II. *Computation of the Lengths of the Waves of Light corresponding to the Lines in the Dispersion Spectrum measured by* KIRCHHOFF. *By* GEORGE BIDDELL AIRY, *Astronomer Royal.*

Received March 2,—Read March 21, 1867.

THE greatest and most valuable system of measures which we possess of the lines in the Dispersion Spectrum, produced by the emanation of light from the Sun, by transmission through the Atmosphere, and by the combustion of Metals, is that published by Professor KIRCHHOFF in the Memoirs of the Berlin Academy for 1861 and 1862. This noble series includes about 1600 lines, taken in uninterrupted succession through the spectrum, beginning a little before FRAUNHOFER'S line A and ending a little after G. The same apparatus was used throughout, and in the same manner; and the system followed in the whole process was so nearly constant that we may speak of it generally as one consistent series of measures. This work has been made known to English readers by an accurate translation published by Professor ROSCOE.

The measures thus exhibited depend upon the form of the apparatus, the refractive and dispersive powers of the glass, the nature of the scale employed, and the value of its unit of measure. They are not therefore available for physical research, until they are cleared of the effects of these circumstances of experiment. There can be no hope of our arriving at, or even commencing, any mechanical theory on the formation of the spectral lines, until we have obtained the one natural measure of each, namely the length of the Wave of Light corresponding to each.

I have therefore undertaken the labour of computing from each spectral measure the corresponding length of the Wave of Light; and I trust that the result may not be unacceptable to the Royal Society.

I will now describe the method which I have used.

When I commenced this work, I could not learn (although I made inquiries) that any careful measures had been made of the Diffraction Spectrum since the original measures of FRAUNHOFER. I therefore determined to make FRAUNHOFER'S measures of the principal lines the basis of my computations. From GILBERT'S 'Annalen der Physik und der Physikalischen Chemie,' XIV. Band, Leipzig 1823, page 559, I took the following values of the Length of a Wave, omitting the value for B, which apparently was not determined in the same series of measures with the others:—

					in.
Fr_C =	Length of wave for	C,	in Paris inch,		= 0·00002422,
Fr_D =	,,	,, D	,,		= 0·00002175,
Fr_E =	,,	,, E	,,		= 0·00001945,

in.

$\mathrm{Fr_F}$ = Length of wave for F, in Paris inch, = 0·00001794,

$\mathrm{Fr_G}$ = „ „ G „ = 0·00001587.

The lines are not designated, in KIRCHHOFF's tables of measures, by the received letters; the letters, however, as well as KIRCHHOFF's scale-numbers, are attached to his engravings of the spectrum, which appear to be carefully drawn. From these I took the following numbers:—

$\mathrm{K_C}$ = KIRCHHOFF's scale-measure for C = 694·1,

$\mathrm{K_D}$ = „ „ D = 1004·8,

$\mathrm{K_E}$ = „ „ E = 1527·7,

$\mathrm{K_F}$ = „ „ F = 2080·0,

$\mathrm{K_G}$ = „ „ G = 2854·3.

The next step was to construct a formula, which, when applied to KIRCHHOFF's values for C, D, E, F, G, should produce FRAUNHOFER's values for the same lines. I know no physical reason for adopting one formula in preference to another; and I therefore adopted the simplest algebraical formula. Putting $k_l = \frac{1}{1000}\mathrm{K}_l$, and $f_l = 100000000 \times \mathrm{Fr}_l$, I assumed

$$f_l = a + b \cdot k_l + c(k_l)^2 + d(k_l)^3 + e(k_l)^4,$$

and formed five equations numerically by putting successively on the left side f_C, f_D, &c., and on the right side k_C, k_D, &c., giving to those symbols the numerical values derived from the small tables above. Solving the equations, I found

$$\begin{aligned} f_l = {} & 3596{\cdot}688 \\ & -2582{\cdot}018 \times k_l \\ & +1587{\cdot}046 \times (k_l)^2 \\ & - 476{\cdot}676 \times (k_l)^3 \\ & + 52{\cdot}959 \times (k_l)^4. \end{aligned}$$

From this formula, values of f_l and Fr_l were tabulated for every 0·01 of k_l, or for every 10·0 of KIRCHHOFF's scale. It will be sufficient to give here every tenth number.

Kirchhoff.	Fraunhofer. in. 0·0000	Kirchhoff.	Fraunhofer. in. 0·0000	Kirchhoff.	Fraunhofer. in. 0·0000
0	35967	1000	21780	2000	18148
100	33539	1100	21199	2100	17888
200	31400	1200	20697	2200	17625
300	29525	1300	20262	2300	17358
400	27887	1400	19879	2400	17087
500	26462	1500	19538	2500	16814
600	25227	1600	19229	2600	16539
700	24162	1700	18942	2700	16269
800	23244	1800	18671	2800	16007
900	22456	1900	18407	2900	15760
				3000	15535

Between the numbers computed for every 10·0 of KIRCHHOFF's scale, the numbers were interpolated for every one of KIRCHHOFF's line-measures by simple proportion of

first differences. Thus I had a complete table of the values of the length of the wave of light expressed in Paris inches for every one of KIRCHHOFF'S lines. Each number was then multiplied by 27·0700, and thus I had a complete table of the values of the length of the wave of light expressed in millimetres for every one of KIRCHHOFF'S lines. In this state I very carefully revised all the final numbers. This is the table of results now offered to the Royal Society. It did not appear necessary to publish a long series of results expressed by a measure which is now so nearly obsolete as the Paris inch; although, as will appear below, the possession of those numbers in my own hands has proved to be of considerable utility.

From the description which I have given of the process by which I have computed the wave-lengths from KIRCHHOFF'S measures, it will be perceived that the results are not rigorously accurate, unless the same system (whatever it may be) has been rigorously followed by KIRCHHOFF through the whole of his measures. Now KIRCHHOFF has distinctly stated that he did not in every case adapt his prisms carefully to the angle of minimum deviation. So far as I could learn by communication (through Professor ROSCOE) with M. KIRCHHOFF, no memorandum was preserved on the possible amount of the error thus introduced. I was confident, however, as well from the character of Professor KIRCHHOFF as from the absence of any apparent *saltus* in the measures, that the error must be small, perhaps imperceptible. It was a matter of great satisfaction to me therefore, after the completion of my work, to be referred to two late series of direct measures of wave-length for numerous lines. One is that by ÅNGSTRÖM, published in POGGENDORFF'S 'Annalen der Physik und Chemie,' CXXIII. Band, p. 498, in which I have found 51 lines apparently identifiable with lines measured by KIRCHHOFF. The measures in these series are expressed by the Paris inch; and the possession of my own calculations in terms of the Paris inch, to which I have alluded above, greatly facilitated the comparison of ÅNGSTRÖM'S measures with my calculations. The other is that by DITSCHEINER, published in the 'Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Classe der Kaiserlichen (Wiener) Academie der Wissenschaften,' L. Band, II. Abtheilung, 1864, page 340: it contains direct measures of the wave-length, expressed in millimetres, for 107 of the lines measured by KIRCHHOFF. The comparison of these direct measures with my computed values of the wave-length exhibited small discrepancies, of which the greater part arises from discordances between the values for the fundamental lines found by FRAUNHOFER and those determined by ÅNGSTRÖM and DITSCHEINER (which those philosophers ascribe to an erroneous evaluation by FRAUNHOFER of his interference-grating); a part apparently is produced by faults inherent in every process of interpolation among a limited number of values, especially when that interpolation is so extended as to become extrapolation; but, as I believe, no sensible part, or a very small part, can arise from the suspected class of errors in the measures of the prismatic dispersion-spectrum.

I had arrived at this stage of my work, when I became acquainted with DITSCHEINER'S Essay contained in the 'Sitzungsberichte der Mathematisch-Naturwissenschaftlichen

Classe der Kaiserlichen Akademie der Wissenschaften,' LII. Band, II. Abtheilung, page 289, &c. This paper gives the details of a new measure of the grating with which FRAUNHOFER'S original measures of wave-lengths were made (as I understand M. DITSCHEINER'S words); and by means of this correction of measure, and the corresponding correction of wave-length for the line D common to FRAUNHOFER'S and DITSCHEINER'S measures, DITSCHEINER computed new values of wave-lengths for the entire series of lines, primary and secondary, which he had himself observed. On careful consideration of all the circumstances of formation of these new values, it appeared to me that it was indispensable for me to base my reduction of KIRCHHOFF'S measures upon DITSCHEINER'S new values. I should thus have the opportunity of introducing a value for B, which would enable me to adopt a function of the 5th order instead of the 4th order (upon which all my preceding calculations were founded); and I could use the same opportunity for making correction for a petty error which I had committed in the line E (I had inadvertently used 1527·7 instead of 1523·2 for KIRCHHOFF'S measure).

My immediate object, in calculation, now was, to make such an addition to the function embodied in my former calculations as would produce definite alterations in the wave-lengths computed for B, C, D, E, F, G. This, it was evident, could be done by a function or a sum of functions of the 5th order; and I had only to adopt the most convenient form. Remarking that KIRCHHOFF'S measures for B, C, D, E, F (with the decimal point thrown back three places) differ very little from 0·6, 0·7, 1·0, 1·5, 2·1, and that the measure for G is not very different from 2·9, I adopted the following form for general correction; where by [0·6], [0·7], [1·0], [1·5], [2·1], [2·9], are meant certain constants whose values will shortly be seen.

General correction for all values of k.

$$\frac{\text{correction for } k=0{\cdot}6}{[0{\cdot}6]}\times(k-0{\cdot}7)\times(k-1{\cdot}0)\times(k-1{\cdot}5)\times(k-2{\cdot}1)\times(k-2{\cdot}9)$$

$$+\frac{\text{correction for } k=0{\cdot}7}{[0{\cdot}7]}\times(k-0{\cdot}6)\times(k-1{\cdot}0)\times(k-1{\cdot}5)\times(k-2{\cdot}1)\times(k-2{\cdot}9)$$

$$+\frac{\text{correction for } k=1{\cdot}0}{[1{\cdot}0]}\times(k-0{\cdot}6)\times(k-0{\cdot}7)\times(k-1{\cdot}5)\times(k-2{\cdot}1)\times(k-2{\cdot}9)$$

$$+\frac{\text{correction for } k=1{\cdot}5}{[1{\cdot}5]}\times(k-0{\cdot}6)\times(k-0{\cdot}7)\times(k-1{\cdot}0)\times(k-2{\cdot}1)\times(k-2{\cdot}9)$$

$$+\frac{\text{correction for } k=2{\cdot}1}{[2{\cdot}1]}\times(k-0{\cdot}6)\times(k-0{\cdot}7)\times(k-1{\cdot}0)\times(k-1{\cdot}5)\times(k-2{\cdot}9)$$

$$+\frac{\text{correction for } k=2{\cdot}9}{[2{\cdot}9]}\times(k-0{\cdot}6)\times(k-0{\cdot}7)\times(k-1{\cdot}0)\times(k-1{\cdot}5)\times(k-2{\cdot}1).$$

The numerical values of the products following the fraction in each line are given, for every 0·1 of k from 0·0 to 3·0, in the last six columns of the following Table.

Corrections to the computed Wave-lengths, on different suppositions as to the parts of the series which are to be left without alteration.

