DEPARTMENT OF MINES AND RESOURCES, CANADA
MINES, FORESTS, AND SCIENTIFIC SERVICES BRANCH

PUBLICATIONS
OF THE
Dominion Astrophysical Observatory
VICTORIA, B.C.

Volume VIII, No. 5

LINE INTENSITIES IN SPECTRA OF ADVANCED TYPE

BY A. PANNEKOEK

ABSTRACT:—This paper presents the results of a spectro-photometric study of III-prism spectrograms of seven stars and the sky in the region 4000 A. to 5000 A. The spectral range is from F3 to G6 and both giant, and dwarf, stars are included. Photometric problems connected with the reduction of the microphotometer records are investigated and discussed.

The observed line profiles are analysed by a method which yields the intensities of the component lines making up the blend. The equivalent widths of the spectral lines in the above wave-lengths range are given in a catalogue (Tables 8 and 9).

SECTION I. INTRODUCTION

The Observations. In "*Publications of the Astronomical Institute of the University of Amsterdam*", No. 6, photographic spectra are studied which were very kindly taken in 1924 for this Institute by Professor H. H. Plaskett, then at the Dominion Astrophysical Observatory. The promising results obtained in the first investigation of these plates, in those years of incipient quantitative photometric study of line intensities in stellar spectra, aroused the desire to make a more extensive photometric investigation of stellar spectra of different types by means of plates standardized in the same way. On my inquiry about the possibilities of similar, more extensive series of plates being taken with the Victoria telescope, Dr. J. S. Plaskett proposed that I take them myself and invited me for a stay of several months in 1929 at the Observatory. I here express my sincere gratitude for the helpfulness with which he prepared the way for me and gave me access to the resources of the observatory. The discussion of these plates and the derivation of results from them has been much delayed because the methods of measurement and discussion had to be devised at the same time, and often led to side-tracking and theoretical studies. Moreover, other kinds of research often interfered with the progress of the work.

The aim in view was to make a study of line intensities as related to spectral class and surface gravity, with emphasis upon stars of advanced type. Chiefly for the sake of comparison, a number of spectra of early types were added but they could not be made sufficiently numerous to present the variations of line intensities through all the

43962—1

sub-classes, and hence to be comparable with the work of E. G. Williams[1]. Thus the program mainly consisted in stars of the spectral classes F, G, K, M, as far as possible giants, supergiants and dwarfs for each division. All the spectra were taken with the same optical combination, three prisms of light flint of 63° angle, between a 45-inch collimator and a camera of 28 inches focal distance. This system produces spectra 8 cm. in length between λλ4050 and 4950, and gives a dispersion of 10 A/mm. at λ4350. For the fainter stars Eastman 40 plates were used, with a slit-width of 0″0015; for the brighter stars Eastman 33 plates (slit-width 0″0010) and for the brightest, Eastman Process plates (slit-width 0″0005) were used, completed by shorter exposures on E 40 plates for the sake of comparison with the faint stars. In the case of the most difficult objects, K0 and K5 dwarfs, faint reddish stars, the exposure had to be extended over two nights. As an additional program a certain number of plates of *δ Cephei* were taken.*

At first the plates were developed with the hard alkali Ross developer, as used for all plates taken at the observatory. Afterwards, when it was realized that, for photometric purposes, a soft developer giving a larger range with weaker gradients is to be preferred, a borax developer was prepared and used from July 5th onward.

The standardizing spectra required to convert the density of the silver deposit into light intensities were produced by an artificial source with continuous spectrum whose light passed through a dark wedge covering the slit. The wedge was covered by a comb of equally-distanced metal strips so that the continuous spectrum was broken up and appeared as a row of bands, spectra of different intensities, separated by clear spaces. The silver densities in the centre of each of these bands provide the scales of reduction to intensity for each wave-length. Two different wedges were used. One was a Zeiss step-reducer, consisting of platinum dust deposits of different thickness, forming adjacent bands of decreasing transparency on a thin glass plate. The other was a Hilger neutral glass wedge, of the same construction as described by H. H. Plaskett[2]. During the first months the Zeiss step-reducer was used and the Hilger wedge served only for comparison purposes. During the months following the Hilger wedge was also used in putting standardizing spectra upon the stellar plates. In the case of the Zeiss step-reducer, the teeth of the comb exactly covered the border lines of the separate bands; each of these bands and of the spectra produced had a nearly constant density over their whole width but the successive differences of absorption were not exactly equal and depended on chance. In the case of the Hilger wedge the teeth of the comb had a spacing width of exactly 1 mm., so that, on the plates, the spacing width of the bands was $28/45 = 0{\cdot}62$ mm. The absorption is directly proportional to the linear coordinate, and within each band it gradually increases.

In order to put the standardizing spectra upon the plates the telescope was set in a vertical position and a board carrying an incandescent lamp, with a hole covered by a ground glass, was attached to it. The pencil of light from the hole fell horizontally on a mirror, inclined at 45° just above the slit, and was reflected downward in to the collimator. A lens near the hole produced an image of the evenly-illuminated ground glass upon the

*They have been discussed afterwards by Dr. Th. Walraven in his thesis: "The Line Spectrum of δ Cephei" (*Publ. Amsterdam* No. 8, 1948).

[1] *Ap. J.*, 83, 279, 1936.

[2] *These Publications*, 2, 216, 1923.

slit. Immediately above the slit a brass wedge-holder was placed, carrying, above the wedge and comb, another lens producing an image of the first lens upon the collimator objective.

The standardizing spectra were put upon the plates at the end of a night's work. The slit was usually opened to a width of 0″.020, corresponding to an exposure time of some few minutes, varying with the brand of the plates, usually 1^m for E40, 2^m for E33 and 4^m or 5^m for E Process plates. Since the colour of the lamp is much redder than that of the stars, either the short wave-length part is lacking in the standards or the long wave-length part is overexposed, and is sometimes bordered by a halo. Hence, after the first weeks, it was decided to put two standardizing spectra of different intensity on opposite sides of the stellar spectrum. The difference in intensity during the first part of the work was produced by taking the second exposure time one-quarter of the other. During the last months the same exposure time was used but with different slit-widths, usually 0″.040 and 0″.010. On a few evenings a tungsten ribbon lamp was taken as light source, the same as that used by H. H. Plaskett in his determinations of colour temperature.[3] Since, however, its handling was more laborious, and since it was not our intention to make absolute determinations of colour temperature by means of the continuous spectrum, we soon ceased using it.

Calibration of the Wedges. The transmission ratios of the wedges had to be determined by the same kind of exposures that were used to standardize the plates. On the same plate exposures were made with different slit-widths, varying between ″.005 and ″.040. Since the zero correction of the slit-width was found to be insignificant (smaller than 0·1 of that unit) the working intensity may be assumed to be proportional to that width. By varying the exposure time, spectra of different density were obtained, the strongest giving good data for the short wave-length parts but with the densest parts overexposed; the weaker ones showing these parts, λλ4500-4800, well but with the short wave-lengths lacking. These calibration plates were taken on cloudy nights. The following plates were used for the derivation of the absorption coefficients (slit-width in 0″.001);

May 23: Zeiss, 4 plates—(*A*) slit 5 and 15 (1^m); (*B*) slit 10 and 25 (1^m); (*C*) slit 10 and 25 (3^m); (*D*) slit 5 and 15 (30^s).

Sept. 17: Hilger, 6 plates—slit 5, 10, 20, 40: (*A*) 40^s; (*B*) 20^s; (*C*) 80^s; (*D*) 120^s; (*E*) 60^s; (*F*) 30^s.

Sept. 30: 3 plates with Zeiss slit 20, Hilger slit 10 and 40: (*A*) 120^s; (*B*) 180^s; (*C*) 240^s.

Oct. 3: 4 plates with Zeiss slit 20, Hilger slit 10 and 40: (*A*) 60^s; (*B*) 240^s; (*C*) 600^s; (*D*) 120^s.

The plates of the latter four days were used to derive the absorption of the Hilger wedge, for which only one value (the absorption per unit length or per unit bandnumber) had to be derived for each wave-length. Here, moreover, the standardizing spectra of a number of stellar plates, all taken with slit-widths ″.010 and ″.040 and with exactly equal exposure times, could be used as additional data. The absorption differences between the steps of the Zeiss reducer were derived by means of the comparisons with the Hilger wedge on Sept. 19, Sept. 30 and Oct. 3 and by the transmission *S*, read from the cross-tracings of

[3] *These Publications*, 2, 227, 1923.

the band rows, made at determined round values of the wave-length. To locate the wave-lengths, an iron spectrum was put upon some of the plates; they were all invariably placed in the same manner with one side pressed to the inner border of the plateholder. Corrections for chemical fog and small variations of transparency of the plate between the bands were applied.

(*a*) *The Hilger Wedge.* On each of the plates of Sept. 17, four spectra are photographed with intensity ratios 1:2:4:8. For each of them the transmission S in the middle of each band, plotted against band-number 2-7, gives a characteristic curve. The four characteristic curves are displaced horizontally, relatively to one another by an amount corresponding to log 2; hence the value of log 2 expressed in unit band-number is exhibited by the horizontal distances D in the graph, and the absorption $\log I_n/I_{n+1}$ per unit band-number is given by $0\cdot301/D$.

There were found, however, two kinds of deviations from a regular equality of the horizontal curve distances. First the curves were not exactly parallel over their entire course. The distances in the lower parts, those of small transmission and stronger blackening, were nearly always smaller, and were larger in the upper parts than in the middle part. The characteristic curves produced by the lesser slit-widths are steeper; those produced by the wider slit-widths are less inclined. It is difficult to find a photographic effect to which this could be ascribed; all the silver densities compared are produced in the same exposure time. What we compare, on a horizontal line of the plot, are equal blackenings produced in the same exposure time beside one another on the same plate which, therefore, after the first photographic axiom, we may safely ascribe to equal acting intensities (for a given wave-length). These equal intensities are produced here by a strong light, weakened by a thick layer of dark glass, there by a light one-half as strong falling through a thinner part of the wedge. It is not easy to understand how this simple relation could be upset by the condition of the light before passing the wedge. It might be understood if the gradient of the wedge were more pronounced in the thinner part but this is contradicted by the equality of the successive horizontal distances of the curves. We might express the deviation in this way, that the gradient of the wedge seems to be larger when derived from denser than from weaker silver deposits. Since, in practice, medium blackenings will chiefly be used, we shall exclude, for the derivation of results, all transmissions below 30, and above 70, per cent.

Another source of deviation was the variation of the light intensity. It was not found possible to provide for a light source both sufficiently constant during the time of the experiments and ready for use within the brief period available. So for these calibration plates the same lamp was used as for all the standardizing spectra—an ordinary incandescent filament lamp fed by the city's central power station. Though the plates were taken in the night when the current is practically constant, we cannot be sure that it was sufficiently constant. We are not certain, therefore, that in the successive exposures the intensities were in the exact proportion of the slit-widths. We can only suppose that, on the average, the fluctuations act as accidental errors.

The horizontal distance of two successive characteristic curves was found by comparing each measured value of S on one curve with the same value interpolated on the other curve. This was done for all the different wave-lengths. If there has been a perceptible fluctuation of light intensity it was the same for all wave-lengths; hence any deviations from the mean should show a systematic character. This was actually found to be the case in several instances; hence for each pair of exposures these deviations for all wave-lengths were averaged, considered as real fluctuations, and, with reversed sign, used as corrections to the individual results so as to make them more homogeneous. The corrections used were:

for plate	B	F	A	E	C	D
slit 5—10	.....	+ ·01	.....	− ·02	.....	+ ·06
" 10—20	− ·03	− ·10	+ ·04	+ ·11	− ·01	− ·02
" 20—40	+ ·07	+ ·05	− ·11	+ ·01	− ·09	+ ·05

A deviation 0·10, in which an amount of nearly 1·2 corresponds to ratio 2, means a deviation of 6 per cent in light intensity.

The collected absorption coefficients for the Hilger wedge are given in Table 1 which also gives, in the penultimate column, the weighted mean values and in the final column the values read from a smooth curve through the means.

TABLE 1. ABSORPTION COEFFICIENT OF THE HILGER WEDGE PER UNIT BAND NUMBER

λ	Sept. 17	wt	Sept. 19	wt	Sept. 13, 15, 25	wt	Sept. 30	wt	Oct. 3	wt	Mean	wt	Curve
4050	0·273	1	0·294	1	0·305	3	0·330	1	0·316	2	0·306	8	0·312
4100	0·301	2	0·299	2	0·302	5	0·321	2	0·319	3	0·308	14	0·309
4150	0·306	3	0·298	2	....		0·316	2	0·311	3	0·308	10	0·306
4200	0·297	5	0·301	3	0·301	8	0·301	3	0·301	3	0·300	22	0·300
4250	0·291	7	0·292	3	....		0·301	3	0·293	3	0·292	16	0·291
4300	0·283	9	0·281	4	0·289	10	0·284	3	0·284	3	0·285	29	0·284
4350	0·286	10	0·282	4	....		0·286	4	0·285	4	0·285	22	0·285
4400	0·281	11	0·282	4	0·285	12	0·284	4	0·283	4	0·283	35	0·283
4450	....		....		....		0·279	3	0·267	4	0·272	7	0·276
4500	0·266	13	0·269	5	0·271	12	0·263	3	0·255	4	0·267	37	0·266
4600	0·245	13	0·248	5	0·245	12	0·239	2	0·241	2	0·245	34	0·245
4700	0·235	12	0·230	5	....		....		....		0·234	17	0·234
4800	0·232	12	0·233	4	0·224	12	0·217	1	0·229	1	0·228	30	0·228
4900	0·227	11	0·231	5	....		....		....		0·228	16	0·223
5000	0·223	12	0·226	6	0·213	12	....		0·227	2	0·220	32	0·219
5100	....		0·225	5	0·208	12	....		....		0·213	17	0·215

In Fig. 1 the different results with their means are plotted. The variation of absorption coefficient with wave-length shows a marked irregularity; after a steady increase with decreasing wave-length from λ5100 to λ4400 it remains constant between λ4400 and λ4300 after which the increase is resumed. There can be no doubt as to the reality of this curious behaviour; moreover it presents itself in nearly the same way in the results of H. H. Plaskett[3] for an analogous wedge, which, after his Table 2, (where they are given for unit length 0·5 mm.) have been plotted below our figure. The irregularity may be presented by a regular increase through the entire range of wave-lengths, to which is added a broad absorption band at λ4400 extending roughly from λ4600 to λ4250. This additional absorption amounts in the middle part to 0·017 per unit bandnumber, corresponding to 1 mm. thickness of the dark neutral glass. (From H. H. Plaskett's results

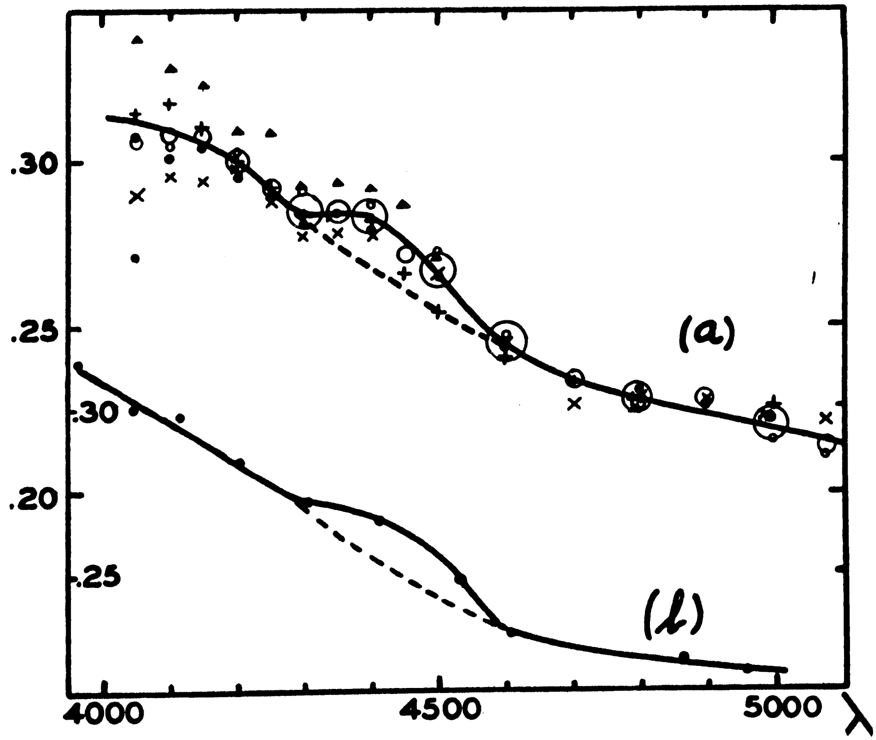

FIG. 1. The absorption coefficient of the Hilger wedge plotted as a function of wave-length. Curve (*a*) is for the wedge used in the present paper while (*b*) is for a similar wedge exhibiting the same peculiarity in the region about 4500 A. Large circles are the mean values from the several individual determinations.

this value is found to be 0·013.) It may be remarked that the intensity of the continuous spectrum produced by the Victoria spectrograph, as demonstrated by our curves α and A (in Fig. 2)[4] shows an absorption band at exactly the same place, from λ4600 to λ4250 amounting to 0·075 in log I, produced by an average path of 20 cm. through the clear glass. Moreover the same band was found, in a discussion of the flash spectrum at the total solar eclipse of 1927[5], in the continuous spectrum produced by three prisms twice traversed, corresponding to 45 cm. thickness of glass. Hence the same absorption band occurring in the staining substance of the neutral dark glass is also present faintly (50 times fainter) in the light flint glass of which the prisms of the spectrographs are made.

(*b*) *The Zeiss Step-reducer.* The characteristic curves derived from the Hilger wedge for plates taken on Sept. 19, Sept. 30 and Oct. 3 could be used immediately to read log I for every measured S of one of the Zeiss steps. Thus the difference between two successive steps, expressed in units of Hilger band-numbers, was found. Only the data derived from the steep middle part of the curves were used. It was not necessary to determine all step-differences for each wave-length separately, because the ratio of two step-differences is the same for all wave-lengths. Hence the ratios $\frac{(1\text{-}2)}{(2\text{-}3)}, \frac{(2\text{-}3)}{(3\text{-}4)}, \frac{(3\text{-}4)}{(4\text{-}5)}$ were derived from the data of all the wave-lengths; they were used to derive, from each measure of a difference, a value for the standard difference (2-3), and to find its variation with wave-length.

[4] *P.A. Inst.*, Amsterdam, No. 6, Pt. 1, p. 6, 1939.
[5] *A.* Pannekoek and M. G. J. Minnaert, *Verhand. K. Ak.*, Amsterdam, 13, No. 5, 1928.

The results for the difference ratios (with their weights) are:

	$\frac{1\text{-}2}{2\text{-}3}$	$\frac{3\text{-}4}{2\text{-}3}$	$\frac{4\text{-}5}{3\text{-}4}$
Sept. 19	1·07 (10)	1·10 (11)	1·27 (3)
Sept. 30	1·03 (4)	1·28 (7)	1·25 (1/2)
Oct. 3	1·05 (6)	1·21 (9)	1·44 (1)

The results for the step-difference 2-3 in units of Hilger band-numbers are given in Table 2 and plotted in Fig. 2. As in the preceding case, because all wave-lengths are not

TABLE 2. DIFFERENCE OF ZEISS STEPS 2-3 IN HILGER BAND NUMBER UNITS

λ	Sept. 19	wt	Sept. 30	wt	Oct. 3	wt	Mean	wt
4050	1·15	2	1·18	4	1·14	6	1·16	12
4100	1·15	4	1·20	5	1·15	7	1·17	16
4150	1·16	7	1·23	5	1·17	7	1·18	19
4200	1·18	7	1·25	5	1·18	8	1·20	20
4250	1·21	8	1·31	5	1·20	8	1·23	21
4300	1·26	10	1·28	6	1·23	8	1·25	24
4350	1·25	10	1·28	6	1·20	8	1·24	24
4400	1·24	10	1·26	7	1·18	8	1·22	25
4450	....		1·29	6	1·24	7	1·26	13
4500	1·32	10	1·32	7	1·27	6	1·30	23
4600	1·37	10	1·35	6	1·33	6	1·35	22
4700	1·42	11	....		....		1·42	11
4800	1·42	11	1·59	5	1·38	6	1·45	22
4900	1·41	11	....		....		1·41	11
5000	1·49	12	....		1·50	6	1·50	18
5050	1·54	12	....		....		1·54	12
5100	1·57	9	....		....		1·57	9

represented for each of the days, small day-corrections were derived (−0·03 for Sept. 30, +0·04 for Oct. 3, 0 for Sept. 19) and applied before averaging to the mean of the last column. The figure clearly shows a hump at λλ4400-4300, opposite to, and just neutralizing, the hump in the absorption coefficient of the Hilger wedge. Deriving the absorption differences between the Zeiss bands 2 and 3 from the corrected results for Zeiss 2-3 expressed in Hilger units, and the values of one Hilger unit, as adopted in the last column of Table 1, we find the values of Table 3, plotted in the lower part of Fig. 2, where the irregularity has entirely disappeared.

The plates taken on May 23 were treated in the same way as described for those of Sept. 19 and 30; out of the two exposures with a ratio of slit-widths 2·5 or 3 a combined characteristic curve was built up, when, for the separate bands of each exposure, the measured *S* afforded the logarithmic intensity differences. In the strong exposures, the blackest parts surrounded by halo had of course to be rejected, in the weak exposures the short wave-lengths were lacking. Here again the difference 1-2, 3-4, 4-5, 5-6 were reduced to the difference 2-3. This was done by taking differences instead of ratios, which would have been the right way, but for practical purposes this did not matter. The

TABLE 3. ABSORPTION DIFFERENCE OF ZEISS STEPS 2 AND 3

λ	Sept. 19	wt	Sept. 30	wt	Oct. 3	wt	May 23	wt	Mean	wt	Adopted
4050	0·359	2	0·368	4	0·356	6	....		0·355	12	0·356
4100	0·355	4	0·371	5	0·355	7	0·337	7	0·353	23	0·354
4150	0·354	7	0·376	5	0·358	7	....		0·356	19	0·353
4200	0·354	7	0·375	5	0·354	8	0·330	9	0·350	29	0·351
4250	0·352	8	0·381	5	0·349	8	....		0·353	21	0·349
4300	0·358	10	0·364	6	0·349	8	0·325	10	0·347	34	0·347
4350	0·356	10	0·365	6	0·342	8	....		0·348	24	0·345
4400	0·351	10	0·357	7	0·334	8	0·339	12	0·345	37	0·344
4450	....		0·356	6	0·342	7	....		0·343	13	0·342
4500	0·351	10	0·351	7	0·338	6	0·329	9	0·341	32	0·340
4600	0·336	10	0·331	6	0·326	6	0·334	8	0·331	30	0·336
4700	0·332	11	....		....		....		0·327	11	0·333
4800	0·324	11	0·363	5	0·315	6	0·322	7	0·327	29	0·329
4900	0·314	11	....		....		....		0·309	11	0·326
5000	0·326	12	....		0·328	6	0·306	7	0·322	25	0·322
5050	0·334	12	....		....		....		0·329	12	0·320
5100	0·338	9	....		....		....		0·333	9	0·318

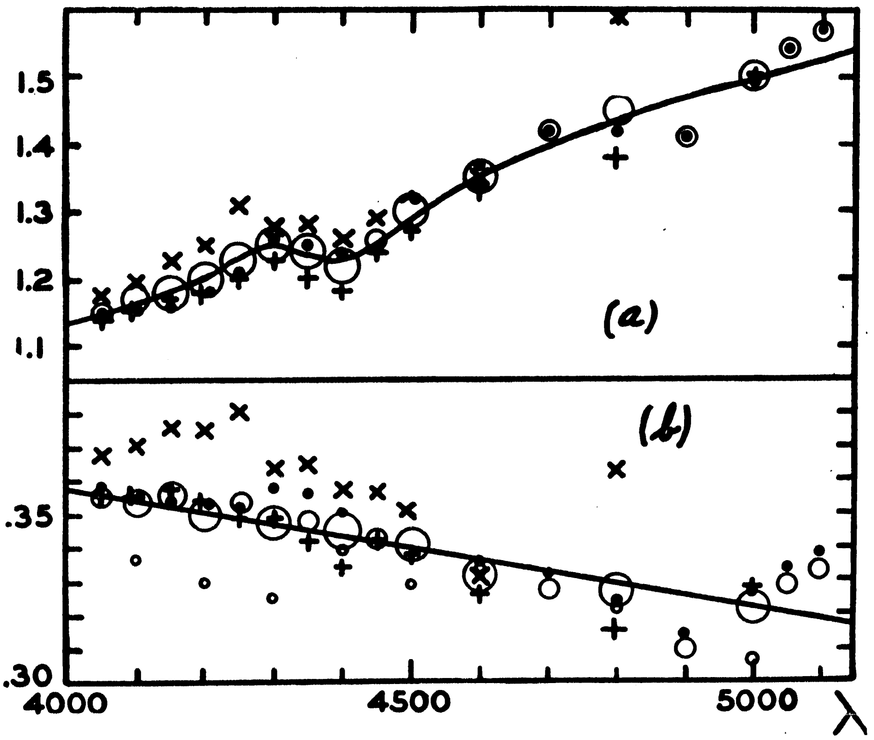

Fig. 2. The absorption coefficient of the Zeiss step-weakener plotted as a function of wave-length. The upper curve (*a*) gives the calibration in units of the Hilger wedge while (*b*) is the rectified curve. Large circles are mean values from the several individual determinations.

resulting values for the absorption difference 2-3 are given in the 5th column of Table 3 and the corresponding ratios are:

(1-2)/(2-3)	(3-4)/(2-3)	(4-5)/(3-4)	(5-6)/(4-5)
1·09 (5)	1·15 (5)	1·22 (3)	0·86 (1/2)

The results for absorption show systematic differences, those of May 23 being smaller and those of Sept. 30 larger than the others. So before averaging, corrections −5, −16 +2 +12 were applied. Fig. 2 shows the uncorrected values as well as the resultant means. They may be represented by the following linear function of the wave-length, slowly increasing to the violet:

$$0{\cdot}358 - 0{\cdot}036{\cdot}10^{3} (\lambda - 4000) = 0{\cdot}358 (1 - 10^{4} (\lambda - 4000))$$

For the ratios of the other step-differences we find, by averaging the four day values according to their weights:

(1-2)/(2-3)	(3-4)/(2-3)	(4-5)/(3-4)	(5-6)/(4-5)	(4-5)/(2-3)	(5-6)/(2-3)
1·06 (25)	1·18 (32)	1·27 (7)	0·86 (1)	1·50	1·29

Hence the logarithmic differences of the Zeiss steps are adopted:

1–2	2–3	3–4	4–5	5–6
0·379	0·358	0·422	0·537	0·462

all holding for λ = 4000 and decreasing linearly by 0·1 of their value from λ4000 to λ5000. The percentages of transmitted light (for λ4000) are,

100, 41·8, 18·3, 6·93, 2·01, 0·695 for steps 1 to 6.

Exposure-Time Effects. Exact photometry by means of photographic silver densities demands the comparison of equal blackenings produced in the same exposure time by equal intensities. In the case of stellar spectra this might be realized by photographing the stellar spectrum itself through a wedge or a step-reducer. On account of the large spreading and loss of intensity this can be done only for a few bright stars, in special investigations. For most of the stars we must content ourselves with putting artificial spectra on the plate beside the stellar spectrum. To save time they are usually produced by stronger intensities with shorter exposure times. Producing them by exposing a faint light source for the same time as the star would not solve the problem either, for the star is trailed along the slit, so that each point of the plate is illuminated only during an unknown part of the total time. It may perhaps be possible to devise a contrivance by which the artificial light is admitted intermittently in the same way as the stellar light arrives at each point on the plate.

In our own case the standardizing spectra were produced by exposures of 1-2 minutes (for slow plates 5 minutes), whereas the stellar exposures lasted longer than 10 minutes and often several hours. It is possible that the characteristic curves are different for such cases. In order to see whether any influence of the exposure time on the characteristic curve is perceptible, special plates were taken on three nights. On each plate, in addition to two ordinary short exposures of 1-3 minutes, an exposure of several hours was taken with the light source strongly dimmed. It was found that the long exposures generally had a steeper characteristic curve than the short ones.

Fundamental researches on the general relation between silver density on the plate, exposure time and intensity (in American literature usually called the Reciprocity Law Failure) have been made by E. Kron at Potsdam[6]. The results of his experiments are expressed by curves of equal silver density $S = \text{Const.}$, on a diagram where the coordinates are I and $I.t$ rather than the usual I and t and thus represent $\log (It) = f(\log I)$. The curves all have the shape of a catenary or an hyperbola; two straight parts inclined with slopes of nearly $-0{\cdot}2$ and $+0{\cdot}2$, connected by a lower transition part. They are parallel for different S, with the lowest point the transition point with optimum effect at the same I. For slow plates this optimum corresponds to a larger intensity. It is, moreover, dependent on the development. For $I \gg$ optimum

$$\log It = c + 0{\cdot}2 \log I$$

$$\text{and therefore } \log t = c - 0{\cdot}8 \log I$$

$$\text{or } tI^{0{\cdot}8} = \text{const.},$$

for $I \ll$ optimum

$$\log I\,t = c - 0{\cdot}2 \log I$$

$$\text{hence} \quad \log t = c - 1{\cdot}2 \log I$$

$$\text{or } tI^{1{\cdot}2} = \text{const.}$$

Thus his result, for the latter case of weak intensities, corresponds to the well known Schwarzschild exponential law

$$t^p I = \text{const., with } p = 0{\cdot}8$$

It widens the application of the law by adding that, for strong intensities, the Schwarzschild exponent is nearly $1{\cdot}2$.

If we assume Kron's result as a sufficient approximation, we may derive a characteristic curve by cutting his system of parallel curves S = const. S_1, S_2, ... with the line t = Const., a straight line inclined at 45°, and reading $\log I$ at the points of intersection. In the realm of each of the straight portions of the Kron-curves the characteristic curves for different exposure times are parallel; in the case of large t and faint intensities the values of $\log I$ are closer together; in the case of small t and strong intensities they are farther apart. Hence, for long exposures of faint light the characteristic curve is steeper; for short exposures of strong light it is less steep, the horizontal scales of $\log I$ having the ration $0{\cdot}8{:}1{\cdot}2$. The transition between the two types, in passing the optimum, takes place in such a way that, by increasing the intensity and diminishing the exposure time, the lowest part of the characteristic curve (i.e. that for greatest density, proceeding from the upper Kron curves) first begins to diminish its slope. This diminution of slope grows stronger and creeps upward along the characteristic curve, so that its upper part belongs to a steeper type and the lower part to a less steep type. For still stronger intensities and smaller exposure times only the upper part shows the steeper type.

It should be remarked that the lack of parallelism in the characteristic curves discussed above in the calibration exposures cannot be explained in this way. There the exposure time was the same, hence all characteristic curves are formed by intersecting the Kron curves by the same straight line t = const. Only lack of parallelism in the case of different exposure times can be accounted for by this theory.

[6] *P. Ap. O.*, Potsdam, **22**, No. 67, 1913.

It is not possible to compare Kron's intensities with ours; nor can we compare his measured densities of silver deposit with our transmission values, because his measures consist only in readings of the Hartmann microphotometer. We may, however, assume that his "normal" curve corresponds to a medium density. Then we find from his tables that for this case the optimum corresponds to an exposure time of nearly 60 seconds for fast plates (Seed 27) and 160 seconds for slow (diapositive) plates; and that in the first case the straight parts extend above $t = 200^s$ and below $t = 20^s$. This means that our standardizing exposures fall into the transition region where the characteristic curve most rapidly changes with the exposure time. Had these exposures been made with a stronger light source, so that they lasted less than 20 seconds, then by a constant well-defined and known reduction of the horizontal scale the characteristic curve from the standard spectra could be adapted to the stellar spectra. In the present case, however, this reduction had to be found from the special exposures mentioned above and was probably different for different plates.

For all the special plates a characteristic curve was derived for each of the three exposures at different points of the spectra corresponding to wave-lengths 4100-5100. For each curve two points were read, including the straightest middle part, e.g. at $S = 70$ and 40, or 80 and 50 or 45, or 60 and 35, according to the part represented by all three curves. The horizontal distances were read for such points; between the values for the two short exposures a value was interpolated (or slightly extrapolated) to the same density as that of the long exposure. Then the ratio of this interpolated distance to the distance found for the long exposure was the ratio of the slopes of the characteristic curves. The results are given in Table 4.

