6	...	7-02	5	6	6	4	...	5	5	4	5	...	5	...	...	...	...	6
336	5	...	6-65	5	5	5	4	...	5	4	3	4	...	4	...	...	5	...	5
350	7	...	6-31	7	7	7	6	...	7	6	5	6	...	6	...	...	6	...	6
359	1	5	6-07	...	...	2	...	...	3	2	3	...	...	...	...	...	...	...	5
389	2	4	5-33	2	3	2	2	...	2	...	...	...	...	...	...	...	4	...	3
400	9	...	5-04	10	8	8	11	...	9	10	8	8	...	9	...	...	7	...	10
409	2	...	4-81	...	...	2	3	...	2	...	...	...	...	...	...	...	...	...	...
427	9d	{	4-39	{	10	9	{	8	{	11	...	10	10	9	...	9	...	8	8	...	10
443	4		...																		
451	6	...	3-77	5	6	6	5	...	5	5	4	5	...	6	...	...	...	5	6
467	7	...	3-35	7	7	7	6	...	6	5	5	6	...	7	...	...	...	5	6
481	2	...	3-01	2	...	2	...	...	2	...	...	...	...	...	...	...	...	...	...
492	5	...	2-73	6	5	5	6	...	5	5	4	5	...	5	...	...	...	5	5
501	6	...	2-50	6	6	6	6	...	6	5	4	5	...	5	...	...	...	...	5
516	10	...	2-13	11	9	10	12	...	10	10	9	9	...	9	...	9	10	...	10		
538	3	...	1-57	3	2	2	...	...	2	...	2	3	...	3	...	...	...	...	3
548	2	...	1-33	3	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...
561	6	...	1-00	6	6	7	6	...	8	7	5	7	...	6	...	...	...	...	6
568	2	...	0-82	3	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...
586	4	...	0-37	5	4	4	4	...	4	3	4	4	...	4	...	...	...	...	5
595	5	...	0-16	5	5	5	b	...	4	3	4	4	...	4	...	...	...	...	5
600	1	...	5010-03	...	...	1	...	...	...	...	...	...	...	...	...	...	...	...	...
607	5	...	5009-85	5	5	4	{	4	...	3	3	4	4	...	4	...	...	...	...
614	4	...	9-66	4	4	3													
624	1	...	9-42	...	...	2	...	...	...	...	...	...	...	...	...	...	...	...	...
633	2	...	9-19	2	...	2	3	...	...	...	...	2	...	2	...	...	...	...	3
652	4	...	8-72	5	4	4	...	...	3	2	2	3	...	3	...	...	...	...	4
673	2	...	8-19	2	2	2	...	...	2	...	...	2	...	...	...	...	...	E	3
687	4	...	7-83	5	4	4	4	...	4	3	2	4	...	3	...	...	...	...	4
707	10	...	7-34	11	9	10	12	...	11	10	10	9	...	11	...	9	11	10	10		
724	2	4	6-90	2	2	2	3	...	...	3	2	2	...	...	...	...	...	4	3
738	2?	...	6-57	...	2b	...	...	...	...	...	...	...	...	...	...	...	...	...	...
750	11	...	6-26	11	10	11	12	...	11	10	10	10	...	11	...	9	11	10	11		
199766	10	...	5005-85	10	9	10	11	...	9	9	9	9	...	10	...	B	10	10	10		

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.									
	O at Medium Altitudes.	Telluric Lines on the Horizon.		6	7c	13a	54	56a	57b	61	63	65	68a	69	70	
				28 1.2	55 1.5	64 1.8	28 30	38 13	42 17	28 18	40 16	40 15	30 30	33 25	27 18	
199780	2	...	5005.52	2	...	...	...	...	...	...	...	...	...	...	...
786	4	...	5.35	3	4	4	...	3	3d {	2	3	2	...	4b {	3	
797	3	...	5.09	3	4	3	...	2		2	3	2	...		4	
821	3	5	4.48	3	3	3	...	3	...	...	4	...	...	5	4
831	5	...	4.23	5	6	6	5	5	5	4	5	5	...	5	5	
843	5	...	3.92	5	5	5	5	5	5	4	5	5	...	5	5	
860	1	...	3.50	...	...	2	...	...	...	...	...	...	...	...	...
870	2	...	3.25	2	2	2	...	...	...	...	...	...	...	...	3
883	7	...	2.92	8	7	7	8	8	8	6	7	7	...	8	7	
890	2d	4	2.75	3	3	1d	...	4	...	...	...	...	...	4	4
919	9	...	2.03	10	9	9	11	9	10	8	8	8	...	9	9	
933	3	...	1.67	3	2	3	...	...	3	2	2	...	...	4	3
954	5	...	1.14	6	5	6	5	5	5	4	5	5	...	5	5	
965	3	...	0.88	3	2	2	...	...	...	...	...	...	...	4	...
981	6	...	0.47	6	6	6	8 {	6 {	8 {	6	7	7	...	7	7	
199986	4	...	5000.34	4	5	4		5 {		7	7	7	...	7	4	
200001	2	...	4999.98	2	...	2	...	1	2	...	...	...	...	...	2
014	8	...	9.64	8	8	9	8	9	9	7	8	9	...	8	9	
029	4	...	9.28	4	5	5	4	5	3	3	4	5	...	4	5	
052	2	...	8.69	3	1	2	...	2	...	...	...	...	...	...	3
065	7	...	8.37	7	7	7	6b	7	7	5	6	6	...	6	7	
074	3	5	8.14	3	3	2	...	...	3	...	2	...	...	4	4
084	2	...	7.91	...	...	...	...	...	...	...	...	...	...	...	3
091	2	...	7.73	2	2	2	...	2	...	...	2	2	...	...	2
113	5	...	7.18	5	6	6	5	6	5	5	4	5	...	5	5	
123	6	...	6.92	6	7	7	5b	6	6	5	5	6	...	5	6	
142	3	...	6.45	3	3	3	3b	3	2	2	3	2	...	3	4	
155	1	3	6.13	...	...	2	...	...	3	...	2	...	...	...	3
169	4	...	5.77	3	4	4	...	3b	3	3	3	3	...	4	4	
178	3	...	5.54	3	4	3	...	3	4	3	3	3	...	...	4
193	2	...	5.19	2	2	2	...	2	...	...	...	...	...	...	2
201	2	...	4.97	b	...	...	...	...	...	...	2	2	...	2	...
211	2	...	4.72	2	1	2	...	2	2	...	...	...	...	...	2
231	9	...	4.23	9	9	9	8	9	9	7	8	8	8	8	9	
248	6	...	3.80	6	6	6	5	6	6	5	6	6	5b {	5b {	5	
264	5	...	3.42	6	5	6	4	5	5	4	5	5				
277	2	...	3.09	2	...	...	b	...	...	...	...	...	...	...	...
286	3	...	2.87	3	3	3	4	3	2	2	3	3	...	...	3
301	3	...	2.49	3	3 {	3 {	3b {	3 {	2 {	2 {	3 {	3 {	...	3 {	3 {	
305	3	...	2.40	3												
324	4	...	1.92	3	4	4	...	3	2	2	3	3	...	3	3	
338	5	...	1.56	...	...	...	...	...	...	...	...	...	...	5	...
346	9	...	1.37	9	8	8	12 {	9	8	7	7	8	12 {	10 {	9	
354	9	...	1.17	9	9	8		9	8	8	7	8			9	
371	3	...	0.75	...	...	3	...	...	...	...	...	...	...	...	3
378	5	...	0.58	6	5	6	4b	4	4	4	5	4	...	4	5	
397	3	...	4990.10	2	3	3	...	2	...	...	3	2	...	...	3
412	3	...	4989.72	2	2	2	...	2	3	2	...	2	...	3	2	
425	1	...	9.39	...	...	...	...	...	1	...	...	...	...	...	...
432	5	...	9.22	6	5	5	...	4	5	...	5	6	...	6	5	
200439	8	...	4989.04	8	8	9	9	8	8	8	8	7	9	8	8	