Approximate places of principal lines.	Values of k.	No correction for $k=0{\cdot}7, 1{\cdot}0, 1{\cdot}5, 2{\cdot}1, 2{\cdot}9$; Correction for $k=0{\cdot}6$ being +124·2.	No correction for $k=0{\cdot}6, 1{\cdot}0, 1{\cdot}5, 2{\cdot}1, 2{\cdot}9$; Correction for $k=0{\cdot}7$ being +73·9.	No correction for $k=0{\cdot}6, 0{\cdot}7, 1{\cdot}5, 2{\cdot}1, 2{\cdot}9$; Correction for $k=1{\cdot}0$ being +125·4.	No correction for $k=0{\cdot}6, 0{\cdot}7, 1{\cdot}0, 2{\cdot}1, 2{\cdot}9$; Correction for $k=1{\cdot}5$ being +302·4.	No correction for $k=0{\cdot}6, 0{\cdot}7, 1{\cdot}0, 1{\cdot}5, 2{\cdot}9$; Correction for $k=2{\cdot}1$ being +1109.	No correction for $k=0{\cdot}6, 0{\cdot}7, 1{\cdot}0, 1{\cdot}5, 2{\cdot}1$; Correction for $k=2{\cdot}9$ being +1077.
	0·0	+6395	−5481	+3837	−2558	+1827	− 132
	0·1	+4234	−3528	+2352	−1512	+1058	− 76
	0·2	+2668	−2134	+1334	− 821	+ 562	− 40
	0·3	+1572	−1179	+ 674	− 393	+ 262	− 18
A	0·4	+ 842	− 561	+ 281	− 153	+ 99	− 7
	0·5	+ 384	− 192	+ 115	− 58	+ 36	− 2
B	0·6	+ 124	0	0	0	0	0
C	0·7	0	+ 74	0	0	0	0
	0·8	− 38	+ 76	+ 38	− 11	+ 6	− 0
	0·9	− 29	+ 43	+ 86	− 14	+ 7	− 0
D	1·0	0	0	+ 125	0	0	0
	1·1	+ 29	− 36	+ 144	+ 36	− 14	+ 1
	1·2	+ 46	− 55	+ 138	+ 92	− 31	+ 2
	1·3	+ 46	− 54	+ 108	+ 161	− 40	+ 2
	1·4	+ 29	− 34	+ 59	+ 235	− 34	+ 2
E	1·5	0	0	0	+ 302	0	0
	1·6	− 35	+ 39	− 59	+ 351	+ 70	− 3
	1·7	− 67	+ 74	− 106	+ 370	+ 184	− 6
	1·8	− 87	+ 95	− 131	+ 348	+ 348	− 10
	1·9	− 86	+ 93	− 125	+ 281	+ 562	− 11
	2·0	− 59	+ 63	− 82	+ 164	+ 819	− 9
F	2·1	0	0	0	0	+1109	0
	2·2	+ 88	− 94	+ 118	− 202	+1411	+ 20
	2·3	+ 200	− 212	+ 261	− 424	+1697	+ 57
	2·4	+ 321	− 340	+ 413	− 643	+1928	+ 116
	2·5	+ 432	− 456	+ 547	− 821	+2052	+ 205
	2·6	+ 502	− 528	+ 627	− 912	+2006	+ 334
	2·7	+ 490	− 514	+ 605	− 857	+1714	+ 514
	2·8	+ 344	− 360	+ 420	− 582	+1081	+ 757
G	2·9	0	0	0	0	0	+1077
	3·0	− 621	+ 648	− 745	+ 994	−1656	+1490

It is easily seen now that [0·6] is the number corresponding to $k=0{\cdot}6$ in the third column of the Table; that [0·7] is the number corresponding to $k=0{\cdot}7$ in the fourth column of the Table; and so for the others.

It appeared now that the corrections to be applied to numbers which I had actually computed, in order to produce DITSCHEINER'S numbers, were the following:—

For line B . . . +320
C . . . +147
D . . . +142
E . . . + 97
F . . . +123
G . . . +213.

And, after making a preliminary calculation, the following corrections were found to be necessary:—

For $k=0{\cdot}6$, $+306=+140+124\times(1+\frac{1}{3})$
$0{\cdot}7$, $+142=+140+74\times\frac{1}{50}$
$1{\cdot}0$, $+140=+140$
$1{\cdot}5$, $+109=+140-302\times\frac{1}{10}$
$2{\cdot}1$, $+149=+140+1109\times\frac{1}{120}$
$2{\cdot}9$, $-98=+140-1077\times(\frac{1}{5}+\frac{1}{50})$.

The factors in the last column are [0·6], [0·7], &c. respectively.

Then, using the number +140 as a general correction, and using the numbers of the last column for "Correction for $k=0{\cdot}6$," "Correction for $k=0{\cdot}7$," &c. in the general formula (or, in other words, multiplying the 3rd, 4th, &c. columns of the Table, by $(1+\frac{1}{3})$, $\frac{1}{50}$, &c.), the following special numerical corrections are obtained.

Corrections to the wave-lengths as originally computed. (The unit of the corrections is the same as the unit of the last figure of the computed wave-lengths in millimetres.)

k.	Correction.	k.	Correction.	k.	Correction.
0·0	+8857	1·0	+140	2·0	+ 55
0·1	+5891	1·1	+174	2·1	+ 149
0·2	+3750	1·2	+191	2·2	+ 283
0·3	+2257	1·3	+184	2·3	+ 447
0·4	+1269	1·4	+154	2·4	+ 616
0·5	+ 654	1·5	+110	2·5	+ 761
0·6	+ 305	1·6	+ 61	2·6	+ 832
0·7	+ 141	1·7	+ 18	2·7	+ 770
0·8	+ 92	1·8	− 4	2·8	+ 493
0·9	+ 103	1·9	+ 6	2·9	− 97
				3·0	−1116

With these numbers, a curve was laid down, and the corrections for every 0·01 of k were obtained graphically. Between these, the corrections for all the individual lines were interpolated numerically, and were applied separately to each computed wave-length. Every number which is presented in the following Tables is affected with the correction.

The agreement of the computed numbers with DITSCHEINER's, or with ÅNGSTRÖM's (after multiplication by the proper factor), as far as they admit of comparison, is not so close as I expected. For the lines B, C, D, E, F, G, the accordance with DITSCHEINER's

numbers is necessarily (from the nature of the process) almost perfect. But between each of these principal lines and the next, the discordance rises gradually from 0 to a considerable value and then drops gradually to 0. Between F and G the value is large. The discordances, however, are systematic. There is no appearance of any *saltus* between one principal line and the next; but there is nothing to enable us to decide positively whether there is a *saltus* at each principal line.

It appears to me that we must look to one of the three following causes for explanation:—

1. The actual inability of a formula of the fifth order to represent the wave-length in terms of the spectrum-measure with sufficient approximation.

2. A change in Professor KIRCHHOFF'S method of observation at each successive principal line.

3. A change in DITSCHEINER'S and ÅNGSTRÖM'S methods at each successive principal line.

The third of these suggestions is extremely improbable: and after remarking the harmonious flow in the course of the discordances in every interval between principal lines (a harmony which gives no small testimony to the care employed in both classes of measures, and to the accuracy of the interpolation-details in the computation which connects them), I am hardly inclined to advocate the second suggestion. I think it more probable that the real cause is to be found in the first.

I remark, however, that this doubt affects only the physical question on the broad scale. It does not affect the possibility of computing with accuracy the wave-length for any one of KIRCHHOFF'S lines. By means of the comparison between the computed wave-lengths and DITSCHEINER'S measures (at the end of the Tables) there is no difficulty in computing for any other line the correction that ought to be applied to the wave-length in the principal Tables, in order to exhibit the true wave-lengths on DITSCHEINER'S scale, without appreciable error.

I have now only to explain the Tables which follow.

The principal Table, headed "Conversion of KIRCHHOFF'S Spectral Measures into Wave-lengths in terms of the Millimetre," corresponds, in extent, to KIRCHHOFF'S Tables in the Berlin Memoirs, 1861 and 1862. Instead, however, of adopting the broken arangement of these Memoirs, I have placed the numbers in a continuous series, and I have omitted the repetitions in KIRCHHOFF'S successive Tables.

The Table consists throughout of four columns (one of which is occasionally blank). The first column contains simply KIRCHHOFF'S measures; and the second contains the corresponding wave-lengths, computed by the process described above. The third column contains KIRCHHOFF'S symbols expressing the darkness and the breadth of the lines; 1 expresses a slight darkness, 2 a little darker, and so on up to 6 which is very dark; *a* denotes a very narrow line, *b* a little broader, and so on up to *g*, which is a line of considerable breadth (the measure of the breadth is not given). The fourth column (where it is used) contains the contracted name of the metal which, by combustion, pro-

duces a line corresponding in spectral position to the line here measured. This Table is, in fact, KIRCHHOFF'S Table, with the insertion throughout of one column containing the computed values of the wave-lengths. In copying the first column, I have endeavoured to copy the braces and brackets of KIRCHHOFF'S Table, without in every case understanding their application.

The Table which next follows is KIRCHHOFF'S special Table for the lines produced by the metals Cerium, Didymium, Lanthanum, Palladium, Platinum, Ruthenium, Iridium, with the corresponding wave-lengths. Two of its compartments contain the lines in a combination of Lanthanum and Didymium, and in a combination of Ruthenium and Iridium. It is accompanied by a similar Table of lines produced by the atmosphere.

The next Table (formed by myself) contains the wave-lengths for each of the metals whose lines have been measured by KIRCHHOFF, and are contained either in the General Table of lines of the solar spectrum, or in the smaller special Table which I have just described. The numbers are simply extracted from those Tables. I may mention that my original intention was to confine my computations to these metal-lines, in the hope that they might give some assistance to the formation of a mechanical theory.

The two last Tables contain the comparison of direct measures of the wave-length made by ÅNGSTRÖM and DITSCHEINER with the computed measures given in the General Table, as far as the identity of the lines appears to be established. ÅNGSTRÖM'S measures were given in terms of the Paris inch: I have preserved these; and have also given their equivalents in terms of the millimetre.

I have only to add that, in my original communication to the Royal Society, dated 1867, March 2, the modifications of the first computed numbers, now introduced after consideration of DITSCHEINER'S later measures, had not been applied. I have now incorporated them in the finished Tables, with the permission of the President and Council of the Society.

G. B. AIRY.

Royal Observatory, Greenwich,
1867, *October* 15.

Conversion of KIRCHHOFF's Spectral Measures into Wave-Lengths, in terms of the Millimetre.