TABLE 4. RATIO OF SLOPES FOR SHORT AND LONG EXPOSURES

λ	July 14 A $40^s 160^s$ 105^m*	July 21 B $50^s 150^s$ 94^m*	Aug. 21 A $45^s 180^s$ 22^m*	Aug. 21 B $45^s 180^s$ 40^m	Aug. 21 C $45^s 180^s$ 180^m	Aug. 21 D $45^s 180^s$ 60^m	Oct. 3 A 120^s† 180^m	Oct. 3 B 60^s† 60^m
4100	....	....	....	....	....	....	0·85	....
4200	....	....	....	....	....	....	0·89	....
4300	....	....	....	0·90	0·89	0·89	0·91	0·91
4400	0·99	....	1·00	0·91	0·88	0·91	0·97	0·96
4500	0·94	....	0·96	0·95	0·95	0·92	0·95	1·03
4600	0·84	0·99	1·03	0·95	0·93	0·97	....	0·92
4800	0·77	1·00	0·94	0·91	0·99	0·91	....	0·94
5000	0·94	0·90	1·07	0·97	0·98	0·99	0·98	0·97
5100	....	....	....	0·94	0·90	0·95	....	....
Mean	0·90	0·96	1·00	0·93	0·93	0·93	0·92	0·96

*Slightly extrapolated.
†Slit width 10 and 40.

It is not probable that the difference between the values from separate plates have anything to do with the length of the long exposure (though its smallest value 22^m coincides with the extreme result 1·00). Neither can a relation be found connecting them with the duration of the short exposures, mostly 40-60^s and 150-180^s. We must consider them as chance deviations, and we have to confine ourselves to adopting their average 0·94 as the correction factor to be applied to all the characteristic curves deduced from the standardizing spectra so that they hold for the stellar spectra. This was done by multiplying by the factor 0·94 all the values for logarithmic intensity differences of the bands as they had been found by the calibration.

The Characteristic Curves. For each of the stellar spectrum plates the characteristic curve was derived by means of the standardizing spectra put upon the plate. Cross-tracings of the row of bands were registered, either at a number of points previously computed to correspond to round wave-lengths 4050-5000, or at equidistant points 10 or 5 mm. apart, for which the wave-lengths 4049 . . . . 4892, 4983, 5084 were computed afterwards. By plotting the measures transmission value S for each band (or the exact centre of the band in the case of the Hilger wedge) against the light intensity known from the calibration results we find a characteristic curve (or part of it) for each of the wave-lengths.

Most of the plates first reduced did not show any distinct differences between the curves for different wave-lengths. Therefore they all were combined into one general curve which was used for all wave-lengths. There were, however, other cases where a variation with wave-length was clearly indicated; around $\lambda\lambda$4500-4700, the blackest part of the spectrum, the curves were steeper than elsewhere. In such cases a gradual variation of slope was introduced by multiplying the abscissae of the curve, log I, by factors about 1, varying with wave-length.

Evidence on this point is contradictory in results hitherto published. In our discussion of the Victoria plates, taken by H. H. Plaskett in 1924[7] a decided and regular change with wave-length was found (cf. Fig. 2) with maximum slope in the blackest part of the spectrum. In the discussion of the flash-spectrum plates taken by the Dutch Solar Eclipse expedition (1927) the characteristic curve was found to be independent of wave-length[5]. In the course of the present discussion, the idea arose that the difference might be an effect of the method of developing. The Victoria plates of Plaskett were developed in the hard alkali Ross developer, whereas for the Lapland eclipse plates a soft borax developer was used. In this case our earlier plates, taken before July 5, which were treated with the Ross developer, should show the wave-length effect, and the later plates should not.

The investigation was carried out by means of the standardizing spectra ready by that time. It was made in such a way that for each separate wave-length the transmission values S were transformed by means of the mean characteristic curve into intensities and intensity differences, and these were compared with the real differences. If the real curve is steeper than the mean curve the latter affords too large a difference in log I, i.e. a factor above. 1.

The results are given in the graphs in Fig. 3. In the upper part dots represent the combined results of plates 17542, 548, 555, 557 (each of which has small weight, because they contain only one standard spectrum). Circles are deduced from plates 17574 and 590, crosses from plate 17642 (x) and 18785 (+), all from the first months. In the lower part giving data of the later months, dots represent the results of 4 Eastman 40 plates

[7] *P. A. Inst.*, Amsterdam, No. 6, Pt. 1, p. 6, 1939.

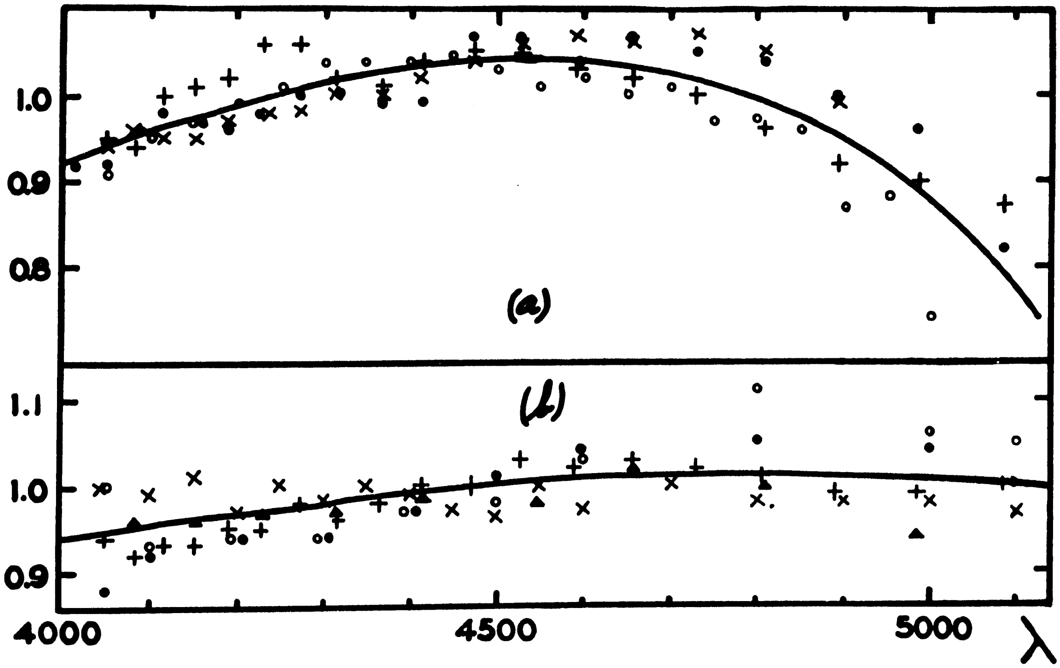

FIG. 3. The variation in the slope of the characteristic curves with wave-length. In the upper curve (*a*) a greater variation is apparent because of the developer used in the early stages of the observations.

(17965, 977, 991, 994); triangles those of 17865, 920, 981; oblique crosses those of 17891 and 921; vertical crosses those of 17937 (read for more numerous points). It appears that in the first period there is a small but decided variation with wave-length, the characteristic curve being steepest in the dark middle parts of the spectrum, between λ4300 and λ4800 and falling off on both sides. In the second period a similar but much smaller variation is perceptible. To take account of this variation the difference in log *I* deduced from a mean characteristic curve must be divided by the ordinates read from the graphs to have the true differences. Thus, for the first period their reversed values have been used as factors, viz.,

1·087 1·045 1·011 ·986 ·971 ·962 0·975 1·002 1·053 1·140

for every 100 angstroms from λλ4000 to 5000. For the second period the factors are

1·063 1·045 1·030 1·017 1·006 ·997 ·991 ·988 ·988 ·990 ·993

However, they were not considered sufficiently warranted nor important for any essential improvement of the results.

On some of the plates the standardizing spectra could not be used because the silver-mirror reflecting the light downward to the wedge was deteriorated by irregular spots where the silver layer was affected. By comparing intensity variations in spectral lines with other normal plates the changes in the differences between the band intensities could be estimated; thus the spectra could be reduced with characteristic curves derived from corrected step differences. In these results the absolute scale value remains highly uncertain, and only the relative intensities have any significance for such plates.

Section II. Reduction of the Stellar Spectra

Methods of Analysis. The stellar spectra were registered by means of the Moll registering microphotometer of the Amsterdam Astronomical Institute[8], using a 50 times enlargement of the linear scale (so that a dozen sheets 40 cm. long were needed for each spectrum). By means of the characteristic curve these tracings may readily be converted into true intensity curves, by making use of the intensigraph, constructed at the Amsterdam Institute and described by D. Koelbloed[9]. Thus, a large scale representation of the intensity curve of each spectrum was obtained on a number of paper sheets 20 cm. wide; an enlargement of 500 times, relative to the original plate, was found most practical for subsequent treatment and handling.

The unit of intensity scale is arbitrary in such a curve, depending as it does on expediency. What we want is the intensity within the spectral lines, expressed in the continuous background intensity of the spectrum as a unit. In spectra of an advanced type, crowded as they are with lines, the determination of the background is a difficult and often uncertain job, and special care has to be taken with it. Usually the wings of adjacent lines overlap, leaving no free space between them; only in the deepest points between the line tops may we assume their influence to be negligible. However, we can find small parts which, according to Rowland's tables, are devoid of lines stronger than 0 on his scale. In our spectra such lines, owing to intrumental broadening, do not take away any appreciable amount from the background intensity. In such parts the background may be traced as crossing the irregular waves due to silver grain. Combining all such regions over the entire spectrum into a smooth curve we may assume it to be a near representation of the continuous spectrum background. A treatment of three negatives of the sky spectrum according to this method, and comparison with the Utrecht Photometric Atlas of the Solar Spectrum, served as a control that in such a way the true background is very nearly reached.

If this procedure is already followed on the original sheets, the cellophane-curves used in the intensigraph may be drawn on such a scale that, in the intensity curve of the spectrum, the height of the continuous background is represented everywhere by a constant amount of around 10 or 20 cm. It was found more expedient, however, to use another method, leaving open for further discussion the possibility of correcting the background assumed first. It consists of using log I instead of I itself as the vertical ordinate. Any difference or change in scale value reduces here to an up or down displacement of the zero line. Different spectra of the same star may then be superposed and averaged, by bringing their zero lines into coincidence, in order to eliminate the silver grain wavelets.

Our aim is to determine the equivalent width of the absorption lines in the spectrum. Nearly all the lines in spectra of advanced type are blends of two or more closely adjacent lines, though in many cases one strong line dominates. This blending is chiefly due to the broadening of the true profiles of the absorption lines by instrumental influences (slit-width, scattering of light in the instrument, deviations of focus, photographic effects

[8] *P. A. Inst.*, Amsterdam, No. 6, Pt. 1, p. 2, 1939.
[9] *B. A. N.*, No. 335, 1940.

of light diffusion). Their effect is expressed by the "instrumental curve", showing the distribution of intensity in the image of a line with an extremely narrow true profile. The "apparent profile" of an isolated line is the effect of the combination of its true profile and the instrumental curve; the equivalent width is not changed by this broadening. The lack of resolution in stellar spectra is due mostly to this instrumental broadening, and so is the blending of lines—though for some stars rapid rotation or, for hydrogen lines, the Stark effect may be the cause. It is our task to decompose the blends and derive the equivalent width of each of the components.

Two different methods have been used at the Amsterdam Institute for the analysis of such spectra. One, the contracting method, has been described by G. B. van Albada[10]. In order better to separate the constituents of a blend, the line profiles are contracted—a mechanical contrivance for this purpose was constructed by Th. Walraven and D. Koelbloed[11]—so as to represent the true profile combined with a narrower instrumental curve. Then the surface of the separately distinguishable lines was measured. Since the wings of stronger separate lines overlap also in the contracted curve, corrections must be applied for the clipped wings of the line considered and for the foreign wings extending over the range of this line. Tables for these corrections were given in the description of the procedure[10]. The advantage of this method is that no previous knowledge about the lines is required. The intensity curve observed shows on analysis which lines are present; if catalogued they can be identified.

The other method, applied to obtain the results given below, consists in reconstructing each blend or separate group from the constituent single lines by combining them in such a way that the wave-length is supposed to be known, but the intensity is unknown. It may safely be assumed that we know what lines take part in forming these spectra; they are the same metal lines that are found in the solar spectrum, though with different intensity. There are, it is true, some few lines in the Rowland table to which no origin is assigned; probably they are other metal lines, produced perhaps by ionized or doubly ionized atoms. Therefore we reckon with them also as possible components. The faintest Rowland lines (below 0, or even those marked 0 or sometimes 1) cannot be distinguished in these less-resolved stellar spectra, and are omitted from the working list. It is different, of course, with the enhanced lines which in giant stars are stronger than in the sun; hence their working list includes the faint Rowland lines and is, when necessary, completed from other data.

The problem therefore is: given the wave-lengths of the lines and an estimate of their relative importance, to allot to each of them such an intensity (equivalent width) as to make their combined effect equal to the observed profile of the blend.

To apply this method, therefore, it is necessary to know beforehand, from theory, the profile of a single line, and the processes by which, in a stellar spectrum, a number of these lines are combined into a blend. The derivation of the theoretical profile of a line consists of two parts; first the derivation of the true profile and then its broadening by the instrumental curve.

[10] *B. A. N.*, No. 301.
[11] *B. A. N.*, No. 335, 1940.

The True Profile of an Absorption Line. The range of a spectral line comprises all wave-lengths affected by the transition of the atom from one quantum state into another, absorbed by the upward, emitted by the downward, transitions. The extent to which each wave-length takes part in these processes is given by its line-absorption and diffusion coefficients which decreases rapidly from the central wave-length to both sides. Simple theory represents it by a combination of two terms,

$$\frac{s}{n} = \frac{\epsilon^2}{m\,c\,m_a}\left(\frac{\gamma}{\Delta\nu^2} + \frac{\sqrt{\pi}}{b}\,e^{-\Delta\nu/b^2}\right)$$

in which n is the concentration of the atoms active in producing the line considered; $\Delta\nu$ is the frequency difference from the centre; γ is half the natural width of the line, and b is half the Doppler width, given by $\frac{\nu}{c}\sqrt{\frac{2RT}{\mu}}$ (R=gas constant, μ=molecular weight). A more accurate evaluation of the integral expressing the line absorption coefficient is given by F. Hjerting[12] in the form of tables, where S, (expressed in units of its central value), is represented as a function of $v = \frac{\Delta\nu}{b}$ and $a=\gamma/b$, the ratio of the natural width to the Doppler width.

In the original simple theory it was assumed that the Doppler width b was due to molecular heat motion only and hence determined by the temperature and atomic weight (for Fe at 6000° and for λ4000 it corresponds to 0·018 angstroms). It appeared afterwards that the real value of b in stellar spectra was considerably greater, in consequence of turbulence and stream motions in the stellar atmospheres. The natural line-width was first assumed, after classical theory, to be a simple function of physical constants, called the damping constant. In frequency units it is

$$\gamma = \frac{2\pi\epsilon^2\nu^2}{3mc^3}$$

corresponding to 0·000059 A. Wave mechanics had already made it a larger and more complicated function of transition probabilities between different atomic states. Moreover, collisions were shown to have a considerable broadening influence upon the lines. For the solar lines γ was found, by different investigators, to be nearly ten times the classical value. Hence both constants, b and γ may be larger than was formerly assumed, dependent on factors not previously known. Therefore their ratio a is variable over a larger range also. For the original classical values, a was always very small (e.g. 0·0033 for Fe under the above standard conditions). The extension of Hjerting's tables over values from a=0·01 to 0·20 was necessary only for extreme amounts of collisional broadening. There the decomposition of the integral into two separate terms does not hold any longer. Yet in these cases, too, the curve for the line absorption as a function of distance to the centre may be considered to consist of two parts: a central Doppler core falling off rapidly beyond v=1 and then merging into the wings that slowly decrease beyond v=3, ending as $\frac{1}{\nu^2}$. The derivation of the profile of an absorption line produced by a stellar atmosphere from this function, i.e., the derivation of the residual intensity for a certain $\Delta\lambda$ in the line from the line absorption coefficient, is a difficult and complicated matter. It depends on the various transitions of energy between atomic states and

[12] *Ap. J.*, 88, 508, 1938

radiation, and, moreover, on the conditions in the layers of the stellar atmosphere, temperature, electron pressure, general absorption coefficient, and their variation with depth. The problem has been dealt with by a number of investigators, who made use of more or less simplifying assumptions and standard models. The solutions, omitting all complicating factors, may be expressed in simple standard forms. As such we have the Shuster-Schwarzschild form, derived for the case of pure diffusion, where the residual intensity $r = \frac{1}{1 + Cs}$, and the Milne-Eddington form, from a combination of diffusion and absorption, for which $r = \frac{1}{\sqrt{1 + Cq}}$, where q is the ratio of the diffusion to the continuous absorption coefficient. The difference in the resulting profile between the two expressions is notable only where r is small, and s and q are large, i.e. in the central part of strong lines.

In the case of a small number of active atoms, producing a weak line, the expressions for r give to the profile the well-known bell shape, in which only the Doppler core is significant. With increasing strength its bottom is flattened against the zero line, whereas it increases only slowly in width. When the number of atoms further increases the wings are gradually added, finally producing a widening funnel-shaped profile. For small values of the constant a, the Doppler core reaches the bottom and can widen slowly before the wings appear early and broaden considerably before the central core reaches full development. This dependence on a is manifest in the curve of growth. For small a there is a long, nearly horizontal central part, whereas for large a there is a rapid transition between the strongly inclined weak-line part and the less inclined strong-line part of the curve.

For a certain value of the parameter a we have to construct a set of profiles for increasing values of the concentration of the active atoms, i.e. increasing strength of the line. If this is done for different values of a we see that a doubly-infinite series covers the totality of all possible forms of true absorption line profiles. The horizontal coordinate v has, of course, to be transformed into wave-length distances from the centre of the line.

The Instrumental Curve. The apparent profile of an infinitely narrow line shows the figure of the instrumental curve. Hence the latter may be derived by measuring lines which, we know, are in reality very narrow. This is the case with emission lines of metal atoms, where only the Doppler core plays a role. Such emission lines we have in the iron comparison spectrum present on every stellar plate. Lines are selected which are single and isolated, and which show medium silver densities. On registrograms their breadth was measured at heights corresponding to 75%, 50% and 25% of the top intensity. From eight E40 and E33 plates, which showed no marked difference, the results were 21·0, 35·2 and 54·7μ, whereas eight Process plates gave 17·0, 27·9 and 44·3μ. The slit-width projected upon the plate, for the three kinds of plates, was 22, 15 and 8μ. Thus we see that slit-width played only a secondary role in the broadening, the chief part of which must be attributed to diffracting and scattering influences and photographic effects.

The breadth of the instrumental curve varies with wave-length. Because of the curvature of the focal plane of the camera and the dependence of focus on wave-length, the entire spectrum cannot be brought into sharp focus even by inclining the plateholder. Moreover, all the diffraction and scattering influences increase with wave-length. The ends of the spectrum, especially that toward the red end, show a broader instrumental curve than the middle parts, and near λ4200 it is narrowest. From a number of plates the factors expressing the variation were found, for λλ4100 to 4800: 1·15, 1·0, 1·0, 1·07, 1·16, 1·26, 1·36, 1·46. They were used, conversely, to reduce all measures to the minimum values, and thus to deduce the averages given above in microns. The amount of these scale factors, as well as the minimum values, are found to be somewhat different from night to night. At the beginning of each night's work the focus was determined and set anew by means of the ingenuous and rapid method described by J. S. Plaskett[13]. As the inclination was also corrected now and then, there may have been small chance variations.

There is, moreover, some reason to expect all these values to be rather too large, because the iron comparison spectrum was taken with a small exposure time, only a few seconds, for which, according to Kron's results, the slope of the characteristic curve is smaller than that for the stellar spectra. Hence, being reduced by one curve, the stellar lines must come out narrower than the iron lines.

The extreme wings of the instrumental curve are cut off in the iron arc emission lines because the intensity does not reach the threshold value. They could be determined, however, by means of one of the plates (18022) where, by chance, a strong continuous spectrum was produced by a drop of molten iron forming a background to the emission lines. Here, the complete curve could be derived. The relative intensity found in this way at different distances is given in Table 5. It corresponds to the minimum breadth

TABLE 5. INSTRUMENTAL CURVE DETERMINED FROM IRON COMPARISON LINES

Distance μ	Distance A.U.	Intensity	Distance μ	Distance A.U.	Intensity	Scale factors	
0	0·00	1·00	35	0·35	0·125	4100	0·79
5	0·05	0·928	40	0·40	0·087	4200	0·79
10	0·10	0·760	45	0·45	0·064	4300	0·91
15	0·15	0·585	50	0.50	0·047	4400	1·11
20	0·20	0·415	60	0·60	0·030	4500	1·36
25	0·25	0·280	70	0·70	0·020	4600	1·66
30	0·30	0·186	80	0·80	0·014	4700	1·97
						4800	2·35

at λ4200. The central part of the instrumental curve has the shape of a Gaussian curve with exponent $-(x/22)^2$ and its far wings resemble a function c/x^2.

The variation in breadth with wave-length, here indicated, relates to the linear scale. Since the unit in the line profiles is the Angstrom, we must also express the intrumental curve in this wave-length unit. For λ = 4100, 4200 .... 4800, one angstrom equals

147 127 110 96 85 76 69 62,

so that, if as a normal average, we replace in the arguments of our table 100μ by one angstrom, the arguments for the wave-lengths indicated have to be multiplied by the scale factors of Table 5.

The Apparent Line Profiles. The apparent profile of a single line produced by the combination of the true profile $W(x)dx$ and the instrumental curve $A(x)dx$, normalized in such a way that $\int A(x)dx = 1$, by means of the integral

$$F(x) = \int A(y)\, W(x-y)\, dy = \int W(y)\, A(x-y)\, dy.$$

[13]*These Publications*, **1**, 87, 1919.

If the functions W and A are given either numerically or by curves, the resulting F can be deduced by numerical integration; this, however, is a long and tedious procedure. Burger and Van Cittert have described[14] an automatic optical method in which the quantity of light, passing through curves A and W, combined in a gradually changing way by their relative translation, is received by a thermocouple and so measured and registered. The principles of this method have been applied at the Amsterdam Institute by the chief computer, D. Koelbloed, in a device for constructing a large number of apparent profiles. The figure of the instrumental curve as well as those of the different true profiles were drawn in black, and photographed on small-film, so that entirely transparent surfaces of 1 cm. height and a few cm. width, bordered by these curves, were obtained. The radiation from an Argenta lamp, spread uniformly over a condenser lens, after passing through the A film placed immediately in front of it, was projected upon the W film by means of a vertical cylindrical lens, $f=16 \cdot 5$ cm. (with diaphragm 2 cm. height, 1 cm. breadth) placed in the middle between them. Horizontally the figure of A is sharply depicted; vertically it is diffusely spread out, so that the projected image, except in the unused upper and lower borders, consists of a band of light whose intensity, uniform over every ordinate, varies horizontally proportionately to $A(y)$, the curve ordinate. Over this band the W film has to be moved in a horizontal direction, so that its height $W(x\text{-}y)$ is multiplied by the intensity $A(y)$. For this purpose the W film was placed instead of a stellar plate in the actinometer of the Amsterdam Institute, so that its movement could be read exactly at the scale of horizontal coordinates. The radiation transmitted through the W film was concentrated by a condenser lens upon a photo-electric cell which took the place of the thermoelement of the actinometer, and was measured by the galvanometer deflection. Since in this actinometer the readings of the coordinate scale and of the galvometer are observed simultaneously one above the other, the observer can read, in the field of one telescope, a consecutive series of corresponding abscissae and intensities of the function $F(x)$, while a recorder inserts them directly as points on a sheet of millimetre paper. In this way a number of apparent profiles was derived from different true profiles combined with instrumental curves of different scale factors.

The width of the instrumental curve considerably exceeds the Doppler width of the true profile; hence the apparent profiles of weak lines have nearly the same figure and width as the instrumental curve, only gradually growing deeper with increasing strength of the line. Then when for stronger lines the resonance wings make their appearance in the true profile and finally dominate it, the combined curve grows broader; its width in the end considerably exceeds that of the instrumental curve, and then hardly differs from the true profile.

Since the breadth of the true profile depends on b and its shape on a, the resulting apparent profiles will also vary with these parameters. For large b and small a, the Doppler curve grows very deep before the wings begin to appear; then the apparent profiles also remain narrow, growing deep before they begin to widen. For small b and large a, the wings become important before the Doppler core has fully developed; thus the apparent profiles will be a shallower and broader. We see the difference in Fig. 4, where, in addition

[14] *Z. f. Phys.*, **79**, 722.

43962—4

to two sets of true profiles: (a) for $b=0 \cdot 018$ $a=0 \cdot 1$, (b) for $b=0 \cdot 1$ $a=0 \cdot 01$, the corresponding apparent profiles (scale factor 1) are given on a logarithmic scale with the ordinates representing log I/I_0.

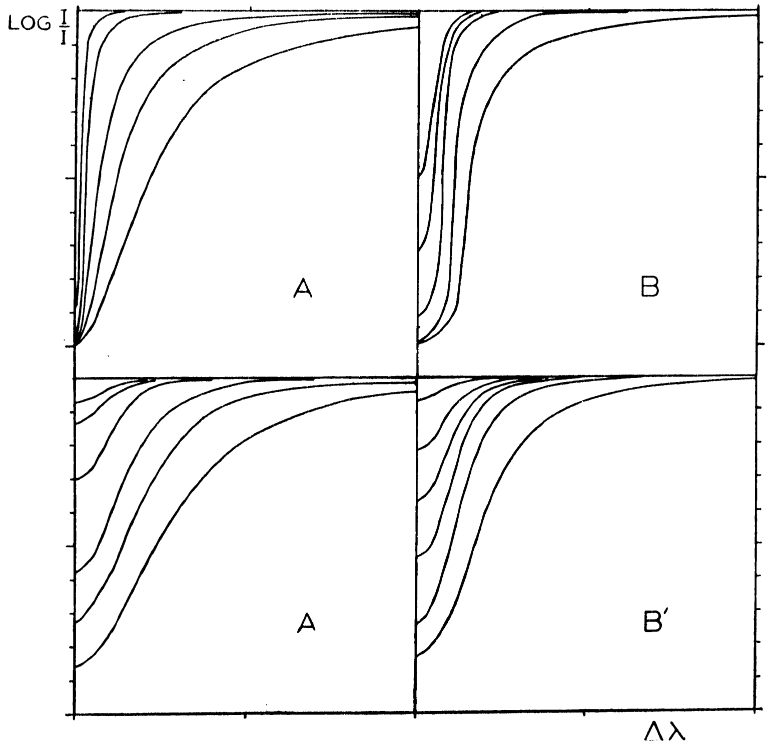

FIG. 4. Theoretical profiles of absorption lines. In the upper curves *A*, *B*, are shown typical line-shapes with different amounts of Doppler width and radiation damping. In the lower set the same profiles are shown after distortion by the spectrograph.

In investigating a blend we should distinguish between real and apparent blends. If radiation of a certain wave-length is absorbed and diffused in stellar atmosphere by two kinds of atoms, they act as a mixture and combine their absorptions, s being formed by the sum total of the separate absorption coefficients $s_1 + s_2$. Such lines, of which the true profiles in their relevant parts coincide either entirely or partially, cannot be separated in our procedure; the broadened apparent profile cannot be distinguished from a single line. Our analysis deals with the lines whose true profiles are separated, just as in the solar spectrum, but which, in our stellar spectra, merge owing to the broad instrumental curve.

To analyze the blends, a large number of sets of profile curves were constructed. For every value of b, combined with one of the different values of a, a graph of a set of curves for different values of s was drawn, for each of which the equivalent width A was derived. Each of them had then to be combined with instrumental curves of different breadth, indicated by the scale factors holding for different parts of the spectrum. It appeared that a range of b from $0 \cdot 018$ to $0 \cdot 1$, a range of a from $0 \cdot 001$ to $0 \cdot 1$, and a range of $0 \cdot 8$ to 3 for the scale factor practically covered all cases. If b and the scale factor are enlarged proportionally the figure remains the same with only the wave-length scale changing; it was therefore sufficient to combine $b=0\cdot018$ (with $a=0\cdot001$, $0\cdot01$ and $0\cdot1$) with scale factors $0\cdot18$ to 3.

For the sky-spectrum the values $a=0\cdot04$ $b=0\cdot024$ (the average of the results obtained by different observers from the curve of growth of the solar spectrum) were used. Combined with scale factors 1 to $2\cdot6$ they represented the observed profiles very well. For the stellar spectra the best fitting values had to be derived from the observed profile of a number of single lines of different intensity. Only lines occupying the transition region between pure Doppler and pure resonance lines are sensible to differences in a and may reveal the value of this parameter; these are the lines between $0\cdot025$ and $0\cdot32$ equivalent width. But only above $0\cdot10$ does the apparent profile begin to deviate perceptibly from the instrumental curve. From this small range of line profiles, with some uncertainty traced in the spectra, no definite value of a could be derived. A value $a=0\cdot01$ was assumed for the ordinary stars, from which a value $b=0\cdot36$ (twice the mean width by thermal velocities) was derived from the observed widths. This holds for *η Draconis, ξ Bootis, ξ Ursae Majoris, α Canis Minoris.* In six divisions of the spectra scale factors 1, 1·27 1·54 1·77 2. 2·50 were used.

The spectra of *γ Cygni* and *α Ursae Minoris* show narrower lines. This means that the value of b is larger than in the other stars, because the Doppler core is stronger and produces stronger, i.e. deeper, apparent profiles before the resonance broadening begins. The transition part comprises important lines with equivalent widths between $0\cdot13$ and $1\cdot6$. Here the parameter a could be well determined; for both stars $a=0\cdot01$ was adopted, with $b=0\cdot1$, much higher than the thermal value, hence indicating an appreciable amount of turbulence. In the spectrum of *ρ Cassiopeiae* the lines show a certain asymmetry, present also in the iron arc comparison spectrum, hence having an instrumental source. Here, a set of line profiles was constructed and used in the analysis which possessed the same asymmetry.

It is clear that accurate values of the parameters a and b must be derived afterwards from the curve of growth, and cannot be found from the broadened figure of the profiles. Nor are such accurate values needed here. What is needed to assign a correct equivalent width to a line profile of a certain depth is its average width; this is chiefly determined by the width of the instrumental curve and is deduced from these data themselves, secondly (in the relation between width and depth) by the value of b, and only in the third place in some minor features, by a. Thus, an incorrect choice of the set of curves generally used has but an insignificant effect on the resulting equivalent width.

In the practical analysis which was entirely carried out by D. Koelbloed, sets of curves were used increasing by $0\cdot1$ in $\log A$ where A is the equivalent width. Usually for each blend the strongest component was first taken and its curve inserted; the excess of the observed profile over this curve at the place of a second component then gave the top value of its curve. In this way the profile observed was built up from the separate curves. Strictly speaking it is the ordinates of the real profiles $1\text{-}r$ that should be added in this composition; in adding instead the ordinates of the broadened apparent profiles, however, the differences in the results are mostly insignificant.