Osc. Freq.	Mean Intensity.		λ	High Sun.						Low Sun.													
	O at Medium Altitudes.	Telluric Lines on the Horizon.		6	7a	7b	7c	12b	13a	54	56a	57b	58a	59b	61	62	63	65	69	70	74a		
				28 1·2	56 1·3	55 14	55 1·4	45 2·6	64 1·8	28 36	38 17	42 15	39 9	35 10	28 22	43 21	40 22	40 12	33 31	27 18	44 19		
201173	5	...	4970·84	6	...	...	5	...	5	} 8	7d	{ 5 6	...	4	} 6	...	{ 4 6	5	} 5b	{ 5 6	...
180	6	...	0·66	6	7	...	6				6	...		6	...	6	...
194	3	...	0·32	...	...	...	3	...	3	...	...	...	...	...	...	...	...	...	...	2	...
205	8	...	4970·06	8	...	...	8	...	8	8	7	7	...	8	6	...	6	8	5b	8	...
223	2	(3?)	4969·61	...	...	...	1	...	2	...	1	...	...	...	...	...	3	...	...	2	...
231	2	(3?)	9·41	1	...	...	2	...	2	...	1	...	2	3	...	2	2	...	...	2	...
254	6	...	8·84	8	...	...	5	...	6	} 8	8	7	...	6	6b	...	6	7	5b	{ 5 4	...
257	6	...	8·76	3b	5	...	6				6	7
267	4	...	8·52	4	...	...	4	...	4	...	5	5	...	5	2	...	4	4	...	4	...
288	8	...	8·00	9	...	...	7	...	8	8	8	7	...	9	7	...	7	8	5b	8	...
303	3	...	7·64	3	...	...	2	...	3	...	...	3	...	3	3	...	3	2	...	3	...
313	1	...	7·39	2	...	...	...	...	1	...	1	...	...	2	2	...	2	2	...	1	...
329	2	...	6·99	...	...	...	2	...	...	...	...	...	...	2	2	...	2	2	...	1	...
340	2	...	6·71	2b	...	...	2	...	2	...	2b	2	...	...	...	...	...	...	...	1	...
361	9	...	6·21	9	...	...	9	...	9	12	10	9	...	9	8	...	8	9	6	9	...
372	5	...	5·94	5	...	...	4	...	4	...	4	5	...	5	4	...	4	4	6	5	...
390	1	...	5·48	...	...	...	...	...	1	...	...	...	...	...	...	...	...	...	...	2	...
399	5	...	5·27	5	...	...	5	...	5	...	4	5	...	6	5	...	4	4	} 5d	{ 4 5	...
409	6	...	5·02	6	...	...	5	...	6	...	b	5	...	6	5	...	5	5		...	...
418	2	(4?)	4·80	2	...	...	2	...	...	...	4	...	...	...	...	...	...	3	...	3	...
440	4	...	4·26	3	...	...	4	...	4	...	...	2	...	4	3	...	4	3	...	4	...
452	2	...	3·96	...	...	...	2	...	...	...	...	...	...	...	...	...	3	...	...	...	...
466	3	...	3·62	3	...	...	2	...	2	...	...	2	...	3	3	...	2	3	...	2	...
486	2	...	3·12	2	...	...	2	...	2	...	...	2	...	...	...	...	2	2	...	2	...
504	7	...	2·68	8	...	...	7	...	6	4b	7	7	...	7	5	...	6	7	6	7	...
513	2	...	2·46	2	...	...	3	...	2	...	...	...	...	...	...	...	...	...	...	3	...
530	5	...	2·03	6	...	...	5	...	5	...	...	3	...	5	3	...	5	5	4	5	...
545	2	...	1·66	2	...	...	2	...	2	...	...	...	...	...	...	...	2	3	...	2	...
565	4	...	1·18	5	...	...	4	...	4	...	...	} 3	...	4	{ 2 b	...	{ 4	4d	...	3	...
573	3	...	0·98	4	...	...	3	...	2	...	...										
591	3	...	0·55	2	...	...	3	...	2	...	...	1	...	4	2	...	3	2	...	2	...
613	2	...	4960·00	...	...	...	3	...	2	...	...	2	...	3	...	...	3	2	...	2	...
626	1	...	4959·68	2	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...
641	4	...	9·30	5	...	...	4	...	4	...	4	4	...	4	3	...	4	4	4	4b	...
656	2	...	8·94	...	...	E	2	E	2	...	...	...	B	...	...	...	...	...	...	2	...
676	3	...	8·44	4	...	3	3	3	3	...	...	3	3	3	...	...	3	3	...	3	...
698	5	...	7·90	...	B	...	...	5	...	...	...	...	...	...	E	...	...	...	...	E	...
705	12	...	7·73	13	10	12	12	12	12	} 14	{ 12 12	10	12	12	13	11	12	11	{ 14	{ 11 11	12		
720	11	...	7·36	12	9	12	12	11	11														
751	3	...	6·60	E	3	2	B	2	B	E	E	3	2	...	B	} 2b	B	B	B	B	3b		
776	3	...	6·00	...	3	3	...	3	...	...	...	3	2	2	...						
788	2	...	5·69	...	2	...	...	3	...	...	...	...	2	...	...	...	...	...	...	...	...
804	2	...	5·30	...	2	2	...	3	...	...	...	3	...	...	...	...	...	...	...	...	...
821	6	...	4·88	...	5	6	...	7	...	...	...	6	5	6	...	} 8d	...	...	...	...	9
830	6	...	4·66	...	5	6	...	7	...	...	...	5	5	6	...						
848	2	...	4·23	...	3	2	...	2	...	...	...	2	2	2	...	...	...	...	...	...	...
865	2	...	3·80	...	3	2	...	2	...	...	...	2	2	...	...	...	...	...	...	...	...
884	7	...	3·34	...	6	7	...	7	...	...	...	7	7	7	...	7	...	...	...	...	6
897	2?	...	3·03	...	...	...	...	...	...	...	...	2	...	...	...	...	...	...	...	...	...
908	6	...	2·76	...	5	6	...	6	...	...	...	6	7	7	...	6	...	...	...	...	6
201924	5	...	4952·37	...	5	5	...	5	...	...	...	5	5	5	...	6	...	...	...	...	5

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.					
	at Medium Altitudes.	Telluric Lines on the Horizon.		7a	7b	12b	57b	58a	59b	62	74a	75
				56	55	45	42	39	35	43	44	43
				1.3	1.4	2.5	13	10	11	20	18	18
201953	3	...	4951.65	3	3	2	2	2	2	...	...	...
964	2	...	1.37	3	...	3	...	2	...	...	...	...
978	1	...	1.03	2	...	...	...	...	...	...	...	...
201988	3	...	0.79	3	2	2	2	2	2	...	3b	...
202010	9	...	4950.26	8	8	9	9	8	8	9	9	...
034	2	...	4949.67	2	2	2	...	...	...	1b	3	...
053	2	...	9.19	3	2	2	2	2	3	...	...	...
070	1	...	8.79	...	...	2	2	2b	...	...	...	...
091	3	...	8.26	3	3	3	3	3	4	1	2	...
099	1	...	8.08	...	2	...	...	...	...	b	...	...
117	4	...	7.63	4	4	4	3	3	5	1	3	...
137	2	...	7.13	2	2	2	...	1	2	...	...	...
162	9	...	6.53	8	8	9	9	9	8	8	9	...
176	4	...	6.18	4	4	5	4	5	4	...	...	...
195	6	...	5.73	6	6	6	6	5	5	...	...	...
203	6	...	5.52	6	6	6	6	5	5	7	7	...
228	2	...	4.92	2	2	1	...	2	2	2b	...	...
240	3	...	4.61	3	3	2	2	2	2	3	3	...
251	3	...	4.34	3	3	2	2	2	2	b	3	...
267	2	...	3.95	2	2	2	2	1	...	3	3	...
287	2	...	3.47	2	...	2	2	2	2	...	...	...
300	1	...	3.15	...	2d	1	...	...	...	...	...	...
321	9	...	2.65	9	8	9	9	9	9	8	8	...
346	3	...	2.04	3	3	3	2	2	2	...	2	...
371	3	...	1.42	3	2	2	2	2	2	...	2	...
390	2	...	0.96	2	...	2	...	...	2	...	...	...
403	3	...	0.64	3	2	2	2	2	2	2	2	...
422	3	...	4940.19	4	3	3	3	3	3	...	...	...
435	8	...	4939.86	8	8	8	9	8	8	8	7	...
453	7	...	9.41	7	7	7	8	7	6	7	7	...
471	8	...	8.98	8	8	8	9	8	8	8	8	...
492	4	...	8.46	...	4	5	...	...	...	...	...	...
497	7	...	8.35	7	8	7	8	8	7	7	8	...
513	3	...	7.95	3	3	2	3	3	...	2	...	...
530	8	...	7.54	7	8	8	8	8	8	8	8	...
542	4	...	7.26	4	4	4	4	4	...	4	6	...
559	2	...	6.84	3	3	3	...	1	...	1	...	...
574	6	...	6.48	6	6	6	5	7	6	6	6	E
595	7	...	5.96	6	7	7	7	7	7	7	7	5
615	2	...	5.48	2	2	2	...	...	...	2b	...	...
629	3	...	5.12	2	2	2	2	2	2	...	3	...
644	2	...	4.76	2	...	2	...	2	2	...	...	...
667	10	...	4.20	10	9	9	10	11	11	11	12	11
673	7	...	4.05	6	7	7	5	6	...	...	...	...
699	8	...	3.42	9	8	7	8	8	9	9	10	9
706	5	...	3.26	4	6	7	4	5	...	...	...	...
731	2	...	2.66	2	2	2	2	2	...	1	...	...
751	6d	...	2.17	7	6	6	6	5b	7	5	7d	6d
765	2	...	1.81	3	2	2	...	...	...	...	4	...
786	2	...	1.32	2	2	2	...	...	...	...	...	...
202799	5d	...	4931.00	5	4	5	5	5	4	4	4d	6b