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000.		
381·7	77694	1 *c*		(476·4	73266	1 *b*	
384·1	77574	2 *c*				2	
385·9	77479	2 *d*		(477·0	73240	5 *b*	
387·5	77396	3 *d*				2	
388·9	77322	4 *d*		(477·8	73206	4 *b*	
390·4	77249	4 *e*		(479·1	73153	2 *c*	
392·1	77160	5 *e*				1	
393·6	77085	6 *e*		(480·1	73113	6 *c*	
395·0	77012	6 *e*		(480·4	73100	4 *d*	
396·2	76950	5 *e*		481·2	73067	4 *c*	
397·4	76890	4 *e*		482·1	73031	2 *d*	
398·4	76838	4 *d*		483·3	72979	4 *d*	
399·2	76799	4 *d*		484·1	72949	2 *d*	
399·8	76767	4 *d*		485·1	72906	3 *d*	
400·4	76743	3 *d*		486·2	72861	6 *e*	
(401·9	76670	4 *c*		486·8	72836	2 *c*	
A (		} 3		from (488·2	72778	1	
(402·4	76648	}		(488·8	72754	5 *a*	
402·8	76625	} 4		489·6	72719	6 *c*	
403·2	76605	} 5		(491·2	72652	3 *e*	
405·0	76517	} 6		(491·5	72641	5 *b*	
405·6	76492	} 5		491·9	72621	4 *c*	
(406·2	76462	} 4		493·1	72575	2 *c*	
(		} 3		494·1	72531	3 *b*	
(406·8	76436	} 5 *e*		(495·4	72478	1 *e*	
408·5	76336	1 *d*		(495·7	72466	2 *b*	
423·7	75641	2 *b*		497·2	72400	1 *b*	
426·6	75477	2 *b*		497·5	72388	2 *a*	
433·8	75147	2 *c*		498·4	72351	4 *c*	
437·0	75003	2 *b*		499·0	72324	5 *b*	
442·8	74746	2 *d*		499·9	72287	5 *d*	
444·6	74663	2 *c*		500·8	72253	3 *d*	
445·8	74611	2 *b*		(501·8	72214	2 *c*	
446·1	74599	2 *b*		(502·0	72207	5 *b*	
447·0	74560	2 *a*		502·6	72183	5 *c*	
448·4	74496	1 *b*		503·8	72132	6 *d*	
452·6	74308	2 *c*		504·3	72113	5 *b*	
453·0	74292	1 *b*		505·1	72082	6 *c*	
454·4	74231	1 *b*		(506·2	72036	2 *b*	
460·0	73981	1 *c*		(506·4	72029	5 *b*	
461·0	73937	1 *b*		(506·6	72020	2 *b*	
462·2	73884	2 *b*		507·4	71990	5 *c*	
463·3	73837	2 *a*		508·2	71956	3 *b*	
466·0	73720	1 *b*		509·1	71918	3 *b*	
466·5	73698	2 *c*		509·9	71885	2 *b*	
467·0	73676	1 *b*		510·9	71846	1 *a*	
468·1	73627	2 *e*		512·9	71767	2 *b*	
470·0	73542	2 *b*		513·6	71741	3 *b*	
470·5	73520	3 *c*		517·1	71606	2 *b*	
470·9	73504	2 *b*		519·3	71513	2 *b*	
(472·4	73437	2 *e*		521·6	71426	1 *b*	
(472·7	73425	3 *c*		529·4	71129	1 *b*	
(473·8	73379	4 *d*		530·4	71089	1 *c*	
(		1		532·8	70997	1 *b*	
(474·7	73341	3 *b*		536·9	70840	2 *b*	
from 475·7	73297	2		537·3	70826	1 *b*	

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000.			Kirchhoff's measure.	Wave-length, m.m. 0·000		
540·6	70705	3 *b*		597·4	68681	1 *b*	
541·1	70685	2 *c*		601·2	68556	1 *a*	
542·0	70649	1 *a*		601·8	68535	1 *b*	
543·6	70591	4 *b*		602·8	68501	1 *a*	
544·6	70554	3 *d*		606·0	68396	1 *b*	
547·0	70464	4 *c*		608·3	68317	1 *a*	
547·9	70430	2 *b*		612·4	68186	1 *b*	
549·6	70366	3 *e*		613·4	68151	1 *a*	
551·2	70310	3 *c*		623·4	67831	1 *b*	
552·5	70263	3 *c*		626·1	67744	1 *b*	
553·8	70213	1 *c*		631·4	67576	1 *b*	
554·0	70207	3 *b*		638·4	67357	1 *b*	
554·6	70183	2 *b*		639·8	67310	1 *b*	
557·0	70100	1 *a*		641·0	67273	2 *b*	Ca
557·7	70073	2 *b*		645·3	67140	1 *b*	
558·1	70058	1 *b*		648·1	67053	1 *b*	
559·7	69999	1 *c*		654·3	66865	2 *b*	
561·5	69937	1 *b*		659·3	66713	2 *a*	
562·5	69902	3 *b*		665·7	66524	2 *a*	
563·0	69883	2 *c*		669·5	66410	2 *b*	
564·1	69845	4 *c*		678·6	66150	1 *b*	
565·0	69809	2 *c*		681·4	66068	1 *a*	
566·0	69773	2 *c*		682·8	66028	1 *b*	
566·9	69741	2 *b*		683·1	66020	2 *a*	
567·4	69722	3 *b*		685·3	65956	1 *b*	
568·6	69680	2 *b*		689·8	65829	2 *b*	
		1		690·9	65798	1 *a*	
569·2	69660	2 *b*		692·1	65765	2 *a*	
		1	C from	693·4	65729	1	
570·0	69629	3 *c*		694·1	65710	6 *e*	Air
570·6	69608	2 *b*	C to	694·8	65690	1	
572·2	69552	3 *b*		698·1	65598	2 *a*	
572·9	69526	1 *b*		700·0	65545	2 *a*	
573·6	69502	3 *c*		701·1	65514	2 *b*	
574·4	69473	1 *b*		702·1	65486	2 *a*	
575·1	69449	2 *d*		702·6	65472	1 *b*	
576·6	69398	2 *d*		705·5	65395	2 *a*	
578·1	69346	3 *d*		705·9	65383	2 *a*	
579·6	69290	3 *d*		707·5	65339	1 *b*	
581·1	69238	3 *e*		708·6	65311	2 *b*	
582·5	69192	3 *e*		710·5	65258	2 *e*	
583·8	69137	4 *e*		711·4	65233	3 *c*	
585·0	69106	4 *f*		712·0	65218	2 *b*	
586·2	69065	4 *e*		713·2	65185	1 *b*	
587·0	69035	3 *e*		714·4	65151	1 *c*	
587·9	69005	2 *b*		717·8	65059	2 *b*	Ca
589·0	68970	3 *b*	from	718·7	65035	2	Ba
589·4	68955	3 *b*		719·6	65011	3 *a*	
589·9	68938	3 *b*		720·1	65000	2 *e*	Ca
590·3	68925	3 *b*		721·1	64972	2 *b*	Fe
590·7	68911	3 *b*		723·7	64903	2 *c*	
591·1	68896	3 *b*		724·2	64890	1 *b*	
591·5	68882	4 *b*		725·1	64867	1 *b*	Air
591·9	68869	4 *b*		726·7	64825	3 *c*	
592·3	68856	3 *b*		727·8	64796	1 *c*	
B 592·7	68853	6 *c*		728·0	64791	2 *a*	
593·1	68829	4 *g*		729·0	64764	2 *b*	Ca
595·0	68764	1 *a*		731·7	64695	5 *b*	Ca
596·6	68707	1 *a*		734·0	64634	1 *d*	

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000.		
736·9	64559	3 *b*	Ca	838·2	62158	1 *b*	
740·9	64456	5 *b*	Ca, Cd	838·6	62150	2 *b*	
743·7	64384	2 *b*		839·2	62136	2 *b*	
744·3	64368	4 *b*		845·7	62001	2 *b*	
748·1	64271	4 *b*		849·7	61915	3 *c*	Fe
748·7	64257	3 *b*		851·2	61881	1 *a*	
750·1	64220	1 *a*		851·8	61868	1 *a*	
751·0	64199	1 *b*		855·0	61802	2 *a*	
752·3	64165	4 *b*		856·8	61764	2 *a*	
753·8	64129	3 *b*	Sr	857·5	61749	2 *a*	
756·9	64049	5 *b*	Fe	858·3	61734	2 *a*	
759·3	63989	3 *b*		859·7	61704	3 *a*	
764·2	63869	1 *a*		860·2	61693	3 *d*	Ca
771·8	63683	1 *a*	Zn	861·6	61662	2 *a*	
773·4	63644	2 *b*		862·2	61649	1 *a*	
774·8	63611	2 *b*		863·2	61631	2 *c*	
778·3	63525	1 *b*	(Ru, Ir)	863·9	61617	5 *b*	Ca
779·5	63498	1 *b*		864·4	61606	1 *d*	
781·9	63438	3 *b*		866·2	61568	2 *b*	
783·1	63411	4 *b*		867·1	61549	2 *b*	
783·8	63395	3 *b*		867·6	61539	1 *a*	
786·8	63323	1 *a*		869·2	61507	2 *b*	
788·9	63273	3 *b*		870·9	61472	1 *b*	
791·0	63223	1 *d*		871·4	61461	2 *b*	
791·4	63214	3 *b*		872·5	61439	1 *b*	
792·9	63180	2 *d*		874·0	61411	1 *b*	
794·5	63144	1 *d*		874·3	61405	4 *b*	Ba
798·1	63059	3 *a*		876·5	61358	4 *a*	
798·5	63049	4 *a*	Fe	877·0	61348	4 *c*	Fe
799·8	63019	2 *b*		879·8	61292	1 *b*	
800·3	63005	2 *b*		880·9	61271	1 *a*	
801·2	62987	1 *a*		881·6	61255	2 *a*	
801·5	62980	1 *a*		882·6	61237	1 *a*	
802·7	62952	1 *b*		883·2	61223	1 *b*	
803·5	62935	2 *a*		884·9	61191	4 *b*	Ca, Co
805·8	62881	1 *b*		887·7	61135	2 *a*	Ni
807·4	62845	2 *b*		890·2	61086	1 *b*	Ba
808·2	62826	2 *c*		891·7	61056	2 *a*	Ni
808·7	62815	1 *c*		894·9	60990	2 *e*	Ca, Li
809·5	62796	3 *b*	Au	896·1	60968	1 *a*	
809·9	62785	2 *d*		896·7	60957	1 *b*	
812·7	62723	1 *a*		898·9	60912	1 *a*	
813·1	62715	2 *a*		899·1	60909	1 *a*	
815·0	62672	4 *b*		900·2	60888	1 *a*	
816·8	62631	2 *b*		901·4	60864	1 *a*	
818·0	62606	3 *c*		901·6	60860	1 *a*	
819·0	62582	4 *b*		902·4	60844	1 *a*	
820·1	62558	4 *b*		903·1	60829	1 *a*	
820·9	62542	4 *b*		903·6	60821	1 *a*	
823·5	62482	1 *a*		904·6	60803	1 *a*	
824·0	62471	4 *b*		906·1	60773	2 *c*	
824·9	62452	1 *d*		912·1	60659	3 *b*	Fe
826·4	62420	2 *a*		*916·3	60578	2 *b*	
827·6	62393	1 *a*		923·0	60452	2 *b*	
828·0	62382	2 *a*		929·5	60330	2 *b*	
830·2	62333	3 *b*		931·3	60297	4 *b*	Fe
831·0	62317	4 *c*	Fe	932·5	60277	4 *b*	
831·7	62301	1 *b*		933·3	60262	4 *c*	
836·5	62196	2 *b*		935·1	60229	4 *b*	

* A large proportion of the measures, from 916·3 to 1006·8, are included in a subsequent Table of Atmospheric Lines.—G. B. A.