The Spectral Plates Used. Only the results derived from the plates contained in Table 6 are given here. If more spectra of the same star were available, their intensity curves were combined by superposition upon one sheet; a mean curve was drawn wherein

TABLE 6. OBSERVATIONS OF STELLAR SPECTRA

Star	Type	Plate No.	Date	Emulsion	Slit	Mean Hour Angle	Exposure Time	Seeing	Wave-Lengths Used
			1929				(min.)		
γ *Cygni*......................	F8c	17642	June 3	E33	0″.0010	3^h02^mE	135	1—1½	4221—4845
		17685	June 30	E33	0″.0010	0^h28^mW	73	2	4112—4966
		17937	Sept. 10	E40	0″.0015	0^h58^mE	105	1½	4112—4966
α *Urs. Min*..................	F8c	18023	Sept. 30	E33	0″.0010	1^h23^mE	100	1+	4118—4630
ρ ~~γ~~ *Cass*......................	G5c	17965	Sept. 13	E40	0″.0015	2^h01^mE	380	1½—1	4168—4966
α *Can. Min*..................	F3d	18005	Sept. 27	E33	0″.0010	2^h37^mE	76	1	4063—4939
ξ *Urs. Maj*..................	G0d	17542	May 8	E40	0″.0015	1^h38^mW	140	1—1½	4140—4958
Sky..........................	G0d	17759	July 28	E40	0″.0015	....	7	....	4044—4955
		17761	July 28	E33	0″.0010	....	25	....	4044—4955
		18020	Sept. 30	Proc.	0″.0005	....	70	....	4112—4687
ξ *Bootis*......................	G6d	17555	May 10	E40	0″.0015	1^h08^mE	250	1+	4140—4957
		17556	May 10	E40	0″.0015	1^h36^mW	72	1½	4461—4773
η *Drac*......................	G5g	17557	May 10	E40	0″.0015	1^h10^mW	46	1½—2	4048—4946
		17558	May 10	E40	0″.0015	1^h45^mW	16	1½—2	4230—4946
		17976	Sept. 15	E33	0″.0010	4^h11^mW	220	1+—0+	4119—4946

TABLE 7. OBSERVED PROFILES OF THE HYDROGEN LINES

Distance A.U.	0	·25	·50	·75	1	1·50	2	3	4	5	6	7	8	9	10	Equiv. Width
$H\beta$																
α C. Mi.	237	264	330	420	498	598	658	727	776	803	827	845	863	880	890	6·57
ξ Boo	389	438	573	672	740	816	860	912	946	964	979	990	993	995	998	1·80
ξ U. Ma.	360	406	485	572	636	729	787	850	892	915	938	952	962	972	984	3·08
Sun	420	469	551	659	697	780	830	892	931	950	966	976	981	988	994	2·23
η Dra	331	403	524	650	760	859	903	939	960	974	984	990	993	995	998	1·60
γ Cyg	188	238	355	465	554	664	720	787	830	860	888	910	928	942	950	4·68
$H\gamma$																
α C. Mi.	177	245	380	478	536	621	665	735	785	823	855	883	904	919	928	5·59
ξ Boo	292	384	550	651	720	816	886	932	948	965	978	990	…	…	…	1·81
ξ U. Ma.	204	351	531	621	673	762	824	890	925	949	965	979	988	995	…	2·30
Sun	331	420	549	655	708	796	856	921	944	960	978	990	…	…	…	1·95
η Dra	216	331	519	655	738	847	918	954	974	990	…	…	…	…	…	1·56
γ Cyg	114	212	354	466	547	673	756	842	882	914	944	963	974	984	991	3·33
α U. Mi.	126	250	400	498	567	672	742	813	853	888	915	940	960	972	982	3·77
$H\delta$																
α C. Mi.	113	228	391	474	530	586	626	690	747	774	801	830	848	864	888	6·99
Sun	325	437	560	638	682	740	781	834	877	905	928	950	964	978	985	3·02
η Dra	217	470	664	758	804	858	909	960	980	…	…	…	…	…	…	1·41

the small chance fluctuations of the separate spectra were eliminated. With these mean curves the analysis could be made with greater certainty. Lines on the wings of the broad hydrogen lines were omitted, since it was impossible to compute their undisturbed strength from the apparent profiles with any certainty. For the hydrogen lines themselves, the profiles derived by subtracting as well as possible the metallic lines on the wings, and then by reflection upon the centre, computing the average resulting total equivalent width are given in the last column.

The catalogue of line intensities (Table 8) gives the logarithm of the equivalent width in milliangstroms. Only two figures after the decimal point are given. The results for the line intensities have of course very different weights. Strong lines, especially when isolated and little disturbed by adjacent companions, are determined most accurately; for lines not seen separately but only deduced as an excess of intensity on the slope of a stronger line, or even as a remnant intensity in a valley between two lines, the intensity deduced is more uncertain. A system of weights was adopted, such that 9 was assigned to a line of which the profile in its chief part entirely coincided with the theoretical curve, and lower values down to 5, where the slopes were disturbed by satellite lines in an increasing measure. Weights 4 down to 1 were assigned to lines of which the assumed profiles in their centre were lower, at an increasing rate, than the observed intensity curve and hence represented only a part or a lesser remnant of the total intensity. These weights were diminished at the rate of 3/4 when only one spectral plate was available. Moreover, at the extreme ends of the spectra, below λ4200 and above λ4700, the density of the silver deposit is so much smaller than in the middle part, that the computed residual intensities are less reliable; here again a factor 3/4 was applied to the weight deduced according to the above scale.

The origin of the lines was taken from the *Revised Rowland Catalogue*. Only the strongest contributing member, as a rule, is given; where one component line of a blend corresponds to more than one of the fainter Rowland lines, we did not aspire to completeness either, and lines below Rowland 0 were disregarded. The matter is different for the super-giant stars, where a number of enhanced lines occur that are scarcely, if at all, perceptible in the solar spectrum. Here, other sources were used in assigning the lines to their atoms of origin. In addition to Miss Moore's Revised Multiplet Table[15], Th. Dunham's study on *α Persei*[16], F. E. Roach's catalogue of lines in the spectrum of *γ Cygni*[17], and W. A. Hiltner's paper on the spectrum of *β Coronae Borealis*[18] were consulted. It may be remarked that nearly all the lines shown by Roach's more highly resolved spectrum (3 mm. to 1 angstrom) were disclosed by the anlaysis of the less resolved Victoria spectra. Here, too, only those origins that seemed to be the most important are indicated in our lists. We had the impression, however, that for the fainter parts of the blends, which are caused by faint and often unknown enhanced lines, the Rowland catalogue cannot be used as a reliable guide.

[15] *Princ. Cont.*, No. 20, 1945.
[16] *Princ. Cont.*, No. 9, 1929.
[17] *Ap. J.*, **96**, 272, 1942.
[18] *Ap. J.*, **102**, 438, 1945.

ASTRONOMICAL INSTITUTE
AMSTERDAM, HOLLAND, 1946.

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS

Wave-length	Identification	*α C. Min.* log A wt	*ξ U. Maj.* log A wt	Sun log A wt	*ξ Boot.* log A wt	*η Drac.* log A wt
4044·64	Fe I	...	...	2·24 3	...	...
47·31	Fe I	...	...	1·89 3	...	...
47·74	Sc I, Y I	...	...	1·73 3	...	...
48·07	...	...	...	1·70 3	...	...
48·72	Mn I	...	...	2·15 3	...	2·43 4
49·09	Mn I	...	...	1·49 1	...	1·65 1
49·34	Fe I	...	...	1·91 2	...	2·25 3
49·56	...	...	...	1·62 1	...	...
49·72	...	...	...	1·78 3	...	2·07 3
50·38	Zr II	...	...	1·56 3	...	1·99 3
4050·66	Fe I	...	...	1·85 3	...	2·00 3
51·08	...	...	...	1·48 2	...	1·94 2
51·32	...	...	...	1·56 2	...	2·05 2
51·92	Fe I	...	...	2·01 3	...	2·18 3
52·32	Fe I	...	...	1·69 1	...	2·16 1
52·48	Fe I, Mn I	...	...	2·00 2	...	2·19 1
52·71	Fe I	...	...	1·94 2	...	1·96 1
52·98	Co I	...	...	1·39 1	...	...
53·27	Fe I	...	...	1·76 2	...	2·05 3
53·43	Cr II	...	...	1·44 1	...	1·89 2
4053·83	Ti II, Fe I	...	...	1·88 3	...	2·00 2
54·06	Cr II	...	...		...	1·85 1
				1·79 2		
54·19	Fe I	...	...		...	1·95 1
54·49	Zr I	...	...	1·58 2	...	2·04 2
54·82	Fe I	...	...	2·15 2	...	2·45 1
55·01	Zr I	...	...	2·01 2	...	2·39 1
55·55	Mn I	...	...	2·11 4	...	2·38 4
56·01	Fe I, Cr I	...	...	...	...	1·75 1
56·20	...	...	...	1·83 3	...	2·13 1
4056·37	Fe I	...	...	1·92 3	...	2·13 1
56·58	...	...	...	...	...	1·70 1
57·18	Co I	...	...	2·03 1	...	1·93 0
57·36	Fe I	...	...	...	...	2·29 1
57·52	Mg I	...	...	2·36 2	...	2·52 2
57·68	...	...	...	1·91 1	...	...
57·92	...	...	...	1·71 1	...	2·25 2
58·20	Fe I	...	...	2·06 3	...	2·26 3
58·56	Co I	...	...	1·46 1	...	1·99 1
58·76	Fe I, Cr I	...	...	1·97 1	...	2·33 2
58·93	Mn I	...	...	2·11 1	...	2·15 1
4059·40	Mn I	...	...	1·92 2	...	2·18 3
59·72	Fe I	...	...	1·93 3	...	2·06 3
59·98	...	...	...	...	...	1·68 2
60·28	Ti I	...	...	1·72 3	...	2·02 3
60·51	...	...	...	1·41 1	...	1·73 1
60·78	Fe I	...	...	1·55 2	...	1·78 2
61·09	Nd II, Fe I	...	...	1·80 3	...	2·05 3
61·47	...	...	...	1·46 2	...	1·60 2
61·74	Mn I	...	...	1·90 2	...	2·05 2
61·97	Fe I	...	...	1·95 2	...	2·15 3

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4062·45	Fe I					2·12	3				
62·68						1·59	0				
62·96						1·38	0				
63·31	Fe I					2·30	1				
63·61	Fe I	2·56	4			2·80	3			3·04	0
63·93	V I					2·17	1				
64·07	Cr II	1·51	1								
64·22	Ti I					1·79	0				
64·48	Fe I	1·94	2			2·02	2				
65·09	Ti I, Mn I	1·52	2			1·77	2			2·18	2
4065·39	Fe I	1·74	2			1·86	2			2·10	2
65·62		1·41	2			1·43	1			1·86	1
66·15	Mn I	1·53	3			1·97	2			2·10	1
66·37	Co I	1·48	2			2·00	1			2·17	1
66·60	Fe I	1·88	2			2·01	1			2·18	1
66·78						1·70	0			1·94	0
66·99	Fe I	2·14	3			2·14	2			2·27	2
67·29	Fe I	2·13	3			2·05	2			2·32	2
67·54		1·06	0			1·57	1			1·95	1
67·80		1·11	0			1·55	1			1·86	1
4068·00	Fe I	2·16	4			2·25	3			2·30	3
68·57	Co I	1·28	2			1·67	3			2·06	3
68·86	Ce II					1·37	1			1·76	1
69·09		1·56	3			1·77	4			2·11	2
69·28	Nd II	1·28	2							1·76	1
69·61		1·48	3			1·42	2			1·86	3
70·05	Fe I	1·16	0			1·17	0			1·31	0
70·30	Fe I, Mn I	1·76	3			1·87	3			2·06	2
70·81	Fe I	1·98	3			2·06	2			2·25	2
71·11	Zr II	1·63	2			1·37	0			1·76	1
4071·76	Fe I	2·57	5			2·86	5			2·97	3
72·36										1·77	0
72·53	Fe I	1·80	2			1·86	2			2·18	2
72·70	Zr I	2·44	1								
72·91										1·47	0
73·13		1·22	2							1·65	2
73·49	Ce II	1·37	1			1·27	0			1·77	2
73·77	Fe I	2·07	4			2·05	4			2·27	3
74·07										1·22	0
74·33		1·17	1			1·37	2			1·52	1
4074·81	Fe I	2·09	3			2·20	4			2·55	4
75·12	Nd II	1·67	2			1·85	2			1·86	1
75·32		1·17	0			1·57	1			1·72	1
75·74	Ce II	1·54	2							1·77	0
75·95	Fe I	1·87	2			1·97	4			2·37	2
76·21	Fe I	1·57	2			1·88	2			2·27	2
76·50	Fe I	1·85	1								
76·65	Fe I	2·19	2			2·30	2			2·57	3
76·87	Fe I, Cr II	2·09	2			2·14	2			2·07	1
77·08	Cr I									1·47	0

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A wt	*ξ U. Maj.* log A wt	Sun log A wt	*ξ Boot.* log A wt	*η Drac.* log A wt
4077·39	La II, Y I	...	...	1·81 1	...	2·42 1
77·72	Sr II	2·67 4	...	2·56 4	...	2·70 2
77·96	...	...	...	1·52 0	...	2·12 1
78·42	Fe I, Ti I	2·12 3	...	2·23 4	...	2·40 4
78·83	Fe I	1·12 0	...	...	...	1·37 0
79·24	Mn I	2·05 2	...	2·19 3	...	2·47 2
79·40	Mn I	2·07 2	...	2·08 2	...	2·13 1
79·85	Fe I	2·04 3	...	1·98 2	...	2·17 3
80·23	Fe I	1·96 3	...	1·95 4	...	2·05 2
80·44	...	...	...	...	...	1·55 1
4080·60	...	1·17 0	...	...	...	1·52 1
80·90	Fe I	1·77 2	...	1·81 4	...	1·96 3
81·25	Fe I	1·78 2	...	1·78 4	...	2·04 3
81·73	Cr I	1·34 2	...	...	...	...
82·14	Fe I	1·84 2	...	1·80 4	...	2·13 3
82·44	Ti I, Sc I	1·79 2	...	1·91 2	...	2·24 3
82·96	Mn I	1·98 3	...	2·04 4	...	2·15 3
83·20	Ce II	1·49 1	...	...	...	1·68 1
83·65	Mn I, Fe I	2·36 4	...	2·38 6	...	2·49 4
84·02	...	1·28 0	...	...	...	...
4084·32	...	1·28 0	...	...	...	1·58 0
84·50	Fe I	2·16 3	...	2·28 5	...	2·23 3
85·04	Fe I	1·98 2	...	2·12 2	...	2·13 2
85·32	Fe I	2·18 2	...	2·18 3	...	2·33 2
85·99	Fe I	...	...		...	2·06 2
				2·04 2		
86·13	...	...	...		...	1·68 0
86·32	...	...	...	2·00 2	...	2·34 3
86·72	La II	...	...	1·80 2	...	1·93 2
87·10	Fe I	...	...	1·98 4	...	2·08 2
87·30	Fe II	...	...	...	...	1·70 1
4087·60	Cr II	...	...	1·68 3	...	1·80 2
87·80	...	...	...	...	...	1·68 2
88·28	...	...	...	...	...	1·39 1
88·57	Fe I	...	...	1·98 4	...	2·02 2
88·85	Ce II	...	...	...	...	1·75 2
89·22	Fe I	...	...	1·98 4	...	1·98 3
90·08	Fe I	...	...	2·06 3	...	2·44 4
90·54	V I, Zr II	...	...	1·88 3	...	2·28 3
90·98	Fe I	...	...	1·90 4	...	2·16 4
91·56	Fe I	...	...	...	...	2·02 4
4092·38	Co I	...	...	...	...	2·68 2
92·65	V I	...	...	...	...	2·48 2
93·17	...	...	...	...	...	1·48 1
93·63	...	...	...	...	...	1·63 2
93·99	...	...	...	...	...	1·58 2
94·41	...	...	...	...	...	2·16 2
94·70	...	...	...	...	...	1·78 1
94·96	Ca I	...	...	...	...	2·25 2
95·30	Mn I	...	...	...	...	2·31 2
95·49	V I	...	...	...	...	1·78 1

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4096·05	Fe I									2·63	5
96·66										2·16	1
96·95	Fe I									2·58	4
4101·75	H δ	3·84				3·48				3·15	
06·65										1·79	1
06·93										1·54	2
07·50	Fe I									2·39	4
07·90										1·52	1
08·13										2·18	3
08·51										2·19	3
09·04	Fe I									2·10	3
09·47	Nd II									2·19	2
09·80	Fe I, V I									2·50	4
4110·53	Co I									2·45	4
10·91	Cr I									2·23	3
11·42	Cr I									1·97	2
11·80	V I					2·14	4			2·49	4
12·30	Fe I					1·98	2			2·28	4
12·72	Ti I					1·73	1			2·03	2
12·92	Fe I					2·12	3			2·24	3
13·25										1·41	0
13·66						1·40	1			1·74	2
13·86						1·45	2			2·26	2
4114·12						1·38	1			1·51	1
14·45	Fe I					2·08	4			2·27	4
14·95	Fe I					1·89	2			1·90	1
15·19	V I					2·00	2			2·20	3
15·36	Ce II									1·40	0
15·96	Ni I					1·80	4			2·00	3
16·52	V I					1·88	3			2·40	3
16·73	V I					1·53	1			1·93	1
16·93						1·63	3			1·89	1
17·57										1·80	1
4117·83	Fe I					1·92	3			2·20	2
18·18	Ce II					1·52	2			1·80	1
18·55	Fe I					2·12	2			2·60	2
18·77	Co I					2·39	3			2·48	2
19·38	Fe I					1·95	2			2·34	3
19·60						1·58	2			1·79	1
19·86	Ce II					1·77	2			2·02	2
20·19	Fe I					2·05	3			2·30	4
20·60	Cr I					1·59	2			1·90	2
20·82	Ce II					1·35	2			1·65	1
4121·32	Co I	2·14	3			2·17	2			2·41	4
21·80	Fe I	2·04	3			2·09	3			2·30	3
22·15	Cr I, Ti I	1·29	0			1·60	2			1·80	1
22·31										1·60	0
22·52	Fe I	2·00	1			2·09	2				
										2·42	4
22·67	Fe II	2·02	1			1·87	2				
23·23	La II	1·90	2			1·78	2			2·02	1

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A wt	Sun log A	wt	*ξ Boot.* log A wt	*η Drac.* log A	wt
4123·47	V I	1·66	1	...	1·96	2	...	2·38	2
23·76	Fe I	2·11	2	...	2·20	4	...	2·56	3
24·49	...	1·68	2	...	1·73	3	...	1·90	2
4124·84	Ce II, Y II	1·92	2	...	1·80	4	...	2·10	3
25·63	Fe I	1·93	2	...	2·04	2	...	2·29	2
25·88	Fe I	1·91	2	...	1·92	2	...	2·19	2
26·18	Fe I	2·08	2	...	2·14	2	...	2·35	2
26·50	Cr I	1·72	2	...	1·84	2	...	1·91	1
26·86	Fe I	1·64	2	...	1·76	2	...	1·96	2
27·30	Cr I	1·78	2	...	1·61	2	...	1·76	0
27·62	Fe I	2·11	2	...	2·13	2	...	1·56	2
27·80	Fe I	2·11	2	...	2·14	2	...	2·31	2
28·11	V I	2·21	3	...	2·14	3	...	2·41	3
4128·35	Y I, Cr I	1·41	0	...	...		...	...	
28·75	Fe II	1·94	2	...	1·82	3	...	2·01	3
28·94	...	...		...	...		...	1·46	0
29·19	Cr I, Fe I	1·96	2	...	2·05	3	...	2·15	2
29·47	...	1·79	2	...	1·93	2	...	2·41	2
29·72	Eu II	1·83	2	...	1·86	2	...	2·21	1
30·01	Fe I	1·82	2	...	1·97	3	...	2·22	2
30·40	...	1·55	1	...	1·51	2	...	1·93	2
30·65	Ba II	1·93	2	...	1·76	2	...	2·15	2
30·88	...	1·81	2	...	1·36	0	...	1·52	0
4131·12	Ce II	1·73	2	...	1·89	2	...	2·11	2
31·39	Cr I	1·61	2	...	1·41	0	...	1·58	0
32·07	Fe I	2·46	4	...	2·63	5	...	2·86	4
32·55	...	1·93	2	...	2·07	2	...	2·34	2
32·89	Fe I	2·17	3	...	2·20	4	...	2·31	2
33·34	...	1·37	1	...	...		...	...	
33·61	Fe I	1·53	2	...	1·75	2	...	2·01	1
33·84	Fe I	2·07	2	...	2·17	3	...	2·40	1
34·46	Fe I	2·05	2	...	2·42	3	...	2·81	3
34·68	Fe I	2·20	2	...	2·20	2	...	2·41	1
4135·05	Mn I	1·64	2	...	1·62	2	...	1·71	1
35·30	Nd II	1·62	2	...	1·63	2	...		
								2·14	2
35·47	...	...		...	1·44	2	...	...	
35·75	...	1·58	2	...	1·61	3	...	2·01	3
35·99	...	1·51	2	...	...		...	...	
36·30	...	1·53	2	...	...		...	...	
36·54	Fe I	1·93	2	...	2·02	4	...	2·19	5
37·02	Fe I	2·09	2	...	2·09	3	...	2·36	4
37·23	Mn I, Ti I	1·57	1	...	...		...		
								2·30	3
37·41	...	1·83	2	...	2·02	2	...		
4137·66	Ce II	1·72	2	...	1·64	2	...	1·89	2
37·96	Fe I	1·64	2	...	1·83	3	...	1·99	2
38·36	...	1·82	2	...	1·80	3	...	2·11	3
38·82	Fe I	1·65	2	...	1·57	2	...	2·14	3
39·10	...	1·61	2	...	1·72	2	...	1·97	2
39·41	...	...		...	...		...	1·84	2

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4139·94	Fe I	1·91	2	1·91	2	2·00	4	2·11	2	2·21	5
40·19	...	1·27	0	...		1·41	0	...		1·72	2
40·42	...	1·94	3	2·02	3	1·92	2	2·12	2	2·30	4
40·75	...	1·32	0	1·42	0	1·44	2	1·62	0	1·92	2
4141·06	Mn I	1·55	2	1·42	0	1·60	2	1·82	2	1·67	2
41·63	...	1·62	2	1·62	1	1·63	2	1·83	1	2·12	2
41·87	Fe I	1·82	2	2·02	2	1·97	2	2·16	2	2·31	2
42·25	...	1·92	2	1·83	2	2·06	2	2·12	1	2·37	2
42·52	Ti I	1·97	2	2·02	2	2·14	2	2·22	1	2·42	2
42·93	...	1·66	2	1·82	2	1·83	2	1·87	0	2·32	2
43·44	Fe I	2·26	3	2·31	2	2·45	2	2·62	0	2·67	2
43·87	Fe I	2·46	4	2·52	3	2·72	4	2·82	0	2·97	4
44·52	...	1·57	2	1·72	2	1·57	2	...		1·87	2
44·80	...	1·22	0	1·52	1	...				1·77	2
								1·77	1		
4145·00	...	1·56	2	1·74	1	1·60	2			2·02	2
45·20	Fe I	1·64	2	1·82	2	1·67	2	1·77	1	1·92	2
45·55	...	1·49	2	1·57	1	1·63	1	1·81	1	1·82	2
45·77	...	1·86	2	1·75	2	1·92	2	1·97	1	2·30	2
46·06	Fe I	1·92	2	1·97	2	2·12	4	2·22	2	2·36	3
46·46	Cr II	1·58	2	1·57	0	...		1·62	1	1·67	2
46·69	Cr I	1·36	1	1·47	0	...		1·57	1	1·82	2
46·98	...	1·77	2	1·72	2	1·80	2	1·90	1	2·02	2
47·35	...	1·87	2	2·04	2	1·90	2	1·93	1	2·20	2
47·64	Fe I	2·16	3	2·22	3	2·23	4	2·29	2	2·58	4
4148·22	...	1·50	2	1·52	1	...		1·72	1	1·72	2
48·51	...	1·32	2	1·62	2	1·62	2	1·67	1	1·92	2
48·78	Mn I	1·54	2	1·62	2	1·55	2	1·72	1	1·90	2
49·18	Zr II	1·94	1	1·92	1			2·11	1	2·42	2
						2·40	5				
49·36	Fe I	2·24	2	2·11	2			2·32	1	2·49	2
49·77	Fe I	1·57	1	2·00	2	2·01	2	2·04	1	2·45	4
49·98	Ce II	1·36	1	1·64	1	...		1·83	1	...	
50·26	Fe I	1·95	2	1·94	2	2·05	2	2·14	1	2·27	2
50·46	Co I	1·80	2	1·85	2	1·93	2	1·71	1	2·09	2
50·72	...	1·52	2	...		...		...		1·87	2
4150·98	Ti I, Zr II	1·81	3	1·84	3	1·91	4	1·94	2	2·30	3
51·70	...	1·38	0	1·62	1	...		1·92	0	1·97	2
51·94	Fe I	2·17	2	1·82	1	1·93	2	2·16	1	2·52	2
52·17	Fe I	2·18	2	2·32	3	2·43	4	2·37	2	2·62	3
52·57	...	...		1·52	1	...		...		...	
52·76	Cr I, La II	1·58	2	...				1·52	0	1·97	2
						1·74	3				
53·05	Cr I	1·52	2	1·52	2			1·66	1	1·72	2
53·42	Fe I	1·52	2	1·92	3	1·83	2	1·89	1	1·95	2
53·62	...	1·32	0	...		...		...		...	
53·91	Fe I	2·23	3	2·17	2	2·33	3	2·52	2	2·55	4
4154·11	Fe I	1·90	2	1·97	1	1·92	2	2·02	1	2·02	2
54·50	Fe I	2·20	2	2·25	2	2·28	2	2·34	1	2·50	3
54·79	Fe I	2·17	3	2·15	2	2·22	3	2·32	2	2·32	3
55·16	...	1·22	0	...		...		...		1·57	2
55·37	...	1·22	1	...		1·39	2	...		1·82	2

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4155·60		1·52	2	1·82	3	1·58	2	1·77	2	1·82	2
56·01		1·78	2	1·95	2	1·89	2	2·02	1	2·21	2
56·32		2·17	2	2·12	2	2·24	2	2·22	1	2·52	3
56·75	Fe I	2·38	4	2·37	3	2·41	4	2·57	2	2·72	5
57·26		...		1·55	1	1·28	0	1·62	1	...	
4157·79	Fe I	2·15	3	2·23	3	2·27	5	2·37	3	2·42	4
58·06		1·52	1	1·47	0	...		1·72	1	2·04	2
58·39		1·62	2	1·82	2	1·78	2	1·72	1	1·92	2
58·81	Fe I	2·10	2	2·03	2	2·09	3	2·21	2	2·21	4
59·18		2·06	2	2·14	3	2·14	3	2·23	2	2·17	4
59·64		1·28	1	1·73	2	1·36	2	...		1·63	2
59·85		1·57	2	1·38	0	1·28	2	1·63	1	2·10	3
60·10		1·38	1	1·60	1	1·59	2	1·87	1	2·01	2
60·35		1·89	2	1·92	2	1·93	2	2·13	2	2·20	3
60·55	Fe I	1·75	2			1·68	2			1·73	2
				1·73	2			1·63	0		
4160·77		1·33	1			1·50	2			1·53	0
61·06	Fe I	1·73	1								
				2·02	2	2·11	2	2·29	2	2·53	4
61·23	Zr II	2·04	2								
61·52	Ti II, Fe I	2·14	2	2·12	3	2·13	2	2·13	1	2·43	4
61·80	Sr II	1·97	2	1·46	1	1·68	2	1·91	1	1·78	0
62·46		1·53	2	1·68	2	1·70	2	1·78	1	1·88	2
62·66		1·38	1	1·68	2	1·70	2	1·71	1	1·88	2
62·92		1·51	2	...		...		...		...	
63·62	Ti II	2·30	4	2·11	3	2·23	6	2·33	3	2·49	6
64·01		1·44	2	1·43	0	...		1·60	1	1·93	2
4164·28		1·73	3	1·78	2	1·96	4	2·05	2	2·19	3
64·64	Ni I	1·43	1							1·94	1
				1·73	1	1·75	3	1·75	2		
64·81		1·61	2							1·93	1
65·12		1·61	2	1·56	2	1·63	2	1·88	1	2·11	2
65·39	Fe I	1·87	2	1·88	2	2·07	2	2·23	2	2·34	2
65·59	Ce II, Cr I	1·78	2	1·89	2	1·82	2	1·43	0	2·03	2
66·00	Ba II	1·59	2	1·73	2	1·33	2	1·74	2	1·88	2
66·28		1·63	3	...		1·50	3	1·60	2	1·73	2
66·67		1·33	2	...		...		...		2·03	2
66·91		1·61	1	...		1·80	2	...		2·23	2
4167·27	Mg I	2·37	4	2·44	3	2·46	3	2·53	2	2·61	4
67·63		1·75	1	1·68	1	1·90	2	1·95	1	2·28	2
67·90	Fe I	1·96	2	2·17	3	2·18	4	2·23	2	2·43	3
68·60	Fe I	1·77	3	1·82	2	1·90	3	1·98	2	2·13	4
68·96	Fe I	1·83	3	1·83	2	1·81	2	2·00	2	2·08	3
69·29	Ti I	1·33	1	...		1·33	2	...		1·96	2
69·61		1·59	1	1·73	1	1·80	2	1·88	1	1·83	2
69·76	Fe I	1·83	2	2·00	2	1·93	2	2·17	2	2·13	2
70·10		1·63	2	1·53	2	1·58	2	1·90	1	1·97	2
70·43		1·43	2	...		1·33	0	...		1·73	2
4170·91	Fe I			1·93	2			2·23	1	2·33	6
		2·37	6			2·34	6	2·23	1		
71·06	Ti I			2·13	3			...		...	
71·51		1·18	1	...		...		...		...	