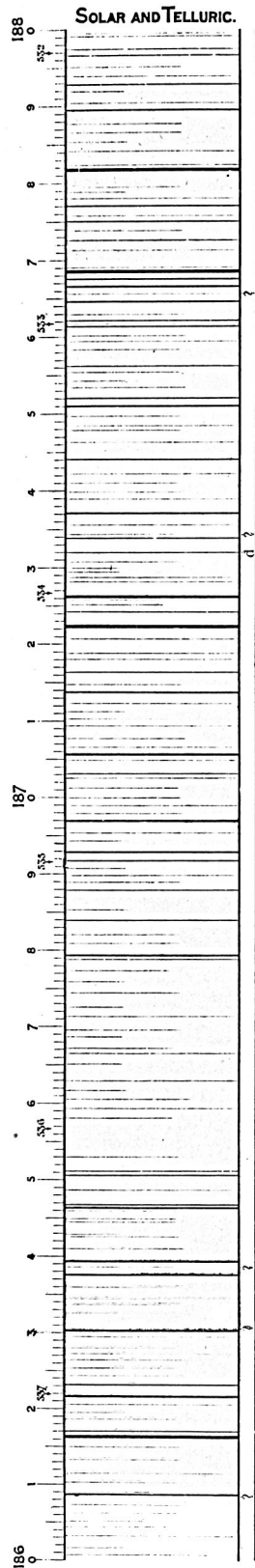
Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.						
	☉ at Medium Altitudes.	Telluric Lines on the Horizon.		7a	7b	12b	57b	58a	59b	60	62	74a	75
				56 1·3	55 1·4	43 2·5	42 11	39 10	35 11	26 12	43 18	44 17	43 17
202823	8	...	4930·42	8	8	8	9	9	8	...	9	8	7
850	2	...	4929·76	2	2	2	2	1	2	...	3	3	...
874	2	...	9·18	2	1	2	2	...	2	...	3	3	...
882	1	...	8·98	2	...	...	...	...	...	...	...	...	...
904	5	...	8·43	5	5	6	6	5	5	...	5	5	5
920	8	...	8·04	6	8	8	8	7	7	...	7	6	} 5b
942	7	...	7·52	6	7	7	7	6	7	...	7	6	
955	5 ?	...	7·21	...	...	...	...	...	...	...	...	5	
966	3	...	6·93	3	3	3	2	2	3	...	3	4	...
202995	3	...	6·24	3	3	3	2	2	3	...	3	4	...
203016	6	...	5·72	7	6	6	7	7	6	...	6	} 5d	6
027	5	...	5·45	5	5	4	5	5	4	...	4		
041	3	...	5·11	...	3	...	...	...	...	...	...	...	...
050	9	...	4·90	9	8	8	9	9	8	...	8	8	7
071	3	...	4·38	3	3	3	...	1	...	...	...	...	...
085	10	...	4·04	9	9	10	10	11	10	...	9	10	10
100	2	...	3·68	3	...	...	2	...	...	...	...	...	...
118	3	...	3·25	4	3	3	2	2	4	...	3	4	...
132	3	...	2·91	3	3	3	2	2	...	...	3	...	...
141	1	...	2·70	...	1	...	...	...	...	...	...	...	...
156	8	...	2·33	8	7	7	8	10	8	...	7	7	8
161	4	...	2·21	...	4	4	...	...	...	...	...	...	...
175	6	...	1·87	6	5	6	5	5	5	...	5	5	5
188	2	...	1·55	2	2	3	...	...	...	B	...	...	...
208	5	...	1·07	5	5	4	4	5	4	4	4	4	...
220	4 ?	...	0·77	...	4	...	...	...	...	...	...	...	...
226	12	...	0·63	11	11	13	11	12	12	11	12	12	12
234	4	...	4920·44	4	4	...	...	...	...	...	...	...	...
254	4	...	4919·96	4	3	4	4	3	4	3	4	2	...
269	2	...	9·58	2	2	...	...	...	...	...	...	...	...
288	11	...	9·12	10	10	12	10	11	11	10	11	11	11
299	5	...	8·87	5	5	5	4	5	4	4	5	...	...
315	7	...	8·48	7	7	7	6	6	5	6	7	6	6
329	6	...	8·13	6	6	7	5	6	5	5	7	6	6
340	3 ?	...	7·87	3	...	...	...	...	...	...	...	...	...
361	8	...	7·37	7	8	8	7	8	8	8	8	7	7
378	2	...	6·95	...	...	...	2	...	...	...	3	...	...
392	3	...	6·62	3	3	3	2	2	2	1	2	3	3
400	2	...	6·41	2	2	2	...	...	...	...	...	...	...
421	3	...	5·92	3	3	3	2	2	2	2	2	3	2
443	3	...	5·38	3	3	2	2	2	2	2	2	2	1b
465	1	...	4·84	1	...	...	...	...	...	...	...	2	...
475	2	...	4·61	3	3	2	2	2	...	2	2	2	...
495	7	...	4·13	7	6	8	7	7	6	7	6	6	4b
509	7	...	3·78	7	6	7	7	7	6	7	6	5	} 4d
528	3	...	3·34	4	3	3	...	3	3	3	3	4	
537	...	2	3·10	...	...	...	2	3	...	...	...	2	
552	3	...	2·74	4	3	3	3	3	3	2	3	2	
573	6	...	2·25	6	5	6	5	6	5	6	5	6	}
582	6	...	2·03	6	5	6	5	6	5	6	5	6	
203595	4	...	4911·72	4	4	5	3	5	4	2	4	...	...

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.							
	☉ at Medium Altitudes.	Telluric Lines on the Horizon.		7a	7b	12b	57b	58a	59a	59b	60	62	74a	75
				56	55	45	42	39	35	35	26	43	44	43
				1·3	1·4	2·4	10	12	21	12	13	16	15	15
203610	6	...	4911·34	7	6	7	6	7	...	7	6	6	6	4
638	7	...	0·68	7	6	7	6	8	...	6	6	7	7	7
648	7	...	0·44	7	6	7	6	8	...	6	6	7	7	7
660	8	...	4910·15	8	7	8	6	8	...	8	8	8	7	7
671	1	...	4909·88	2	...	...	...	...	...	...	1	...	...	...
685	8	...	9·54	8	7	8	7	7	...	8	7	8	7	7
700	1	...	9·17	2	1	...	2	...	...	...	...	...	...	...
714	2	...	8·84	2	...	3	2	2	...	...	1d	3	2	1
724	2	...	8·59	...	3	3	...	...	...	2	...	2	...	...
742	5	...	8·16	5	6	5	5	5	...	6	5	6	6	6
755	7	...	7·85	6	7	7	7	7	...	7	7	7	7	8b
782	2	...	7·20	3	2	3	...	3	...	2	1	2	3	...
796	3	...	6·86	3	3	3	3	3	...	3b	2	2	3	3
824	3	...	6·20	2	3	3	2	2	...	2	2	2	3	2
836	2	...	5·91	2	2	2	...	...	...	...	...	...	...	...
863	5	...	5·25	5	5	6	6	7	...	5	5	6	4	4
876	2?	...	4·94	...	...	2	...	...	...	...	...	...	...	...
891	8	...	4·57	8	8	8	9	9	...	8	9	8	8	8b
912	2	...	4·07	2	2	1	...	...	...	...	...	...	2	...
928	2?	...	3·70	2	...	...	...	...	B	...	...	...	...	...
939	10	...	3·42	9	9	10	10	12	10	10	10	9	10	10
977	3	4?	2·52	3	3d	3	3	3b	4b	4d	2b	3	4b	4b
203990	3	4?	2·21	...	3	3	3	3b	4b	4d	2b	3	4b	3
204010	2	...	1·72	2	2	2	2	...	...	...	...	1	...	2
033	4	...	1·18	3b	4	4	4d	3	4	4	4b	4b	4b	3d
043	4	...	0·94	...	4	4	...	...	...	...	4b	4b	4b	...
069	7	...	0·31	6	7	8	7	7	8b	7	7	7	5	7
080	7	...	4900·05	6	7	8	7	7	...	7	7	7	6	...
096	3	...	4899·65	2	3	3	...	...	...	...	...	2	2	...
106	2?	...	9·41	...	...	...	...	...	...	...	...	2	...	...
126	2	...	8·93	2	2	2	...	...	3	2	1	1	3	2
147	2	...	8·44	2	2	2	2	...	b	2	...	2	3	...
180	3	...	7·64	3	...	3	2d	...	3	2	1	2	...	2
192	2	...	7·35	3	3	...	...	...	...	...	...	...	3	...
217	4	...	6·75	...	...	4	...	...	...	...	...	...	...	...
223	6	...	6·61	6	7	6	5	5	6	6	5	5	6	4b
245	1	...	6·07	2	...	...	...	...	...	...	...	...	...	...
253	2	...	5·88	2	3	2	...	...	...	2	...	2	3	...
273	2	...	5·40	3	1	3	2	...	...	2	...	...	3	...
305	3	...	4·65	3	3	3	3	...	...	3	3	3	4	...
331	4	...	4·01	4	4	4	3	4	...	3	3	3	4	...
351	1	...	3·53	1	2	...	...	...	...	...	...	...	...	...
370	7	...	3·08	7	7	8	7	7	7	7	6	6	7	4
392	2	...	2·55	2	2	1	...	...	...	...	...	...	...	...
408	1	...	2·18	...	1	2	...	...	...	...	...	...	...	...
429	11	...	1·68	11	10	12	12	12	11	11	11	11	12	11
...	2	...	...	...	...	...	...	...	...	...	2	...	...	...
463	10	...	0·87	10	9	11	11	11	10	11	10	10	11	11
485	2	...	4890·34	1	2	3	E	...	...	...	...	2	2	...
505	3	...	4889·86	2	2	3	...	3b	...	2	2	3	3	3
528	7	...	9·31	...	...	7	...	...	...	...	...	...	...	...
204532	7	...	4889·22	8	8d	7	...	8	9	9	9	8	8	10

Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.						
	☉ at Medium Altitudes.	Telluric Lines on the Horizon.		7a	7b	12b	58a	59a	59b	60	62	74a	75
				56 1·3	55 1·3	45 2·3	39 13	35 20	35 13	26 14	43 13	44 14	43 13
204550	8	...	4888·79	7	7	8	8	8	8	8	7	8	9
570	2	...	8·31	2	2	2	...	...	...	1	2	3	...
589	2	...	7·86	2	2	2	...	...	...	...	2	...	2
608	7	...	7·40	6	7	7	} 7b	} 7b	{ 7	7	6	6	} 7b
617	7	...	7·19	6	7	7				7	6	7	
633	3	...	6·81	3	3	2	...	...	...	3	...	...	...
646	7	...	6·49	6	8	8	7	7	8	7	7	7	7
660	3	...	6·15	4	3	3	...	...	...	4	} 4d	...	...
668	4	...	5·96	5	4	4	5	5	3	4		{ 4	...
684	6	...	5·58	6	7	7	6	6	6	6	6	6	5
701	6	...	5·18	6	6	7	5	5	6	6	6	6	6
707	3	...	5·03	3	...	...	...	...	...	...	...	...	...
719	5	...	4·75	4	5	5	...	4	4	...	4	5	5
745	2	...	4·12	3	3	2	...	1	...	...	2	...	...
761	7	...	3·75	7	7	7	7	7	8	7	7	8	7
773	2	...	3·47	3	2	2	...	...	...	2	1	...	...
796	3	...	2·90	3	3	2	...	...	3	...	2	4	...
810	2?	...	2·57	...	...	2	...	...	...	...	...	...	...
821	8	...	2·30	7	7	8	7	7	6	7	7	8	6
840	7	...	1·85	7	6	7	} 8d	8	7b	{ 7	7	} 8	7
847	7	...	1·70	7	6	7							
875	3	...	1·02	3	3	3	3	...	3	1b	2	3	...
892	3	...	0·61	3	3	3	3	...	3	...	2	...	...
912	2	...	4880·14	2	2	3	...	...	...	2	1	3	...
933	2	...	4879·65	2	...	2	...	...	...	...	1	3	...
951	2	...	9·21	2	2	2	...	...	...	...	...	...	...
968	2	...	8·81	2	2	2	...	...	...	2	1	3	...
204989	11	...	8·30	11	10	10	11	11	10	11	10	11	11
205010	3	...	7·80	3	...	3	...	...	...	...	...	...	...
014	4	...	7·71	4	4	4	4	4	4	3	3	4	3
034	2	...	7·24	2	...	2	...	...	...	...	2	3	...
046	2	...	6·94	2	2	2	...	...	...	...	...	...	...
062	4	...	6·56	} 6	7	{ 4	} 5	6	6	5d	7	7	6b
065	6	...	6·49										
076	2?	...	6·23	2	...	...	...	...	...	...	...	...	...
085	6	...	6·02	6	6	5	5	6	6	5	6	5	5
106	5	...	5·53	6	5	6	5	6	5	5	5	5	5
126	4	...	5·05	4	4	5	} 4b	5d	{ 4	} 5	{ 4	4	} 4d
135	4	...	4·85	4	4	5							
155	4	...	4·36	4	4	4	...	4	4	...	3	...	...
169	5	...	4·03	5	5	5	3	5	5	5	4	4	4b
178	4	...	3·81	3	4	4	...	...	...	...	...	...	...
195	7	...	3·41	6	6	7	8	7	7	...	6	7	5b
201	5	...	3·26	5	4	5	...	...	...	...	4	...	...
214	3	...	2·95	3	3	2	...	...	...	} 4b	{ 2	3	...
226	2	...	2·67	2	2	2	...	...	...	
247	9	...	2·19	8	9	8	11	10	10	11	9	11	} 10d
255	6	...	1·98	6	5	6	5	...	
267	2?	...	1·70	...	2
279	11	...	1·41	9	10	10	11	10	11	11	10	11	11
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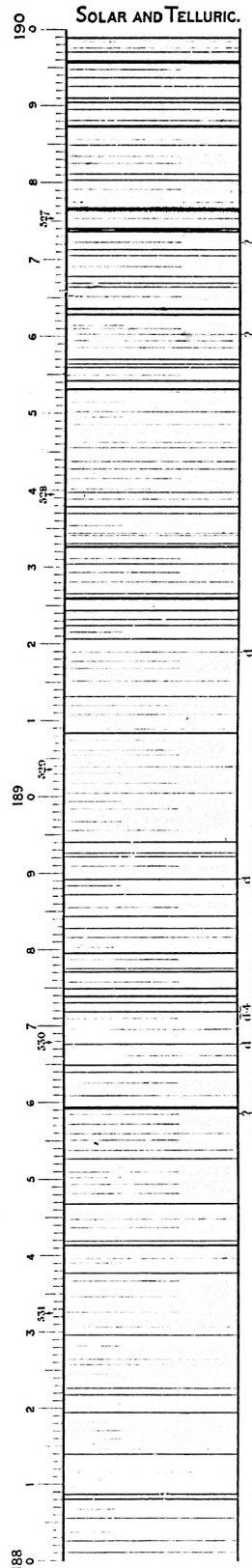
Osc. Freq.	Mean Intensity.		λ	High Sun.			Low Sun.					
	Ost Medium Altitudes.	Telluric Lines on the Horizon.		7a	7b	12b	58a	59a	59b	62	74a	75
				56 1·3	55 1·3	45 2·2	39 14	35 17	35 14	43 11	44 13	43 12
205315	2	...	4870·56	...	2	2	4	...	...	...	...	...
328	6	...	0·26	6	6	6	5	6	6	5	6	5
333	4?	...	4870·15	...	...	...	b	...	...	4	...	...
358	5	...	4869·55	5	5	5	5	5	4	5	5	5
383	3	...	8·95	3	3	3	...	...	...	3	3	2
400	5	...	8·55	5	5	5	} 6	7	5	{ 5	{ 5	6
406	5	...	8·41	5	5	5						
425	6	...	7·95	7	6	6	6	7	5	7	6	6
439	3	...	7·63	3	3	...	...	...	...	1	4	...
456	2	...	7·23	...	2	3	...	...	...	...	...	...
459	1	...	7·16	} 2b	{ ...	2	...	...	...	...	...	...
470	2	...	6·88			2	...	...	1	...	1	
489	8	...	6·44	9	8	8	8	8	7	8	8	8
497	2?	...	6·24	2	...	...	...	...	...	...	...	...
515	6	...	5·82	5	6	6	3	6	6	6	5	5
535	3	...	5·35	1	2	3	...	...	...	2	4	...
550	5	...	4·99	5	5	...	...	5	5	4	5	4
571	6	...	4·50	6	7	7	5b	6	5	5	7	5
586	3	...	4·15	4	4	3	...	...	...	3	...	...
599	7	...	3·84	7	7	7	5	6	6	5	7	5
618	2	...	3·40	2	3	...	...	...	...	2	...	...
628	3	...	3·15	...	3	3	...	...	...	...	...	...
645	5	...	2·74	5	5	4	...	4	4	4	4	4
661	2	...	2·37	2	2	...	...	...	...	...	...	...
675	4	...	2·05	4	4	3	...	...	...	3	4	3
687	} 13	{ ...	1·76	} 12	12	14	14	14	14	11	14	14
701			1·42									
205716			4861·08									
				E	B	B	E	E	B	B	B	B

SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



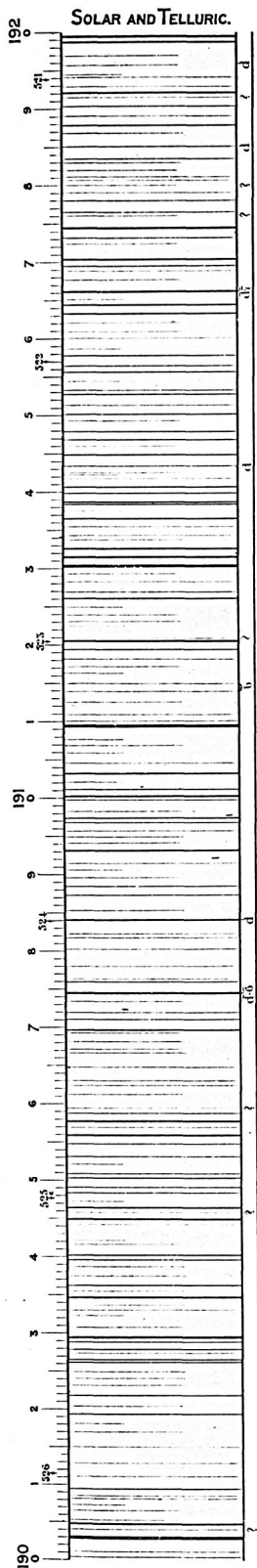
TELLURIC.

SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



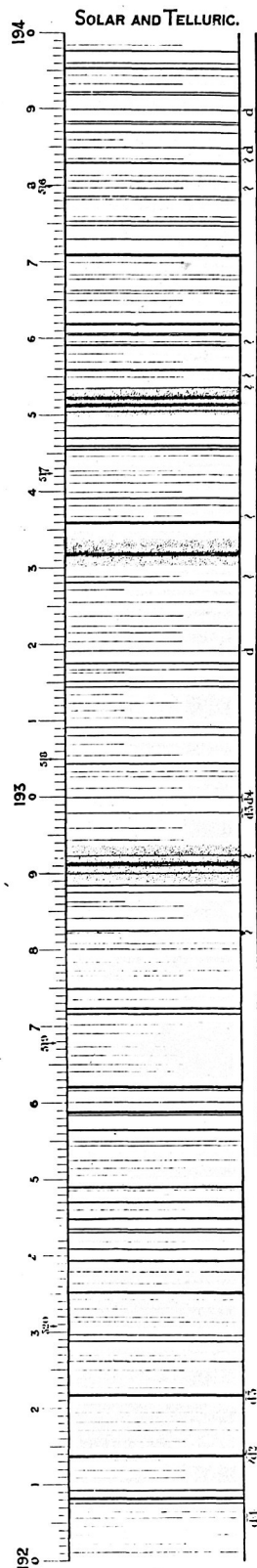
TELLURIC.

SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



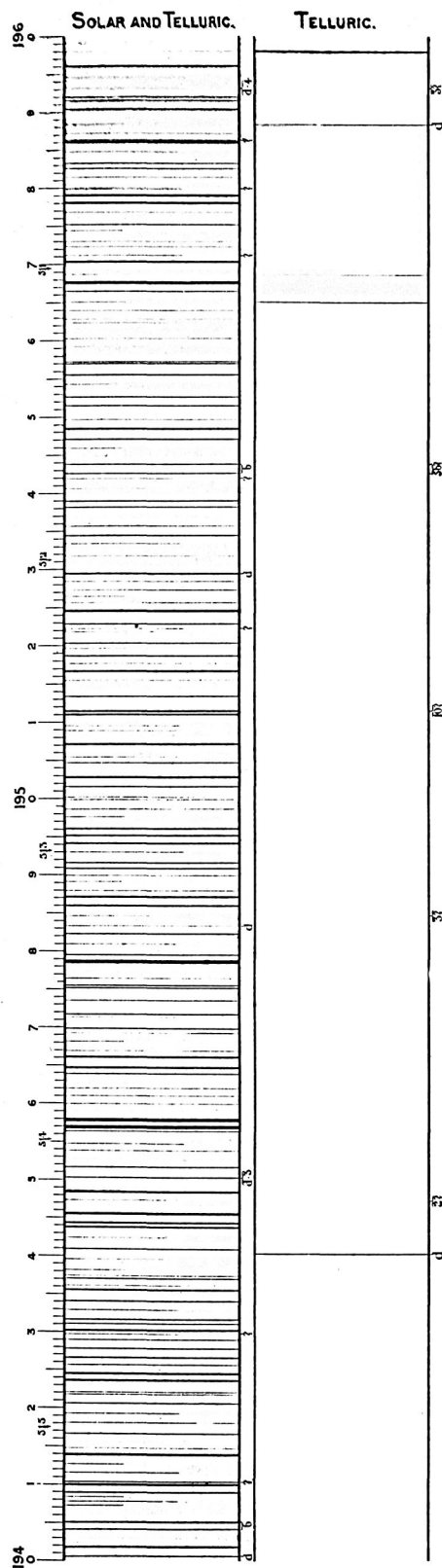
TELLURIC.

SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.

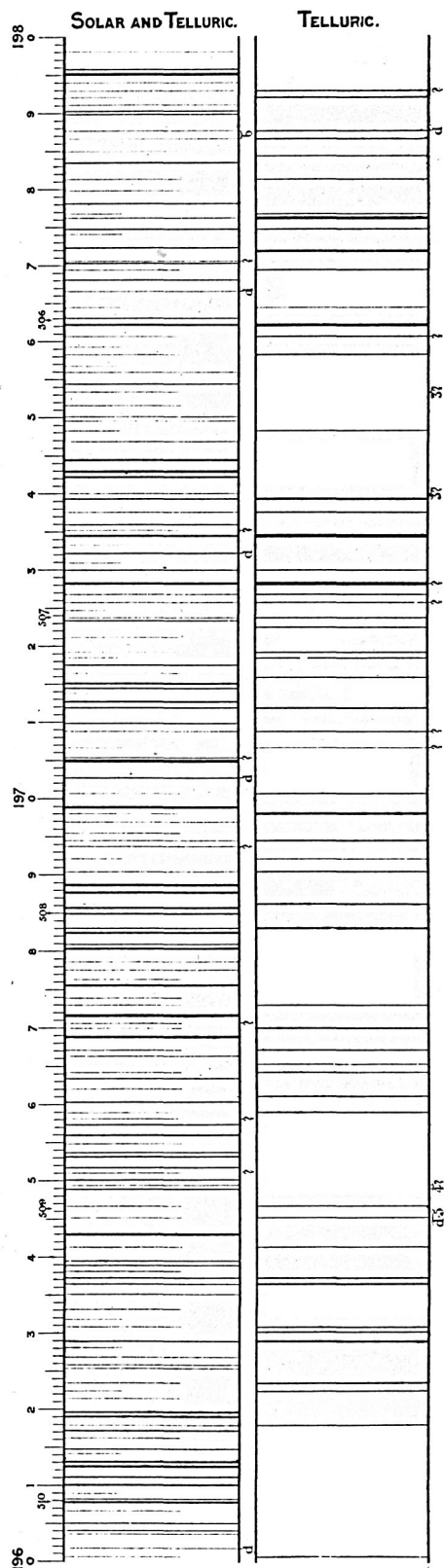


TELLURIC.

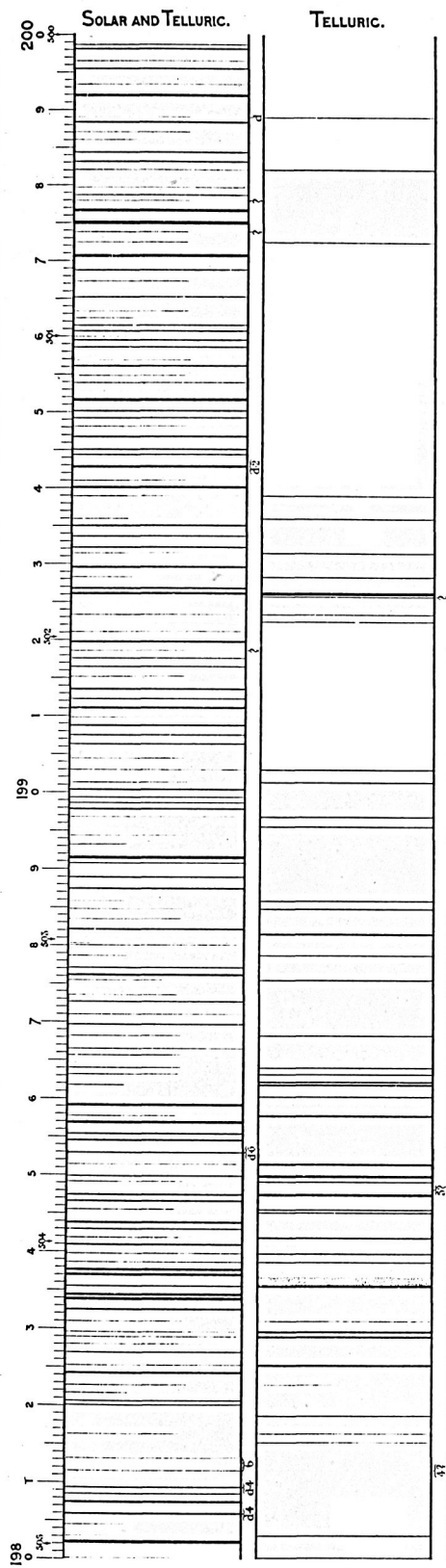
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