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000		
936·7	60199	4 *b*		1005·0	59017	2 *b*	Ni
937·4	60187	1 *b*		D*a* 1006·8	58988	6 *b*	Na
940·1	60134	3 *b*		1011·2	58916	3 *a*	
940·4	60128	2 *b*		1023·0	58726	1 *a*	
943·4	60075	3 *b*		1025·5	58686	3 *a*	
946·6	60018	3 *b*		1027·7	58653	2 *a*	
947·0	60011	1 *a*		1029·3	58626	3 *c*	Ca, Ni
949·4	59967	1 *b*		1031·8	58583	2 *a*	Ba
949·8	59960	1 *b*		1032·8	58567	1 *a*	
951·7	59925	1 *c*		1035·3	58528	1 *a*	
952·9	59904	3 *b*		1058·0	58180	2 *b*	
954·3	59880	3 *b*		1063·0	58104	2 *b*	
954·8	59872	3 *b*		1065·0	58072	2 *b*	
958·8	59801	3 *b*		1066·0	58059	1 *a*	
959·6	59788	3 *b*		1067·0	58046	2 *b*	
961·9	59745	1 *a*		1070·5	57990	2 *b*	
963·7	59713	1 *c*		1073·5	57946	1 *a*	
964·4	59703	1 *c*		1074·2	57936	1 *a*	
968·7	59628	2 *a*		1075·5	57916	3 *a*	
969·0	59623	2 *a*		1077·5	57888	1 *a*	
969·6	59613	3 *a*		from 1078·9	57866	1	
970·5	59597	1 *b*		to 1079·7	57854		
971·5	59578	2 *c*		1080·3	57845	1 *a*	
972·1	59568	1 *b*		1080·9	57836	1 *a*	
973·1	59551	3 *a*		1081·8	57824	2 *b*	Cu
973·5	59544	3 *a*		1083·0	57805	2 *a*	Ba
974·3	59531	2 *a*		1087·5	57738	2 *a*	
975·0	59519	2 *a*		1089·6	57709	2 *a*	
976·8	59487	3 *a*		1096·1	57616	3 *c*	Fe
977·4	59477	2 *a*		1096·8	57607	1 *a*	
977·7	59471	2 *a*		1097·8	57592	1 *a*	
979·1	59448	1 *b*		1100·4	57554	1 *a*	
980·8	59421	1 *a*		1102·1	57527	3 *b*	
981·2	59415	3 *b*		1102·9	57517	3 *a*	
982·0	59401	1 *a*		1103·3	57511	2 *b*	
982·3	59396	2 *a*		1104·1	57498	2 *b*	
983·0	59384	3 *c*		1107·1	57455	2 *c*	
984·5	59359	1 *c*		1111·4	57397	1 *a*	
986·3	59329	1 *a*		1119·0	57289	2 *a*	
986·7	59323	2 *c*		1122·6	57244	2 *a*	
987·4	59310	1 *b*		1128·3	57162	2 *b*	
988·9	59284	2 *a*		1130·9	57126	2 *b*	
989·2	59279	2 *a*		1133·1	57098	3 *c*	
989·6	59272	2 *a*		1133·9	57087	3 *c*	
990·8	59252	2 *a*		1135·1	57068	4 *d*	
991·2	59246	1 *a*		1135·9	57057	2 *c*	
991·9	59234	3 *b*	Fe	1137·0	57043	2 *b*	
992·4	59225	1 *a*		1137·8	57034	3 *b*	
993·9	59199	1 *b*		1141·3	56985	2 *c*	
994·3	59192	1 *b*		1143·6	56956	2 *c*	
995·0	59180	1 *a*		1146·2	56921	1 *b*	
997·2	59145	2 *b*		1147·2	56908	1 *b*	
998·1	59130	1 *a*		1148·6	56890	1 *b*	
998·9	59117	1 *a*		1149·4	56879	1 *b*	
999·2	59112	1 *a*		1151·1	56852	4 *b*	
1000·0	59099	1 *a*		1152·5	56834	2 *b*	
1000·4	59093	1 *a*		1154·2	56811	3 *b*	
1001·4	59078	1 *a*		1155·7	56790	3 *b*	
D*b* 1002·8	59053	6 *b*	Na	1155·9	56788	2 *c*	

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000		
1158·3	56756	2 *a*		1264·4	55439	1 *a*	
1160·9	56724	2 *a*		1264·9	55434	2 *a*	
1165·2	56666	1 *a*		1267·3	55406	3 *a*	
1165·7	56660	1 *a*		1268·0	55398	3 *a*	
1167·0	56644	1 *d*		1271·9	55352	1 *a*	
1168·3	56627	1 *a*		1272·4	55347	1 *a*	
1169·4	56612	1 *a*		1274·2	55326	3 *b*	Ba
1170·6	56596	2 *c*		1274·7	55320	3 *a*	Sr
1174·2	56550	5 *d*		1276·2	55303	2 *a*	
1175·0	56540	2 *a*		1276·7	55297	1 *a*	
1176·6	56518	3 *c*		1280·0	55259	6 *d*	
1177·0	56513	2 *a*		1281·3	55246	3 *c*	
1177·3	56509	1 *a*		1282·6	55231	2 *c*	
1177·6	56505	1 *a*		1285·3	55199	2 *c*	
1178·6	56494	1 *a*		1287·5	55175	1 *c*	Ba
1179·0	56489	1 *a*		1289·7	55149	2 *c*	
1179·4	56483	1 *a*		1291·9	55125	3 *c*	
1179·8	56478	1 *a*		1293·8	55105	3 *c*	
1180·2	56472	1 *a*		1294·5	55097	3 *c*	
1183·4	56432	2 *a*		1295·6	55083	1 *a*	
1184·8	56413	3 *a*		1296·3	55075	2 *c*	
1186·8	56386	2 *a*		1297·5	55061	1 *a*	
1187·1	56383	2 *a*		1298·9	55044	5 *c*	
1189·3	56356	3 *b*		1299·7	55036	2 *c*	
1190·1	56345	2 *b*		1302·0	55012	2 *c*	
1193·1	56307	3 *a*		1303·5	54994	5 *c*	
1199·6	56223	2 *d*		1306·7	54958	5 *c*	
1200·6	56210	4 *b*	Fe	1315·0	54865	4 *c*	
1201·0	56204	2 *a*		1315·7	54857	2 *b*	
1203·5	56175	2 *c*		1319·0	54821	3 *c*	Co
1204·2	56166	2 *c*		1320·6	54805	4 *c*	Sr
1204·9	56158	2 *d*		1321·1	54797	3 *b*	
1206·1	56143	1 *c*		1323·3	54773	2 *b*	
1207·3	56129	5 *g*	Fe	1324·0	54765	2 *b*	
1217·8	55997	5 *d*	Fe, Ca	1324·8	54757	4 *d*	Ni
1219·2	55981	3 *c*	Ca	1325·3	54751	2 *d*	
1220·1	55970	2 *c*		1327·7	54726	4 *b*	
1221·6	55951	5 *d*	Ca	1328·7	54715	2 *b*	
1224·7	55913	5 *d*	Ca	1330·4	54696	3 *b*	
1225·3	55904	1 *b*		1333·3	54665	1 *a*	
1226·6	55888	2 *d*		1334·0	54657	4 *b*	
1228·3	55868	2 *d*	Ca	1336·3	54634	1 *b*	
1229·6	55852	4 *c*	Ca	1337·0	54626	4 *d*	Fe
1230·5	55842	2 *c*		1337·8	54618	1 *b*	
1231·3	55833	5 *d*	Fe	1338·5	54609	1 *b*	
1232·8	55814	2 *b*		1343·5	54556	6 *c*	Fe
1235·0	55787	3 *d*	Ca	1351·1	54477	5 *d*	Fe
1237·8	55752	2 *c*		1352·7	54456	5 *b*	Fe
1239·9	55728	4 *a*	Fe	1356·5	54417	1 *a*	
1242·6	55696	6 *c*	Fe	1360·9	54373	1 *a*	
1245·6	55660	4 *d*	Fe	1361·6	54365	1 *a*	
1247·4	55639	3 *b*		1362·9	54351	5 *b*	Fe
1248·6	55625	3 *d*		1364·3	54337	1 *a*	
1250·4	55605	3 *c*		1364·7	54333	1 *a*	
1251·1	55597	2 *b*		1367·0	54309	6 *d*	Fe
1253·3	55571	2 *b*		1371·4	54262	1 *b*	Ba
1255·2	55548	2 *b*		1372·1	54255	1 *b*	
1257·5	55521	3 *c*		1372·6	54250	5 *b*	Fe
1258·5	55510	2 *b*		1374·8	54226	1 *c*	

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000		
1375·8	54214	2 *a*		1483·0	53158	4 *b*	
1377·4	54198	1 *a*		1487·7	53113	5 *b*	Fe
1379·0	54181	1 *a*		1489·2	53098	2 *c*	
1380·5	54167	4 *c*	Fe	1489·9	53093	1 *a*	
1384·7	54121	4 *c*	Fe	(1491·2	53081	1 *c*	
1385·7	54112	5 *b*	Cr	1491·6	53078	3 *c*	
1386·3	54107	2 *b*		1492·4	53070	4 *b*	
1387·4	54096	2 *b*		1493·1	53064	4 *b*	
1389·4	54076	6 *c*	Fe	1494·5	53050	1 *a*	
1390·9	54063	5 *d*	Fe	1495·9	53036	1 *a*	
1394·2	54028	4 *c*		1497·3	53024	1 *a*	Cu
1395·3	54017	1 *c*		1501·3	52988	2 *b*	
1396·4	54006	2 *c*		1504·8	52956	1 *a*	
1397·5	53995	5 *c*	Fe	1505·3	52950	1 *a*	
1400·2	53964	3 *b*		1505·7	52947	1 *a*	
1401·6	53949	4 *c*	Fe	1506·3	52941	5 *c*	Fe
1403·1	53936	3 *c*		1508·6	52919	5 *b*	Fe
1404·1	53927	1 *b*		1510·3	52904	2 *c*	Co
1405·2	53916	3 *b*		1515·5	52855	4 *d*	
1410·5	53862	4 *c*	Fe	1516·5	52847	4 *c*	
1412·5	53842	2 *b*		1519·0	52823	4 *d*	
1414·0	53828	2 *b*		E { 1522·7	52792	6 *c*	Fe, Ca
1415·8	53809	2 *b*		{ 1523·7	52782	6 *c*	Fe
1419·4	53771	2 *b*		1525·0	52770	1 *b*	Co
1421·5	53749	6 *c*	Fe	1527·7	52747	5 *c*	Fe, Co
1423·0	53736	5 *b*	Fe	1528·7	52739	5 *c*	Ca
1423·5	53730	2 *b*		1530·2	52725	4 *c*	Ca
1425·4	53713	5 *b*	Fe	1531·2	52715	4 *c*	
1427·5	53690	3 *b*		1532·5	52705	4 *b*	Ca
1428·2	53685	5 *b*	Fe	1533·1	52701	4 *b*	Ca
1430·1	53666	5 *b*		(1541·4	52622	1 *g*	
1431·2	53655	1 *b*		1541·9	52618	3 *b*	
1438·9	53579	4 *c*	Co	1543·7	52601	2 *a*	
1440·2	53568	1 *b*	Co	1545·5	52584	2 *a*	
1443·1	53541	2 *b*		1547·2	52569	3 *a*	
1443·5	53536	2 *b*	Ca	1547·7	52565	2 *a*	
1444·4	53528	4 *c*		1551·0	52539	2 *a*	
1446·7	53508	4 *c*		1551·6	52532	2 *a*	
1448·7	53488	2 *a*	Co	1555·6	52495	2 *a*	
1449·4	53479	1 *a*	Co	1557·3	52481	3 *a*	
1450·8	53463	5 *c*	Fe	1561·0	52450	1 *a*	
1451·8	53454	5 *b*	Fe	1564·2	52423	1 *a*	
1453·7	53436	1 *a*		1566·5	52401	2 *b*	Co
1454·7	53425	3 *b*		1567·5	52392	2 *b*	
1456·6	53408	1 *a*		1569·6	52375	5 *c*	Fe
1458·6	53388	3 *c*		1573·5	52341	5 *a*	
1461·5	53359	2 *c*		1575·4	52325	1 *b*	
1462·2	53351	2 *c*		(1577·2	52309	5 *c*	Fe
1462·8	53346	5 *c*	Fe	1577·6	52306	3 *c*	
1463·3	53343	5 *c*	Fe	1579·4	52292	2 *a*	
1464·8	53326	1 *a*		1580·1	52286	2 *a*	
1465·3	53323	1 *a*		1588·3	52215	1 *g*	Cu
1466·8	53309	5 *c*	Fe	1589·1	52208	3 *b*	
1468·8	53289	2 *b*		1590·7	52195	3 *b*	
1469·6	53280	1 *b*		1592·3	52180	3 *b*	
1473·9	53243	5 *b*	Fe	1598·9	52123	2 *b*	
1475·3	53229	1 *a*		(1601·4	52102	6 *b*	Cr
1476·8	53215	1 *a*		1601·7	52099	3 *d*	
1477·5	53208	1 *a*		1604·4	52077	5 *b*	Cr