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4171·72	Fe I	1·85	1	1·77	1	1·73	0	2·13	1	2·22	2
71·91	Fe I, Ti II	2·20	2	2·05	1	2·00	2	2·17	1	2·35	2
72·10	Fe I	2·23	2	2·14	2	2·28	3	2·23	1	2·38	2
72·52	...	1·99	2	1·63	1						
						2·44	5	2·55	2	2·74	5
72·73	Fe I	2·15	2	2·31	3						
72·99	...	...		1·53	0	1·73	0	1·83	0	...	
73·30	Fe I			1·74	1	1·58	0	1·98	1		
		2·51	5							2·57	5
73·48	Fe II, Ti II			2·27	3	2·35	5	2·28	2		
4173·96	Fe I	2·13	3	2·11	4	2·09	5	2·23	2	2·44	4
74·39	...	1·74	2	1·75	2	1·66	3	1·87	1	1·94	2
74·92	Fe I	2·14	4	2·17	4	2·18	3	2·44	2	2·44	5
75·16	...	...		...		1·94	2	1·78	0	1·69	2
75·64	Fe I	2·14	4	2·11	3	2·15	4	2·34	2	2·34	4
75·92	...	1·44	1	1·66	2	1·71	2	1·79	1	1·94	2
76·56	Fe I, Mn I	2·14	4	2·19	3	2·19	5	2·39	3	2·49	5
76·98	...	1·37	1	1·74	2	1·60	2	1·54	1	1·84	2
77·31	Nd II			1·64	0	...					
		2·45	5					2·54	3	2·79	5
77·57	Y II, Fe I			2·34	3	2·38	5				
4177·84	...	...		1·69	1	1·89	2	1·74	0	1·54	0
78·05	Fe I	1·86	2	1·64	1	2·02	3	2·08	1	2·06	2
78·46	...	1·57	2	...		1.65	3	1·84	1	2·27	2
78·86	Fe II	2·24	4	2·04	3	1·99	3	2·10	2	2·20	2
79·20	...	1·58	0	...		...		...		...	
79·37	V I, Cr II	2·22	4	2·17	3	2·29	6	2·38	3	2·62	6
79·82	Zr II	...		...		1·29	2	...		1·54	0
80·08	...	1·36	2	...		...		...		1·97	2
80·40	Fe I	1·50	3	1·59	2	1·88	4	1·88	1	2·26	2
80·79	...	1·62	3	1·79	2	2·05	4	2·15	2	2·38	3
4181·19	...	1·36	2	1·84	2	...		...		1·79	2
81·54	...	1·72	1	...		1·84	2	...		2·30	2
81·77	Fe I	2·29	2	2·34	3	2·36	3	2·73	3	2·47	2
81·97	...	1·86	1	1·94	1	2·03	2	...		...	
82·37	Fe I	2·02	2	2·06	3	2·09	3	2·22	2	2·37	5
82·75	Fe I	1·84	2	1·80	2	1·85	3	2·01	1	2·14	2
83·00	Fe I	1·54	2	1·72	1	1·84	3	1·59	0	1·99	2
83·28	...			...		1·57	0			2·12	2
		1·95	4					2·24	2		
83·46	...			2·06	3	2·01	3			2·04	2
83·99	...	2·10	2	2·14	3	2·19	3	2·34	2	2·24	3
4184·29	Ti II	2·04	2	2·04	2	1·99	3	1·94	1	2·22	4
84·53	Ni I, Fe I	...		1·54	1	...		1·54	1	...	
84·88	Fe I	2·14	4	2·14	3	2·12	5	2·24	3	2·22	6
85·38	...	1·40	2	...		...		...		1·57	2
85·65	...	1·34	2	1·76	2	1·76	4	1·89	3	1·94	4
86·11	Ti I	1·58	3	1·69	2	1·74	3	1·74	1	2·05	3
86·34	...	...		1·54	1	1·64	2	2·04	1	1·84	2
86·61	Ce II	1·84	2	2·09	2	2·03	3	2·24	1	2·14	3
87·05	Fe I	2·29	5	2·34	3	2·46	5	2·63	2	2·59	6
87·56	Fe I	...		1·94	0	...		...		...	
87·78	Fe I	2·44	4	2·44	4	2·59	6	2·75	2	2·69	6

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4188·12	...	...		1·64	0	...		...		...	
88·34	...	...		1·54	1	...		...		...	
88·73	...	2·16	4	2·13	3	2·19	3	2·29	2	2·27	5
89·02	...	1·75	2	1·90	2	2·10	3	2·25	2	1·94	3
89·55	...	1·85	4	1·95	3	1·95	5	2·13	3	2·23	5
89·87	...	1·40	1	1·70	1	1·45	2	...		2·05	3
90·16	Cr I ...	1·55	2	1·85	2	1·69	3	1·99	3	2·21	5
90·42	...	1·65	3	1·55	1	...		...		...	
90·70	Co I ...	1·55	2	1·79	2	1·88	3	1·99	2	2·25	6
91·42	Fe I ...	2·33	4	2·43	4	2·48	5	2·61	3	2·65	5
4191·67	Fe I ...	1·99	2	1·90	1	2·05	2	2·07	2	2·25	3
92·05	...	1·59	2	1·95	2	1·82	3	1·93	2	1·88	2
92·54	...	1·67	3	1·97	2	1·93	5	2·19	2	2·00	4
92·88	...	1·30	1	...				...		1·65	2
						1·30	2				
93·13	Ce II ...	1·49	3	...				...		1·75	3
93·34	...	...		1·68	2	1·35	2	1·85	2	1·99	3
93·65	Cr I ...	1·72	4			1·60	5			2·28	5
				1·89	3			2·00	4		
93·88	...	1·45	2			...				...	
94·28	...	1·35	3	1·55	1	1·56	3	...		1·94	4
94·48	...	...		1·61	2	...		...		...	
4194·70	...	...		...		1·90	3	2·05	2	2·23	3
94·88	...	1·76	2	1·87	2	2·01	3	2·05	2	2·22	3
95·35	Fe I ...	2·23	4	2·21	2	2·30	3	2·35	2	2·45	4
95·59	Fe I ...	2·03	2	2·18	2	2·01	2	2·33	2	2·30	3
95·95	...	...		...		...		1·45	0	...	
96·22	Fe I ...	2·07	4	2·08	3	2·18	3	2·22	2	2·41	4
96·58	Fe I, La II ...	1·91	2	1·98	2	2·13	3	2·20	2	2·58	4
96·88	...	1·45	1	...		...		...		...	
97·07	CN ...	...		1·95	2	2·08	4	2·25	3	2·55	5
97·24	Cr I ...	1·68	2	...		...		...		...	
4197·49	...	1·50	2	...		...		...		...	
97·70	CN ...	...		...		...		1·80	0	...	
98·10	Fe I ...	...		...		2·00	0	...		...	
98·28	Fe I ...	2·55	4	2·70	4	2·66	3	2·75	3	2·85	6
98·61	Fe I ...	2·03	2	2·09	1	2·12	2	2·20	2	2·25	2
99·11	Fe I ...	2·33	4	2·32	3	2·39	5	2·55	3	2·41	6
99·95	Fe I ...	1·97	4	2·13	2	2·19	5	2·25	3	2·40	7
4200·44	Ni I ...	1·57	2	1·85	1	1·75	2	1·65	2	...	
00·70	...	1·69	1	2·15	2	2·25	3	2·31	2	2·39	3
00·93	Fe I ...	2·12	4	2·09	2	2·08	3	2·25	2	2·31	3
4201·28	...	1·25	0	1·58	2	...		1·65	0	...	
01·70	Ni I, Fe I ...	1·73	1	1·95	2	1·92	0	1·85	0	...	
02·04	Fe I ...	2·43	4	2·47	3	2·69	4	2·84	3	2·95	7
02·35	V II ...	1·90	2	1·81	1	1·72	0	...		...	
02·75	Fe I ...	1·81	2	1·99	2	1·91	3	2·05	1	2·13	3
02·97	Ce II ...			...		...		...		1·98	3
		1·63	2								
03·14	...			1·92	2	1·77	3	1·97	2	...	
03·58	Fe I, Cr I ...	1·67	2	1·91	2	1·98	3	2·13	2	2·25	4

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4203·99	Fe I	2·23	4	2·25	2	2·26	5	2·36	3	2·41	4
04·22	...	1·74	1	1·69	1	...		...			
										1·81	2
04·48	Cr I	...		1·66	1	...		...			
4204·75	CH, Y II	1·77	2	2·10	2	2·02	4	2·22	3	2·10	3
05·04	...	2·05	3	1·86	2	1·99	3	1·97	2	2·46	3
05·38	...	...		1·76	1	1·61	2	1·81	2		
										2·36	5
05·54	Fe I	2·14	4	2·06	2	2·10	5	2·16	3		
05·92	...	1·37	1	...		...		...		1·51	2
06·32	...	1·56	2	...		1·45	2	...		...	
06·69	Fe I	2·15	4	2·36	4	2·28	5	2·51	4	2·54	7
07·14	Fe I	2·00	2	1·96	2	1·93	3	2·16	2	2·23	4
07·41	CN, Cr II	1·77	2	1·77	2	1·87	3	1·88	2	1·87	3
07·82	...	1·48	3	1·76	2	1·45	4	1·56	0	1·76	4
4208·14	...	...		...		...		1·86	2	1·74	2
08·33	Cr I	1·36	0	1·76	2	1·45	2	...		2·11	3
08·61	Fe I	2·06	4	2·01	2	2·11	5	2·21	2	2·26	4
08·97	Zr II	1·91	3	1·76	2	1·74	3	1·96	2	2·01	4
09·49	...	1·66	2	1·81	2	1·99	3	2·03	2	2·11	3
09·79	V II	1·85	3	1·93	2	1·84	2	2·25	2	2·25	3
10·35	Fe I	2·26	5	2·36	3	2·35	5	2·46	4	2·56	6
10·96	CH	1·68	3	2·00	2	2·06	5	2·16	2	2·16	4
11·35	Cr I	1·56	3	1·72	2	1·45	2	1·75	2	2·11	4
11·72	...	1·53	1	...		...		...		1·76	0
11·90	Zr II	1·92	2	1·96	2	2·01	5	2·06	4	2·35	5
4212·28	...	1·46	2	...		...		...		1·76	3
12·65	...	1·84	4	2·01	5	2·01	5	2·15	3	2·21	5
12·90	...	...		...		...		1·56	1	1·46	0
13·16	CN, Cr I	1·41	2	1·56	2	1·49	3	1·61	0	2·14	4
13·64	Fe I	2·12	4	2·04	3	2·11	5	2·22	2	2·36	5
13·93	...	1·36	1	1·71	2	1·81	2	2·03	2	2·16	2
14·31	...	1·47	2	1·55	2	1·46	3	1·79	2	2·16	3
14·60	...	1·38	2	1·56	2	1·60	3	1·76	1	2·25	3
14·98	...	...		1·72	2	1·56	2	1·98	2	2·21	2
15·56	Sr II, Fe I	2·62	5	2·56	4	2·62	5	2·60	4	2·96	4
4215·97	Fe I, CN	...		...		1·83	2	...			
										2·73	3
16·17	Fe I	2·23	4	2·26	3	2·29	3	2·53	4		
16·60	...	...		1·61	1	1·75	3	1·76	1	...	
17·23	CH	1·74	2	1·96	2	2·08	4	2·16	2	2·16	4
17·54	Fe I	2·19	4	...		2·21	5	2·26	2	2·26	5
18·22	...	1·79	2	...				2·01	2	2·06	5
						2·04	5				
18·41	...	1·56	1	...				1·84	1	...	
18·71	CH	1·71	2	1·96	2	1·94	3	2·01	2	1·86	5
19·19	...			1·63	0						
		2·30	5			2·34	6	2·47	5	2·42	8
19·41	Fe I			2·27	3						
4220·04	V II	1·81	2	1·72	2	1·76	3	1·87	2	1·99	3
20·35	Fe I	2·04	3	2·03	3	2·05	4	2·21	3	2·27	5
20·69	...	1·57	2	1·57	2	1·36	1	...		...	
21·20	...	1·46	2	...		...		...		...	

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4221·49	....	1·79	3	1·89	3	2·00	5	2·13	4	2·08	7
22·22	Fe I................	2·22	4	2·34	4	2·31	5	2·54	4	2·43	7
22·66	Ce II, Cr I..........	1·78	2	1·73	2	1·69	2	1·69	1	2·07	3
23·13	....	1·63	2	1·87	2	1·95	3	2·11	3	2·25	4
23·32	....	1·66	2	....		....		....		....	
23·54	....	1·73	2	2·10	3	2·24	5	2·25	2	2·17	3
4223·77	....	1·57	2	....		....		....		....	
24·19	Fe I................	2·15	4	2·27	2	2·28	4	2·45	3	2·43	4
24·50	Fe I................	2·10	4	2·07	2	2·18	3	2·22	2	2·27	3
24·85	CH................	1·76	2	1·90	2	1·90	3	2·08	2	1·77	1
25·21	V II................	1·81	1	1·77	1	....		1·57	0	....	
25·46	Fe I................	2·16	3	2·15	2	2·29	3	2·48	2	2·62	4
25·68	....	1·69	1	....		1·63	0	....		....	
25·95	Fe I................	2·00	2	2·10	1	2·20	2	2·57	0	2·27	1
26·43	Fe I................			2·26	0	....					
		2·77	5					3·12	0	3·32	4
26·73	Ca I................			2·97	2	3·05	4				
4227·38	Fe I................	2·40	4	2·45	2	2·58	3	2·84	0	2·67	3
27·89	....	1·57	2	1·87	1	2·10	2	2·28	1	1·87	0
28·32	....	1·74	3	....		....		1·94	0	....	
28·69	....	1·55	3	1·83	2	1·70	3	1·92	2	1·69	1
29·06	....	1·47	3	1·60	2	....		....		....	
29·49	Fe I................	1·91	3	1·90	2	2·04	3	2·22	2	2·32	4
29·79	Fe I, Cr II..........	2·02	3	2·17	2	2·33	5	2·42	3	2·44	5
30·50	Cr I................	1·60	3	1·77	2	1·67	3	1·72	2	2·02	5
31·02	Ni I, CH...........	1·84	4	1·97	3	2·07	5	2·22	4	2·02	7
31·67	Fe I, Zr II..........	1·64	3	1·92	2	1·97	4	1·97	2	2·11	5
4231·96	....	1·75	3	1·75	2	1·81	3	1·82	2	1·97	3
32·39	Nd II, V I..........	1·65	3	1·47	1	1·58	3	1·72	2	2·07	3
32·73	Fe I................	1·59	2	1·87	1			2·17	2	2·30	4
						2·09	3				
32·94	....	....		1·77	1			2·00	1	....	
33·17	Fe II................	2·38	4	2·31	2	2·27	3	2·27	2	2·39	4
33·61	Fe I................	2·26	4	2·28	3	2·46	5	2·53	3	2·55	6
34·00	....	1·08	0			....		1·88	1	2·06	3
				1·59	2						
34·24	V II................	1·38	3			....		....		1·83	3
34·54	V I................	1·50	3	1·76	3	1·57	3	1·71	2	1·88	5
35·24	Mn I................	2·10	4	1·98	3	2·22	5	2·36	4	2·38	6
4235·97	Fe I................	2·43	5	2·68	6	2·72	7	2·82	4	2·78	8
36·38	Ni I................	1·60	1	....		....		....		....	
36·85	....	1·66	2	1·78	1	1·97	2	2·18	2	2·14	2
37·15	Fe I................	2·08	5	2·28	3	2·30	5	2·32	2	2·48	6
37·69	....	1·48	2	1·59	1	....		1·78	2	1·98	3
38·01	Fe I................	2·05	3	2·08	3	2·18	4	2·18	3	2·31	4
38·36	La II................	1·66	2	1·63	1	1·58	1	1·68	1	2·10	3
38·82	Fe I................	2·28	5	2·23	3	2·43	5	2·49	4	2·50	6
39·34	....	1·74	2	1·88	2	1·61	1	1·70	2	1·78	2
39·72	Mn I................	2·03	1								
				2·36	3	2·47	5	2·48	4	2·63	7
39·85	Fe I................	2·18	1								

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4240·41	Fe I, Ca I	2·06	4	2·08	3	2·19	3	2·28	2	2·37	5
40·70	Cr I	1·58	2	1·72	2	1·79	2	1·92	1	2·10	3
41·12	...	1·68	4	1·89	3	1·93	5	1·90	3	2·10	6
41·68	Zr I	1·48	3	...		...		...		1·68	4
42·22	...	1·78	1	...		...		...		1·99	2
42·42	CH, Mn II?	2·13	2	2·21	3	2·38	4	2·38	2	2·40	3
42·68	Fe I	1·98	2	2·12	3	2·11	2	2·31	2	2·35	3
43·29	...	1·88	2			2·48	6				
				2·28	3			2·48	4	2·53	6
43·56	...	1·87	2			...					
43·82	...	1·60	2	1·91	3	1·85	2	1·86	2	1·98	2
4244·27	Mn II	1·48	3	1·73	3	1·68	4	1·58	0	1·38	1
44·78	...	1·50	2	1·58	2	...		1·28	0	1·38	1
45·28	Fe I	2·28	6	2·23	4	2·36	8	2·36	6	2·36	9
46·05	Fe I	1·96	3	2·10	3	2·09	7	2·07	6	2·36	9
46·82	Sc II	2·24	5	2·23	3	2·32	6	2·31	4	2·46	8
47·43	Fe I	2·23	4	2·39	4	2·49	6	2·56	5	2·56	8
48·25	Fe I	2·02	4	2·08	2			2·28	3		
						2·37	5			2·56	6
48·46	Fe I	1·66	1	1·92	1			2·10	1		
48·73	CH	1·74	2	1·98	2	2·06	2	2·12	1	2·03	2
48·96	CH	1·50	1	1·91	2	1·91	2	2·03	1	2·03	3
4249·59	CH	1·71	2	2·11	3	2·25	3	2·33	2	2·34	6
50·14	Fe I	2·32	5	2·40	3	2·58	4	2·68	4	2·64	6
50·79	Fe I	2·38	5	2·49	5	2·65	6	2·78	4	2·78	7
51·34	...	...		1·53	0	1·48	1	1·83	1	...	
51·71	...	1·48	3	1·68	3	1·53	2	...		2·00	3
52·02	...	1·57	2	...		...		...		...	
52·31	Co I	1·37	1	1·74	3	1·83	3	1·87	3	2·37	4
52·68	...	1·96	4	1·82	3	2·04	3	2·04	3	2·09	4
53·01	...	1·62	2			1·73	2	...		1·69	2
				1·90	3						
53·21	...	1·37	1			1·71	2	2·01	2	1·83	2
4253·40	Ce II	1·39	2	...		...		...		1·84	2
53·87	...	1·60	2	1·99	2	2·07	3	2·19	2	2·12	2
54·35	Cr I	2·38	6	2·39	5	2·67	6	2·79	4	2·79	7
54·98	CH, Fe I	1·67	2	1·99	3	2·09	3	2·11	2	2·25	3
55·25	CH	1·53	2	1·84	2	1·88	2	1·94	0	1·79	1
55·57	Fe I	1·73	2	2·03	2	2·19	3	2·29	2	2·24	3
55·84	Fe I	1·79	2	1·92	2	2·11	3	2·24	2	2·39	4
56·21	Fe I	1·77	3	1·97	3	2·03	3	2·19	4	2·45	5
56·68	...	1·59	3	1·54	0			1·39	0	1·84	3
						1·86	5				
56·86	...	...		1·69	3			1·49	2	...	
4257·14	...	1·39	3	...		...		...		1·39	3
57·65	Mn I	1·70	3	1·59	3	1·84	5	1·77	3	2·04	5
58·13	Fe II	2·02	2	...		...		2·12	1	2·35	2
58·32	Fc I	2·08	2	2·18	3	2·30	3	2·29	2	2·52	3
58·61	Fe I	1·88	2	1·86	1	2·26	3	2·29	2	2·34	2
58·95	Fe I	1·72	2	1·97	3	1·83	2	2·14	2	2·24	3
59·24	...	1·59	3	1·69	2	2·12	3	1·89	1	2·16	2
59·78	...	...		1·54	0	...		1·49	0	...	

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4260·00	Fe I	1·85	0								
				2·27	2	2·39	2	2·52	1	2·69	3
60·13	Fe I	2·19	2								
4260·49	Fe I	2·49	6	2·61	3	2·83	5	2·99	3	2·93	5
61·27	CH	1·63	3	1·95	2	1·96	2	2·13	1	2·07	2
61·56	CH	1·65	2	1·89	1	2·17	3	2·09	1	2·19	2
61·74	CH	...		1·79	1	...		1·93	1	2·17	2
61·95	Cr II, CH	2·09	4	2·11	3	2·27	5	2·24	2	2·38	4
62·34	...	1·53	2	1·67	2	1·29	0	1·69	1	1·89	2
62·68	...	1·34	2	1·75	3	1·74	3	1·84	3	1·87	4
63·18	Ti I, Cr I	1·73	4	1·89	3	1·92	4	1·99	4	2·09	5
63·62	La II	1·54	3	1·64	3	1·76	3	1·84	3	1·85	4
64·00	...	1·47	1	1·59	1	1·61	2	1·49	0	1·77	2
4264·24	Fe I	1·96	4	1·92	1	2·09	3	2·14	3	2·33	5
64·49	...	...		1·74	1	1·89	2	1·89	1	...	
64·74	Fe I	1·77	3	1·89	3	2·07	3	2·07	3	2·09	4
65·28	Fe I	1·83	4	1·99	3	1·91	3	1·99	3	2·15	5
65·60	...	...		...		1·76	3	1·54	1	...	
65·94	Mn I	1·79	4	1·91	3	1·89	5	1·91	4	2·09	5
66·70	...	...		1·64	1	1·72	2	1·74	1	...	
66·97	Fe I	1·98	4	2·02	3	2·17	5	2·19	4	2·29	6
67·39	CH	1·59	2	1·80	2	1·82	2	1·89	2	1·90	2
67·82	Fe I	2·16	4	2·19	3	2·38	3	2·39	2		
										2·59	8
68·10	...	...		1·99	2	2·03	2	2·22	2		
4268·75	Fe I	1·95	4	2·07	3	2·10	5	2·19	4	2·34	6
69·02	...	1·70	2	...		...		...		...	
69·26	Cr II	1·78	2	1·60	0	1·79	2	1·65	1	1·87	2
69·48	...	1·68	1	1·85	2	1·97	2	1·90	2	2·19	3
69·80	...	1·80	3	2·18	3	2·31	3	2·35	3	2·50	4
70·20	Ti I	1·77	3	1·94	3	1·90	2	2·13	2	2·12	2
70·49	...	1·30	1	...		...		...		...	
71·21	Fe I	2·37	5	2·55	3	2·72	4	2·85	4	2·82	5
71·78	Fe I	2·60	5	2·74	4	2·94	5	3·00	3	3·10	5
72·48	...	1·76	2	1·80	1	1·84	1	2·25	1	2·10	2
4272·87	...	1·54	2	1·80	2	1·42	0	1·88	1	1·90	2
73·40	Ti I, Fe II	2·19	4	2·15	3	2·32	4	2·33	2	2·45	5
73·86	...	1·93	3	2·20	3	2·32	3	2·50	3	2·54	5
74·20	CH	1·56	2	1·90	2	1·60	1	1·80	0	...	
74·80	Cr I	2·40	5	2·46	3	2·68	6	2·80	5	2·87	7
75·36	...	...		1·99	2	2·24	2	2·30	2	2·30	2
75·62	...	2·13	4	2·15	3	2·24	2	2·39	3	2·45	5
76·07	...	1·58	2	1·30	0	...		1·65	1	...	
76·34	...	1·42	2	1·50	1	1·60	2	1·70	1	...	
76·70	Fe I	1·84	3	1·90	3	1·92	3	2·05	3	2·22	4
4277·00	V I	1·60	2	1·68	1	1·70	2	1·75	1	1·82	2
77·26	...	1·75	2	1·68	1	1·70	2	1·80	1	1·81	2
77·52	CH ?	1·62	2	1·98	3	2·04	3	2·13	4	2·36	5
78·24	Fe I, Ti I	2·10	5	2·06	5	2·07	6	2·10	4	2·20	6
78·87	...	1·60	2	1·70	1	1·78	3	1·63	1	2·02	4
79·07	...	1·55	2	1·75	1	1·72	2	1·80	2	1·80	3
79·50	Fe I, CH	1·84	3	1·88	2	1·83	2	1·85	1	1·90	1

43962—6½

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4279·82	....	1·98	2	2·15	2	2·33	3	2·30	2	2·55	4
80·14	CH, Fe I	1·60	1	2·10	2	2·23	3	2·24	2	2·37	2
80·50	....	1·92	3	1·96	1	2·28	3	2·33	2	2·50	3
4280·79	Sa II	1·81	2	1·85	1	2·03	2	2·00	1	2·17	2
81·06	Mn I	1·90	2	2·07	3	2·18	3	2·25	3	2·37	4
81·39	Ti I	1·55	1	1·58	1	....		1·50	1	1·83	2
81·98	CH	1·61	2	1·90	3	1·91	3	2·00	1	2·02	3
82·44	Fe I	2·27	4	2·20	3	2·31	4	2·50	3	2·60	5
82·73	Ti I	1·50	0	1·70	1	1·96	2	1·90	0	2·02	1
82·99	Ca I	2·24	4	2·26	3	2·31	5	2·44	4	2·40	5
84·23	Cr II	2·10	4	2·06	3	2·20	5	2·31	4	2·44	5
84·48	....	....		....		....		....		2·11	2
84·75	Ni I	1·83	3	1·89	2	2·12	3	2·09	2	2·26	3
4285·02	Ti I	1·77	2	2·01	2	1·96	2	2·11	2	2·21	3
85·46	Fe I	2·10	4	2·15	3	2·30	3	2·31	2	2·43	5
85·80	Co I, Fe I	1·43	1	1·83	1						
						2·39	3	2·51	3	2·64	5
86·08	Ti I	1·97	3	2·28	3						
86·48	CH, Fe I	1·88	3	2·11	2	2·18	3	2·26	2	2·31	3
86·87	Fe I	1·71	1								
				2·21	3	2·24	5	2·31	4	2·39	5
87·01	La II	1·86	2								
87·45	Ti I	1·78	2	1·80	2	1·55	1	2·01	2	2·01	3
87·92	Ti II	2·29	4	2·19	3	2·30	4	2·26	4		
										2·57	8
88·16	Fe I	1·95	2	1·86	2	1·84	2	1·81	1		
4288·76	CH	1·61	1	2·01	2	1·88	2	2·14	1	2·11	2
89·02	Ti I, Fe I	2·04	2	2·12	1	2·34	3	2·36	1	2·47	3
89·37	Ca I	2·23	2	2·24	2	2·16	2	2·46	1	2·51	3
89·74	Cr I	2·40	4	2·45	3	2·61	3	2·76	3	2·83	5
90·22	Ti II	2·41	4	2·29	3	2·34	3	2·44	2	2·46	3
90·93	Ti I, CH	2·13	4								
				2·51	4	2·59	5	2·61	4	2·66	6
91·15	Ti I	1·63	1								
91·47	Fe I	1·99	4	1·97	2	1·92	2	2·16	1	2·27	3
92·06	Fe I, CH	1·78	2	2·20	3			2·41	3	2·61	7
						2·41	7				
92·29	Fe I	1·84	4	1·81	1			1·91	0	....	
4293·11	CH	1·90	4	2·16	4	2·14	7	2·27	5	2·30	8
93·80	....	....		1·69	0	....		....		....	
94·11	Ti II, Fe I	2·44	6	2·41	3	2·59	7	2·71	6	2·71	8
94·78	Zr I, Sc II	1·85	2	2·05	1	1·89	2	1·92	1	2·21	1
95·02	CH	1·81	1	2·31	3	2·30	3	2·45	4	2·36	1
95·22	CH	1·81	2	....		2·15	3	....		2·25	1
95·82	Ti I, Cr I	1·86	2	1·96	3	2·01	3	2·07	3	2·31	4
96·11	La II	1·63	1	1·79	1	1·68	2	1·71	1	2·13	2
96·66	Fe II	2·19	4	2·29	3	....		2·46	4	2·51	4
96·99	CH, Cr I	1·91	2	2·21	2	....		2·37	1	2·31	1
4297·24	CH	1·85	2	2·01	1	....		2·26	1	2·29	1
97·52	CH	1·76	2	....		....					
								2·06	1	2·26	1

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4297·70	Cr I	....		2·04	1	....					
98·00	Fe I	2·01	3	2·20	3	....		2·44	4	2·46	5
98·18	....	1·66	1	2·21	4	....		....		....	
98·74	Ti I, CH	1·69	1	1·93	0	....		2·31	1	2·31	0
98·98	Ca I	2·30	2	2·38	2	....		2·54	1	2·71	2
99·24	Fe I	2·46	2	2·66	3	....		2·84	2	2·91	2
99·69	Ti I	1·56	0	2·11	1	....		2·31	0	....	
4300·06	Ti II			2·48	3	....		2·65	2	2·81	4
		2·48	4								
00·30	Ce II, CH			2·01	1	....		....		....	
4300·58	CH, Ti I	1·96	2	2·21	2	....		2·61	2		
										2·61	3
00·83	Fe I	1·93	2	2·11	1	....		....			
01·10	Ti I	2·11	4	2·43	3	....		2·56	4	2·61	4
01·94	Ti II	2·30	4	2·29	1	....		2·31	2	2·51	4
02·24	Fe I	1·99	2	2·36	1	....		2·41	1	2·46	2
02·54	Ca I	2·40	4			....		2·76	2	2·78	4
				2·63	4						
02·88	CH	1·57	0			....		2·36	0	2·13	0
03·18	Fe II	2·26	4	2·30	2	....		2·37	0	2·54	3
03·58	Nd II	1·86	2	2·12	1	....		2·17	1	2·35	2
03·91	....	1·97	4	2·38	4	....		2·52	3	2·46	3
4304·34	CH	....		1·95	1	....		2·20	2	2·16	0
04·58	Fe I	1·93	3	2·26	2	....		2·32	2	2·45	1
04·80	....	1·37	0	2·02	1	....		2·05	1	2·21	1
05·13	Ce II	1·72	2	2·07	1	....		2·02	0	2·24	1
05·43	Fe I	2·20	3	2·42	2	....		2·62	3	2·70	4
05·70	Sc II	1·90	1	1·90	0	....		....		....	
05·90	Ti I	2·29	4	2·42	2	....		2·65	3	2·76	4
06·17	CH	....		1·92	2	....		....		....	
06·64	....	1·55	1	2·16	2	....					
								2·58	2	2·62	4
06·86	CH	1·92	2	2·17	2	....					
4307·36	CH			2·07	0	....		2·17	0	....	
		2·72	6								
07·86	Fe I, Ca I			2·94	4	....		3·02	2	3·22	6
08·58	....	1·62	1	2·12	2	....		2·47	1	2·27	0
09·06	Fe I	2·11	2	2·49	3	....		2·68	1	2·63	3
09·42	Fe I	2·21	2	2·34	1	....		2·40	1	2·23	0
09·68	Y II	2·04	2	2·27	1	....		2·52	1	2·77	3
09·90	....	....		1·95	0	....		2·05	0	....	
10·14	....	1·82	2	2·20	1	....		2·32	1	2·22	0
10·44	CH	1·87	2	2·27	1	....		2·46	1	2·54	0
10·68	....	1·54	1	2·02	0	....		2·14	1	2·20	0
4310·96	CH	1·78	2	2·10	0	....		2·22	1	2·35	1
11·18	CH	1·62	1	2·02	1	....		2·36	1	2·22	0
11·48	Fe I, CH	1·92	3	2·30	2	....		2·48	1	2·60	3
11·72	....	....		2·00	2	....		2·28	1	....	
12·09	CH	1·64	1			....					
				2·24	2			2·56	4	2·48	3
12·30	CH	1·67	1			....					

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4312·52	Mn I	1·72	1	2·00	2	...		...		2·07	0
12·84	Ti II	2·30	4	2·46	4	...		2·65	5	2·72	6
13·66	CH	...		1·47	2	1·89	3	2·10	2	2·02	3
14·07	Sc II			2·32	2						
		2·42	6			2·39	5	2·50	5	2·62	8
14·28	Ti I			2·00	1						
4314·99	Ti II, Fe I	2·52	6	2·52	6	2·57	7	2·67	5	2·77	8
15·96	La II	...		1·67	4	1·42	2	1·58	2	1·32	0
16·85	Ti II	1·99	5	1·80	4	1·97	5	1·83	4	2·13	5
17·32	Zr II	1·48	2	1·77	3	1·27	3	1·68	4	1·93	4
18·06	...	...		1·73	4	...		1·63	2	...	
18·67	Ca I	2·22	6	2·23	5	2·30	8	2·43	6	2·51	9
19·53	Fe I, Cr I	1·57	4	1·55	2	1·52	4	1·68	2	1·83	5
20·18	...	...		1·43	0	...		1·43	1	...	
20·50	...			1·78	2	1·82	3	1·63	1	2·15	3
		2·45	7								
20·80	Sc II, Ti II			2·29	4	2·30	5	2·45	5	2·50	5
4321·43	...	...		...		...		...		1·63	2
21·74	Fe I	1·81	3	2·01	4	2·06	7	2·09	5	2·20	5
22·49	La II	1·48	3	...		...		...		1·70	2
23·01	...	...		1·91	0	2·02	1	2·13	1	2·29	2
23·25	...	...		2·23	2	2·47	3	2·53	1	2·55	3
23·51	Cr I	...		2·21	2	2·31	2	2·23	1	2·22	1
23·87	CH	...		2·18	2	2·43	2	2·45	1	2·48	3
24·10	...	...		1·80	0	...		1·87	1	1·81	0
24·40	...	...		1·96	2	1·99	2	2·28	2	2·03	2
25·02	Sc II	...		2·35	4	2·56	3	2·63	2	2·78	5
4325·76	Fe I	...		2·83	6	2·93	5	3·05	4	3·13	7
26·80	Fe I	...		2·11	2	2·07	2	2·22	2	2·21	2
27·09	Fe I	...		2·06	2	2·11	2	2·23	2	2·29	4
27·93	Fe I	...		2·03	3	2·13	7	2·16	4	2·30	8
28·62	...	...		1·77	3	...		1·94	4	1·53	2
29·04	...	...		...		...		...		1·94	3
29·33	...	...		1·93	3	...		1·94	5	1·83	3
30·03	V I	...		1·83	3	...		2·02	3	2·23	5
30·34	Ti II	...		1·89	2	...		1·94	2	2·16	2
30·71	Ti II	...		2·03	2	...		2·19	2	2·43	4
4331·00	Fe I	...		1·93	2	...		1·86	2	1·87	2
31·45	...	...		1·46	2	...		1·61	2	1·71	0
31·66	Ni I	...		1·95	4	...		2·01	4	2·25	5
32·58	Cr I	...		...		...		1·88	2	2·06	3
32·89	V I	...		...		...		2·23	4	2·29	4
33·35	...	...		...		...		1·33	0	1·76	2
33·80	La II	...		...		...		2·01	2	2·33	4
34·06	...	...		...		...		1·83	2	2·03	3
34·22	...	...		...		...		1·83	2	...	
34·74	...	...		...		...		1·83	2	1·98	5
4334·94	La II	...		...		...		1·78	2	1·73	3
35·30	...	...		...		...		2·03	4	1·89	4
35·85	...	...		...		...		...		1·63	4
40·48	H γ	3·75		3·36		3·29		3·26		3·19	