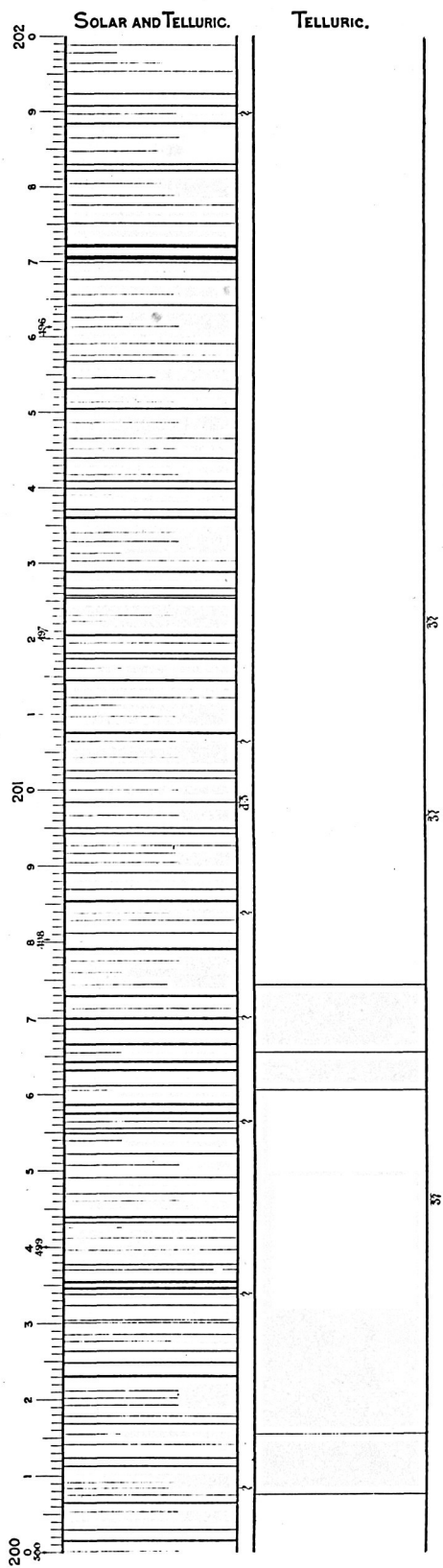
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



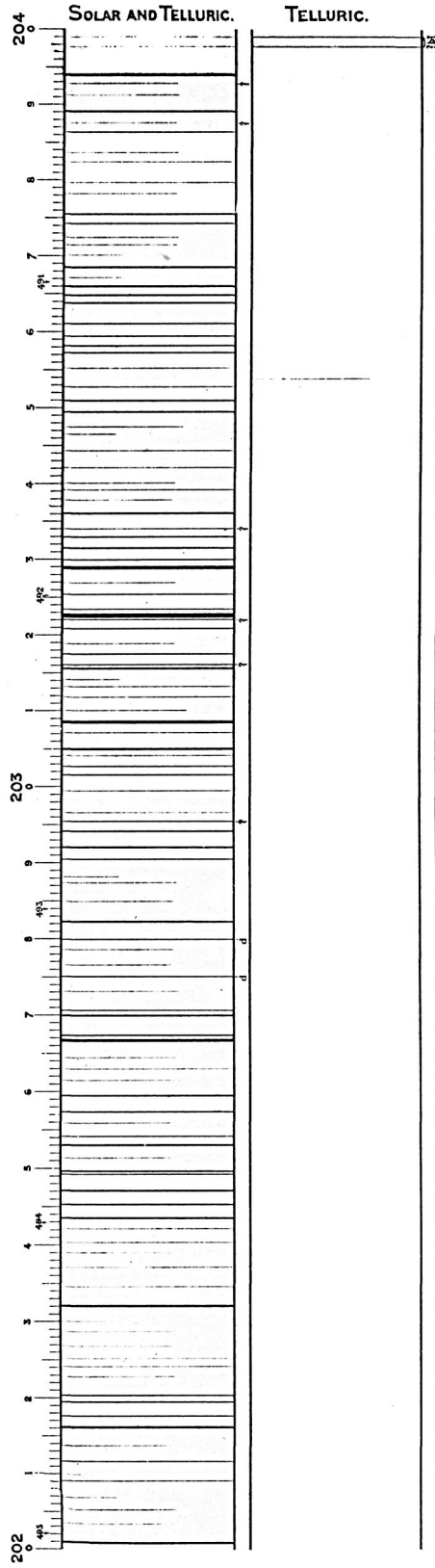
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



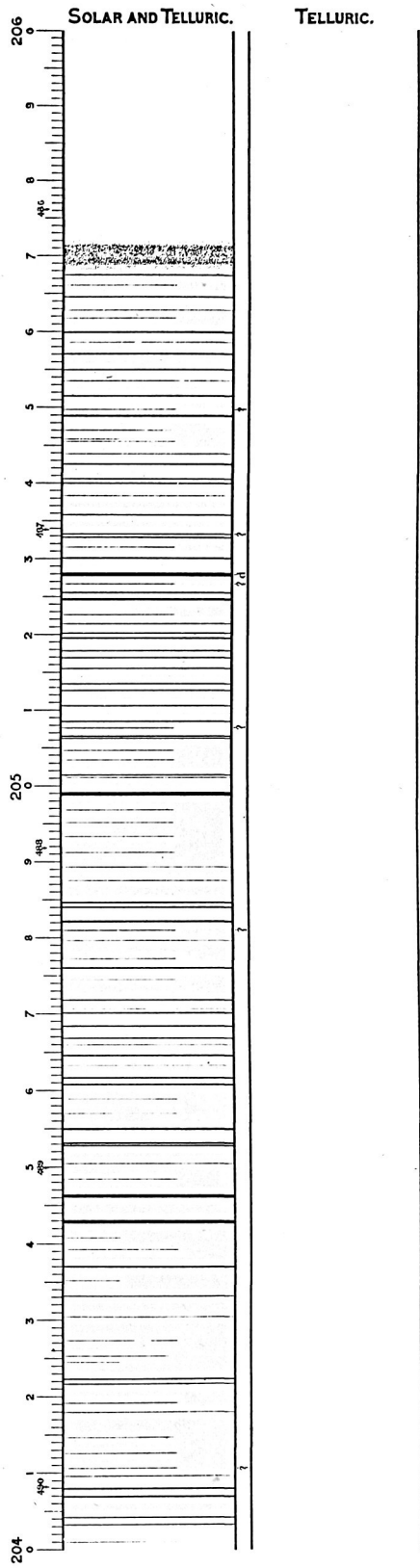
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



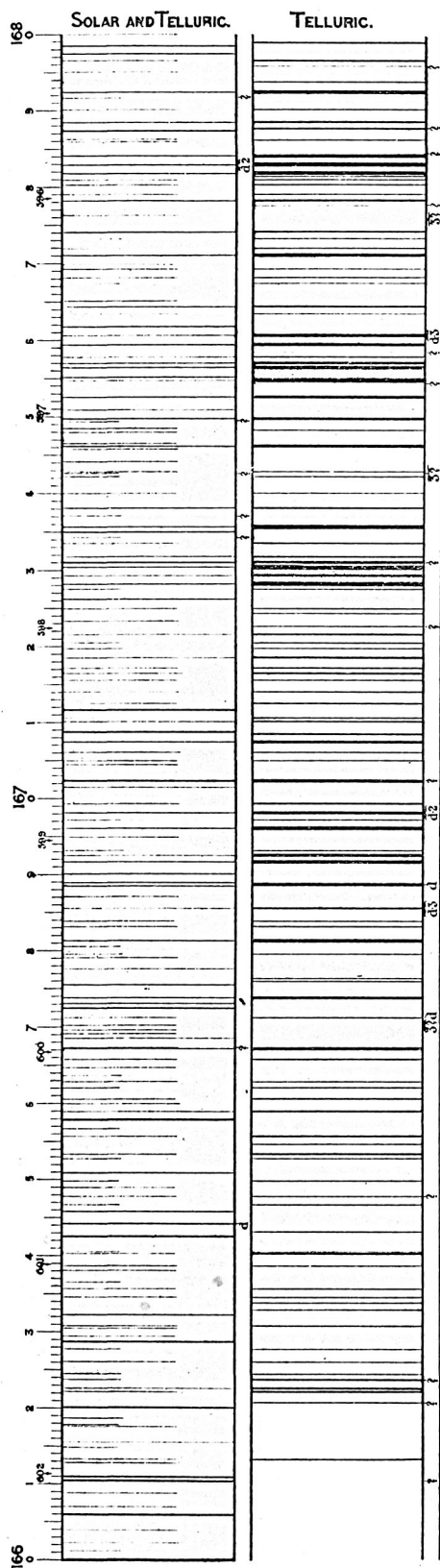
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