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000		
1606·4	52060	5 *b*	Cr	1710·7	51213	5 *a*	
1609·2	52033	5 *b*		1712·2	51201	3 *b*	
1611·3	52017	1 *c*		1713·4	51193	5 *b*	
1613·9	51996	3 *b*		1715·2	51178	4 *b*	
1615·6	51982	2 *b*		1717·9	51157	4 *b*	
1616·6	51976	1 *b*		1719·4	51145	1 *c*	
1617·4	51968	2 *b*		1726·9	51087	1 *a*	
1618·2	51961	3 *b*		1727·3	51084	3 *b*	Ni
1618·9	51956	4 *b*		1733·6	51035	5 *b*	
1621·5	51932	1 *b*		1734·6	51027	3 *b*	
1622·3	51925	5 *c*	Fe	1737·7	51002	5 *d*	
1623·4	51915	5 *b*	Fe	1741·0	50976	4 *b*	Cu
1627·2	51883	5 *b*	Ca	1742·7	50964	1 *a*	
1628·2	51875	1 *b*		1743·1	50961	1 *a*	
1631·5	51848	1 *b*		1744·6	50950	2 *a*	
b 1633·5	51832	4 *g*		1748·9	50917	3 *c*	Ni
1634·1	51826	6 *g*	Mg	1749·6	50912	2 *d*	Ni
1634·7	51821	4 *g*		1750·4	50906	5 *c*	
1638·7	51790	1 *b*		1752·0	50896	2 *b*	
1642·1	51761	1 *b*		1752·8	50889	4 *c*	
1643·0	51754	1 *b*	Ni	1762·0	50821	3 *c*	
1647·3	51718	5 *a*		1771·5	50748	3 *c*	
1648·4	51709	4 *e*		1772·5	50741	3 *c*	
b_1 1648·8	51705	6 *f*	Mg	1774·0	50729	2 *b*	
1649·2	51702	4 *e*		1775·8	50716	3 *b*	Ni
1650·3	51693	6 *b*	Fe	1776·5	50712	3 *c*	Ni
b_2 1653·7	51664	6 *b*	Fe, Ni	1777·5	50704	3 *c*	
1654·0	51661	4 *c*		1778·5	50696	3 *e*	
1655·6	51647	6 *e*	Fe, Mg	1782·7	50665	3 *b*	
1655·9	51644	4 *d*		1784·4	50651	1 *b*	
1657·1	51635	5 *b*		1785·0	50647	4 *b*	
1658·3	51627	2 *b*		1787·7	50626	2 *c*	
to 1659·4	51618	1		1788·7	50618	3 *b*	
1662·8	51592	5 *b*	Fe	1793·8	50583	4 *b*	
1667·4	51554	3 *a*		1795·4	50571	1 *a*	
1670·3	51531	1 *a*		1796·0	50567	3 *a*	
1671·5	51522	3 *b*		1797·8	50555	1 *a*	
1672·2	51517	4 *a*	Ni	1799·0	50546	4 *c*	
1673·7	51506	4 *a*		1799·6	50542	3 *b*	
1674·7	51497	3 *c*	Cu	1806·4	50492	2 *b*	
1676·2	51484	2 *d*		1818·7	50403	5 *b*	
1676·5	51481	4 *b*		1821·4	50384	5 *b*	
1677·9	51469	4 *c*		1822·6	50376	3 *a*	
1681·6	51438	4 *c*		1823·2	50371	2 *a*	
1684·0	51421	4 *a*	Ni	1823·6	50368	2 *a*	
1684·4	51418	1 *b*		1828·6	50330	1 *b*	
1685·9	51404	2 *a*		1830·1	50320	3 *b*	
1686·3	51401	2 *a*		1832·8	50302	2 *a*	Ca
1689·5	51377	5 *c*		1833·4	50298	6 *c*	
1690·0	51373	5 *b*	Ni	1834·3	50292	6 *c*	
1691·0	51365	5 *b*		1835·9	50282	3 *b*	
1693·8	51343	6 *e*	Fe	1836·7	50276	3 *c*	
1696·5	51321	3 *c*		1837·5	50271	3 *c*	
1697·0	51317	3 *c*	Ni	1841·0	50244	4 *b*	
1701·8	51281	5 *c*	Fe	1841·6	50240	4 *b*	
1704·6	51259	2 *c*		1842·2	50236	4 *b*	Ni
1704·9	51257	3 *b*		1848·9	50189	2 *c*	
1707·6	51236	2 *c*		1851·0	50173	1 *c*	
1707·9	51234	3 *b*		1853·2	50157	3 *b*	

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000		
1854·0	50152	2 *b*		1966·2	49398	2 *b*	
1854·9	50146	4 *c*		1966·7	49394	2 *b*	
1856·9	50133	1 *c*		1970·1	49373	3 *b*	
1857·9	50127	2 *b*		1974·7	49344	4 *b*	
1860·4	50108	2 *b*		1975·7	49337	2 *d*	
1861·3	50102	3 *c*		1979·2	49316	3 *c*	
1862·3	50095	2 *b*		1982·8	49293	5 *a*	
1864·9	50079	3 *b*		1983·3	49289	5 *a*	
1867·1	50063	5 *d*	Fe	1983·8	49286	5 *a*	
1868·4	50054	5 *b*	Ni	1984·5	49282	4 *b*	
1869·5	50046	1 *c*		1985·8	49273	4 *b*	
1870·6	50038	3 *a*		1986·9	49266	2 *a*	
1872·4	50025	5 *b*		1987·5	49263	3 *a*	Ni
1873·4	50018	6 *b*		1989·5	49250	6 *c*	Ba
1874·2	50013	2 *a*		1990·4	49243	5 *b*	
1874·8	50009	2 *a*		1991·8	49234	1 *b*	
1875·8	50002	2 *c*		1994·1	49219	5 *b*	
1876·5	49997	6 *b*		1996·9	49201	2 *a*	
1884·3	49945	6 *b*		1997·5	49198	2 *a*	
1885·8	49933	6 *b*		1999·6	49184	2 *c*	
1886·4	49929	6 *b*		2000·6	49176	5 *a*	
1889·5	49908	1 *g*		2001·6	49169	5 *c*	Fe
1891·0	49898	3 *b*		2003·2	49159	3 *b*	
1892·5	49890	5 *b*		2003·7	49157	1 *a*	
1893·8	49879	1 *b*		2004·9	49149	2 *d*	
1894·8	49871	3 *b*		2005·2	49148	6 *d*	Fe
1896·2	49861	4 *b*		2007·2	49135	6 *c*	Fe
1897·9	49850	1 *c*		2008·1	49129	1 *b*	Ni
1900·0	49835	1 *c*		2008·6	49125	1 *b*	
1904·5	49806	4 *b*		2009·8	49118	2 *b*	
1905·1	49802	2 *c*		2013·9	49094	2 *a*	
1908·5	49778	5 *d*		2014·3	49092	2 *a*	
1911·9	49755	3 *c*		2015·7	49083	1	
1916·2	49726	1 *d*		to 2016·9	49076		
1917·5	49719	4 *b*		2017·7	49070	2 *b*	
1917·9	49716	4 *b*				1	
1919·8	49704	4 *b*		2018·5	49066	2 *b*	
1920·2	49701	4 *b*	Ni	2019·5	49061	2 *a*	
1921·1	49694	4 *b*		2021·2	49048	1 *g*	
1922·0	49689	4 *b*		2024·9	49025	1 *a*	
1922·4	49686	4 *b*		2025·7	49020	4 *a*	Ni
1923·5	49678	4 *b*		2026·8	49012	4 *b*	
1925·8	49662	4 *b*	Ni	2031·1	48986	2 *c*	Ba
1928·0	49647	4 *b*		2035·4	48959	1 *b*	
1931·2	49625	1 *c*		2039·6	48934	1 *b*	
1932·5	49618	1 *c*		2041·3	48923	6 *c*	Fe
1936·2	49593	3 *c*		2042·2	48917	6 *b*	Fe
1939·5	49574	2 *c*		2044·5	48904	5 *b*	
1940·6	49566	2 *c*		2045·0	48901	5 *b*	
1941·5	49561	3 *b*		2047·0	48888	3 *d*	
1943·5	49548	2 *c*		2047·8	48884	3 *b*	
1944·5	49543	3 *b*		2049·3	48874	3 *a*	
1947·6	49522	4 *c*		2049·7	48873	3 *a*	
1949·4	49510	1 *c*		2051·3	48862	3 *c*	
1953·6	49482	2 *b*		2053·0	48851	4 *b*	
c 1960·8	49433	6 *b*		2053·7	48846	4 *c*	
		4	Fe	2058·0	48820	6 *c*	FeCa
1961·2	49431	6 *b*		2060·0	48808	2 *b*	
1964·3	49412	2 *c*		2060·6	48804	2 *a*	

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000		
2061·0	48802	1 *a*		2148·5	48284	4 *a*	
2064·7	48778	2 *c*	Ni	2148·9	48282	3 *a*	
2066·2	48769	5 *c*	Fe	2150·1	48277	3 *a*	
2067·1	48764	5 *c*	Fe	2150·5	48276	3 *a*	
2067·8	48761	3 *b*		2157·0	48239	3 *a*	Co, Au
2068·8	48755	3 *b*		2157·4	48237	5 *a*	
2070·6	48743	1 *b*		2159·0	48229	1 *c*	
2071·3	48739	1 *b*	Co	2160·6	48219	5 *a*	
2073·5	48728	3 *b*	Ni	2160·9	48217	4 *a*	
2074 6	48721	2 *b*		2161·7	48213	4 *a*	
2076·5	48709	1 *b*		2162·6	48207	3 *a*	
2077·3	48704	2 *b*		2163·7	48201	4 *a*	
F 2079·5	48690	4 *e*		2164·0	48198	4 *a*	Ni
2080·0	48689	6 *g*		2167·5	48178	6 *b*	
2080·5	48686	4 *e*		2171·5	48155	3 *b*	Co
2082·0	48676	6 *a*	Fe	2172·2	48151	2 *a*	
2084·6	48661	2 *b*		2175·7	48131	2 *b*	
2086·0	48651	1		2176·4	48127	1 *b*	
to 2086·9	48646			2179·9	48107	5 *b*	
2086·9	48646	3 *b*	Ni	2181·2	48100	3 *e*	
2087·6	48642	1 *a*		2184·9	48080	5 *b*	
2089·7	48632	1 *a*		2186·5	48072	3 *b*	
2090·9	48625	1 *a*		2187·1	48069	5 *a*	
2094·0	48606	2 *b*		2187·9	48064	5 *a*	
2096·8	48589	1 *b*		2188·5	48061	5 *a*	
2098·8	48577	1 *a*		2190·1	48052	5 *b*	
2099·8	48573	2 *a*		2191·9	48042	3 *e*	
2100·4	48569	1 *a*		2192·3	48039	5 *b*	
2102·6	48556	4 *a*		2193·3	48034	5 *a*	
2103·3	48552	4 *b*		2195·7	48017	2 *b*	
2104·0	48548	4 *a*		2197·1	48010	2 *b*	
2105·1	48543	4 *b*		2197·7	48007	2 *b*	
2107·0	48531	1 *a*		2198·8	48000	4 *a*	
2107·4	48528	2 *a*		2199·2	47998	3 *a*	Ni
2109·1	48520	2 *b*		2201·1	47988	2 *b*	
2111·1	48507	3 *b*		2201·9	47983	5 *c*	
2112·7	48497	3 *b*	Ni	2203·3	47975	2 *a*	
2115·0	48484	3 *a*	Ni	2203·8	47973	1 *a*	
2115·4	48481	3 *a*		2205·1	47965	1 *b*	
2119·8	48456	1 *b*		2206·4	47958	1 *a*	Co
2121·2	48446	4 *b*		2206·7	47956	1 *a*	
2121·9	48442	5 *c*		2209·1	47943	4 *c*	
2124·3	48428	1 *b*		2211·7	47928	4 *b*	
2125·1	48424	2 *b*		2213·4	47918	4 *b*	
2127·7	48408	3 *b*		2215·1	47909	1 *b*	
2132·3	48379	2 *a*	Co	2216·7	47900	3 *b*	
2132·7	48376	1 *a*		2217·5	47895	3 *b*	
2133·8	48369	2 *a*		2218·3	47890	3 *a*	
2134·3	48367	1 *a*		2219·8	47882	3 *b*	
2136·0	48357	5 *a*	Zn	2221·3	47873	1 *a*	
2138·0	48346	2 *g*		2221·7	47871	1 *a*	
2138·4	48343	4 *a*		2222·3	47868	5 *c*	
2139·5	48336	4 *a*		2223·5	47862	3 *c*	
2140·4	48331	4 *a*		2225·4	47851	2 *b*	
2141·9	48322	2 *a*		2226·2	47845	4 *b*	
2142·4	48319	5 *a*		2227·6	47837	2 *a*	
2144·6	48307	4 *a*		2228·6	47832	2 *a*	
2146·9	48293	3 *a*		2229·1	47829	4 *a*	
2147·4	48291	4 *a*		2230·7	47820	4 *a*	