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4345·66		…		…		…		1·54	2	…	
45·90		…		…		…		1·69	2	1·94	3
46·26		…		…		…		1·96	2	2·04	2
46·56	Fe I	…		…		…		2·24	2	2·26	3
46·86	Cr I	…		…		…		1·84	2	1·94	2
47·25	Fe I	…		…		…		1·84	2	2·14	3
4347·56		…		…		…		1·79	2	1·84	2
47·86	Fe I	…		…		…		2·24	4	2·34	5
48·32	CH	…		…		…		1·94	3	1·82	2
48·94	Fe I	…		1·91	3	…		2·00	5	2·04	6
49·80	Ce II	…		…		1·27	0	…		1·70	5
50·25		…		1·47	0	1·67	2	…		1·62	2
50·58	Fe I	…		1·76	1	1·67	2	1·92	2	2·05	2
50·83	Ti II	…		1·91	2	1·83	2	2·07	2	2·17	1
51·06	Cr I	…		2·01	2	2·07	2	2·15	2	2·45	3
51·81	Mg I, Cr I	…		2·63	5	2·79	6	2·87	5	2·90	7
4352·45		…		1·87	2	…		…		…	
52·76	Fe I	…		2·27	4	2·47	5	2·67	5	2·67	7
53·54		…		1·82	3	…		1·77	2	1·77	3
53·95		…		1·47	0	…		1·66	2	1·85	2
54·28		…		1·87	2	…		1·93	2	1·87	1
54·60	Sc II	…		1·97	2	2·19	3	2·20	2	2·50	5
55·08	Ca I	…		1·97	4	2·18	3	2·37	3	2·30	4
55·40		…		…		1·54	0	1·85	2	…	
55·71	CH	…		1·77	2	1·85	2	1·96	2	1·93	2
55·94	CH, Ni I	…		1·97	2	2·09	3	2·17	2	2·31	3
4356·36	CH	…		1·88	2	1·83	2	2·01	2	1·98	2
56·62		…		1·88	3	1·90	3	1·98	2	2·08	4
57·51	Cr I	…		1·83	4	1·72	3	1·83	3	1·98	4
57·87		…				1·67	2	1·58	2	1·98	2
				1·98	3						
58·16		…				1·71	2	1·80	2	2·08	2
58·51	Fe I	…		2·18	2	1·99	2	2·28	2	2·46	2
58·76		…		2·08	2	2·27	3	2·26	2	2·45	2
59·60	Cr I	2·27	4	2·36	4	2·47	7	2·58	6	2·63	7
60·38	Ti I	1·83	3	1·98	3	2·11	3	2·18	3	2·18	3
60·79	Fe I	1·85	3	1·76	2	1·85	3	1·88	2	2·24	5
4361·29		1·70	3	1·58	3	1·55	4	1·66	2	1·78	3
62·12		1·95	3	1·96	4	1·88	5	1·94	2	2·13	5
62·52		1·68	2	1·89	2			2·04	2	2·13	3
						2·00	3				
62·77		1·63	1	1·68	1			1·90	2	1·81	2
63·19	CH, Cr I	1·93	3	2·08	3	2·18	3	2·27	3	2·33	5
63·55		1·68	2	1·80	2	1·88	2	1·96	2	1·70	2
64·15	Y II	1·81	3	1·91	4	2·15	6	2·18	4	2·18	5
64·68		1·70	3	…		…		…		1·68	4
65·22		…		1·73	3	…		…		…	
65·53		1·49	2	…		1·67	3	1·88	2	1·67	3
4365·91	Fe I	1·85	3	1·98	4	1·80	3	1·88	2	2·08	4
66·50	CH	1·82	3	1·83	2			2·03	2		
						2·28	7			2·28	4

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4366·66	CH	...		1·83	2			1·98	2		
67·63	Fe I, Ti II	2·46	4	2·36	4	2·48	4	2·58	4	2·68	5
67·91	Fe I	1·96	2	2·04	2	2·09	2	2·07	2	2·33	3
68·28	Ni I	...		1·83	2	1·68	1	...		...	
68·65	...	1·70	3	...		1·39	1	...		1·93	3
69·42	Fe II	2·02	2	1·80	2	1·66	1	1·91	2	2·06	2
69·78	Fe I	2·29	3	2·34	3	2·39	4	2·45	3	2·56	6
70·25	...	1·66	1	1·39	0	1·65	1	1·69	2	...	
4371·03	Zr II	1·85	2	2·04	2	2·21	2	2·24	2	2·29	3
71·33	Cr I	2·22	3	2·28	2	2·30	2	2·39	3	2·49	5
71·84	...	1·54	2	1·69	2	...		...		...	
72·35	...	1·65	3	1·64	2	1·73	3	1·88	2	1·99	5
72·88	CH, Fe I	1·86	3	2·02	3	2·22	5	2·29	3	2·27	4
73·25	Cr I	1·54	2	1·90	2	1·73	2	1·89	2	2·04	2
73·58	Fe I	1·99	3	2·04	2	1·99	2	2·19	2	2·32	4
73·86	...	1·19	0	1·92	2	1·93	2	...		1·89	1
74·21	Cr I, CH	1·69	0	2·16	2	2·15	2	...		2·21	3
74·49	Sc II	2·37	2	2·29	2	2·29	3	...		2·39	3
4374·94	...	2·46	4	2·29	2	2·22	3	...		2·59	4
75·24	...	1·29	0	1·69	0	2·03	2	...		2·05	1
75·62	CH	1·49	0	1·90	2	2·10	2	...		2·17	2
75·94	Fe I	2·38	5	2·38	4	2·46	5	...		2·56	5
76·78	Fe I	1·97	3	1·89	2	1·97	3	...		1·95	3
77·28	CH	1·81	3	2·11	3	2·18	4	...		2·22	5
77·78	Fe I	1·79	3	1·73	3	1·71	3	...		1·83	3
78·25	CH	1·76	3	1·99	3	1·94	3	...		1·92	5
78·51	...	...		...		1·56	2	...		...	
78·96	...	1·72	1	1·79	2	1·75	2	1·95	2	1·89	1
4379·25	V I	2·10	3	2·19	3	2·17	5	2·17	3	2·29	4
79·78	Zr II, Cr I	1·80	2	1·81	2	1·43	2	1·71	2	1·74	2
80·08	...	1·84	2	1·99	2	1·90	3	2·01	3	2·09	3
80·45	Fe I	1·74	1	1·69	2	1·63	1	1·74	2	2·09	2
80·73	CH	1·87	2	2·09	2	2·28	3	2·08	2	2·24	2
81·07	Cr I	1·74	2	1·87	2	1·84	2	1·92	2	1·62	1
81·80	...	1·72	3	1·89	2	1·73	2	...		...	
82·14	Ce II	1·79	2	...		...		...		1·74	1
82·79	Fe I, CH	2·11	2	2·39	2	2·43	3	2·52	2	2·59	2
83·11	...	...		...		2·28	1	...		...	
4383·55	Fe I	2·76	6	2·99	4	3·02	4	3·19	3	3·24	4
84·34	...	2·01	2	2·01	1	...		...		...	
84·72	V I	2·33	3	2·34	2	2·43	2	2·59	2	2·71	2
85·05	Cr I	2·07	1	2·19	0	2·31	2	2·37	2	2·49	2
85·36	Fe II	2·37	4	2·34	2	2·29	2	2·39	2	2·29	2
86·04	...	...		1·89	2	1·82	3	2·01	3	...	
86·54	...	...		...		1·71	3	...		1·84	2
86·84	Ti II	2·10	2	2·09	2	1·99	2	2·09	2	2·19	3
87·08	CH	1·96	2	2·00	2	1·99	2	2·01	2	1·89	2
87·50	...	1·82	2	1·99	2	2·14	3	2·12	3	2·14	3
4387·91	Fe I	2·10	3	2·19	2	2·09	3	2·11	2	2·23	3
88·42	Fe I	2·19	3	2·25	3	2·19	3	2·29	4	2·29	3
88·79	CH	1·69	1	1·91	2	2·09	2	1·89	2	1·94	2

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4389·25	Fe I	1·95	3	2·01	2	2·09	2	2·11	3	2·27	4
89·68	......	1·64	2	1·89	2	2·20	2	1·99	2	2·14	2
89·98	V I	2·07	3	2·19	2	2·19	3	2·20	2	2·39	3
90·50	Fe I	1·98	2	2·21	3	2·24	3	2·25	2	2·23	3
90·97	Fe I	2·28	3	2·24	3	2·19	3	2·09	2	2·45	3
91·73	Cr I	2·09	3	2·14	3	2·37	5	2·34	4	2·51	7
92·06	......	......		1·90	2	1·65	1	2·02	2	......	
4392·60	......	1·88	3	1·81	2	1·74	3	1·60	3	1·95	3
93·00	......			1·93	2	1·85	2	1·98	3		
		1·90	3							2·14	3
93·28	......			......		1·79	2	......			
93·53	Cr I	1·72	2	2·12	2	1·93	2	2·20	2	2·20	3
93·83	......	......		1·96	1	1·99	2	1·95	1	......	
										2·30	5
94·05	Ti II	2·28	4	2·13	2	2·09	3	2·00	1	......	
95·03	Ti II	2·56	5	2·43	3	2·42	3	2·58	3	2·80	7
95·25	V I	......		2·12	1	2·22	2	2·10	2	......	
95·54	Fe I	......		1·65	0	1·84	1	1·84	1	......	
95·86	Ti II	2·18	4	2·01	2	1·99	3	2·00	2	2·09	3
4396·33	......	1·57	2	1·95	3	1·99	4	1·90	4	1·60	3
96·95	CH	......		1·81	2	1·89	3	1·90	3	1·95	5
97·26	......	1·84	3	1·80	2	1·87	3	......		......	
98·03	Y II	2·18	4	1·90	0	1·97	3	1·93	4	2·25	5
98·30	Ti II			1·80	0	1·84	2	1·75	2	1·80	2
		1·68	1								
98·55	......			1·89	1	1·84	2	1·90	2	1·95	3
98·84	......	1·70	2	......		1·84	2	......		......	
99·20	......	......		......		......		1·70	2	1·90	3
99·75	Ti II	2·39	5	2·20	3	2·36	5	2·35	4	2·44	6
4400·42	Sc II	2·30	3	2·25	3	2·25	3	2·31	4	2·54	4
4400·95	......	1·90	2	1·98	1	2·01	3	2·22	2	2·29	2
01·39	Fe I	2·42	4	2·45	4	2·53	5	2·57	4	2·60	5
03·14	......	1·82	2			1·93	2	2·30	2	2·30	4
				2·08	3						
03·38	......	1·78	2			1·99	2	......		......	
04·76	Fe I	2·61	6	2·83	4	2·99	7	3·11	6	3·13	8
05·71	......	1·60	1	1·90	1	1·67	2	2·00	1	......	
06·09	......	1·66	2	1·90	2	1·68	2	1·90	2	1·70	2
06·65	V I	1·86	3	2·00	2	2·14	5	2·24	2	2·30	4
07·18	......	1·30	0	1·65	1	1·55	2	1·69	2	1·80	2
07·71	Fe I	2·30	5	2·30	4	2·30	3	2·41	4	2·48	6
4408·43	Fe I	2·37	5	2·40	4	2·50	5	2·60	5	2·75	6
09·17	Fe I	2·04	2	1·91	2	1·92	3	1·96	2	2·28	3
09·50	Ti II	1·96	2	1·86	2	1·80	3	1·76	2	2·20	3
10·10	......	1·76	3	1·81	3	1·84	3	1·89	3	1·71	3
10·55	Ni I	1·92	3	1·79	3	1·83	3	1·91	2	2·13	4
11·10	......	2·15	4	1·97	3	1·95	4	1·93	3	2·19	5
11·95	Ti II	2·01	3	1·91	3	1·89	4	1·91	4	2·21	4
12·27	Cr I	1·66	1	1·76	3	1·70	3	1·81	2	1·96	3
12·82	......	1·61	2	......		......		......		......	
13·16	......	1·59	2	......		......		......		......	

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4413·60	....	1·85	3	1·61	2	1·80	3	1·56	2	1·86	2
13·88	Cr I...............	1·56	1	1·61	1	1·55	0	1·61	2	1·91	2
14·19	....	1·41	1	....		1·50	0	....		1·71	0
14·50	....	1·51	1	....		....		....		....	
14·86	Mn I...............	....				1·90	0	....		....	
15·12	Fe I...............	2·55	4	2·66	3	2·80	7	2·96	5	3·01	7
15·54	Sc II..............	2·22	2	2·18	1	2·05	1	2·31	2	....	
16·43	....	....		1·86	2	1·73	3	1·91	2	2·11	2
16·84	Fe II..............	2·31	5	1·90	3	2·05	3	2·19	3	2·24	3
17·31	Ti I...............	....		1·83	2	1·88	3	2·01	2	2·03	3
4417·71	Ti II..............	2·31	4	2·16	4	2·11	4	2·29	4	2·23	4
18·36	Ti II..............	2·23	4	1·85	3	2·06	4	2·07	4	2·21	5
18·94	....	1·56	3	1·61	3	1·80	5	1·71	3	2·01	5
19·86	....	1·73	3	1·51	3	1·48	4	1·41	3	1·79	5
20·30	....	1·51	1	1·61	3			1·36	3		
						1·76	4			2·15	5
20·59	Sa II, Sc II.........	1·87	4	....				....			
21·12	....	1·79	3	....		....		....		1·81	3
21·53	V I................	1·61	2	1·82	4	2·03	4	1·99	3	2·21	3
21·93	Ti II..............	2·05	3	2·01	3	2·04	3	2·11	2	2·13	3
22·59	Fe I...............	2·30	4	2·21	4	2·30	4	2·41	3	2·48	4
4422·91	....	1·46	0	1·51	0	1·58	1	1·76	1	2·11	2
23·19	Fe I...............	1·89	2	1·89	3	2·11	3	2·11	3	2·32	4
23·84	Fe I...............	1·91	3	1·71	1	1·91	3	1·81	2	2·01	3
24·17	....	1·71	2	1·86	2	1·94	3	2·01	2	2·31	5
24·59	....	1·75	3	1·61	2	1·46	1	1·56	2	....	
25·46	Ca I...............	2·29	5	2·30	4	2·37	5	2·51	4	2·53	5
25·70	....	....				1·81	1	....		....	
				1·58	1					2·22	3
26·02	V I, Ti I...........	1·61	2			1·66	2	2·01	2	....	
27·08	Ti I...............	1·71	0	1·99	2			2·21	2		
						2·44	8			2·71	8
27·32	Fe I...............	2·28	3	2·31	4			2·51	4		
4427·90	....	1·66	2	....		....		....		....	
28·50	....	1·75	3	1·85	4	1·86	5	1·91	4	2·21	5
29·23	....	1·71	3	1·66	3	1·46	2	....		2·01	3
29·91	....	1·78	2	1·81	1	1·98	2	2·01	2	2·61	4
30·20	Fe I...............	1·96	2	2·14	2	2·21	3	2·35	2	2·32	2
30·59	Fe I...............	2·30	4	2·22	3	2·31	4	2·42	4	2·60	4
31·35	Sc II..............	1·77	2	1·87	3	1·76	3	1·74	2	2·10	3
31·83	....	1·67	2	1·64	1	1·80	3	1·82	2	2·02	3
32·15	Cr I...............	1·95	3	1·84	3	1·81	3	1·87	2	2·16	3
32·57	Fe I...............	1·89	2	1·72	3	1·81	3	1·89	2	1·97	3
4433·23	Fe I...............	2·20	5	2·19	4	2·20	5	2·30	4	2·40	5
33·84	Fe I...............	2·04	3	2·10	3	2·10	4	2·26	4	2·50	5
34·33	....	1·72	2	1·72	1	....		....		1·99	2
34·98	Ca I...............	2·37	3	2·52	4	2·59	6	2·68	5	2·76	5
35·17	Fe I...............	1·82	0	....		....		....		....	
35·65	Ca I...............	2·23	5	2·30	4	2·21	3	2·46	3	2·53	3
36·29	Mn I...............	1·90	3	2·02	3	2·03	3	2·20	3	2·37	3
36·92	Fe I...............	1·94	4	2·07	4	2·01	4	2·02	4	2·22	3

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4437·57	....	1·52	1	1·57	2			1·67	2		
						1·89	4			2·28	5
37·84	V I................	1·57	2	1·62	2			1·92	2		
4438·36	Fe I................	1·72	2	1·82	3	1·82	4	1·72	3	2·12	5
38·55	....	1·42	1	....		....		....		....	
39·17	....	1·72	4	1·42	2	1·56	5	1·32	1	1·87	1
39·64	Fe I................			1·37	1			1·52	1		
		1·84	4			1·85	4			2·12	3
39·90	Fe I................			1·70	2			1·88	2		
40·46	Zr II, Fe I..........	1·87	3	1·98	2	2·04	3	2·02	2	2·22	3
40·82	Fe I................	1·57	1	1·87	1	1·68	2	1·96	2	2·22	3
41·07	....	1·80	1	1·84	1	1·90	2	1·84	2	2·07	2
41·69	....	2·05	2	2·02	3	2·03	3	2·10	2	2·40	3
42·38	Fe I................	2·32	4	2·35	4	2·39	5	2·52	4	2·64	5
4442·88	Fe I................	1·52	0	2·02	1	2·01	2	1·90	2	2·17	2
43·20	Fe I................	2·19	2	2·14	2	2·13	2	2·23	2	2·34	2
43·81	Ti II...............	2·33	5	2·31	3	2·28	4	2·34	3	2·47	5
44·24	V I................	....		1·47	0	1·52	1	1·72	2	2·17	2
44·58	Ti II...............	1·92	4	1·82	3	1·89	4	1·99	3	2·32	5
45·48	....	1·53	3	1·73	3	1·79	4	1·86	4	2·15	6
46·26	Fe II...............	....		1·73	3	....		1·73	2	....	
46·39	Nd II...............	1·68	2	....		....		....		1·93	3
46·84	Fe I................	1·88	3	1·98	2	2·02	2	2·12	2	2·21	2
47·13	Fe I................	1·94	2	1·97	2	2·03	2	2·12	2	2·21	2
4447·73	Fe I................	2·31	5	2·33	6	2·32	5	2·49	5	2·48	7
49·19	Ti I................	1·88	3	1·96	4	2·02	6	2·14	5	2·36	5
49·74	....	1·63	2	....		....		....		1·88	3
50·32	Fe I................	1·79	0								
				2·17	4	2·31	5	2·26	3	2·56	5
50·50	Ti II...............	2·31	2								
50·87	Ti I................	1·66	1	2·03	4	1·87	3	2·13	3	2·12	2
51·62	Mn I...............	2·11	4	2·11	4	2·06	6	2·09	3	2·27	5
52·00	V I................	1·53	1	1·63	1	....		1·71	2	1·91	2
52·60	....	....				1·76	3				
				1·68	2			1·88	2	2·23	4
52·77	....	1·68	2			....					
4453·00	Mn I...............	1·63	1	1·84	2	1·89	3	1·92	2	2·13	3
53·32	Ti I................	1·78	2	1·93	2	1·93	3	2·03	2	2·06	3
53·70	Ti I................	1·65	2	1·83	2	1·62	2	1·83	2	1·93	2
54·40	Fe I................	2·19	2	2·22	2	2·02	1	2·26	2	2·41	2
54·82	Ca I...............	2·51	3	2·51	2	2·62	3	2·73	2	2·73	3
55·04	Mn I, Fe I..........	1·48	0	1·98	0	....		1·95	0	1·88	0
55·34	Mn I, Ti I..........	1·81	1	1·98	1	1·97	2	2·12	2	2·13	2
55·88	Ca I, Mn I..........	2·32	4	2·27	2	2·27	3	2·47	2	2·43	4
56·31	Fe I................	....		1·93	2	1·81	2	1·96	2	2·24	2
56·63	Ca I...............	1·90	3	2·07	2	1·92	2	2·05	2	2·21	2
4457·05	Mn I...............	1·68	2	1·55	1	1·68	2	1·73	2	1·98	2
57·50	Ti I, Mn I..........	2·15	4	2·22	3	2·23	4	2·39	3	2·44	5
58·17	Fe I, Mn I..........	2·12	3	2·22	3	2·13	3	2·28	2	2·43	3
58·50	Cr I, Sa II..........	1·61	1	1·54	1	1·64	2	1·63	1	1·83	1
59·07	Fe I, Ni I...........	2·47	5	2·43	4	2·52	6	2·64	4	2·73	6

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4459·38	...	...		1·88	1	...		1·98	1	...	
59·76	V I	1·63	1	1·73	1	1·67	2	1·96	2	2·13	3
60·29	V I	1·88	3	2·03	4	2·05	4	2·20	4	2·38	5
61·16	Fe I, Mn I	2·15	2	2·01	4	2·23	3	2·29	2	2·59	4
61·67	Fe I	2·36	2	2·12	3	2·35	3	2·43	2	2·60	2
4462·02	Fe I	2·07	2	2·08	1	2·25	2	2·40	2	2·52	2
62·46	Ni I	1·87	2	2·08	2	2·02	2	2·08	2	2·21	2
63·00	...	1·63	1	...		...		...		1·98	2
63·36	Ti I	1·87	3	1·98	3	2·03	5	1·98	4	2·20	5
64·47	Ti II	2·27	3	2·14	1	2·03	2	1·99	2	2·23	2
64·73	Mn I, Fe I	2·13	2	2·23	1	2·31	4	2·33	2	2·53	4
65·29	Cr I	...		1·74	2	1·63	3	1·94	2	1·97	2
65·82	Ti I	1·61	2	1·44	0	1·65	3	1·79	2	1·94	3
66·54	Fe I	2·33	5	2·35	4	2·33	5	2·44	4	2·57	6
66·94	Fe I	1·64	1	1·83	1	1·95	3	1·84	2	2·04	2
4467·42	...	1·74	2	1·82	2	1·53	2	...		1·94	3
67·88	...	...		1·54	1	1·43	2	1·59	2	1·79	2
68·51	Ti II	2·43	5	2·32	4	2·29	6	2·37	4	2·46	7
69·14	Ti II	2·14	2			1·92	2	...			
				2·38	4					2·63	6
69·40	Fe I	2·19	2			2·30	3	2·52	4		
70·12	Mn I	1·69	2	1·98	1	1·87	2	1·90	2	2·06	2
70·49	Ni I	2·09	2	2·13	2	2·08	3	2·04	2	2·16	2
70·87	...	2·08	2	1·97	1	1·94	3	2·00	2	2·22	2
71·25	Ti I	1·74	2	1·84	1	1·80	2	1·74	2	2·05	2
71·67	Fe I	1·64	3	1·62	2	1·83	3	2·04	4	2·24	5
4472·81	Fe I	2·24	5	2·22	4	2·26	8	2·32	6	2·54	8
73·75	...	1·49	1								
				1·84	3	1·63	4	1·54	2	1·64	4
74·03	...	1·43	1								
74·48	...	1·59	1	1·27	0	1·53	2	1·43	2	1·93	3
74·85	Ti I	1·69	3	1·69	3	1·78	3	1·84	2	2·14	3
75·27	...	1·54	2	1·43	1	...		1·56	2	...	
76·04	Fe I	2·36	7	2·37	7	2·35	8	2·50	6	2·42	7
77·07	Cr I	...		...		...		1·37	0	1·54	2
77·45	Y I	1·69	3	1·54	2	1·43	2	1·37	0	1·43	2
78·01	...	1·52	2	1·54	2	1·53	3	1·74	3	1·80	3
4478·32	...	1·52	1	1·49	1	1·43	2	1·22	0	1·78	3
78·73	...	1·74	2	1·27	0	1·53	3	1·54	2	1·74	3
79·34	Ce II, Mn I	1·49	1	1·64	1	...		1·67	2	1·84	1
79·63	Fe I	1·95	2	2·01	2	2·14	3	2·19	2	2·42	3
79·92	...							1·84	1	1·95	1
		2·09	2	2·14	2	2·22	3				
80·20	Fe I							2·20	2	2·42	3
80·61	Ni I, Ti I	...		1·84	1	1·64	1				
								2·00	2	2·08	3
80·83	...	...		...		1·84	2				
81·24	Ti I	2·61	5	2·37	3	2·32	3	2·28	2	2·44	4
81·62	Fe I	...		1·54	0	1·78	2	1·79	2	1·79	1
4482·20	Fe I	2·38	5	2·40	3	2·44	4	2·55	4	2·58	5
82·75	Fe I	1·85	2	2·02	2	1·99	3	2·15	3	2·09	3

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4483·85	...	1·55	1	1·44	0	1·62	2	1·70	2	1·88	3
84·21	Fe I	2·15	5	2·15	4	2·06	5	2·24	4	2·25	5
85·69	Fe I	2·01	5	2·08	4	2·06	9	2·19	6	2·19	8
86·92	Ce II	1·75	3	1·64	3	1·64	4	1·60	2	1·96	4
87·36	Y I	1·44	2	1·44	2	...		1·72	2	1·80	3
87·76	...	...		...		1·64	3	...		1·70	2
88·09	Fe I	1·99	1	2·13	3			2·24	5	2·33	4
						2·14	4				
88·33	Ti II	2·07	2	...				...		...	
4488·88	Fe I	...		1·96	2	1·84	2	1·96	2	2·20	2
89·20	Fe II	2·23	4	2·15	2	2·09	3	2·15	2	2·35	3
89·74	Fe I	2·09	2	2·25	2	2·11	3	2·22	2	2·35	3
90·10	Fe I, Mn I	1·90	2	1·96	1	2·01	3	2·14	2	2·17	2
90·75	Fe I	1·96	3	2·15	3	2·06	4	2·11	4	2·34	5
91·42	Fe II	2·24	5	2·02	3	1·96	5	1·92	2	2·25	5
91·75	...	...		1·60	1	...		1·65	2	1·55	1
92·32	Cr I	1·55	2					1·60	2	1·83	3
				1·94	4	1·64	5				
92·70	Fe I	1·65	4					1·81	3	1·96	3
93·52	Ti II	1·88	4	1·85	4	1·69	4	1·75	2	2·10	3
4494·08	Fe I	1·60	2	1·85	1	1·94	3	1·75	2	2·25	3
94·57	Fe I	2·33	5	2·33	4	2·40	5	2·55	5	2·65	5
95·48	...	1·70	3	1·65	2	1·74	3	1·91	2	2·16	3
95·95	Fe I	1·65	1	2·01	4	1·79	2	1·85	2	1·96	2
96·18	Ti I	1·85	2	...		1·79	2	2·07	2	2·35	4
96·89	Cr I	2·18	5	2·20	4	2·14	5	2·31	5	2·39	5
97·67	...	1·77	3	1·75	3	1·54	4	1·44	2	2·06	5
98·81	Mn I	1·96	4	1·91	2	2·10	8	2·07	2	2·21	3
99·13	...	1·76	1	1·86	2	...		2·00	2	2·10	4
4500·37	...	1·76	3	1·76	3	1·69	5	1·79	4	2·07	5
4501·27	Ti II	2·40	6	2·36	5	2·27	4	2·36	5	2·56	5
01·80	Cr I	...		...		1·65	2	1·61	2	1·86	2
02·22	Mn I	1·74	3	1·76	3	1·95	4	1·94	2	2·13	3
02·58	Fe I	1·45	2	1·56	2	1·37	0	1·66	2	1·86	2
03·76	...	1·63	5	1·61	3	1·37	4	1·34	0	1·76	4
04·87	Fe I	1·86	5	1·81	3	1·85	5	1·92	5	2·14	5
05·77	...	1·39	3	1·24	1	...		...		1·56	4
06·08	...	...		...		...		1·76	4	...	
06·70	...	1·66	3	1·66	3	1·82	5	1·34	2	2·06	4
07·18	Cr II	1·39	2	...		1·52	3	1·76	4	1·76	4
4508·27	Fe II	2·29	6	2·10	4	2·07	5	2·12	5	2·31	5
09·34	...	1·66	3	1·66	2	1·67	3	1·56	1	1·87	3
09·73	...	1·56	2	1·51	2	1·77	5	2·03	4	2·08	5
10·96	...	1·45	3	1·45	0	1·67	5	1·86	4	1·92	5
11·89	Cr I	1·76	3	...		1·78	3	2·03	4	2·10	5
12·23	Ca I	...		1·86	3	1·62	3	...		...	
12·76	Ti I	1·76	3	1·92	3	1·93	4	2·18	4	2·29	5
13·51	...	1·56	3	1·34	0	1·78	4	1·56	1	1·98	4
14·14	Fe I	1·97	3	1·86	1	1·87	2	2·16	1	2·26	3
14·42	...	1·56	1	2·04	2	2·10	5	2·16	1	2·28	3

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4515·31	Fe II..............	2·26	5	2·26	4	2·19	6	2·16	4	2·43	5
16·26	....	1·25	1			1·55	4	....		1·97	3
				1·57	1						
16·64	....	1·46	2			....		1·77	2	1·87	3
17·15	....	1·52	1	1·72	1	1·77	3	1·98	1	1·87	2
17·52	Fe I...............	1·79	2	1·95	2	1·99	3	2·16	2	2·27	3
18·03	Ti I...............	1·82	3	1·99	2	2·00	3	2·17	2	2·37	3
18·37	....	1·92	3			1·90	2	1·93	1	2·24	2
				2·09	3						
18·66	....	....				1·72	2	1·46	0	1·87	0
19·89	....	....		....		1·72	2	....		....	
20·19	Fe II..............	2·23	7	2·17	4	1·99	5	2·27	6	2·37	5
4521·09	Cr I...............	1·35	1	1·72	1	....		1·46	3	1·85	5
22·65	Fe II, Ti I..........	2·42	6	2·42	4	2·41	6	2·51	5	2·72	6
23·40	Fe I...............	1·57	2	1·73	2	1·73	3	1·82	2	2·07	2
24·12	....	....		1·35	0	....		1·57	2	1·87	3
24·70	Ti II..............	....		1·82	1					2·09	2
						1·79	2	1·82	0		
24·91	....	1·87	1	....							
										2·52	5
25·11	Fe I...............	2·17	3	2·35	4	2·35	5	2·42	4		
25·88	Fe I...............	....		....		....		1·55	0	1·88	2
26·05	Cr I...............	....		1·77	1	....		....		....	
26·46	Cr I...............	2·14	3	2·20	2	2·38	4	2·44	4	2·59	5
4526·94	Ca I...............	1·96	2	2·09	1	2·08	2	2·27	2	2·19	2
27·33	Ti I...............	1·87	2	2·09	2	2·10	3	2·22	2	2·37	4
28·62	Fe I...............	2·45	5	2·52	4	2·66	7	2·76	6	2·80	6
29·59	....	2·23	5	2·28	4	2·28	5	2·32	4	2·51	5
30·74	Cr I...............	1·98	1	2·17	2	2·02	2	2·09	2	2·37	2
30·93	Co. I..............	1·75	1								
				2·27	2	2·46	4	2·57	2	2·67	2
31·15	Fe I...............	2·22	2								
31·60	Fe I...............	1·57	1	1·82	1	1·83	2	1·89	1	2·16	2
32·92	....	1·92	1	....		1·98	2				
								2·45	5	2·53	5
33·22	Ti I...............	2·08	2	2·26	3	2·20	3				
4533·98	Ti II..............	2·50	5	2·40	4	2·38	5	2·39	4	2·56	5
34·80	Ti I...............	1·85	2	2·17	3	2·04	3	2·17	3	2·24	2
35·57	Ti I...............	2·17	2	2·27	2	2·36	3				
								2·72	6	2·88	7
35·96	Ti I...............	2·12	2	2·37	4	2·36	3				
37·76	....	....		1·46	0	....		1·57	3	1·93	4
38·79	Fe I...............	1·72	4	1·94	3	1·90	5	2·11	5	2·39	5
39·72	Cr I...............	1·68	3	1·58	1	1·78	4	1·88	3	2·27	5
40·50	Cr I...............	1·63	1								
				2·08	3	2·11	4	2·33	4	2·43	4
40·70	Cr I...............	1·63	1								
41·07	Cr I...............	1·41	0	1·68	0	1·64	3	1·79	1	2·20	2
4541·51	Fe II..............	2·13	4	2·02	3	2·00	5	2·10	4	2·37	5
42·52	Fe I...............	1·81	5	1·96	4	2·02	5	2·13	4	2·40	5
43·99	Ti II..............	1·88	4	1·91	3	1·89	5	1·89	3	2·29	5
44·69	Ti I...............	1·86	2	2·16	3	2·19	4	2·26	4	2·46	5
45·21	Ti II..............	1·88	2	2·02	2	2·02	3	2·09	2	2·34	3