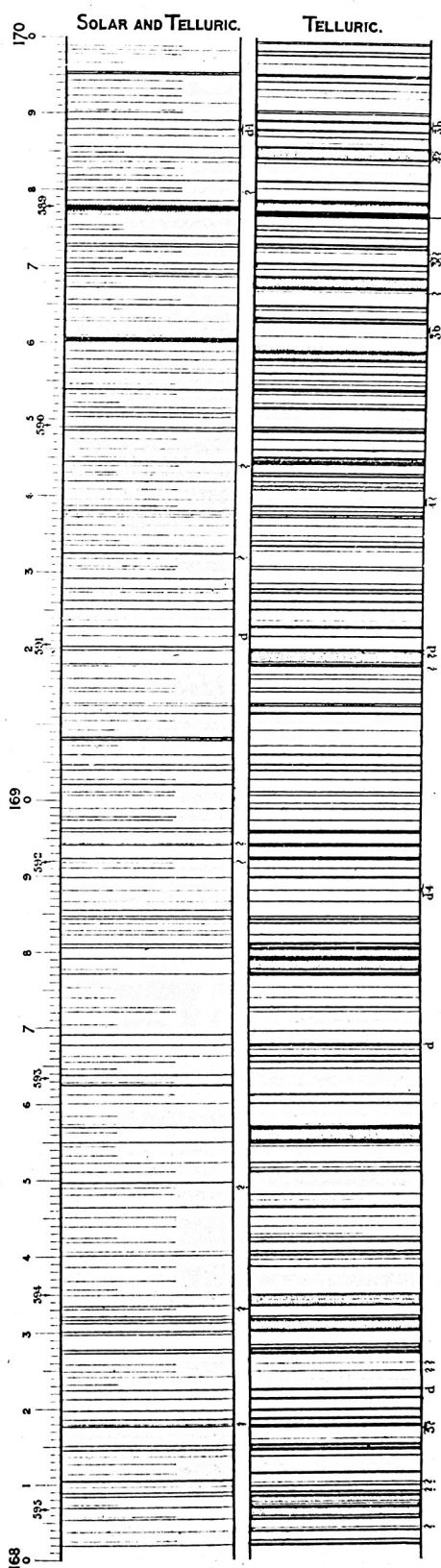
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



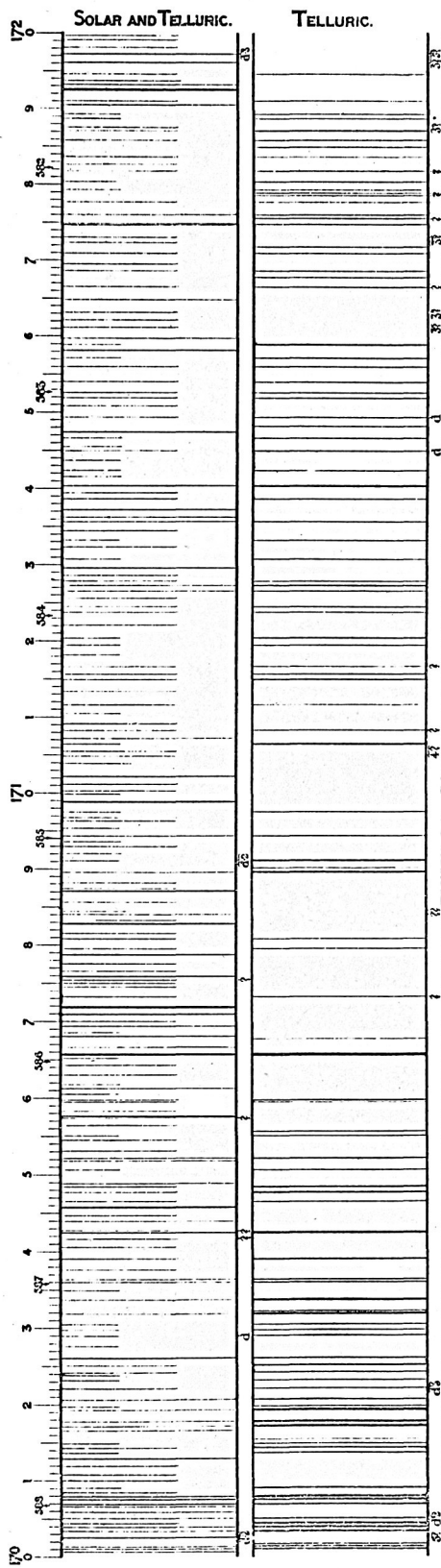
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



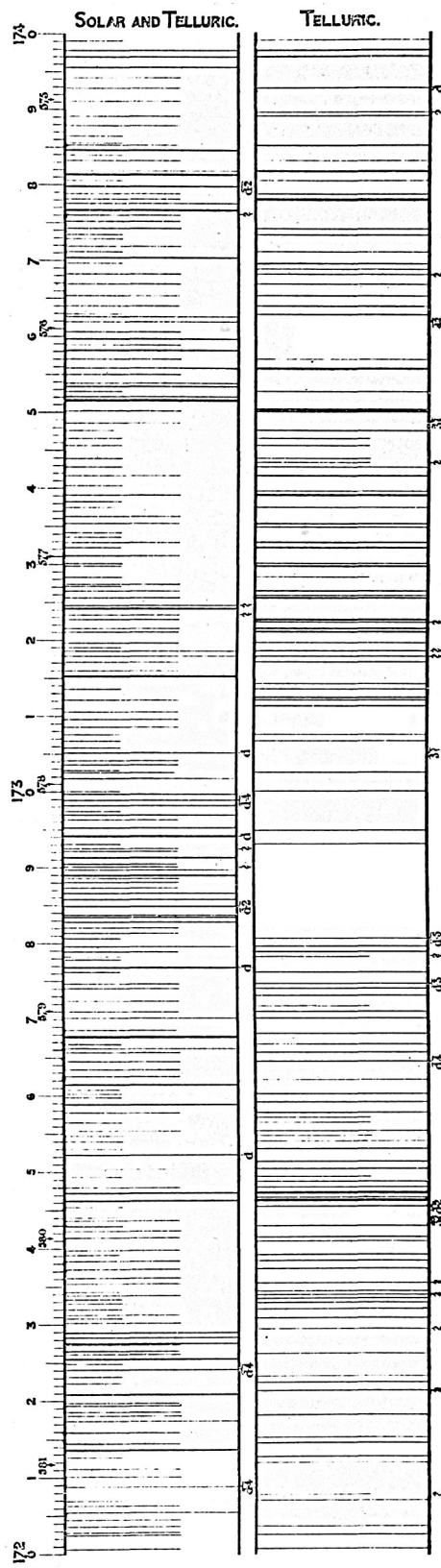
L. BECKER, DEL.

A. FITCHIE & SON, EDIN.

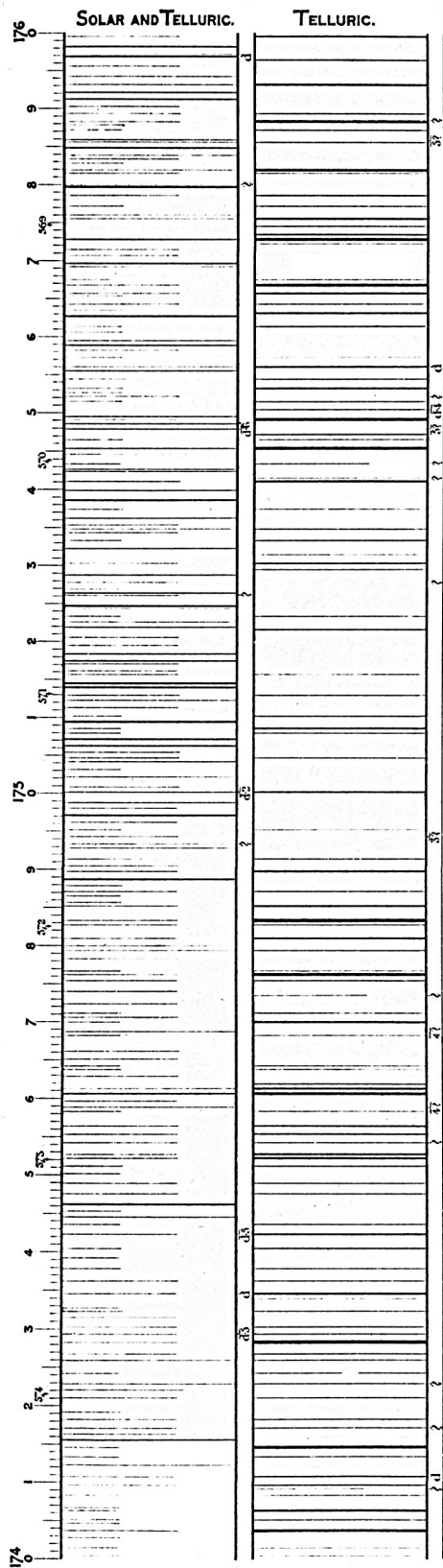
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