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000		
2231·2	47817	2 *a*		2316·0	47344	2 *b*	
2232·3	47811	4 *a*		2316·6	47341	1 *b*	
(2233·7	47803	5 *c*		2322·0	47311	2 *b*	
\2234·0	47801	2 *c*		2323·0	47306	2 *b*	
2237·4	47784	1 *b*		2325·3	47291	6 *d*	
2238·7	47778	1 *b*		2328·3	47275	5 *b*	
2240·0	47769	3 *b*	Zn	2329·5	47269	5 *b*	Cu
2241·4	47760	2 *b*		(2332·8	47250	2 *b*	
2245·1	47739	3 *b*		\2333·0	47248	5 *b*	
2246·2	47733	1 *b*		2334·1	47242	2 *d*	Ni
2248·2	47722	3 *c*		2335·0	47237	5 *b*	
(2249·7	47715	6 *a*	Ni	2336·2	47231	2 *d*	
\2250·0	47712	3 *d*		2336·8	47228	5 *b*	
2255·4	47682	4 *b*		2339·9	47213	4 *b*	
2256·2	47678	2 *b*		2342·5	47198	1 *d*	
2257·1	47673	4 *d*		from (2343·7	47190	1	
2257·6	47670	2 *b*		\2345·1	47181	2 *d*	
2258·5	47666	2 *c*		2346·7	47172	4 *b*	
2259·4	47663	4 *c*		2347·3	47168	4 *b*	
2261·4	47652	1 *b*		2349·4	47157	1 *b*	
2262·1	47649	2 *a*		2349·9	47155	2 *b*	
2263·4	47642	2 *a*		2351·4	47145	1 *c*	
2264·3	47638	6 *d*		2352·2	47141	2 *b*	
2266·2	47627	2 *a*		2354·1	47130	6 *c*	
2266·6	47625	3 *a*		2357·4	47112	5 *a*	
2268·0	47616	3 *a*		2358·4	47104	5 *b*	
2269·1	47611	3 *a*		2361·0	47090	1 *d*	
2269·9	47607	3 *a*		2362·2	47084	1 *c*	
2270·2	47605	3 *a*		2362·6	47083	4 *b*	
2274·2	47587	1 *d*		2364·0	47074	4 *b*	
2278·4	47560	4 *c*		2365·9	47064	2 *b*	
2279·8	47554	2 *a*		2366·8	47059	1 *b*	
2280·7	47548	2 *a*		2367·7	47054	2 *b*	
2282·0	47541	1 *a*		2369·7	47044	2 *b*	
2282·3	47539	1 *b*		(2371·4	47033	2 *b*	
2283·6	47531	2 *a*		\2371·6	47032	4 *b*	
2284·9	47524	2 *b*		2372·4	47027	4 *b*	
2286·1	47518	2 *b*		2374·2	47016	3 *b*	
2288·1	47506	2 *a*		2375·0	47013	2 *b*	
from (2289·1	47501	1		2375·6	47010	4 *b*	
\2289·9	47496	2 *b*		2376·1	47006	1 *b*	
2290·4	47493	1 *b*		2379·0	46989	6 *c*	
2291·8	47486	2 *g*	Zn	2381·6	46975	6 *c*	
(2293·1	47478	2 *a*		2386·1	46951	3 *b*	
(		1		2386·6	46948	2 *a*	
\2293·6	47474	3 *b*		2388·7	46935	2 *c*	
2294·5	47469	2 *b*	Cd	2389·7	46929	2 *c*	
2301·7	47428	4 *c*		2390·7	46924	3 *a*	
2302·9	47420	3 *b*		2391·2	46920	1 *b*	
2305·3	47404	3 *d*		2393·1	46911	5 *b*	
2306·8	47397	4 *c*		2394·4	46904	4 *a*	
2307·8	47391	1 *b*		(2395·8	46896	1 *f*	
2308·2	47389	5 *b*		\2396·1	46895	3 *b*	
(2309·0	47385	5 *c*		(2396·7	46892	2 *a*	
to \2310·4	47378	1		(		1	
2310·9	47375	2 *c*		\2397·4	46887	2 *a*	
2312·5	47365	3 *b*		2399·6	46875	3 *a*	
2313·7	47358	3 *b*		2399·9	46874	3 *a*	
2314·3	47354	3 *b*		2402·2	46858	3 *b*	

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 6·000		
2403·2	46851	3 *b*		2478·7	46404	2 *a*	
2404·9	46842	2 *b*		2479·7	46397	2 *a*	
2406·2	46835	2 *b*		2480·1	46395	2 *a*	
2406·6	46833	6 *c*		2481·1	46388	1 *a*	
2407·2	46828	1 *b*		2482·1	46384	1 *a*	
2408·2	46823	4 *b*		2482·4	36381	1 *c*	
2409·0	46818	1 *b*		2486·6	46355	5 *b*	
2410·2	46811	4 *b*		2487·0	46352	5 *b*	
2412·8	46799	3 *b*		2488·2	46346	4 *b*	
2414·7	46787	2 *b*		2489·4	46339	5 *d*	
(2416·0	46780	3 *d*		(2490·5	46333	5 *a*	
(2416·3	46777	5 *b*		(2490·8	46330	3 *d*	
2418·0	46768	3 *b*		2493·0	46318	3 *a*	
2419·3	46761	5 *b*		(2493·6	46314	5 *a*	Co
2420·6	46753	2 *b*		(2493·9	46313	3 *f*	
2422·3	46744	6 *d*	Co	2495·8	46302	5 *b*	
2423·8	46735	3 *c*		2497·2	46292	6 *d*	
2424·4	46731	4 *b*		2499·0	46282	3 *b*	
2426·5	46720	4 *b*		2499·8	46277	3 *b*	
2428·4	46709	1 *a*		2500·3	46273	4 *c*	
2429·5	46703	3 *b*		(2502·2	46262	4 *c* }	Ba
2431·9	46689	2 *b*		(2502·4	46260	1 *b* }	
2432·4	46686	1 *b*		2505·6	46240	4 *d*	
(2435·3	46668	2 *b*		2509·4	46218	2 *d*	
(2435·5	46667	5 *c*		2512·1	46200	1 *c*	
(2435·7	46665	2 *b*		2512·5	46198	2 *a*	
2436·5	46660	5 *a*		2513·2	46194	2 *b*	
2438·5	46649	1 *a*		2513·5	46192	1 *b*	
2439·4	46644	2 *b*		2517·0	46170	3 *b*	
2440·0	46640	1 *a*		(2518·2	46161	2 *c*	
2441·8	46629	2 *a*		(2518·4	46159	3 *a*	
2442·4	46626	1 *a*		2520·9	46145	3 *a*	
2443·9	46617	5 *a*		2522·3	46136	1 *a*	
2444·2	46615	5 *a*		2525·0	46120	2 *a*	
2445·3	46609	1 *c*		2525·4	46117	1 *b*	
2446·6	46601	5 *b*		2527·0	46106	4 *a*	
2452·1	46570	2 *c*		2532·0	46075	2 *b*	
2454·1	46555	4 *b*		2535·5	46052	2 *b*	
2457·5	46537	4 *b*		2535·9	46049	2 *b*	
2457·9	46534	4 *b*		2536·6	46045	1 *b*	
2458·6	46530	3 *a*		2537·1	46042	5 *c*	
2459·5	46524	2 *b*		2538·0	46035	1 *b*	
2460·4	46518	1 *c*		2538·3	46033	2 *a*	
2461·2	46513	6 *b*	Ba	2540·5	46021	2 *g*	Pt
2463·4	46499	4 *b*		2543·5	46002	4 *c*	
2466·0	46482	3 *a*		2544·5	45995	2 *d*	
(2467·3	46474	3 *c*		2545·4	45989	1 *c*	
(2467·6	46472	5 *c*		2547·2	45976	6 *c*	
(2467·9	46470	3 *c*		2547·7	45972	2 *b*	
2468·7	46465	3 *a*		2548·4	45968	1 *c*	
2470·1	46457	4 *a*		2549·7	45959	1 *b*	
(2471·2	46450	2 *b*		2550·1	45956	1 *b*	
(2471·4	46448	4 *a*		(2551·2	45948	1 *b*	
2472·9	46439	4 *a*		(2551·4	45946	3 *a*	
2473·8	46433	2 *c*		(2552·4	45940	3 *a*	
2474·6	46428	4 *b*		(2552·6	45938	1 *b*	
2475·5	46424	1 *c*		2553·6	45932	3 *a*	
2477·4	46411	2 *a*		2554·0	45929	3 *a*	
2477·8	46408	2 *a*					