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4545·97	Cr I	1·93	4	2·08	3	2·04	4	2·23	4	2·18	4
46·95	Fe I, Ni I	1·83	4	2·10	3	2·08	5	2·16	4	2·38	5
47·21	Ni I	1·58	1	1·70	1	1·78	2	1·85	1	1·99	2
47·92	Fe I	1·99	4	2·13	3	2·00	5	2·13	4	2·16	5
48·80	Ti I	1·36	0	1·88	2	1·89	3	2·10	3	2·13	2
4549·62	Ti II	2·70	6	2·63	5	2·59	6	2·62	5	2·81	6
50·79	Fe I	1·90	2	1·99	3	1·97	4	2·10	4	2·10	3
51·24	Ni I	1·76	3	....		1·49	2	1·76	2	1·88	3
51·66	Fe I	....		....		1·47	2	....		....	
52·21	....	1·78	1	1·88	1	1·79	2	2·11	1	2·23	2
52·53	Ti I, Fe I	2·05	4	2·18	2	2·27	5	2·27	3	2·50	5
54·05	Ba II	2·40	6	2·46	4	2·29	5	2·58	6	2·67	6
54·46	Fe I	....		....		1·79	2	....		....	
54·96	Cr II	1·88	2	1·81	1	1·89	3	1·78	1	2·06	3
55·47	Ti I	1·63	1	1·91	1	1·94	2	1·97	2	2·09	3
4555·90	Fe II	2·28	1			2·09	2				
				2·38	4			2·47	4	2·54	5
56·14	Fe I	2·16	1			2·13	3				
56·92	Fe I			1·58	0	1·49	0	1·58	1	1·93	2
		1·68	4								
57·30	....			1·68	2	1·59	4	1·63	2	1·93	3
58·12	Fe I	....		1·71	2	1·59	3	1·58	1	1·99	5
58·65	Cr II	2·26	6	2·10	4	2·00	5	2·10	4	2·24	5
60·09	Fe I	1·78	4	1·93	3	1·94	7	2·05	5	2·22	5
60·90	....	1·41	3	1·78	3	1·65	4	1·83	4	1·99	4
61·42	....	1·57	3	1·70	3	1·60	4	1·59	3	2·09	5
62·43	Ce II	1·40	3	1·82	3	....		1·59	3	2·14	5
4563·76	Ti II	2·36	6	2·27	4	2·21	5	2·30	5	2·54	5
64·64	....	1·79	3	1·89	3	1·91	4	2·11	4	2·29	4
65·51	Cr I, Fe I	2·13	4	2·21	4	2·36	5	2·46	5	2·72	6
66·52	Fe I	1·54	2	1·69	2	1·68	2	1·79	1	1·84	3
66·86	Fe I	1·69	3	1·71	2	1·85	3	1·98	3	2·19	5
68·31	Ti II	1·79	4	1·95	4	1·60	3	....		1·89	2
68·79	Fe I	1·59	2	1·95	4	1·95	4	2·17	5	2·29	5
69·57	Cr I	1·48	3	1·48	2	1·68	5	1·79	4	2·19	5
71·12	Mg I	1·91	4	2·19	4	2·08	5	2·26	4	2·42	5
71·62	Cr I	1·60	1	1·69	0	1·95	2	....		2·09	1
4571·99	Ti II	2·39	4	2·34	4	2·28	5	2·49	4	2·63	5
74·22	Fe I	1·67	3	1·79	3	1·70	4	1·59	3	2·11	5
74·76	Fe I	1·69	3	1·89	4	1·90	4	1·95	4	2·34	5
75·71	....	1·57	3	1·48	2	1·42	0	1·48	2	1·89	3
76·32	Fe II	2·00	4	2·09	4	1·90	6	1·89	3	2·19	4
77·14	V I	1·18	0	....		1·55	5	1·75	4	2·13	4
77·68	....	1·28	2	1·65	3	....		....		....	
78·56	Ca I	2·01	5	2·14	4	2·00	5	2·28	5	2·31	5
79·33	Fe I	1·60	3	1·80	3	1·78	3	1·85	2	2·15	3
80·03	Cr I	2·01	2	2·12	4	2·13	4	2·26	3	2·50	3
4580·48	....	1·62	1	1·80	1	1·93	3	2·08	2	2·38	3
81·46	Ca I, Fe I	2·28	6	2·40	5	2·41	6	2·55	6	2·66	7
82·78	Fe II	2·01	4	1·85	3	1·86	3	1·90	3	2·20	4
83·27	....	1·79	1	1·75	1	1·76	2	....		1·90	2

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4583·86	Fe II	2·40	4	2·20	4	2·20	5	2·30	5	2·58	5
84·78	Fe I	1·75	4	1·91	4	1·93	4	2·15	4	2·30	4
85·87	Ca I	2·17	4	2·18	4	2·27	5	2·42	4	2·48	2
86·25	...	1·75	2	2·07	2	1·98	2	2·01	1	2·38	2
87·11	Fe I	1·64	4	1·96	4	1·81	4	1·96	3	2·18	4
87·70	...	...		1·49	1	1·44	2	...		1·80	2
4588·19	Cr II	2·15	5	1·91	3	1·91	5	2·06	4	2·12	3
89·94	Cr II, Ti II	2·14	6	2·15	6	1·92	5	2·01	5	2·15	6
90·82	...	1·49	2	...		1·58	2	1·60	1	1·90	2
91·44	Cr I	1·80	2	2·12	5	2·02	4	2·20	4	2·33	4
92·03	Cr II	2·06	3	1·60	1	1·56	1	1·49	0	1·85	0
92·58	Fe I, Ni I	2·20	4	2·33	4	2·29	5	2·50	5	2·54	5
93·58	...	...		1·43	1	...		1·80	2	1·96	2
94·05	...	1·65	4	1·75	4	1·91	5	1·92	3	2·40	4
94·59	...	1·55	3	...		...		...		...	
94·87	Ni I	...		1·70	3	1·61	2	1·60	1	1·80	2
4595·38	Fe I	2·02	4	1·96	3	2·09	4	2·22	4	2·50	3
96·02	Fe I	2·00	4	2·01	4	2·01	3	2·13	4	2·40	4
96·42	...	...		...		1·66	2	...		...	
96·92	Co I	1·40	2	1·38	0	1·46	1	1·60	1	2·01	2
97·36	...	...		1·70	2	1·80	2	1·80	1	2·15	2
97·79	...	1·82	2	1·90	1	1·99	2	2·16	2	2·31	2
98·12	Fe I	1·92	3	1·90	1	2·14	5	2·20	4	2·33	2
99·85	...	1·69	1	1·95	3	1·92	3	2·01	2	2·32	3
4600·15	Cr I			...		1·64	1	1·59	1	1·79	0
		2·10	2								
00·36	Ni I			1·95	1	1·95	2	2·00	1	2·32	2
4600·76	Cr I	1·92	2	2·12	2	2·06	3	2·32	2	2·44	2
00·99	...	...		...		1·87	2	1·64	0	1·97	0
01·30	...	1·54	2	1·59	1	...		...		...	
01·96	Fe I	1·74	3	2·12	4	1·77	4	1·97	4	2·12	3
02·96	Fe I	2·05	5	2·32	4	2·15	5	2·42	6	2·47	5
03·40	...	...		...		1·44	0	...		1·69	2
03·95	...	1·32	1	...		1·57	2	1·59	0	2·07	2
04·56	...	1·61	2	1·86	2	1·63	2	1·74	1	1·97	2
05·00	Ni I	2·00	3	1·96	2	2·10	3	2·12	3	2·32	2
05·58	...	1·69	2	2·07	3	2·00	3	2·04	2	2·27	2
4606·23	Ni I	1·65	3	1·65	2	1·82	4	1·86	3	2·33	4
07·33	Sr I	1·61	2	1·91	1	1·69	3	1·91	1	2·01	2
07·65	Fe I	1·96	4	2·13	3	2·02	5	2·21	4	2·33	4
08·68	...	...		1·60	3	...				...	
								1·49	5		
09·27	...	1·60	3	1·70	3	...				1·86	4
10·03	...	1·46	3	1·75	3	1·62	3	1·70	5	1·90	3
11·30	Fe I	2·09	4	2·25	5	2·30	6	2·43	6	2·53	6
12·23	...	1·33	2	...		...		...		...	
13·25	Fe I	2·13	4	2·33	4	2·23	4	2·43	5	2·51	4
13·93	...	1·49	2			1·62	2			2·01	2
				1·73	2			1·99	4		
14·21	Fe I	1·38	1			1·62	1			1·91	2

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4615·56	Fe I	1·49	2	1·61	1	1·65	3	1·82	2	1·82	2
16·11	Cr I	2·01	2	2·09	3	2·02	4	2·23	4	2·31	3
16·65	Cr II	1·77	2	1·77	2	1·66	2	1·50	1	1·93	2
17·26	Ti I	1·79	4	1·96	4	1·82	5	1·96	4	2·13	4
17·92	...	1·33	0	...		...		...		...	
18·78	Cr II	2·23	4	2·18	4	2·02	5	2·10	2	2·33	4
19·36	Fe I	1·82	2	2·18	4	2·21	5	2·26	4	2·42	3
20·09	...	1·72	2	...		...		...		...	
20·53	Fe II	1·93	4	1·75	4	1·76	5	1·75	4	1·98	4
21·95	Cr I	1·78	4	1·60	2	1·74	3	1·75	1	2·05	3
4622·47	...	1·55	2	1·65	2	1·78	2	1·86	3	2·13	2
22·76	Cr I	1·36	1	...		1·53	1	...		...	
23·09	Ti I	1·55	2	1·96	3	1·88	4	2·07	4	2·23	4
23·59	...	1·38	2	...		...		...		...	
24·39	...	1·49	2	...		...		...		...	
25·04	Fe I	2·00	4	2·16	4	1·93	5	2·28	5	2·30	6
25·85	...	...		...		1·58	2	...		...	
26·17	Cr I	2·01	3	2·16	4	1·90	3	2·28	5	2·31	4
26·58	Mn I	...		...		1·58	2	...		1·55	2
27·47	...	1·66	3	1·81	3	1·63	3	1·71	4	1·92	3
4628·16	Ce II	1·63	2	1·61	2	1·63	4	...		1·81	3
28·46	...	...		...		...		1·61	4	...	
29·29	Ti I	2·24	3	2·14	4	2·00	5	2·20	4	2·33	4
30·11	Fe I	1·92	2	2·19	4	1·97	5	2·02	4	2·16	3
30·55	...	1·45	2	...		...		...		1·66	2
31·04	Fe I	1·29	0	1·61	1	1·51	2	...		1·60	2
31·49	Fe I	1·34	0	1·61	0	...		1·56	3	1·56	2
31·83	...	...		...		1·48	3	...		...	
32·09	Cr I	...		1·71	2	...		...		...	
32·91	Fe I	2·14	4	2·19	3	2·08	5	2·34	5	2·44	6
4633·78	Fe I	...				...		...		1·61	0
				2·14	3						
34·04	Cr II	2·14	2			1·98	4	2·02	4	2·24	4
34·75	...	1·60	2	1·81	4	1·58	2	1·81	3	1·89	3
35·28	Fe II	1·71	2	...		1·68	3	1·66	2	1·66	2
35·82	Fe I	1·73	2			1·93	4	1·94	4	2·24	4
				1·97	4						
36·31	Ti II	1·73	2			1·53	2	...		...	
37·49	Fe I	2·11	3	2·24	4	2·05	3	2·34	2	2·36	3
37·99	Fe I	2·01	3	2·19	4	2·23	4	2·24	1	2·35	3
39·02	...	...		...		...		1·80	1	...	
39·36	Ti I	1·68	1	1·76	1	1·88	2			2·24	2
								2·19	2		
39·66	Ti I	1·66	1	1·76	0	1·88	2			2·24	2
4639·97	Ti I	1·45	1	1·71	0	1·73	1	2·10	2	2·02	2
40·28	...	1·61	1	1·71	1	1·84	2	...		2·02	2
41·19	...	1·71	2	1·76	3	1·84	4	1·97	4	2·02	4
42·21	...	1·52	2	1·56	3	1·44	0	1·66	3	1·92	4
43·46	Fe I	1·95	2	2·08	4	2·07	5	2·27	4	2·34	3
44·47	...	1·71	2	1·71	3	1·74	4	1·92	4	2·00	3
45·31	...	1·81	2	1·81	3	1·82	3	1·81	2	2·21	3
46·20	Cr I	2·19	3	2·23	3	2·14	4	2·39	4	2·49	4

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4646·73	...	...		1·76	1	2·08	3	2·08	1	2·14	2
47·42	Fe I	2·20	2	2·13	3	2·14	4	2·35	2	2·50	3
4648·03	...	1·71	2	2·03	2	2·02	3	1·95	1	2·17	2
48·68	Ni I	2·12	3	2·15	4	2·04	3	2·35	3	2·29	3
49·02	...	...		...		1·84	3	...		1·63	0
49·54	...	1·70	2	1·62	2	1·64	2	1·64	1	1·95	2
49·94	...	...		1·62	1	1·59	2	1·98	4	2·17	2
50·34	...	1·35	1	...		...		...		...	
51·26	Cr I	1·82	4	1·98	4	1·86	5	2·15	4	2·20	4
52·17	Cr I	1·94	4	2·09	4	1·95	5	2·18	4	2·23	4
53·45	...	1·25	0	...		...		1·62	2	1·40	2
54·55	Fe I	2·36	5	2·35	5	2·25	7	2·53	6	2·60	6
4655·69	...	1·57	1	1·72	2	...		1·82	1	2·09	2
56·07	Ti I, Cr I	1·46	1	1·82	2	1·47	2	1·62	0	1·82	2
56·46	Ti I	1·72	2	1·93	2	1·77	4	2·15	2	2·28	2
57·10	Ti II, Fe II	2·12	2	1·88	3	1·77	4	1·93	2	2·29	2
57·58	Fe I	1·74	1	1·57	3	...		1·88	4	1·95	2
58·30	...	1·37	1	...		...		1·51	2	1·62	2
58·75	...	...		...		...		1·40	1	1·62	3
60·06	...	...		...		...		1·46	1	...	
60·40	...	1·46	2	1·35	0	...		1·46	1	1·46	2
60·89	...	1·60	2	1·15	0	...		1·46	1	1·74	2
4661·52	Fe I	1·82	2	1·46	2	1·42	1	1·82	2	1·82	2
61·95	Fe I	1·57	2	1·51	2	1·62	3	1·93	2	2·01	2
62·58	...	1·51	2	...		...		...		2·09	2
63·28	Cr I	1·82	2	1·93	4	1·91	4	2·20	4	2·35	2
63·83	Cr I	1·94	2	1·77	3	1·79	3	2·09	2	2·11	2
64·80	...	1·77	3	1·62	3	1·58	3	2·03	4	2·08	3
65·98	Cr I	1·88	2	1·67	3	2·01	3	2·17	4	2·33	2
66·63	...	2·04	2	2·15	2	2·15	3	2·25	3	2·45	2
67·13	...	1·91	2	1·88	1	1·99	2	2·11	0	2·35	0
67·48	Fe I, Ti I	2·26	2	2·38	2	2·38	3	2·55	2	2·65	2
4667·78	Ni I	...		...		1·70	1	...		...	
68·10	Fe I	2·13	2	2·15	2	2·19	3	2·41	1	2·38	2
68·56	Na I	1·77	1	1·57	1	1·72	2	1·73	0	1·82	0
69·20	Fe I	1·82	2	...		2·05	5	2·34	5	2·42	4
69·41	...	...		1·93	3	...		...		...	
70·32	Sc II	2·17	4	1·79	3	1·87	5	2·09	5	2·26	4
71·47	...	1·63	2	...		1·47	1	1·83	4	1·70	3
72·31	...	1·83	2	1·36	0	1·87	5	2·10	4	2·02	2
72·80	Fe I	1·61	1	1·71	2	1·59	1	1·68	0	1·83	1
73·20	Fe I	2·07	3	1·99	4	2·03	4	2·28	4	2·32	4
4674·12	...	1·76	2	1·68	4	1·77	3	1·68	2	2·10	2
74·70	...	1·63	2	1·47	0	1·72	3	2·04	2	2·26	2
75·12	Ti I	1·63	2	1·47	4	1·60	3	1·73	1	1·94	1
75·60	...	1·38	1	...		1·52	2	1·47	2	...	
76·42	...	1·36	0	...		...		1·58	3	1·63	4
77·54	...	...		1·28	0	1·57	3	1·83	3	1·38	1
78·17	...	2·08	3	1·98	3	2·00	4	2·10	2	1·93	2
78·86	Fe I	2·11	2	2·04	2	2·10	3	2·30	2	2·18	3
79·23	Fe I	1·38	0	1·86	1	1·84	1	1·83	1	1·68	1
80·34	...	2·09	3	2·08	4	2·19	4	2·38	4	2·44	4

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4680·83	Cr I	1·43	1	...		1·77	1	...		1·83	0
81·49	Fe I	...		1·58	0	1·66	1	...		1·58	0
82·00	Ti I	2·05	2			2·06	2	2·29	3	2·39	4
				2·28	4						
82·37	...	1·68	1			1·86	1	1·88	1	1·98	1
83·58	Fe I	1·81	3	1·88	4	1·83	4	1·88	3	1·89	4
84·10	...	1·33	1	...		...		...		1·63	0
84·58	...	1·53	1	...		1·74	4	1·58	1	1·68	1
85·14	Ca I	1·95	2	1·93	4	1·90	3	2·13	3	2·13	4
86·23	Ni I	1·80	3	1·99	4	1·89	4	1·94	3	1·99	4
87·35	Fe I	1·59	2	1·59	3	1·82	3	1·99	4	2·34	4
4688·22	Fe I	1·96	3	1·94	4	1·88	3	1·74	2	2·34	3
88·83	...	...		1·74	1	1·36	2	1·59	2	1·69	0
89·37	Cr I	1·59	2	1·79	3	1·88	3	1·89	2	2·17	3
90·14	Fe I	1·88	2			1·88	2	1·89	2	2·32	3
				1·94	4						
90·38	Fe I	...				1·46	0	...		...	
91·40	Fe I	2·19	4			1·99	3			2·59	4
				2·19	5			2·33	5		
91·68	...	...				1·71	2			...	
92·56	...	1·79	2	1·84	3	1·63	3	1·39	2	2·19	2
93·23	Co I	1·66	2	1·81	3	1·73	2	1·79	3	2·00	1
93·93	Cr I	1·79	2	1·79	3	1·85	3	1·77	2	2·24	3
4694·84	Fe I	1·67	2			1·58	1	1·94	4	2·14	3
				1·99	3						
95·15	...	...				1·70	1	...		...	
95·81	...	1·61	4	...		...		...		...	
96·48	...	1·24	0	...		1·58	2	...		1·69	1
97·00	Cr I	1·49	2	1·89	4	1·79	2	1·99	3	2·00	2
97·44	Cr I	...		...		1·58	2	1·49	0	1·59	0
98·44	...					1·92	1				
		2·06	3	2·09	4			2·39	3	2·69	4
98·72	...					2·09	1				
99·31	...	2·00	2	2·12	3	1·90	2	2·02	2	2·09	2
4700·16	Fe I	1·79	3	1·94	3	1·84	3	1·99	2	2·11	2
4700·94	...	1·83	3	1·59	0	2·01	3	1·84	1	2·19	1
01·43	Ni I	1·74	2	2·04	4	1·88	2	2·22	3	2·39	2
02·32	...	...		...		1·85	1	1·69	0	1·99	1
03·02	Mg I	2·49	4	2·59	6	2·56	4	2·69	4	2·63	4
03·82	Ni I	1·86	1	...		1·93	2	1·86	1	2·04	2
04·42	...	1·59	1	1·59	0	...		1·64	1	1·79	1
04·95	Fe I	1·84	2	2·02	4	1·92	3	2·06	2	2·09	3
05·54	Fe I	1·59	1	...		1·68	2	1·69	1	1·89	2
06·06	...	1·40	0	1·70	3	1·48	0	1·70	2	1·80	2
06·53	V I	1·60	1	...		1·63	2	...		2·00	2
4707·31	Fe I	2·21	2	2·30	4	2·26	3	2·47	3	2·50	4
07·95	Cr I	1·78	1	2·06	2	1·91	2	1·90	1	1·80	1
08·66	Ti II	2·12	2	1·89	1	1·99	1	1·60	0	2·10	1
09·06	Fe I	1·93	1	2·18	2	2·06	1	2·31	3	2·35	2
09·69	Mn I	1·63	1	1·90	1	1·99	2	...		2·13	1
10·22	Fe I	2·14	4	2·20	4	2·15	4	2·30	3	2·40	4
11·55	Fe I	...		1·70	3	...		...		...	

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4712·07	Fe I	1·80	3	...		1·83	4			2·20	3
								2·00	4		
12·71	...	1·43	2	...		1·79	4			2·10	2
14·07	Fe I	...		...		1·90	1	1·80	0	1·90	1
14·41	Ni I	2·24	4	2·32	4	2·26	2	2·42	3	2·58	4
4715·25	Ti I	...		...		1·54	0	...		...	
15·76	Ni I	1·92	2	2·08	4	2·03	4	2·08	4	2·28	4
16·85	...	1·50	1	1·60	0	...		...		1·70	2
17·59	...	1·65	2	1·83	2	1·79	4	1·81	3	1·95	3
18·38	Cr I	1·87	3	2·00	4	1·86	3	2·08	3	2·05	4
19·53	Ti II	1·76	3	1·85	4	1·57	2	...		1·70	3
19·93	...	...		...		...		1·60	2	1·40	2
21·01	Fe I	1·76	3	1·80	4	1·87	4	2·00	3	2·00	4
22·16	Zn I	1·55	2	2·00	4	1·82	3	1·95	3	1·90	2
22·64	Ti I	...		1·50	1	1·46	1	...		1·90	2
4723·10	...	...		1·70	3	1·75	3	1·90	2	2·20	4
24·47	Cr I	1·60	3	1·70	4	1·51	2	1·65	2	2·00	4
26·04	Fe I	...		1·55	3	1·59	1	1·70	2	1·65	3
27·43	Fe I, Mn I	2·10	3	2·32	5	2·30	4	2·45	4	2·60	4
28·13	...	1·40	0	...		1·63	1	...		2·00	1
28·55	Fe I	1·85	2			1·94	2	2·18	2	2·30	2
				2·20	4						
29·09	Fe I	1·60	1			1·87	2	2·00	2	2·15	1
29·67	Fe I	...				1·85	1				
				2·07	4			2·19	2	2·37	3
30·04	Mg I	1·90	2			2·00	2				
30·75	Cr I	...		...		1·91	2	2·10	2	...	
										2·10	2
30·97	...	1·80	2	1·79	1	1·65	0	...		...	
4731·46	Fe II	1·90	2	2·05	4	2·04	3	2·20	3	2·40	3
31·80	Ni I	1·60	1	...		...		...		...	
32·45	Ni I	1·45	0	1·80	0	1·82	4	...		1·70	2
33·60	Fe I	1·93	3	2·10	4	2·07	4	2·31	5	2·30	4
34·11	Fe I	1·56	1	...		1·92	4	...		2·13	2
35·86	Fe I	1·91	3	1·76	2	1·90	3	2·03	3	2·05	4
36·77	Fe I	2·11	2	2·26	4	2·30	3	2·47	3	2·45	3
37·36	Cr I	1·76	2	...		1·93	2	1·96	1	2·33	3
37·69	Fe I	...		1·88	3	...		...		...	
39·06	Mn I	1·81	2	1·51	3	1·68	3	1·97	4	2·11	4
4740·36	Fe I	1·81	2	1·71	2	2·02	4	2·13	3	2·46	3
41·01	...	1·82	2	1·91	3	1·93	2	1·96	2	2·01	2
41·51	Fe I	1·88	2	1·90	4	1·87	3	2·06	3	2·11	3
42·84	Ti I	1·76	2	1·51	3	1·58	2	1·81	2	2·09	4
44·40	Fe I	1·86	2			1·90	4	2·03	4	2·11	4
				2·11	4						
45·03	...	1·56	1			1·60	2	...		2·01	2
45·80	Fe I	1·97	3	2·06	4	1·92	4	2·01	4	2·31	4
48·12	...	2·01	3	2·21	5	2·00	6	2·21	4	2·24	4
49·61	Co I	1·61	2	...		1·62	2	...		2·04	2
50·01	Fe I	...		1·91	5	1·82	3	1·81	3	2·11	3

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4751·10	Fe I	1·60	2	...		1·56	1	1·76	3	1·81	3
52·10	Cr I	1·56	1			...		...			
				1·96	5					2·45	4
52·41	Ni I	1·90	2			2·16	5	2·21	4		
54·07	Mn I	2·08	3	2·21	3	2·24	4	2·39	3	2·47	4
54·77	Cr I, Ni I	1·41	0	1·74	2	1·86	2	1·81	1	2·01	1
55·15	Cr I	...		...		1·56	2	...		...	
56·08	Cr I	1·92	2	2·02	2	2·15	3	2·12	2	2·32	2
56·51	Ni I	1·97	2	1·92	2	1·99	2	2·17	2	2·22	3
57·56	Fe I	1·72	2	1·97	2	1·81	4	2·07	2	2·12	3
58·11	Ti I	1·77	2	1·72	1	1·71	2	1·82	2	1·92	1
4758·80	...	...		1·82	2	1·45	2	...		2·12	3
59·28	Ti I	1·80	3	1·82	2	1·66	4	1·82	2	...	
61·45	Mn I	1·94	2	1·62	1	2·05	5	2·13	2	2·21	4
62·37	Mn I	2·24	2	2·32	3	2·18	2	2·44	3	2·54	4
62·72	...	...		...		1·95	2	...		...	
63·96	...	2·05	2	1·97	2	2·02	3	2·17	3	2·35	4
64·53	...	1·82	2	1·92	2	1·95	2	1·72	1	2·02	1
65·43	Fe I	1·80	2	1·82	1	1·92	2	2·09	2	2·20	1
65·86	Mn I	1·72	1	2·14	2	2·00	2	2·12	2	2·34	1
66·42	Mn I	2·02	2	2·02	2	2·18	3	2·27	2	2·45	4
4767·83	Cr I	...		...		1·69	2	...			
										2·32	4
68·36	Fe I	2·02	3	2·17	3	2·09	4	2·32	4		
69·74	Ti I	1·69	2	1·52	2	...		1·82	3	1·32	1
71·09	Ti I, Co I	...		...		1·74	2	...			
										2·35	5
71·61	...	2·14	3	2·17	2	2·10	3	2·24	4		
72·86	Fe I	1·86	3	2·17	3	2·10	5	2·23	4	2·26	4
73·42	...	...		...		1·39	1	...		...	
74·08	Ce II	1·62	3	...		...		...		...	
76·09	Fe I	1·72	2					...			
				1·90	2	1·94	5			2·23	4
76·44	...	1·85	2					2·21	4		
4777·82	...	1·42	1	...		...		...		1·71	3
78·28	Ti I	...		1·71	3	...		1·75	2	...	
79·43	...	1·60	1	1·78	1	1·62	1	1·78	2	2·10	3
79·99	Ti II, Co I	2·03	3	2·06	3	1·67	2	1·95	2	2·00	3
81·77	Ti I	...		...		...		...		2·06	3
83·45	Mn I	2·22	3	2·34	3	2·32	5	2·52	5	2·59	6
86·08	Fe I, Ni I	1·62	1	1·85	1	2·00	2	2·00	1	2·18	2
86·64	Ni I	2·25	3	2·34	3	2·24	4	2·38	2	2·64	4
87·83	Fe I	...		1·75	2	1·47	1	1·75	2	1·95	1
88·74	Fe I	1·85	2	1·92	2	1·92	2	1·90	2	2·11	1
4789·56	Fe I, Cr I	2·05	3	2·31	3	2·22	4	2·35	3	2·54	4
91·10	...	1·75	3	1·85	4	1·87	4	2·12	3	2·34	3
92·47	Cr I, Ti I	1·99	3	2·12	3	2·07	4	2·18	3	2·44	4
94·35	Fe I	...		1·62	3	...		...		1·78	4
96·16	...	...		...		...		...		2·06	4
96·63	...	1·78	3	...		...		...		...	
98·46	Ti II, Fe I	1·96	3	2·05	3	2·13	3	2·13	3	2·45	4
99·40	Fe I	...		...		...		1·91	1	...	

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4799·85	Ti I	1·68	2	2·23	4	2·08	3	2·07	2	2·35	3
4800·65	Fe I	1·91	2	...							
						2·04	4	2·19	3	2·40	4
01·03	Fe I, Cr. I	...		2·17	3						
4802·85	Fe I	1·72	3	1·88	3	1·83	4	2·13	3	2·13	4
05·15	Ti II	2·23	4	2·30	4	2·25	6	2·35	3	2·50	5
06·99	Ni I	1·76	3	2·07	2	1·83	4	2·01	2	2·24	4
07·71	Fe I	1·66	1	2·01	2	1·88	2	2·13	2	2·19	3
08·16	Fe I	...		...		1·78	2	...		...	
08·80	...	1·91	3	2·01	3	1·93	4	2·13	2	2·45	4
10·54	Zn I	1·96	2	2·07	3	2·01	4	2·07	3	2·13	3
12·28	Cr II	1·86	2	1·72	2	1·93	3	1·86	2	2·11	3
13·33	...	1·83	2	1·91	3	1·68	3	1·96	2	2·30	3
14·23	...	...		...		1·68	3	...		...	
4814·63	Ni I	...		1·86	2	...		1·76	1	2·07	3
15·94	...	1·58	2	...		1·48	2	1·68	1	1·91	4
17·82	Fe I	1·81	2	...		1·78	3	1·91	3	2·19	5
20·42	Ti I	1·54	2	...		1·73	4	1·91	3	2·13	4
21·12	...	1·67	2	...		1·73	4	1·72	2	1·83	3
23·47	Mn I	2·20	1	2·23	3	2·21	4	2·51	3	2·56	4
24·12	Cr II, Fe I	2·06	1	2·02	2	2·13	3	2·17	2	2·22	2
25·40	...	...		1·64	0	1·87	3	1·92	4	2·21	4
27·12	...	...		...		1·89	4	...		1·92	2
27·61	...	...		1·97	3	...		...		2·03	3
4829·19	Ni I, Cr I	2·16	3	2·14	4	2·22	4	2·46	4	2·54	6
31·22	Ni I	2·00	2	2·08	2	1·99	4	2·02	3	2·20	4
31·80	...	1·69	1	...		1·72	1	...		2·12	2
32·70	Fe I	1·92	2	2·20	0	2·00	3	2·17	4	2·47	4
33·47	...	1·80	2	...		...		...		...	
34·51	Fe I	1·89	2	1·77	0	1·93	4	1·84	3	2·14	4
36·10	Fe I, Cr II	2·19	3	2·23	2	2·01	4	2·14	4	2·36	4
38·61	Fe I, Ni I	...		2·14	3	1·98	4	2·08	3	2·36	4
39·55	Fe I	...		1·89	2	1·94	3	1·97	2	2·14	2
40·30	Fe I, Co I	...		2·08	2	1·98	2	2·20	2	2·31	3
4840·89	Ti I	...		1·92	2	1·93	2	1·97	1	2·03	2
41·79	...	...		1·77	2	1·58	1	1·80	2	1·92	3
43·14	Fe I	...		2·12	2	1·98	2	2·33	3	2·52	4
44·06	Fe I	...		1·92	2	1·98	3	1·87	2	2·12	2
45·66	Fe I	...		2·00	2	1·48	0	1·69	2	1·92	4
47·29	Ca I	...		1·73	0	1·73	1	...		1·73	1
48·25	...	...		1·94	2	1·88	2	2·08	2	2·36	3
49·04	Fe I	...		2·09	3	2·14	3	2·08	2	2·42	2
49·69	...	...		...		1·63	0	...		1·93	1
51·59	V I	...		...		...		...		2·15	4
4852·61	...	...		...		...		...		1·98	3
61·34	H β	3·82		3·49		3·35		3·26		3·20	
69·52	...	...		1·65	1	...		...		1·80	1
70·15	Ti I	...		...		...		...		1·88	1
71·22	Fe I	...		2·57	3	...		2·76	3	2·67	3
72·12	Fe I	...		2·36	2	...		2·53	2	2·56	2