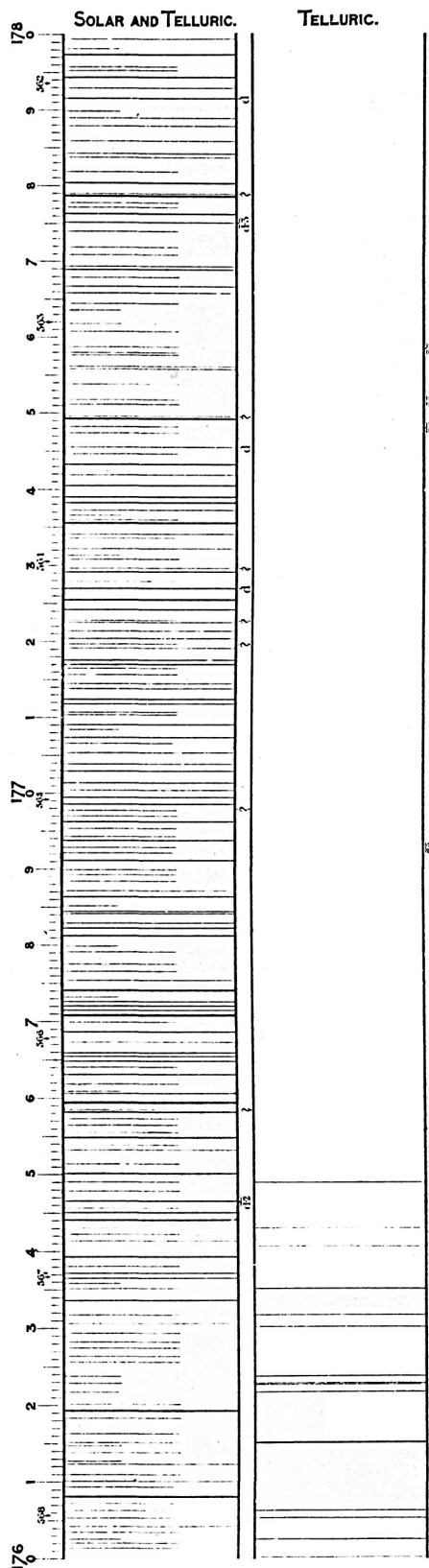
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



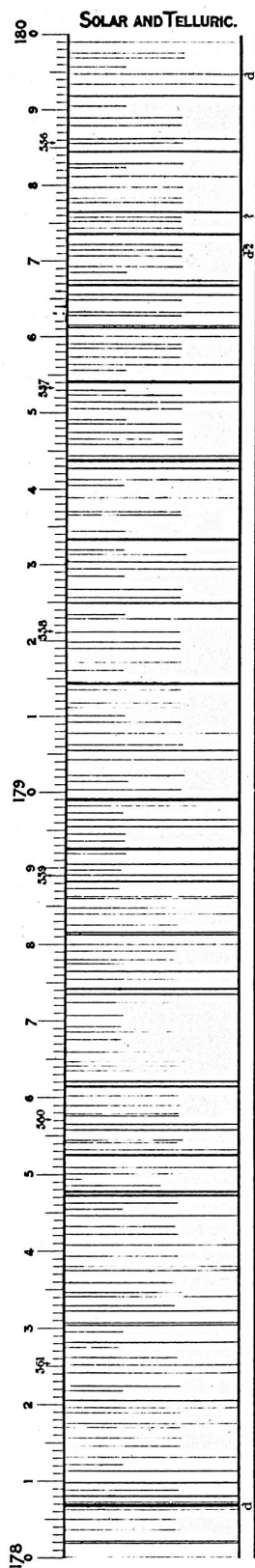
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



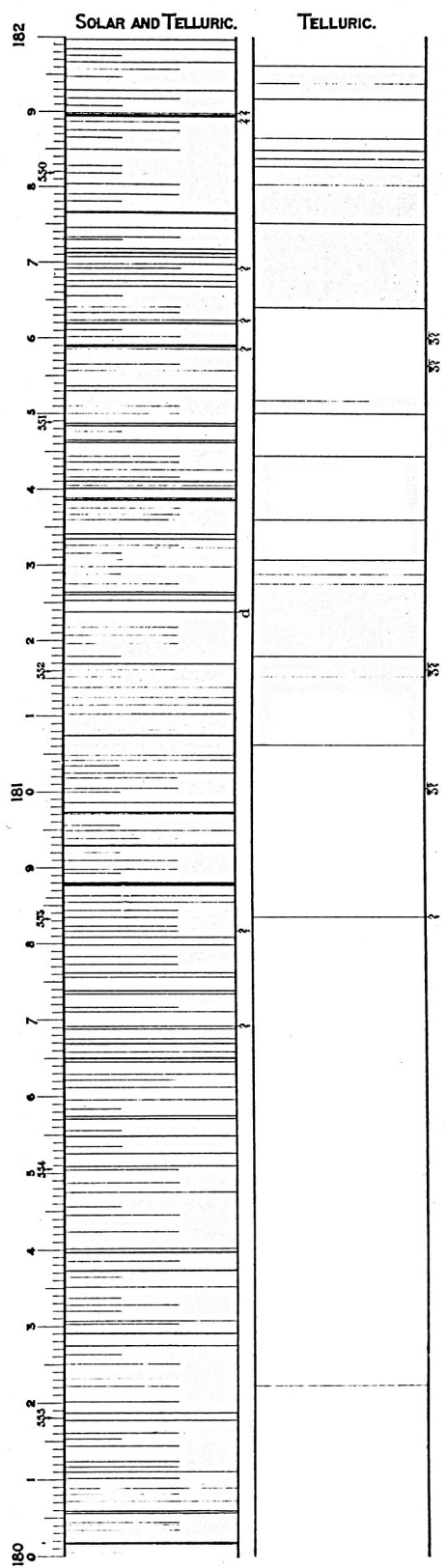
SPECTRA OF THE SUN AS OBSERVED AT MEDIUM ALTITUDES, AND OF PURELY TELLURIC LINES ON THE HORIZON.



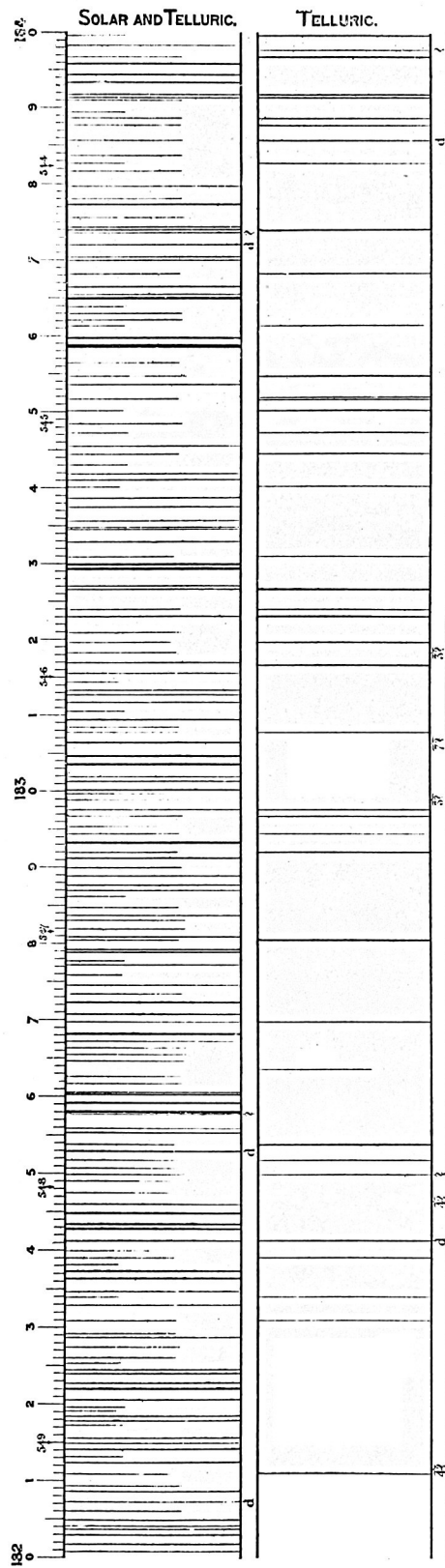
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