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000		
2554·9	45922	3 *a*		2624·1	45428	1 *b*	
2555·1	45921	2 *c*		2625·2	45419	5 *a*	
2556·3	45913	2 *c*		2625·9	45413	4 *a*	
2559·9	45890	3 *b*		2626·3	45410	2 *a*	
2562·1	45875	4 *b*		2627·0	45405	5 *b*	
2564·0	45862	3 *b*		2627·9	45398	2 *a*	
2565·0	45855	6 *c*		2628·9	45391	1 *c*	
2565·9	45848	2 *b*		2629·7	45386	1 *b*	
2566·3	45845	3 *d*		2630·5	45380	1 *a*	
2567·8	45836	3 *b*		2633·6	45356	2 *c*	
2568·4	45832	2 *b*		2634·4	45351	1 *d*	
2574·4	45790	5 *c*		2635·5	45343	3 *b*	
2579·3	45756	3 *d*		2636·4	45337	2 *c*	
2581·0	45744	1 *a*		2637·4	45329	4 *b*	
2581·5	45740	1 *a*		2638·5	45320	4 *e*	Ca
2582·0	45737	2 *a*		2638·8	45318	5 *a*	
2582·4	45733	2 *a*		2639·6	45313	1 *c*	
2582·8	45730	1 *a*		2640·6	45305	2 *c*	
2584·0	45721	3 *e*		2641·6	45297	3 *c*	
2585·4	45712	5 *b*		2642·5	45291	2 *a*	
2587·9	45694	3 *a*		2643·2	45287	1 *a*	
2588·5	45690	5 *b*		2643·5	45285	1 *a*	
2589·7	45681	1 *b*		2645·6	45268	4 *b*	
2591·3	45669	4 *a*		2646·2	45263	2 *g*	(La, Di)
2591·7	45666	2 *c*		2650·5	45233	5 *b*	
2593·0	45656	1 *c*		2650·7	45231	3 *c*	
2594·9	45643	2 *b*		2652·9	45213	1 *d*	Ca
		1		2653·2	45211	5 *b*	
2595·4	45640	4 *a*		from 2656·7	45185	1	
2595·9	45636	4 *a*		2657·9	45177	3 *b*	
		1		2658·6	45171	1 *b*	
2596·4	45632	2 *c*		2664·9	45119	3 *a*	
2597·7	45622	3·*b*		2665·9	45109	3 *b*	
2598·5	45617	1 *b*		2666·7	45102	1 *b*	
2599·4	45611	3 *c*		2667·6	45094	3 *a*	
2599·7	45609	5 *b*		2668·0	45091	1 *b*	
2600·6	45602	2 *a*		2669·4	45079	3 *b*	
2601·0	45599	2 *c*		*f** 2670·0	45074	6 *e*	Fe
2602·1	45590	4 *b*		2673·8	45042	1 *a*	
2602·9	45583	1 *a*		2674·5	45036	2 *a*	
2603·6	45577	2 *b*		2675·6	45026	2 *c*	
2604·0	45574	1 *a*		2676·5	54018	2 *a*	
2604·8	45568	4 *b*		2677·2	45011	1 *a*	
2605·8	45561	3 *b*		2678·4	45001	1 *a*	
		2		2679·0	44996	2 *a*	
2606·6	45555	5 *c*	Ca	2680·0	44988	5 *b*	
2607·1	45551	3 *c*		2680·2	44986	3 *b*	
2608·2	45543	1 *c*		2681·2	44977	5 *a*	
2608·6	45540	1 *b*		2683·1	44961	4 *b*	
2608·9	45538	1 *a*		2686·0	44936	3 *c*	
2610·2	45529	1 *a*		2686·4	44933	6 *f*	Fe
2612·3	45514	3 *b*		2686·8	44930	3 *e*	
2613·6	45504	2 *c*		2688·4	44915	2 *e*	
2614·1	45501	3 *c*		2690·8	44894	5 *b*	
2616·5	45486	2 *b*		2691·1	44890	3 *e*	
2619·1	45467	5 *b*		2692·3	44881	3 *c*	
2619·9	45461	3 *a*		2693·5	44871	4 *c*	
2620·3	45458	3 *a*		from 2695·2	44855	1	
2622·3	45443	1 *b*		to 2696·8	44841		

* The identification of *f* appears doubtful.—G. B. A.

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000		
2698·2	44830	1 *f*		2755·4	44291	1 *b*	
from 2699·8	44816	1		2755·8	44287	2 *b*	
2700·7	44810	2 *a*		2756·5	44279	1 *c*	
2702·1	44799	3 *b*		2757·2	44272	1 *c*	
2702·3	44797	4 *a*		2759·4	44249	1 *a*	
2702·5	44794	3 *b*		2760·1	44242	2 *a*	
2703·5	44786	3 *a*		2760·6	44236	2 *d*	
from 2703·8	44783	1		2762·0	44221	4 *e*	
to 2704·9	44773			2763·8	44202	3 *f*	
2707·4	44751	1 *f*		2767·2	44166	1 *d*	
2707·7	44748	3 *a*		2768·2	44155	2 *a*	
2708·9	44737	4 *b*		2768·5	44152	1 *a*	
2709·6	44731	2 *b*		2770·0	44136	2 *b*	
2710·6	44722	3 *a*		2770·8	44128	2 *b*	
2710·9	44719	1 *g*		2774·0	44095	5 *c*	
2711·9	44711	1 *a*		2775·4	44081	4 *c*	
2712·8	44702	2 *a*		2775·7	44077	6 *c*	
2713·3	44697	3 *a*		2776·0	44073	4 *c*	
2714·3	44688	2 *a*		2777·3	44059	3 *a*	
2715·2	44681	2 *b*				2	
2716·1	44673	1 *d*		2777·8	44054	1	
2718·5	44650	3 *g*					
2719·0	44646	4 *c*		2778·5	44047		
		1		2781·2	44019	2 *b*	
2720·2	44635	2		2782·2	44008	1 *b*	
2720·8	44629	6	Fe	2782·9	44001	3 *b*	
2721·6	44622	3		2783·9	43990	1 *b*	
2722·8	44611			2784·8	43981	1 *c*	
2725·5	44586	2 *d*		2785·1	43978	2 *c*	
2725·8	44582	3 *a*		2788·8	43939	1 *b*	
2726·8	44572	2 *a*		2789·1	43936	3 *c*	
2728·0	44560	4 *b*		2790·5	43921	1 *c*	
2728·4	44557	1 *b*		2791·1	43915	3 *b*	
2729·8	44543	2 *c*		2793·0	43895	1	
2730·7	44534	1 *b*		2794·0	43886	2	
2731·6	44526	3 *c*		2795·7	43868	6	
2732·4	44518	1 *c*		2796·7	43857	2	
2733·7	44506	5 *b*		2797·6	43848	3 *b*	
2734·1	44502	3 *b*				2	
		1		2798·0	43844	3 *b*	
2735·7	44487	3 *b*				1	
2736·5	44479	3 *b*		2798·9	43835	2 *c*	
2736·9	44475	3 *b*				1	
2737·4	44470	1 *a*		2799·5	43829	2 *c*	
2737·8	44466	2 *a*				1	
2739·2	44453	2 *c*		2800·1	43823	3 *b*	
2739·9	44446	1 *b*				1	
2741·3	44433	3 *d*		2800·7	43816	3 *b*	
2741·7	44429	3 *b*				1	
2743·8	44408	1 *f*		2801·4	43807	4 *d*	
2744·1	44406	4 *c*		2804·5	43771	1 *b*	
2744·3	44404	1 *d*		2805·4	43761	1 *b*	
2746·8	44379	1		2806·9	43743	1 *c*	
2747·2	44374			2807·2	43739	2 *a*	
2747·6	44370	3 *a*		2808·6	43723	1 *b*	
2748·0	44367	4 *c*		2808·8	43721	2 *a*	
2749·8	44350	3 *c*		2809·0	43719	1 *b*	
2750·6	44341	3 *a*		2810·8	43697	2 *b*	
2754·5	44300	2 *c*					

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000			Kirchhoff's measure.	Wave-length, m.m. 0·000		
2811·7	43687	2 *a*		2851·6	43202	3 *b*	
2812·0	43683	2 *a*				2	
2812·5	43678	2 *a*		2852·0	43197	4 *a*	
2812·8	43675	1 *e*				2	
2814·1	43659	1 *b*		2852·3	43193	4 *a*	
2817·7	43615	3 *c*				1	
2819·2	43598	3 *b*		2853·1	43181		
2819·6	43594	2 *b*		2853·6	43175	3	
2820·6	43582	2		2854·1	43168	4	} Fe
2821·0	43578	3		G 2854·7	43160	6	} Ca
2821·6	43571	3		2855·2	43153	4	
2822·3	43564	6	Fe	2855·7	43146	3	
		3		2856·9	43129	4 *d*	
2823·4	43552	4 *c*		from 2857·9	43118	3	
2824·2	43543	3 *a*		2858·5	43110	4 *a*	
		2				2	Sr
2825·0	43534	4 *c*		2858·9	43104		
		3				3	
2825·9	43523	4 *b*		2859·4	43098		
		3				1	
2826·5	43516	4 *e*		2860·2	43088		
2828·9	43488	3 *b*		2860·9	43078	2	
2830·7	43467	3 *g*				1	
2834·2	43426	5 *c*	Ca	2861·7	43069	4 *b*	
2837·7	43384	1 *g*		2861·9	43066	3 *b*	
2841·4	43339	5 *b*				1	
2841·7	43335	4 *e*		2863·1	43050	3 *b*	
2843·0	43318	3 *d*		2863·6	43044		
2843·3	43314	4 *a*				4	
2844·0	43304	3 *b*		2864·2	43036	5 *b*	
2845·3	43286	4 *f*				2	
		2		2864·7	43030	4 *b*	Ca
2846·1	43275	3 *c*				2	
		2		2865·3	43022	4 *c*	
2846·9	43264	4 *c*				1	
		1		2866·3	43009	5 *b*	
2847·7	43253	4 *a*				3	
		2		2867·1	42999		
2848·0	43249	4 *a*				2	
		2		2868·1	42985	4 *c*	
2848·4	43243	3 *b*				3	
		2		2869·7	42964	5 *c*	Ca
2848·9	43237	3 *b*				4	
		2		2871·2	42944		
2849·3	43232	3 *b*		2872·2	42930	4 *d*	
		2				1	
2849·8	43225	3 *b*		2873·4	42913	2 *b*	
		2				1	
2850·2	43221	3 *b*		2873·9	42907	2 *b*	
		2				1	
2850·7	43214	3 *b*		2874·3	42901	3 *b*	
		2				1	
2851·1	43209	3 *b*		2874·7	42897	2 *b*	
		2				1	
				2875·2	42890	4 *c*	

Conversion of KIRCHHOFF'S Spectral Measures into Wave-Lengths in terms of the Millimetre, for the lines produced by Metals and Air.

(The lines marked with an asterisk appear to coincide with dark lines in the Solar Spectrum.)—Note by KIRCHHOFF.

Kirchhoff's measure.	Wave-length, m.m. 0·000	
Ce		
1190·1	56345	1
1249·9	55611	1
1256·7	55530	1
1329·1	54710	2
1332·4	54676	2
1336·2	54635	1
1385·0	54118	2
1401·7	53948	2
*1438·9	53580	3
1460·9	53363	1
1517·9	52834	3
from 1571·0	52364	1
to 1572·4	52351	
1573·0	52345	2
1623·1	51918	1
from 1629·2	51866	2
to 1630·4	51858	
1683·1	51427	1
1725·5	51098	1
*1777·5	50705	2
from 1782·4	50669	1
to 1784·5	50650	
1938·8	49579	2
2052·3	48856	1
2221·5	47871	1
Di		
1225·0	55908	2
1230·0	55847	1
from 1364·5	54335	1
to 1365·2	54327	
1431·9	53648	1
1471·1	53269	1
from 1518·6	52828	1
*to 1519·4	52820	
1536·0	52675	1
1541·4	52622	1
1548·9	52555	2
*1567·5	52392	1
1709·2	51224	2
La		
from 1411·6	53851	2
*to 1412·8	53839	
1416·8	53798	2
1451·0	53462	1
1606·8	52056	2
1627·9	51878	2
1634·8	51821	2
2136·8	48352	1

Kirchhoff's measure.	Wave-length, m.m. 0·000	
(La, Di)		
1025·0	58693	1
1064·5	58080	1
1066·1	58058	1
1071·1	57979	1
1075·6	57915	1
1077·0	57895	1
1092·1	57674	2
*1302·0	55012	1
*1303·4	54995	2
1317·6	54836	1
1345·4	54537	1
from 1486·8	53121	2
*to 1489·2	53098	
*1622·3	51925	1
*1623·3	51916	1
1716·6	51167	2
1728·8	51072	2
from 1894·5	49873	2
*to 1895·2	49869	
1903·0	49816	1
1940·2	49569	1
from 1988·6	49255	1
to 1989·5	49250	
2003·8	49156	1
2004·7	49151	2
2031·0	48987	2
2081·0	48682	2
2121·4	48444	1
2208·2	47948	2
2214·5	47912	2
2217·8	47894	2
Pd		
1114·7	57349	1
*1146·2	56921	2
1164·9	56670	2
1185·6	56403	1
1264·6	55438	2
1269·0	55386	2
1279·1	55270	1
from 1400·0	53965	2
*to 1400·7	53959	
1430·1	53666	1
1447·0	53504	1
1477·0	53212	1
1495·2	53042	3
1540·0	52636	1
from 1566·5	52401	2
to 1567·1	52396	
1601·4	52103	1

TABLE (continued).