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Continued*

Wave-length	Identification	*α C. Min.* log A	wt	*ξ U. Maj.* log A	wt	Sun log A	wt	*ξ Boot.* log A	wt	*η Drac.* log A	wt
4873·42	Ni I	...		1·94	1	2·09	2	2·04	2	2·18	2
74·15	...	...		1·94	2	1·69	1	2·04	2	2·04	2
74·92	...	...		1·94	2	2·03	2	1·75	1	2·10	2
75·71	Fe I	...		2·10	2	2·16	2	2·19	2	2·43	2
4876·44	Cr II	...		1·99	1	1·79	1	1·99	2	1·99	1
78·14	Fe I, Ca I	...		2·38	3	2·32	5	2·51	4	2·53	5
81·58	Fe I, V I	...				1·99	2	2·46	4	2·52	3
				2·22	3						
82·22	Fe I	...				1·99	2	...		2·16	2
83·69	Y II	...		1·94	3	2·02	4	1·99	2	2·22	3
85·25	Fe I, Ti I	...		2·27	3	2·30	4	2·39	3	2·61	2
86·29	...	...		1·79	0	2·00	2	2·02	2	2·33	2
87·10	Ni I, Cr I	...		2·38	3	2·29	3	2·31	3	2·53	3
88·59	Fe I	1·99	0	...		2·10	2				
								2·48	4	2·63	4
89·08	Fe I	2·14	1	2·27	2	2·18	2				
4890·77	Fe I	2·39	2	2·42	3	2·57	3	2·70	2	2·68	2
91·50	Fe I	2·44	2	2·58	3	2·60	3	2·72	2	2·76	3
92·93	Fe I	1·94	3	1·82	2	1·80	1	1·82	0	1·71	2
93·92	...			...		1·70	1	1·41	0	1·82	2
		1·94	3								
94·64	...			...		...		1·48	0	...	
96·56	Fe I	1·86	3	1·99	3	1·90	3	1·66	0	1·95	3
4900·00	Ti I	2·23	3	2·27	3	2·10	3	2·16	2	2·56	2
00·88	...	1·79	1	1·55	0	1·60	0	1·75	0	1·82	1
03·32	Fe I	2·18	2	2·43	3	2·27	4	2·44	2	2·49	3
04·41	Ni I	2·07	3	2·17	2	2·09	4	2·06	2	2·22	2
4905·15	Fe I	1·62	0	...		...		1·76	0	1·90	2
07·76	Fe I	1·95	3	2·08	2	2·05	4	2·19	2	2·35	3
09·41	Fe I	2·00	2	2·05	1	2·05	2	2·11	1	2·28	2
10·04	Fe I	1·90	0			2·10	1				
				2·53	2			2·49	2	2·63	3
10·49	Fe I	2·22	1			2·24	2				
11·29	Ti II	2·15	1	1·98	0	1·86	2	1·97	0	2·22	2
11·94	...	1·95	2	2·11	1	1·93	2	2·15	2	2·28	2
13·76	Ti I, Ni I	1·95	3	2·17	3	1·91	2	2·00	0	2·39	2
17·23	Fe I	1·90	1	2·17	2	1·87	2	2·14	2	2·20	2
18·29	Ni I	2·07	1	2·11	1	2·40	2	2·28	0	2·44	1
4919·00	Fe I	2·44	2	2·49	2	2·45	2	2·68	1	2·61	2
20·56	Fe I	2·51	3	2·60	2	2·61	3	2·87	2	2·90	4
21·78	Ti I					1·81	1				
		2·05	2	2·11	3			2·26	1	2·41	2
22·27	Cr I					1·91	2				
23·93	Fe II	2·49	2	2·28	3	2·31	3	2·17	2	2·56	3
24·76	Fe I	2·05	1	2·23	3	2·02	2	2·28	1	2·39	2
25·56	Ni I	1·68	0	1·73	0	1·81	2	2·18	2	2·25	2
27·71	Fe I	2·11	3	2·18	4	2·06	4	2·27	3	2·50	4
30·32	Fe I	1·96	3	2·01	3	1·86	3	2·18	2	2·35	5
32·03	...	1·93	2	1·68	0	...		1·57	0	...	
4933·25	Fe I	2·32	2	1·81	1	2·29	2	1·96	0	2·36	2
34·07	Ba II	2·26	2	2·40	3	2·31	4	2·54	2	2·66	3

TABLE 8. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF DWARF AND GIANT STARS—*Concluded*

Wave-length	Identification	*α C. Min.* log A	wt.	*ξ U. Maj.* log A	wt.	Sun log A	wt.	*ξ Boot.* log A	wt.	*η Drac.* log A	wt.
4935·81	Ni I	....				1·76	3	....			
				1·68	0					2·35	2
36·33	Cr I	1·91	1			1·81	2	....			
37·55	Ni I	2·23	2	1·77	0	1·96	2	2·06	1	2·40	2
38·10	Fe I	2·06	0	1·84	0	2·21	2	2·20	1	2·32	1
38·80	Fe I	2·29	1	2·24	1	2·24	2	2·44	1	2·44	1
39·26	Fe I			....		1·95	1				
		2·10	2					2·55	2	2·65	3
39·65	Fe I			2·12	2	2·04	2				
42·49	Cr I	....		1·84	3	1·92	3	2·18	1	2·27	4
4945·52	Ni I, Fe I	....		1·84	3	1·89	3	1·96	1	2·12	2
46·30	Fe I	....		2·12	3	2·02	2	2·24	2	2·35	2
49·36	....	....		2·12	3	....		....		....	
50·11	Fe I	....		....		1·99	4	2·12	2	....	
52·58	Fe I	....		....		1·87	1	1·96	1	....	
53·20	Ni I	....		1·91	2	1·67	0	1·84	0	....	
54·68	Cr I, Fe I	....		1·91	2	1·92	2	2·24	2	....	
57·45	Fe I	....		2·72	3	....		3·00	4	....	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4111·81	Fe II	2·25	4	...		...	
12·30	Fe I	2·03	2	...		...	
12·56	Cr II	2·18	2	...		...	
12·94	Fe I	2·30	2	...		...	
13·18	Cr II	2·29	2	...		...	
13·82	Nd II	2·18	3	...		...	
14·12	...	1·71	1	...		...	
14·46	Fe I	2·34	4	...		...	
14·95	Fe I	1·94	1	...		...	
15·19	V I	2·16	2	...		...	
15·44	Gd II	1·86	2	...		...	
16·00	Ni I	1·74	4	...		...	
16·39	V I	1·64	2	...		...	
16·66	V I	1·86	1	...		...	
16·82	Nd II	1·94	1	...		...	
17·00	Fe I	1·99	2	...		...	
17·28	...	1·85	2	...		...	
17·60	...	2·07	2	...		...	
17·88	Fe I	2·00	1	2·09	1	...	
18·18	Ce II	2·36	2	2·02	1	...	
18·57	Fe I	2·64	2	2·53	2	...	
18·79	Co I			2·32	0	...	
		2·46	2				
18·91	Fe I			2·12	0	...	
19·50	Gd II	2·41	4	2·28	2	...	
19·78	Ce II			1·91	0	...	
		2·36	3				
19·92	Ce II			2·03	0	...	
20·22	Fe I	2·31	4	2·19	2	...	
20·64	Cr I	...		1·71	0	...	
20·86	Ce II	2·24	4	1·69	0	...	
21·34	Co I	2·38	4	2·30	2	...	
21·80	Fe I	2·34	4	2·26	2	...	
22·52	Fe I			2·35	0	...	
		2·64	4				
22·67	Fe II			2·23	0	...	
23·24	La II	2·56	4	2·32	2	...	
23·74	Fe I			2·35	2	...	
		2·44	4				
23·93	Ce II			1·66	1	...	
24·78	Y II, Fe II	2·55	6	2·35	3	...	
25·45	...			1·52	0	...	
		2·27	2				
25·64	Fe I			2·13	1	...	
25·90	Fe I	2·20	1	2·21	1	...	
26·18	Fe I	2·28	2	2·23	1	...	
26·53	Cr I	1·97	2	1·71	1	...	
26·88	Fe I	1·92	2	1·85	1	...	
27·38	Ce II	2·43	1	2·28	0	...	
27·62	Fe I	2·52	1	2·36	0	...	
27·80	Fe I	2·45	1	2·40	0	...	
28·10	Si II	2·64	3	2·44	1	...	
28·74	Fe II	2·55	3	2·33	2	...	
29·18	Cr I	2·44	2	2·26	1	...	
29·47	...	2·23	1	1·92	0	...	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4129·72	Eu II	2·54	4	2·33	2	...	
30·04	Fe I	1·68	0	1·97	1	...	
30·44	Gd II	2·23	1	...		...	
30·68	Ce II			2·39	2	...	
		2·55	3				
30·87	Si II			1·82	0	...	
31·12	Ce II	2·19	2	1·95	1	...	
32·06	Fe I	2·90	4	2·80	2	...	
32·54	...	2·33	1	2·35	1	...	
32·72	...	...		1·52	0	...	
32·91	Fe I	2·44	2	2·31	2	...	
33·45	Nd II	2·15	2	...		...	
33·60	Fe I			2·04	1	...	
		2·45	4				
33·86	Ce II			2·26	1	...	
34·44	Fe I	2·37	2	2·39	1	...	
34·68	Fe I	2·55	2	2·32	1	...	
35·30	Nd II			2·13	2	...	
		2·28	4				
35·45	...			1·52	0	...	
35·77	Cr II			1·57	1	...	
		1·73	4				
35·91	...			1·22	0	...	
36·58	Fe I	2·14	2	2·02	1	...	
36·73	...	...		1·77	0	...	
37·00	Fe I	2·43	3	2·34	2	...	
37·40	...	2·04	1	2·14	1	...	
37·66	Ce II	2·43	3	2·23	1	...	
38·10	Fe II	2·06	1	1·95	1	...	
38·37	Fe II	2·30	2	2·26	2	...	
39·09	...	1·68	3	1·53	1	...	
39·94	Fe I	2·18	4	2·20	2	...	
40·41	Fe I, Gd II	2·02	4	1·98	2	...	
40·77	...	1·58	2	1·58	1	...	
41·22	...	1·93	3	1·77	1	...	
41·64	La II	1·76	1	2·04	1	...	
41·84	Fe I	2·34	3	2·19	1	...	
42·41	Ce II	2·43	3	2·46	1	...	
42·59	...	...		2·01	0	...	
42·81	...	1·94	1	...		...	
43·08	Dy II	2·36	2	2·22	1	...	
43·42	Fe I	2·62	2	2·57	1	...	
43·86	Fe I	2·76	4	2·65	2	...	
44·52	Nd II	2·14	2	2·03	1	...	
45·02	Ce II	2·26	2	2·19	1	...	
45·20	...	1·86	1	1·83	1	...	
45·80	Cr II	2·23	3	2·01	1	...	
46·12	Fe I	2·36	2	2·27	2	...	
46·50	Cr II	2·08	2	1·84	1	...	
47·00	...	1·74	2	1·73	1	...	
47·36	Fe II	2·10	2	2·03	1	...	
47·50	...	...		1·53	0	...	
47·68	Fe I	2·45	4	2·36	1	2·41	3
48·20	Sc II	1·57	2	1·54	1	...	
48·50	...	1·53	2	1·48	1	...	
48·80	...	...		1·53	0	...	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4149·20	Zr II	2·67	5	2·59	2		
						2·84	3
49·37	Fe I	…		2·14	0		
49·77	Fe I			1·76	0	…	
		2·36	2				
49·94	Ce II			2·14	1	2·41	1
50·26	Fe I	2·24	2	2·17	1	…	
50·48	…	1·76	1	…		…	
51·00	Cr II	2·37	5	2·24	2	2·57	3
51·95	La II, Ce II	2·46	0	2·39	1		
52·06	…	2·11	0	2·04	0		
						2·68	3
52·18	Fe I	2·41	1	2·35	0		
52·76	La II	1·90	2	1·70	1	…	
53·09	Cr II	1·93	2	1·62	0	2·20	2
53·38	…	1·77	1	1·85	1	…	
53·92	Fe I	2·47	2	2·36	1		
						2·43	1
54·10	Fe I	2·22	1	2·19	0		
54·53	Fe I	2·56	2	2·41	1	2·43	0
54·82	Fe I	2·47	2	2·39	1	2·32	0
55·20	Sa II	1·42	0	…		…	
55·51	Ce II	1·80	2	1·46	1	…	
55·91	…			1·94	2		
		2·69	4			2·82	3
56·26	Zr II			2·42	2		
56·79	Fe I	2·59	4	2·63	2	2·30	0
57·79	Fe I	2·43	6	2·29	4	2·30	3
58·38	…	1·83	2	1·67	2	…	
58·84	Fe I	2·37	2	2·32	3	2·43	3
59·17	Ce II	2·27	2	2·15	3	…	
60·10	…	1·70	1	…		…	
60·37	…	2·17	2	2·08	3	2·00	1
60·56	Fe I	2·00	1	1·97	1	…	
60·77	…	1·99	1	1·79	0	…	
61·25	Zr II	2·69	2	2·54	1	2·84	0
61·52	Ti II	2·67	2	2·56	1		
						2·84	0
61·80	Sr II	2·17	0	2·04	1		
62·68	Gd II	1·89	4	1·69	2	…	
63·63	Ti II	2·69	6	2·55	3	2·99	3
64·02	V II	1·98	1			…	
				1·94	2		
64·24	…	1·88	1			…	
64·78	Fe III	1·67	3	1·52	2	…	
65·10	…	1·63	2	1·44	1	…	
65·40	Fe I	1·90	2	2·12	1	…	
65·63	Ce II	2·31	2	2·15	1	2·48	3
66·00	Ba II	2·02	2	1·80	2	…	
66·36	…	…		1·74	1	…	
66·63	…	1·75	2	…		…	
66·94	…	2·20	2	2·12	2		
						2·54	3
67·28	Mg I	2·39	3	2·43	3		
67·63	…	1·79	1	…		…	
67·89	Ce II	2·25	4	2·31	3	2·04	2

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4168·66	Fe I	2·06	3	1·86	2	2·00	3
68·98	Fe I	1·88	2	1·95	2	....	
69·48	Sa II	1·65	2	1·71	2	....	
69·85	Fe I	2·31	3	2·36	2	2·48	3
70·64	Cr II	2·07	2	1·75	1		
						2·51	1
70·93	Fe I	2·52	5	2·45	3		
71·70	Fe I	....		2·05	0	....	
71·91	Ti II	2·68	2	2·62	2	2·99	3
72·14	Fe I	2·54	2	2·30	1	....	
72·58	Fe I			2·22	0	2·45	0
		2·58	4				
72·75	Fe I			2·47	1	....	
73·49	Fe II, Ti II	2·89	5	2·76	3	3·02	2
73·95	Fe I	2·28	0	2·29	1	....	
74·12	Ti II	2·55	2	2·49	1	2·74	1
74·41	Ce II	2·37	2	2·05	1	....	
74·93	Fe I	2·42	4	2·30	2	....	
75·58	Fe I	2·48	4	2·46	3	2·56	3
75·93	....	1·84	2	....		....	
76·55	Fe I	2·39	4	2·37	4	2·30	1
77·53	Y II	2·90	6	2·83	3	2·99	3
78·06	Fe I	1·88	0	....		....	
78·37	V II	2·35	2	2·00	1	2·52	0
78·85	Fe II	2·88	4	2·67	3	2·90	1
79·40	Cr II	2·51	2	2·46	2	2·72	1
79·76	Zr II	2·18	2	2·13	2	....	
80·39	Fe I	1·48	2	1·73	2	....	
80·86	....			1·78	2		
		2·05	3			2·18	0
81·15	Sa II			1·65	1		
81·74	Fe I	2·64	6	2·59	3	2·71	3
82·38	Fe I	2·30	3	2·33	3	2·20	1
82·76	Fe II	1·99	2	1·81	2	....	
83·02	....	1·89	2	....		2·04	0
83·32	....	2·18	1	2·06	1		
						2·69	1
83·47	V II	2·42	1	2·22	1		
84·01	Ce I	2·39	2	2·34	2	....	
						2·87	4
84·31	Ti II	2·55	3	2·37	2	....	
84·90	Fe I	2·41	4	2·39	3		
85·14	....	....		....		2·08	0
85·37	Cr II	1·86	2	1·71	2		
86·14	Ti I	1·79	2	1·74	1	....	
86·62	Ce II	2·49	3	2·31	2	2·70	3
87·06	Fe I	2·67	4	2·61	3	2·59	1
87·76	Fe I	2·70	6	2·64	3	2·70	3
88·74	....	2·28	5	2·30	3	2·08	0
89·55	Pr II	2·19	5	2·12	3	2·00	0
90·12	Ti II	1·69	0	1·96	1		
						2·68	3
90·35	V II	2·40	2	2·25	2		
90·74	....	2·04	2	1·85	2	....	
91·07	....	2·08	1	....		....	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4191·44	Fe I	2·69	4	2·63	3	2·71	2
91·70	Fe I	2·24	2	2·22	1	...	
92·04	Ni II	2·01	2	1·96	2	2·20	0
92·36	...	1·67	2	...		...	
93·12	Ce II	2·13	3	1·82	2	2·26	4
93·32	Ce II	1·90	2	1·56	1	...	
93·72	...	1·83	1	1·76	2	...	
93·90	Ce II	1·76	1	1·86	2	...	
94·40	...	1·49	0	...		...	
94·92	...	2·22	2	1·86	2	...	
95·35	Fe I	2·51	2	2·44	2	2·59	4
95·62	...	2·19	2	2·27	2	...	
96·24	Fe I	2·46	2	2·37	2	...	
96·54	La II			2·27	2	2·70	4
		2·40	2				
96·68	Fe I			1·81	0	...	
97·24	Fe I	1·77	2	1·68	2	...	
97·68	Ce II	2·09	2	...		...	
98·26	Fe I	2·84	4	2·71	3	2·76	3
98·63	Fe I	2·45	2	2·36	1	2·34	0
99·11	Fe I	2·68	4	2·59	3	2·72	3
99·88	...			1·69	0	...	
		2·12	5				
4199·99	Fe I			1·88	1	...	
4200·44	Ti II	1·42	0	1·52	1	...	
00·72	...	1·88	0	1·77	0	...	
00·90	Fe I	2·30	2	2·23	2	...	
01·20	Fe I	1·89	2	1·57	1	...	
02·04	Fe I	2·88	1	2·80	3	...	
						2·94	4
02·37	V II	2·32	2	2·07	1	...	
02·76	...	1·62	0	1·72	1	...	
02·97	Ce II	2·30	2	2·13	2	2·28	1
03·60	Fe I	2·04	2	1·84	1	...	
04·01	Fe I, La II			2·39	2		
		2·52	4			2·51	1
04·24	V II			1·82	1		
04·78	Y II	2·42	2	2·35	1	2·66	0
05·05	Eu II, V II	2·77	2	2·56	2	2·76	0
05·38	Mn II	2·35	0	2·35	1		
						2·61	0
05·56	Fe I	2·37	0	2·22	1		
06·10	Sa II	2·03	2			...	
				1·87	2		
06·44	...	1·90	2				
						2·28	2
06·71	Fe I	2·49	3	2·37	4		
07·15	Fe I	2·37	2	2·34	3	2·51	3
07·42	Cr II	1·95	2	1·52	0	...	
07·83	...	1·48	2	...		...	
08·35	...	1·44	0	1·87	1	...	
08·62	Fe I	2·36	2	2·28	2	...	
09·03	Zr II	2·55	3	2·38	3	2·87	4
09·37	...			1·67	1	...	
		1·98	2				

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4209·60	...			1·67	0	...	
09·83	V II	2·30	2	2·15	2	2·00	0
10·37	Fe I	2·52	4	2·48	5	2·60	3
10·65	Zr II	1·92	2	...		...	
10·97	...	...		1·47	2	...	
11·34	Nd II	1·98	2	1·72	2	...	
11·89	Zr II	2·56	6	2·39	4	2·71	5
12·65	...	1·48	2	1·78	2	...	
13·14	...	1·86	2	1·78	2	...	
13·66	Fe I	2·34	4	2·29	4	2·28	2
14·07	Ce II	1·81	3	1·73	2	...	
15·55	Sz II	2·99	5	2·89	4	3·08	2
16·17	Fe I	2·53	4	2·47	4	2·51	0
17·05	Cr II	1·97	1	1·98	2	1·95	0
17·26	Nd II	2·10	2	1·93	1		
						2·52	3
17·56	Fe I	2·43	5	2·37	4		
18·25	Ti II	1·78	5	1·78	2	...	
19·37	Fe I	2·49	5	2·47	6	2·41	3
20·08	V II	2·19	3	2·08	1		
						2·40	3
20·35	Fe I	2·36	3	2·34	4		
20·67	Sa II	1·96	3	...		...	
21·25	...	1·69	4	...		...	
22·24	Fe I	2·61	5	2·51	4	2·35	0
22·63	Ce II	2·44	3	2·23	2	2·76	3
23·06	Pr II	2·26	3	2·11	3	...	
23·58	...	1·66	1	1·78	2	...	
23·86	Sa II, Ce II	1·76	0	...			
						2·59	3
24·21	Fe I	2·52	3	2·50	3		
24·54	Fe I	2·36	3	2·36	2	...	
24·84	Cr II	2·04	2	...		...	
25·23	V II	2·31	0	2·34	1	...	
25·44	Fe I	2·61	3	2·50	2	...	
25·72	...	1·91	0	...		...	
25·97	Fe I	2·22	3	2·19	2	...	
26·73	Ca I	2·93	5	2·91	4	...	
27·42	Fe I	2·70	4	2·58	3	...	
27·76	Nd II	2·31	2	2·19	1	...	
28·28	...	2·01	4	1·98	3	...	
28·72	...	1·51	2	1·63	3	...	
29·54	...	2·06	2	2·03	2		
						2·34	4
29·77	Fe I	2·25	3	2·26	2		
30·24	...	1·57	2	...		...	
30·50	Cr I	1·79	5	1·81	3	...	
31·08	Ni I	1·92	5	1·94	4	...	
31·72	Zr II	2·25	5	1·99	2	...	
32·04	V II	1·82	2	1·95	2	...	
32·42	Nd II	2·19	2	2·13	2	...	
32·73	...			1·65	0	...	
		3·00	5				
33·22	Fe II			2·71	4	...	
33·60	Fe I	2·64	2	2·51	2	...	
34·26	V II	2·22	3	2·07	3	...	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	γ *Cyg.* log A	wt	α *U. Min.* log A	wt	ρ *Cas.* log A	wt
4234·64	V II	1·82	3	1·69	2	...	
35·15	Mn I			1·79	1	...	
		2·32	4				
35·32	Mn I			2·12	2	...	
35·94	Fe I	2·80	5	2·69	6	...	
36·50	Zr II	2·12	2	1·96	1	...	
36·80	Sa II	2·20	3	1·81	1	...	
37·18	Fe I	2·07	4	2·13	3	...	
37·71	Sa II	1·62	1	1·72	1	...	
38·07	Fe I	2·36	3	2·30	2	2·15	0
38·42	La II	2·46	3	2·32	2	...	
38·82	Fe I	2·52	4	2·48	4	2·75	2
39·37	...	1·97	3	1·79	1	...	
39·85	Fe I, Ce II	2·54	5	2·51	5	2·34	1
40·36	Fe I	2·17	3	2·09	3	2·30	1
40·70	...	1·66	2	1·73	2	...	
41·12	Fe I	2·03	4	1·89	4	...	
42·30	Cr II	2·62	5	2·38	4	...	
42·58	Fe I			1·99	1	2·85	5
		2·31	2				
42·75	Fe I			2·09	1	...	
43·30	Fe I			1·69	1	...	
		2·02	3				
43·55	...			1·89	2	...	
43·83	Fe III	2·05	3	1·81	2	1·93	1
44·23	...	1·57	0	1·29	1	...	
44·81	Ni II	2·14	4	1·92	4		
						2·34	1
45·29	Fe I	2·41	5	2·34	4		
46·02	Fe I	2·36	3	2·28	4	2·43	0
46·85	Sc II	2·92	5	2·67	5	3·02	2
47·36	Fe I, Vd II	2·52	3	2·47	4	2·72	1
48·25	Fe I	2·32	5	2·21	2	...	
48·45	Fe I	...		1·86	1	...	
48·67	Ce II	2·32	5	2·06	2	2·34	2
49·33	...	...		1·40	0	...	
49·50	...	...		1·30	0	...	
49·66	...	...		1·46	0	...	
50·13	Fe I	2·63	5	2·54	5	2·70	2
50·79	Fe I	2·70	5	2·62	5	2·86	3
51·61	...	...		1·60	1	...	
51·83	Mn II	2·26	5	1·80	2	2·40	1
52·06	Ti II	1·77	2	1·62	1	...	
52·24	...	...		1·40	0	...	
52·44	...	2·13	2	1·80	0		
						2·62	2
52·65	Cr II	2·45	4	2·25	2		
53·42	Ce II	2·11	5	1·85	3	2·26	1
53·73	...	...		1·50	0	...	
53·95	...	...		1·60	0	...	
54·37	Cr I	2·70	8	2·57	5	2·73	4
54·99	...	1·65	2	1·63	1	...	
55·52	Fe I	1·87	3	1·99	2		
						2·16	0
55·84	Ce II	2·25	3	2·03	2		
56·20	Fe I	2·21	2	2·16	2	2·36	1

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	γ *Cyg.* log A	wt	α *U. Min.* log A	wt	ρ *Cas.* log A	wt
4256·42	Sa II	2·23	2	1·78	1	...	
56·67	...	...		1·72	2	...	
57·37	...	...		1·40	0	...	
57·65	...	...		1·80	1	...	
58·15	Fe II, Zr II			2·60	4		
		2·82	5			2·87	5
58·33	Fe I			2·00	0		
58·62	Fe I	1·96	1	1·95	0	...	
58·96	Fe I	1·88	2	1·91	2	...	
59·28	Mn II	1·78	2	1·62	2	...	
60·00	Fe I			1·90	0	...	
		2·44	2				
60·13	Fe I			2·41	2	...	
60·50	Fe I	2·80	5	2·69	4	2·85	2
61·26	...	...		1·63	2	...	
61·60	...	...		1·60	0	...	
61·94	Cr II	2·58	5	2·42	4	2·75	4
62·36	...	...		1·62	0	...	
62·70	Sa II	1·83	3	1·44	1	...	
63·15	Ti I	1·84	3	1·81	3	...	
63·62	La II	2·10	4	1·96	4	2·28	2
63·96	Fe II	1·88	2	...		...	
64·23	Fe I	2·20	3	2·11	3	...	
64·84	Fe I	1·92	3	1·81	3	2·08	2
65·22	Fe I	1·97	4	1·89	3	...	
65·92	Mn I	1·83	6	1·89	5	1·54	0
66·65	Nd II	1·70	1	1·41	0	...	
66·93	Fe I	2·33	5	2·29	5	2·08	1
67·38	...	...		1·56	1	...	
67·80	Fe I	2·28	6	2·26	5	2·11	1
68·75	Fe I	2·24	3	2·16	3	2·26	0
69·05	...	2·05	1	...		...	
69·26	Cr II	2·39	3	2·30	2	2·66	2
69·50	La II	2·05	1	1·91	1	...	
69·83	...	1·39	0	1·91	2	...	
70·23	Ce II	2·09	3	1·91	2	2·36	1
70·73	Ce II	2·10	2	1·91	2	...	
71·21	Fe I	2·72	5	2·50	4	2·82	1
71·78	Fe I	2·94	6	2·65	5	2·96	3
72·56	...	...		1·46	1	...	
72·90	...	1·83	2	1·81	1		
						2·85	4
73·37	Fe II	2·70	5	2·46	4		
73·87	Fe I	1·72	1	1·83	2	...	
74·84	Cr I	2·72	6	2·56	5	2·82	3
75·32	...	...		1·31	0	...	
75·56	Cr II	2·49	5	2·40	5	2·72	3
76·71	Fe I	2·09	4	2·01	5		
						2·08	1
76·98	...	1·37	0	...			
77·38	Fe I	2·21	5	1·92	3		
						2·28	1
77·53	...	1·27	0	1·36	0		
78·16	Fe II	2·49	5	2·32	6	2·71	2
78·50	...	1·82	2	...		...	
78·81	V II	1·92	2	1·81	3	2·08	1

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4279·06	Cr II	1·78	2	1·31	0	...	
79·42	Fe I			1·81	1	1·95	0
		2·18	3				
79·70	Sa II			1·66	1		
						2·20	1
79·73	Fe I	2·28	3	2·13	2		
80·47	...	2·26	3	2·19	2	2·32	1
80·78	Sa II	2·28	3	2·02	1		
						2·06	0
81·10	Mn I, Cr II	2·23	3	2·12	2		
81·95	...	...		1·42	0	...	
82·43	Fe I	2·70	5	2·51	4	2·79	4
82·72	...	1·79	0	1·82	0	...	
83·03	Ca I	2·47	5	2·41	4	2·26	0
84·20	Cr II	2·52	5	2·32	4	2·72	3
84·52	Nd II			1·82	0	...	
		2·22	3				
84·68	Ni I			1·97	1	...	
85·08	Ti I	1·78	1	1·62	0		
						2·31	3
85·42	Fe I	2·38	4	2·30	4		
85·79	...	...		1·62	0	...	
86·05	Fe III, V II	2·21	3	2·03	2	1·95	0
86·50	Fe I	2·21	3	2·02	2	2·10	0
87·00	La II	2·23	3	2·21	3	...	
87·44	Ti I	2·10	2	1·92	1	...	
87·86	Ti II			2·48	2		
		2·79	7			3·00	5
88·00	Ni I			2·12	0		
88·17	...	...		1·97	0	...	
88·75	V II	...		1·62	1	...	
89·12	Ti I	2·20	1	2·23	1		
						2·28	0
89·38	Ca I	2·46	1	2·43	1		
89·78	Cr I	3·07	3	2·75	4	2·72	1
90·23	Ti II	2·90	3	2·74	4	3·10	4
90·95	Ti I	2·07	2	2·12	2	2·00	0
91·52	Fe I	2·36	4	2·31	4	2·08	1
92·11	Fe I			2·02	1	...	
		2·25	5				
92·27	Fe I			1·92	1	...	
92·75	...	1·68	2	...		...	
93·05	Zr II	2·04	3	2·00	5	2·11	0
94·14	Ti II	2·89	7	2·62	6	3·11	4
94·80	Sc II	2·59	4	2·41	4	2·77	2
95·20	...	...		1·72	1	...	
95·78	Ti I			1·97	1	...	
		2·13	2				
95·89	Ni I			1·84	0	2·66	1
96·09	La II	2·38	3	2·16	2	...	
96·62	Fe II	2·81	6	2·58	5	2·93	4
97·03	...	...		1·52	0	...	
97·22	...	...		1·77	2	...	
97·76	Nd II	1·95	2	1·62	1	2·04	1
98·04	Fe I	2·32	4	2·33	4	...	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4298·76	Ti I	2·20	2	2·16	1	2·87	2
4299·22	Fe I, Ca I	2·89	4	2·75	5		
4300·05	Ti II	3·00	5	2·65	1	3·10	3
00·26	Ce II, Mn II	...		2·51	1	...	
00·55	Ti I	2·39	2	2·28	1	...	
01·08	V II	2·31	3	2·36	4	...	
01·97	Ti II	2·93	6	2·65	5	3·06	4
02·56	Ca I	2·62	3	2·59	4	2·62	1
03·18	Fe II	2·82	4	2·60	5	2·87	2
03·59	Nd II	2·33	2	2·26	1	2·65	2
03·96	...	...		1·78	1	...	
04·24	...	1·89	2	...		...	
04·58	Fe I	2·18	4	2·17	3	...	
05·12	...	2·26	2	1·98	1	2·28	0
05·45	Fe I	2·62	1	2·38	1		
05·70	Sc II	2·72	1	2·42	1	2·93	4
05·91	Ti I	2·31	0	2·55	2		
06·81	Ce II	2·30	4	2·25	5	2·17	1
07·92	Fe I, Ti II	2·92	8	2·75	7	3·00	6
08·65	Dy II	1·89	0	1·93	1	2·08	1
09·02	Zr II, Sa II	2·26	2	2·20	2		
09·38	Fe I	2·41	2	2·44	2	...	
09·64	Y II	2·77	5	2·49	2	2·91	5
10·46	Fe III	1·84	2	2·11	3	...	
10·71	V II	1·92	3	...		...	
10·95	Gd II	...		1·81	1	...	
11·48	Fe I	...		1·93	3	...	
11·62	...	1·74	4	...		...	
12·11	...	...		1·68	1	...	
12·86	Ti II	2·80	8	2·55	5	3·00	4
14·15	Sc II, Fe II	2·96	6	2·75	5	3·04	4
14·98	Ti II	2·82	6	2·65	5	3·01	4
15·98	Sa II	1·34	0	1·44	1	...	
16·24	V II	1·63	1	...		...	
16·82	Ti II	2·54	5	2·38	5	2·81	2
17·32	Zr II	2·25	4	1·95	2	2·44	2
18·69	Ca I	2·50	3	2·45	5	2·52	6
18·94	Sa II	2·29	2	1·79	0	...	
19·60	Cr I	1·40	1	...		...	
20·76	Sc II	2·92	9	2·61	2	2·93	1
20·94	Ti II			2·45	1	2·90	1
21·64	...	...		1·44	0	...	
21·84	Fe I	1·93	3	1·88	3	...	
22·51	La II	2·17	5	1·91	5	2·26	5
23·27	Fe I	2·00	4	1·75	3	...	
23·49	...	...		1·65	2	...	
23·87	...	1·42	0	1·82	3	...	
25·02	Sc II	2·83	5	2·56	5	3·06	2
25·76	Fe I	2·87	5	2·66	5	2·95	4