Kirchhoff's measure.	Wave-length, m.m. 0·000		Kirchhoff's measure.	Wave-length, m.m. 0·000	
from 1660·0	51613	} 3	from 1488·2	53108	} 3
to 1660·7	51608		to 1489·0	53100	
1732·9	51040	2	1576·8	52313	1
1801·9	50525	1	from 1806·1	50494	} 2
2062·0	48795	2	*to 1806·9	50488	
2123·6	48432	2	2057·0	48826	1
2162·0	48212	2			
			(Ru, Ir)		
Pt			1348·3	54504	2
1325·7	54747	1	*1489·9	53093	1

Atmospheric Lines.

Kirchhoff's measure.	Wave-length, m.m. 0·000		Kirchhoff's measure.	Wave-length. m.m. 0·000	
711·4	65232		977·7	59471	
948·0	59991		982·0	59401	
949·4	59967		982·3	59396	
949·8	59960		988·9	59284	
951·7	59925		989·2	59279	
954·2	59881		989·6	59272	
958·8	59801		993·1	59215	
959·6	59788		993·4	59206	
961·9	59746		998·1	59130	
963·7	59713		999·2	59112	
964·4	59703		1000·0	59099	
965·7	59681		1001·4	59078	
968·7	59624		1005·8	59004	
969·0	59623		1008·3	58963	
969·6	59613		1009·2	58949	
970·5	59597		1010·5	58927	
972·1	59568		1013·9	58873	
974·3	59531		1015·1	58854	
975·0	59519		1016·4	58833	
975·7	59505		1017·7	58812	
976·1	59499		1018·2	58803	
977·4	59477				

Measures of Wave-Lengths, in Millimetres, for the Spectral Lines produced by Air and different Metals: collected from the preceding Tables.

Air.	Ba	Ca	Cr	Fe	La	Na	Pd
m.m.	m.m.	m.m.	m.m.	m.m.	m.m.	m.m.	m.m.
0·000	0·000	0·000	0·000	0·000	0·000	0·000	0·000
65729	65035	43153	54112	54167	53851	59053	52396
65710	61405	43030	52102	54121	53839	58988	52103
65690	61086	42964	52077	54076	53798		51613
65232	58583		52060	54063	53462	Ni	51608
64867	57805	Cd		53995	52056	61135	51040
60011	55326	64456	Cu	53949	51878	61056	50525
59991	55175	47469	57824	53862	51821	59017	48795
59967	54262		53024	53749	48352	58626	48432
59960	49250	Ce	52215	53736		54757	48212
59925	48986	56345	51497	53713		51754	
59880	46513	55611	50976	53685	(La, Di)	51664	Pt
59801	46262	55530	47269	53463	58693	51517	54747
59788	46260	54710		53454	58080	51421	53108
59746		54676	Di	53346	58058	51373	53100
59713		54635	55908	53343	57979	51317	52313
59703	Ca	54118	55847	53309	57915	51084	50494
59681	67273	53948	54335	53243	57895	50917	50488
59624	65059	53580	54327	53113	57674	50912	48826
59623	65000	53363	53648	52941	55012	50716	46021
59613	64764	52834	53269	52919	54995	50712	
59597	64695	52364	52828	52792	54836	50236	(Ru. Ir)
59568	64559	52351	52820	52782	54537	50054	63525
59531	64456	52345	52675	52747	53121	49701	54504
59519	61693	51918	52622	52375	53098	49662	53093
59505	61617	51866	52555	52309	51925	49263	
59499	61191	51858	52392	51925	51916	49129	Sr
59477	60990	51427	51224	51915	51167	49020	64129
59471	58626	51098		51693	51072	48778	55320
59401	55997	50704	Fe	51664	49873	48728	54805
59396	55981	50669	64972	51647	49869	48646	43118
59284	55951	50651	64049	51592	49816	48497	43110
59279	55913	49579	63049	51343	49569	48484	43104
59272	55868	48856	62317	51281	49255	48198	
59215	55852	47871	61915	50063	49250	47998	Zn
59206	55787		61348	49433	49156	47715	63683
59130	53536	Co	60659	49431	49151	47242	48357
59112	52792	61191	60297	49169	48987		47769
59099	52739	54821	59234	49148	48682	Pd	47486
59078	52725	53579	57616	49135	48444	57349	
59004	52705	53568	56210	48923	47948	56921	
58963	52701	53488	56129	48917	47912	56670	
58949	51883	53479	55997	48820	47894	56403	
58927	50302	52904	55833	48769	45263	55438	
58873	48820	52770	55728	48764		55386	
58854	45561	52747	55696	48676		55270	
58833	45555	52401	55660	45074	Li	53965	
58812	45551	48739	54626	44933	60990	53959	
58803	45320	48379	54556	44629		53666	
	45318	48239	54477	44622		53504	
	45213	48155	54456	43564	Mg	53212	
Au	45211	47958	54351	43168	51826	53042	
62796	43426	46744	54309	43160	51705	52636	
48239	43160	46314	54250		51647	52401	

Comparison of the Wave-Lengths found by ÅNGSTRÖM with the Wave-Lengths found in the preceding Tables.

(For ÅNGSTRÖM'S measures, see POGGENDORFF'S 'Annalen der Physik und Chemie,' CXXIII. Band, page 498. ÅNGSTRÖM'S measures were originally given in terms of the Paris inch, but are here converted into measures in terms of the millimetre.)

Designation of line and Kirchhoff's measure.	Wave-length, by Ångström in terms of the Paris inch. in. 0·0000	Wave-length, by Ångström in terms of the millimetre. m.m. 0·000	Wave-length, computed in preceding Tables. m.m. 0·000	Designation of line and Kirchhoff's measure.	Wave-length, by Ångström in terms of the Paris inch. in. 0·0000	Wave-length, by Ångström in terms of the millimetre. m.m. 0·000	Wave-length, computed in preceding Tables. m.m. 0·000
A 401·9—406·8	28120	76121	76561	1463·3	19696	53317	53343
B 592·7—593·1	25397	68750	68841	1466·8	19681	53276	53309
C 694·1	24263	65680	65710	1473·9	19653	53201	53243
849·7	22873	61917	61915	E 1522·7	19484	52743	52792
860·2	22796	61709	61693	1523·7	19480	52732	52782
863·9	22768	61633	61617	1527·7	19468	52700	52747
874·3	22694	61433	61405	1564·2	19364	52418	52423
877·0	22677	61387	61348	1569·6	19346	52370	52375
884·9	22621	61235	61191	1622·3	19196	51964	51925
894·9	22551	61046	60990	*b* 1633·5	19165	51880	51832
D 1002·8	21797	59004	59053	b_1 1648·8	19124	51769	51705
1006·8	21775	58945	58988	b_2 1653·7	19111	51733	51664
1200·6	20761	56200	56210	1655·6	19105	51717	51647
1207·3	20713	56070	56129	*c* 1960·8	18327	49611	49433
1217·8	20654	55910	55997	2001·6	18191	49243	49169
1231·3	20601	55767	55833	2005·2	18184	49224	49148
1337·0	20169	54597	54626	2041·3	18083	48951	48923
1343·5	20136	54508	54556	2066·2	18011	48756	48769
1362·9	20073	54338	54351	F 2079·5	17973	48653	48690
1367·0	20053	54283	54309	2080·5			48686
1389·4	19984	54097	54076	*f* 2670·0	16322	44184	45074
1390·9	19979	54083	54063	2686·4	16285	44083	44933
1421·5	19858	53756	53749	2720·8	16204	43864	44629
1423·0	19853	53742	53736	G 2854·7	15923	43104	43160
1425·4	19842	53712	53713				
1428·2	19835	53693	53685				
1450·8	19742	53442	53463				

Comparison of the Wave-Lengths found by DITSCHEINER with the Wave-Lengths found in the preceding Tables. (See 'Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Classe der Kaiserlichen Akademie der Wissenschaften,' LII. Band, II. Abtheilung, 1865, p. 289, &c.)

Designation of line and Kirchhoff's measure.	Wave-length, by Ditscheiner. m.m. 0·000	Wave-length, computed in preceding Tables. m.m. 0·000	Designation of line and Kirchhoff's measure.	Wave-length, by Ditscheiner. m.m. 0·000	Wave-length, computed in preceding Tables. m.m. 0·000
B 593	68833	68835	1737·6	51180	51002
C 694	65711	65710	1750·4	51068	50906
711·5	65258	65233	1777·4	50879	50729
719·5	65054	65011	1799	50729	50546
783·5	63472	63403	1834	50493	50295
831	62407	62317	1854·5	50363	50149
850	62009	61915	1867	50264	50063
860	61796	61693	1873·5	50205	50018
864	61719	61617	1885·8	50145	49933
874·5	61520	61405	1908·5	50010	49778
877	61470	61348	1920	49914	49701
885	61322	61191	1961	49653	49432
895	61128	60990	1975·6	49541	49337
959	59859	59801	1983	49471	49289
D*b* 1002·8	59053	59053	1989·5	49412	49250
D*a* 1006·8	58989	58988	2002	49269	49169
1029·4	58670	58626	2018	49178	49068
1096·1	57716	57616	2041·4	48990	48923
1103	57621	57517	2058	48854	48820
1135	57193	57068	2067	48791	48764
1155·7	56913	56790	F 2080·1	48687	48689
1174·4	56676	56550	2103·3	48499	48552
1200·4	56339	56210	2119·8	48317	48456
1207·5	56240	56129	2148·9	48092	48282
1218	56119	55997	2157·4	47991	48237
1231·6	55955	55833	2160·6	47959	48219
1242·5	55819	55696	2187·1	47717	48069
1280	55368	55259	2201·9	47626	47983
1303·7	55154	54994	2221·7	47470	47871
1307	55111	54958	2233·7	47371	47803
1324·8	54854	54757	2250	47161	47712
1337	54719	54626	2264·3	47106	47638
1343·5	54646	54556	2309	46742	47385
1351·3	54549	54477	2416	46097	46780
1367	54382	54309	2436·5	45901	46660
1389·6	54132	54076	2457·5	45714	46537
1410·5	53919	53862	2467·4	45606	46472
1421·6	53792	53749	2489·4	45409	46339
1451	53491	53463	2537·1	45089	46042
1463	53369	53345	2547·2	45046	45976
1492·5	53062	53070	2566·3	44880	45845
1506·5	52919	52941	2606	44633	45555
1515·5	52841	52855	2627	44498	45408
E 1523·5	52783	52782	2638·6	44418	45319
1542	52638	52618	2670	44222	45074
1569·8	52413	52375	2686·6	44121	44933
1577·5	52349	52308	2721·6	43908	44622
1589·1	52236	52208	2734·9	43813	44495
1601·6	52171	52101	2775·6	43600	44077
1622·4	52006	51925	2797	43466	43857
1634	51912	51826	2822·8	43314	43564
b 1648·8	51809	51705	G 2854·7	43170	43160
1655·6	51754	51647	2869·7	43070	42964
1693·8	51503	51343			