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4326·76	Fe I, Mn II	2·25	3	2·14	2		
						2·00	2
27·09	Fe I	2·29	4	2·17	2		
27·93	Nd II	2·15	6	2·01	5	1·95	3
29·09	Sa II	2·08	5	...		...	
30·30	Ti II	2·71	3	...		2·70	1
30·68	Ti II	2·72	3	...		2·94	3
31·78	Ni I	...		...		2·02	1
32·81	Fe II	...		...		2·23	3
33·83	La II	...		...		2·70	5
35·00	La II	...		...		1·78	0
40·48	H γ	3·52		3·58		...	
49·84	Ce II	...		...		2·20	2
50·48	...	2·01	1	...		...	
50·85	Ti II	2·54	1	...			
						2·83	2
51·08	Cr I	2·47	1	...			
51·78	Fe II	2·88	6	...		3·05	4
52·74	Fe I	2·58	7	...		2·58	2
53·46	...	1·62	1	...		...	
53·96	...	1·67	1	...		...	
54·62	Sc II	2·65	5	...		2·81	4
55·05	Ca I, Eu II	2·14	3	...		...	
55·98	Ni I	1·92	4	1·96	3	...	
56·38	...	...		1·57	1	...	
56·64	...	1·77	4	1·45	1		
						2·04	2
56·92	...	...		1·72	3		
57·51	Fe II	2·06	5	1·88	2	2·11	2
57·87	...	...		1·70	1	...	
58·19	Nd II	2·36	3	2·13	1		
						2·49	1
58·50	Fe I	2·14	0	2·21	1		
58·74	Y II	2·58	4	2·37	1	2·79	2
59·69	Zr II	2·59	6	2·47	4	2·61	3
60·35	...	1·37	0	1·46	1		
						2·15	2
60·80	Sa II	2·09	4	2·11	3		
61·26	Fe II	1·87	3	1·76	2	2·20	2
61·72	...	2·02	3	...			
						2·51	3
62·05	Ni II	2·29	5	2·16	3		
62·53	...	1·62	1	1·86	2	...	
62·76	...	1·32	0	...		...	
63·10	...	1·77	2	2·01	3	2·06	1
63·61	...	1·42	0	1·76	3	1·88	1
64·17	Y II	1·82	3	1·81	2	...	
64·67	Ce II	2·20	5	2·01	3	2·38	4
65·30	...	1·52	1	...		...	
65·92	Fe I	1·90	4	2·05	4	...	
66·40	Nd II	1·82	3	1·90	2	...	
67·08	...	1·67	1	...		...	
67·59	Fe I			2·47	0	2·96	4
		2·79	6				
67·70	Ti II			2·27	0	...	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4367·91	Fe I…			2·40	0	…	
		2·33	3				
68·32	…			1·77	1	…	
68·65	Nd II…	1·90	2	1·93	2	2·19	1
69·41	Fe II…	2·63	4	2·33	2	2·82	4
69·76	Fe I…	2·40	3	2·46	3	…	
70·31	…	…		1·70	2	…	
71·01	Zr II…	2·47	4	2·26	2	2·69	4
71·29	Cr I…	2·20	3	2·36	2	…	
72·27	Fe II, Fe III…	2·11	5	1·99	3	2·20	2
72·92	Fe I…	1·48	1	1·74	1	…	
73·22	Cr I…	1·71	2	1·57	0	…	
73·60	Fe I…	2·21	3	2·28	2	…	
74·20	…	…		2·17	0	…	
74·51	Sc II…	2·95	3	2·69	2	2·93	1
74·92	Y II…	2·86	3	2·62	2	3·16	2
75·95	Fe I…	2·59	5	2·48	4	2·67	3
76·78	Fe I…	1·81	3	1·82	3	…	
77·35	…	1·65	1	1·47	1	…	
77·55	…	…		1·42	0	…	
77·79	…	1·53	1	1·85	2	…	
78·20	…	1·81	2	1·62	2	…	
78·50	…	…		1·48	1	…	
79·20	V I…	2·26	5	2·15	3	2·04	1
79·76	Zr II…	2·44	4	2·28	3	2·73	4
80·05	Ce II…	…		1·47	0	…	
80·50	…	1·93	2	…		…	
80·73	…	…		2·04	3	…	
81·13	…	1·83	3	1·57	1	…	
81·76	Fe II…	1·87	2	1·73	2	…	
82·16	Ce II…	2·26	3	1·97	3	2·49	0
82·78	Fe I…	2·12	2	2·15	2		
						2·45	0
83·02	…	…		1·47	0		
83·61	Fe I…	2·95	7	2·69	5	3·08	3
84·37	Fe II…	2·62	3	2·41	2	2·77	1
84·81	Sc II…	2·75	3	2·59	1	2·76	1
85·40	Fe II…	2·86	5	2·59	4	3·00	4
86·48	…	…		1·76	0		
						2·90	5
86·86	Ti II…	2·68	7	2·49	4		
87·51	…	…		1·76	1	…	
87·90	Fe I…	2·34	3	2·25	3	…	
88·20	…	1·98	1	…		2·60	3
88·45	Fe I…	2·42	4	2·37	4	…	
89·23	Fe I…	2·20	4	2·14	5	1·92	2
90·01	V I…	2·25	3	2·18	3	2·08	2
90·50	Fe I…	2·30	3	2·13	2	…	
91·01	Ti II…	2·75	5	2·52	5	2·89	3
91·70	Ce II…	2·43	4	2·29	3	2·56	2
92·10	…	…		1·48	2	…	
92·59	Fe I…	1·94	4	1·76	3	…	
93·35	…	2·19	3	2·03	3	…	
94·07	Ti II…	2·76	7	2·47	5	2·97	3
95·05	Ti II…	2·96	7	2·69	5	3·18	4
95·80	Ti II…	2·63	5	2·48	5	2·83	2

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	γ *Cyg.* log A	wt	α *U. Min.* log A	wt	ρ *Cas.* log A	wt
4396·68	...	1·56	2	1·68	4	...	
98·03	Y II			2·39	2		
		2·85	7			2·90	4
98·32	Ti II			2·31	2		
99·21	Ce II	2·06	1	1·70	2	...	
99·79	Ti II	2·92	5	2·58	5	3·04	2
4400·40	Sc II	2·86	4	2·59	2		
						3·03	2
00·56	Ti II	...		1·99	0		
00·87	Nd II	2·37	2	2·30	2		
						2·28	1
01·37	Fe I, Zr II	2·51	5	2·51	4		
02·48	...	1·78	3	...		...	
03·12	...	2·10	3	...			
				2·34	5	2·52	3
03·38	Zr II	2·30	4	...			
04·76	Fe I	2·86	8	2·71	7	2·98	4
05·76	Pr II	1·81	3	...		...	
06·14	...	1·61	2	1·60	2	...	
06·62	Gd II	2·02	3			...	
				1·90	3		
06·87	...	1·56	1			...	
07·35	Ce II	2·17	2	...		...	
07·72	Ti II	2·58	3	2·44	5	2·80	3
08·50	Fe I	2·56	3	2·52	4	2·51	1
08·84	Pr II	2·16	1	...		...	
09·22	Ti II	2·58	2	2·42	2	2·90	4
09·50	Ti II	2·56	2	2·42	2	...	
10·54	Ni I	2·28	3	2·00	3	...	
11·08	Ti II	2·53	5	2·38	4	2·87	4
11·95	Ti II	2·50	6	2·35	3	2·74	4
12·26	...	...		1·94	2	...	
13·11	...	1·89	3	...		...	
13·61	Fe II	2·44	4	2·21	3	2·72	3
13·88	Cr I	...		1·95	2	...	
14·56	Zr II	2·22	2	1·99	2	2·43	1
15·19	Fe I	2·97	3	2·62	2	2·91	1
15·55	Sc II	2·64	2	2·62	2	2·95	1
16·84	Fe II	2·74	6	2·54	5	3·02	4
17·70	Ti II	2·87	5	2·60	5	3·08	3
18·36	Ti II	2·68	3	2·51	4	2·98	4
18·80	Ce II	2·20	2	2·00	2	...	
19·82	...	1·90	4	1·73	5	...	
20·63	Sc II	2·40	4	2·31	5	2·57	3
21·15	Sa II	2·05	3	1·50	2	2·20	1
21·96	Ti II	2·57	4	2·42	4	2·90	2
22·61	Fe I, Y II	2·55	4	2·49	4	2·81	2
23·19	Ti II	2·29	3	2·22	3	2·15	2
23·82	Fe I	2·12	3	2·06	3	1·78	1
24·30	Sa II	2·25	3	2·15	4	2·15	2
24·76	...	1·77	2	...		...	
25·17	...	...		...		2·48	4
25·48	Ca I	2·40	4	2·43	6	...	
26·05	Gd II	1·57	2	1·51	1	...	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4427·12	Ti I	....		1·91	1		
						2·78	4
27·34	Fe I	2·72	6	2·56	4		
27·92	Ti II	2·28	3	2·01	2	2·32	2
28·51	Cr I	2·13	4	1·89	2	2·08	2
29·27	Ce II, Pr II	2·27	4	2·11	4	2·13	1
29·92	La II	2·53	5	2·37	3	2·72	3
30·24	Fe I	2·15	1	1·93	1	....	
30·62	Fe I	2·46	4	2·52	4	2·41	2
31·34	Sc II	2·37	4	2·22	2	2·61	2
31·68	Fe II	1·88	2	1·71	2	....	
32·09	Ti II	2·30	3	2·24	3	2·41	2
32·63	Fe I	2·10	3	1·81	2	2·20	2
33·25	Fe I	2·34	4	2·32	4	2·26	2
33·80	Fe I			2·22	2		
		2·36	4			2·28	2
34·01	....			1·76	1		
34·38	Sa II	2·23	3	2·05	2	....	
35·01	Ca I, Fe I	2·69	5	2·57	4	2·66	2
35·63	Ca I	2·58	5	2·47	4	2·52	2
36·34	Mn I	2·04	3	1·91	2	1·74	0
36·96	Fe I	2·02	4	2·06	4	....	
37·57	Ce II	1·73	3	1·77	3	....	
37·85	....	1·78	3	....		....	
38·34	Fe I	1·98	4	1·96	4	....	
39·15	Fe II	2·04	4	1·66	2	1·78	1
39·64	Fe I	....		1·61	2	....	
39·90	Fe I	2·02	4	1·72	2		
						2·52	4
40·50	Zr II	2·28	4	2·06	2		
40·94	Fe I	2·06	3	1·91	2	....	
41·75	Ti II	2·64	5	2·47	5	2·91	4
42·36	Fe I	2·58	4	2·52	4	2·43	0
42·94	Zr II	2·36	2	2·40	2	2·73	1
43·20	Fe I	2·65	3	2·41	2	....	
43·80	Ti II	2·95	5	2·65	4	3·14	3
44·40	Ce II			1·98	1		
		2·70	5			2·91	2
44·55	Ti II			2·51	3		
45·56	Fe I	1·68	3	1·76	3	....	
46·41	Nd II	2·26	4	2·16	4	2·28	4
46·84	Fe I	2·13	2	2·02	2	....	
47·13	Fe I	2·14	2	1·96	2	....	
47·68	Fe I	2·49	5	2·46	5	2·49	5
49·18	Ti I			2·18	3	....	
		2·31	4				
49·34	Ce II			1·87	2		
						2·32	1
49·74	Dy II	2·16	2	1·97	2		
50·51	Ti II	2·87	7	2·64	4	3·06	4
50·90	....	....		1·88	1	....	
51·61	Nd II	2·37	4	2·31	4	2·26	2
52·04	Nd II	2·09	3	1·67	2	....	
52·72	Sa II	2·17	3	1·92	2	1·85	0
53·01	Mn I	1·84	2	1·90	2	....	
53·30	Ti I	2·12	3	1·96	2	1·60	0

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4453·71	Ti I	1·74	2	1·52	1	...	...
54·42	Fe I	2·47	2	2·28	2	...	...
54·80	Ca I	2·79	3	2·66	3	2·83	5
55·30	Ti I	2·28	2	2·17	2	...	...
55·89	Ca I	2·45	3	2·46	4	2·36	2
56·32	Fe I	2·11	2	1·92	1		
						2·34	1
56·64	Ti II	2·31	3	2·28	2		
57·06	...	2·03	2	1·62	0	...	...
57·50	Zr II	2·39	4	2·38	3	2·39	3
58·10	Fe I			2·07	1	1·65	1
		2·29	3				
58·29	Mn I			2·00	1	...	...
58·52	Sa II	2·21	2	1·94	1	...	...
59·12	Fe I	2·62	5	2·61	5	2·62	4
59·76	...	1·99	2	1·72	1	...	...
60·28	Ce II	2·34	4	2·24	4	2·08	2
61·25	Zr II	2·77	5	2·57	2	2·52	1
61·68	Fe I	2·62	3	2·62	2	2·70	2
62·03	Fe I	2·24	2	2·19	1	...	...
62·44	...	2·17	3	2·00	1	...	...
63·01	Nd II	2·27	3	2·24	3	2·16	2
63·43	Ce II	2·06	3	1·81	1	...	...
64·44	Ti II	2·78	6	2·63	5	2·96	6
64·75	Mn I, Fe I	2·16	1	2·13	0	...	...
65·36	Cr I	1·75	2	1·91	2	...	...
65·82	Ti I	2·01	3	1·63	2	...	...
66·56	Fe I	2·60	5	2·55	5	2·54	4
67·34	Sa II	2·06	2	2·10	3	...	...
67·58	Ce II	1·98	2	...	...	...	...
68·55	Ti II	2·98	6	2·65	5	3·10	4
69·16	Ti II	2·51	2	2·43	2	2·80	2
69·39	Fe I	2·40	2	2·34	2	...	...
70·14	...	...	...	1·53	0	...	...
70·50	Ni I	2·29	2	2·19	1	...	...
70·88	Ti II	2·69	4	2·52	2	2·96	6
71·27	Ce II	2·30	2	2·16	1	...	...
71·72	Eu II	1·50	1	...	...	...	...
72·41	...	1·80	0	...	...	...	...
72·75	Fe I	2·43	2	2·42	2		
						2·81	6
72·93	Fe II	2·45	2	2·24	2		
74·02	...	1·60	3	...	...	...	...
74·54	...	1·80	3	1·53	1	...	...
74·90	...	1·80	3	1·80	2	...	...
75·58	...	2·00	2	...	...	...	...
76·04	Fe I	2·52	5	2·47	5	2·52	5
76·96	Cr I	1·55	2	...	...	...	...
77·51	...	1·95	4	1·63	4	...	...
78·32	...	1·80	3	1·68	2	...	...
78·60	Sa II			1·53	1	2·04	2
		2·12	3				
78·83	Gd II			1·80	2	...	...
79·40	Ce II	2·21	3	1·73	0		
						2·39	3
79·61	Fe I	2·14	2	2·33	2		

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4480·14	Fe I	2·23	3	2·24	2	...	
80·60	Fe II	...		1·98	1	...	
81·18	Mg II	2·81	4	2·62	3	2·93	4
81·61	...	...		1·99	1	...	
82·21	Fe I	2·59	4	2·56	4	2·64	4
82·74	Fe I	2·13	3	1·94	2	...	
83·93	Ce II	2·14	3	2·14	2	2·38	4
84·23	Fe I	2·41	4	2·25	2	...	
84·93	...	1·73	3	...		...	
85·39	Zr II	1·76	2	...			
				2·26	5	2·04	3
85·72	Fe I	2·23	4	...			
86·90	Ce II	2·26	5	2·04	4	2·30	2
88·10	Fe I			1·99	1	...	
		2·61	5				
88·33	Ti II			2·38	2	2·97	4
89·19	Fe II	2·72	4	2·59	5	2·92	3
89·77	Fe I	2·40	3	2·33	1	2·11	0
90·10	Fe I	2·15	2	2·22	1	...	
90·84	Fe I	2·25	3	1·99	2	...	
91·42	Fe II	2·64	6	2·54	5	2·97	5
92·66	Fe I	1·95	4	1·74	3	...	
93·56	Ti I	2·44	4	2·35	5	2·66	3
94·08	...	2·17	2	1·64	0	...	
94·36	Zr II	2·34	2	...			
				2·56	4	2·74	3
94·58	Fe I	2·51	3	...			
95·43	Zr II			1·74	1		
		2·20	4			2·16	2
95·63	Fe I			1·89	1		
95·97	Fe I	1·96	2	1·94	1	...	
96·16	Ti I	1·96	2	1·54	1	...	
96·57	...	2·24	2	...		...	
96·95	Zr II	2·51	4	2·53	5	2·83	5
97·64	...	2·01	3	1·80	1	...	
97·88	Ce II	1·81	2	1·74	1	...	
98·28	Gd II	1·77	3	...		...	
98·88	Mn I	2·01	3	1·86	1	...	
99·14	...	1·86	2	1·94	2	...	
99·50	...	1·51	1	...		...	
4500·30	Eu II	2·30	3	2·11	4	2·18	0
01·27	Ti II	2·87	6	2·65	5	3·14	4
02·22	Mn I	1·86	3	1·95	3	...	
02·59	...	1·41	1	1·53	1	...	
03·82	Mn I	1·31	1	...		...	
04·58	Cr II	...		...		1·90	1
04·82	Fe I	1·96	5	1·87	4	...	
05·80	...	1·52	2	...		...	
06·34	Gd II	...		1·75	2		
						2·46	3
06·74	Ti II	2·25	5	2·05	4		
07·23	Cr II	1·67	2	...		...	
08·27	Fe II	2·72	8	2·59	7	3·02	6
09·34	...	1·82	3	1·65	2	...	
09·77	Fe I	1·77	3	1·83	3	...	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	γ *Cyg.* log A	wt	α *U. Min.* log A	wt	ρ *Cas.* log A	wt
4510·82	...	1·52	3	1·55	3	...	
11·85	Sa II	2·02	4	2·05	5	2·18	4
12·74	Ti I	2·05	4	1·99	4	1·70	0
13·44	...	1·72	4	1·65	1	...	
14·20	Fe I	1·65	2	2·02	4	...	
14·48	Gd II	2·04	3	1·75	1	...	
15·35	Fe II	2·76	7	2·59	6	3·02	6
16·26	Nd II	1·67	2	1·53	1	...	
16·64	...	1·92	3	1·87	3	1·85	0
17·54	Fe I	2·10	3	2·15	3	...	
18·03	Ti I	2·10	2	1·85	1	...	
18·35	...	2·52	5	2·36	4	2·84	5
19·64	Sa II	1·87	2	1·65	1	...	
20·22	Fe II	2·70	6	2·58	6	3·01	6
22·63	Fe II			2·63	2	3·06	6
		2·92	7				
22·85	Ti I			2·35	0	...	
23·16	Ce II	2·07	1	2·27	0	...	
23·90	Sa II	1·57	2	1·76	3	...	
24·70	Ti II			2·10	1	2·61	1
		2·44	3				
24·91	Ba II			1·78	0		
						2·48	1
25·13	Fe I	2·53	3	2·52	3		
26·10	La II	2·01	2	...			
						2·37	3
26·50	Cr I, Fe I	2·31	3	2·37	3		
26·94	Ca I	2·13	2	2·00	1	...	
27·35	Ce II	2·29	3	2·27	3	2·20	2
28·62	Fe I	2·71	6	2·66	5	2·94	4
29·51	Ti II	2·62	6	2·51	5	2·90	4
30·72	Cr I	2·13	2	1·71	0	...	
30·98	...	2·11	1	1·81	0	2·41	4
31·14	Fe I	2·45	3	2·55	3	...	
31·62	Fe I	1·93	2	1·81	1	...	
33·00	...	1·88	1	1·91	0	...	
33·24	Ti I	2·33	2	2·32	1	...	
33·99	Ti II	2·93	7	2·66	1	3·16	6
34·13	Fe II	...		2·45	1	...	
34·78	Ti I	2·16	2	2·24	3	...	
35·11	...	...		1·46	0	...	
35·57	Ti I	2·32	3	2·39	1	...	
35·74	Cr I	...		2·11	0	2·32	3
35·90	Ti I			2·06	0	...	
		2·33	3				
36·05	Ti I			2·06	0	...	
37·96	Sa II	1·83	5	1·66	3	...	
38·88	Fe I	2·03	4	1·96	3	...	
39·59	...			2·06	1		
		2·42	4			2·66	4
39·76	Ce II			2·12	1		
40·50	Cr I	1·83	2	1·97	1	...	
40·72	Cr I	1·83	2	2·05	1	...	
41·08	...	...		1·79	0	...	
41·52	Fe II	2·63	6	2·55	4	2·92	6

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4542·44	Fe I			1·95	2	....	
		2·03	5				
42·67	Fe I			1·67	1	....	
43·80	Cr I	....		1·82	0		
						2·77	3
44·04	Ti II	2·43	5	2·35	2		
44·72	Ti I, Cr I	2·23	2	2·17	1	....	
45·14	Ti II	2·56	4	2·49	3	2·90	4
46·02	Cr I	2·08	4	2·07	3	2·00	1
46·99	Fe I	1·99	3	2·22	5		
						2·19	2
47·29	Eu II	1·67	2	....			
47·86	Fe I	2·08	3	2·17	3	....	
48·78	....	....		1·77	0	....	
49·60	Ti II, Fe II	3·04	8	3·06	6	3·21	6
50·80	Fe I	1·79	2	1·95	2	....	
51·20	....	1·98	3	....		1·78	0
52·21	Ti II	2·33	3	1·96	0		
						2·63	3
52·46	Fe I	2·42	3	2·49	4		
54·05	Ba II	2·85	6	2·69	5	3·06	3
54·99	Cr II	2·48	3	2·36	2	2·78	1
55·50	Ti I	2·24	1	2·07	1	....	
55·90	Fe II	2·71	3	2·61	2	3·06	4
56·13	Fe I	2·39	2	2·28	0	....	
56·93	....	1·44	1	1·65	2	....	
57·30	....	1·64	3	....		....	
58·64	Cr II	2·73	9	2·59	7	2·97	6
60·11	Fe I	2·09	2	1·97	1	....	
60·38	Ce II	2·09	2	1·91	1	2·28	3
61·06	Ce II	2·11	4	1·98	3	1·85	1
61·41	....	1·54	1	1·58	2	....	
62·36	Ce II	2·27	4	2·13	4	1·95	1
63·77	Ti II	2·88	7	2·68	6	3·12	4
64·63	....	2·23	3	2·19	3	2·30	1
65·32	....	1·99	2				
				2·53	5	2·69	3
65·64	Fe I	2·47	3				
66·04	....	2·10	2	....		....	
66·54	Fe I	1·91	3	1·78	1	....	
66·91	Fe I	1·79	3	1·78	1	....	
67·73	....	1·79	3	....		....	
68·35	Ti II	2·33	4	2·24	4	2·69	5
68·75	Fe I	2·05	2	1·88	1	....	
69·59	Cr I	1·81	4	1·68	3	....	
71·16	Mg I	2·16	2	2·18	3	....	
72·00	Ti II	2·93	7	2·77	6	3·12	5
74·47	Zr II	2·10	2	1·79	1	....	
74·71	Fe I	1·84	1	2·08	1	2·38	3
74·90	La II	2·08	2	1·78	1	....	
76·36	Fe II	2·63	8	2·52	7	2·94	5
77·16	V I	1·40	1	1·64	2	....	
77·76	Sa II	1·80	4	1·68	2	2·00	1
78·58	Ca I	2·16	4	2·16	4		
						2·23	2
78·96	....	2·91	2	....			

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4579·38	Fe I	2·11	3	1·98	2	......	
80·03	Cr I, La II	2·53	3	2·46	3	2·85	2
80·45	Ti II	2·42	3	2·29	2	2·60	1
81·37	Ca I, Fe I	2·32	5	2·38	5	......	
82·83	Fe II	2·65	4	2·57	2	2·99	2
83·36	Ti II	2·33	1	2·31	1	......	
83·81	Fe II	3·00	5	2·71	3	3·14	4
84·86	Fe I	1·80	1	1·99	2	......	
85·84	Ca I	2·26	4	2·30	4	2·25	4
86·24	......	1·83	2	1·79	1	......	
87·10	Fe I	1·91	4	1·89	3	......	
88·16	Cr II	2·62	9	2·51	7	2·90	3
89·99	Ti II	2·69	9	2·52	5	3·01	5
91·45	Cr I	2·20	3	2·09	3	......	
92·05	Cr II	2·58	3	2·43	3	2·72	2
92·56	Fe I	2·45	3	2·51	4	2·66	2
93·59	Fe I	2·06	2				
				2·34	5	2·61	4
93·92	Ce II	2·36	3				
94·71	......	1·65	2	......		......	
95·37	Fe I, Sa II	2·30	3	2·19	3	2·20	1
95·66	Fe II	2·12	2	1·89	0		
						2·51	3
96·06	Fe I	2·21	3	2·30	3		
97·21	Gd II	2·01	3	1·79	2		
						2·04	2
97·78	Gd II	2·06	3	1·85	1		
98·13	Fe I	2·22	4	2·30	4	2·20	3
99·84	Fe I	2·21	2	2·04	2	......	
4600·21	V II			2·20	1		
		2·41	3			2·70	3
00·37	Ni I			2·09	1		
00·79	Cr I	2·30	3	2·35	2	1·90	0
01·39	Fe II	2·20	3	1·94	2	2·51	3
02·00	Fe I	2·06	3	1·97	3	......	
02·93	Fe I	2·42	6	2·40	5	2·55	4
04·53	Fe I	1·86	2	1·70	1	......	
05·03	Ni I	2·18	3	2·20	2	2·30	3
05·49	Mn I	2·17	3	1·98	2	......	
06·29	Ce II	2·21	4	2·07	4	2·31	4
07·33	Sr I	1·96	2	1·60	0		
						2·22	4
07·65	Fe I	2·17	3	2·20	4		
09·27	Ti II	2·23	7	2·08	5	2·53	3
10·06	......	......		1·60	1	......	
11·26	Fe I	2·31	7	2·36	5	2·39	5
12·14	......	1·46	2	......		......	
12·62	......	......		......		2·04	2
13·32	Fe I, La II	2·34	5	2·43	6	2·23	2
13·94	Zr II	2·16	5	1·95	2	2·38	3
15·60	Sa II	1·97	3	2·00	3	......	
16·18	Cr I	2·34	3	2·16	2	2·49	0
16·62	Cr II	2·46	3	2·41	4	2·77	2
17·27	Ti I	1·70	2	1·68	2	......	
18·80	Cr II	2·57	5	2·52	5	2·93	4

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4619·28	Fe I	2·30	3	2·20	2		
20·14	Dy II	2·10	2				
20·51	Fe II	2·52	5	2·41	4	2·89	4
21·46	Cr II			1·40	0		
21·92	Cr I	1·52	2	1·63	2		
22·43	Cr I	1·42	1	1·79	3		
22·75		1·47	1				
23·10	Ti I	1·77	5	1·82	3		
25·07	Fe I	2·33	5	2·29	4	2·49	4
26·24	Cr I	2·23	5	2·26	5	2·06	1
27·41		1·57	2	1·81	2		
28·15	Ce II	2·31	5	2·05	3	2·45	2
28·53				1·82	1		
29·39	Fe II	2·79	7	2·63	6	3·05	5
30·15	Fe I	2·06	3	2·09	2		
30·55				1·81	1		
32·87	Fe I	2·22	6			2·11	1
34·08	Cr II	2·54	5			2·92	4
34·73	Fe I	1·83	2				
35·33	Fe II	2·20	4			2·48	2
35·84	Fe I	1·88	2				
36·32	Ti II	2·28	5			2·54	3
37·51	Fe I	2·30	4			2·15	2
38·00	Fe I	2·14	3			2·11	2
38·70		1·71	3				
39·39	Ti I	1·92	3				
39·70	Ti I	1·68	2				
39·95	Ti I	1·63	2				
40·31	Fe I	1·85	3				
41·16		1·83	4				
42·24	Sa II	1·97	4			2·23	3
43·42	Fe I	2·20	4			2·04	1
45·28	Ti I	2·02	3				
45·83		2·11	2				
						2·49	3
46·16	Cr I	2·38	3				
46·69	Sa II	1·98	2				
47·44	Fe I	2·37	4			2·40	2
48·05		2·03	2				
48·70	Ni I	2·49	5			2·65	4
49·53		1·98	4				
50·06		1·58	2				
51·28	Cr I	2·19	5			2·08	2
52·10	Cr I	2·23	5			2·30	3
54·50	Fe I	2·52	5			2·62	4
55·70	La II	2·31	4			2·54	2
56·45	Ti I	2·18	2				
						2·96	4
57·10	Ti II, Fe II	2·78	5				
60·78		1·92	5			2·00	1
61·84	Fe I	2·08	5				
62·68	La II	2·30	5			2·61	2
63·31	Cr I	1·98	1				
63·70	Fe II	2·47	5			2·75	4
64·84	Cr I	2·11	4			2·08	2
65·90	Cr I	2·02	3				

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4666·80	Fe II	2·69	5	...		2·96	4
67·48	Fe I	2·49	3	...		...	
68·14	Fe I	2·42	3	...		2·48	1
68·56	...	1·89	1	...		...	
69·10	Fe I	2·21	3	...		2·26	0
69·67	Sa II	2·20	2	...		...	
70·36	Sc II	2·81	5	...		3·03	4
72·30	...	1·89	4	...		2·15	2
73·17	Fe I	2·13	5	...		2·04	0
74·02	...	1·81	3	...			
						2·28	1
74·62	Sa II	2·09	4	...			
75·64	...	1·79	5	...		...	
77·00	Sa II	1·74	4	...		1·95	0
78·10	...	1·93	4	...		2·00	0
78·90	Fe I	2·39	4	...		2·37	2
80·40	Fe I	2·19	5	...		2·28	1
80·77	Nd II	1·99	2	...		...	
81·95	Ti I	2·08	2	...			
						2·69	4
82·36	Y II	2·43	5	...			
83·60	Fe I	1·62	3	...		...	
84·50	Ce II	1·82	3	...			
						2·39	2
85·13	Ca I, Zr II	2·08	4	...			
86·26	Ni I	1·88	4	...		...	
87·17	Sa II	1·91	4	...		...	
88·20	Fe I	1·83	4	...		...	
89·40	Cr I, Fe I	1·90	4	...			
						2·22	0
90·15	Fe I	1·80	4	...			
91·40	Fe I	2·35	7	...		2·34	2
92·50	La II	1·90	4	...		...	
93·17	...	1·65	3	...		...	
93·90	Cr I	1·92	4	...		2·34	1
97·41	...	...		...		2·08	0
98·29	Sc II	2·38	3	...			
						2·74	4
98·73	Cr I	2·26	3	...			
99·34	...	2·00	3	...			
						2·20	0
4700·13	Fe I	1·92	4	...			
01·05	Fe I	2·00	3	...		...	
01·42	Ni I	1·80	2	...		2·30	1
01·81	...	1·60	2	...		...	
03·00	Mg I	2·60	5	...		2·75	4
03·81	Ni I	2·03	3	...		...	
04·42	Sa II	1·92	3	...		2·11	0
04·96	Fe I	2·00	5	...		2·18	0
06·50	Nd II	2·10	4	...			
						2·53	1
07·21	Fe I	2·35	4	...			
07·92	Cr I	2·01	2	...		...	
08·70	Ti II	2·52	4	...		2·92	4
09·16	Fe I	2·22	2	...		...	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4709·97	Mn I	1·95	2	...		...	
10·32	Fe I	2·06	3	...		2·32	2
11·86	...	1·75	5	...		...	
13·10	Sa II	1·96	4	...		2·40	1
14·34	Ni I	2·43	6	...		2·45	1
15·75	Ni I	2·16	5	...		2·41	2
17·60	...	1·81	4	...		...	
18·40	Cr I	1·94	4	...		2·38	1
19·51	Ti II	2·06	3	...			
						2·66	2
20·06	La II	2·11	3	...			
21·06	Fe I	1·49	4	...		2·28	0
22·20	Zn I	2·06	6	...		2·22	1
23·19	...	1·81	4	...		2·32	1
24·48	Nd II	1·91	6	...		2·22	1
25·42	...	...		...		2·22	1
26·15	...	1·46	2	...		...	
27·42	Fe I	2·21	5	...		2·34	1
28·04	...	1·83	2	...			
						2·49	2
28·55	Fe I	2·21	3	...			
29·02	Fe I	1·81	1	...		...	
29·65	Fe I	1·71	3	...			
						2·22	1
30·01	Mg I	1·73	3	...			
31·54	Fe II	2·61	5	...		2·98	4
32·50	Ni I	1·61	1	...		...	
33·59	Fe I	2·14	4	...		2·43	4
34·07	Fe I	1·91	2	...		...	
35·82	Fe I	1·94	3	...		...	
36·80	Fe I	2·45	3	...		2·69	2
37·36	Cr I	2·10	2	...		...	
39·12	Mn I	1·86	3	...		...	
40·40	La II	2·22	3	...		2·53	2
41·02	...	1·52	0	...		...	
41·52	Fe I	2·10	4	...		2·38	1
42·94	La II	2·02	4	...		2·36	1
44·40	Fe I	1·82	3	...		...	
45·27	...	1·82	2	...		...	
45·72	Fe I	2·07	4	...		2·36	1
47·10	Ce II	...		...		2·36	2
48·16	...	2·11	4	...			
						2·46	2
48·74	La II	1·91	2	...			
49·60	...	1·82	3	...		...	
52·18	Ni I, Cr I	2·07	5	...		2·41	2
54·02	Mn I	2·31	5	...		2·51	2
54·75	Ni I	1·72	1	...		...	
55·64	Mn II	2·04	1	...		2·56	2
56·11	Cr I	2·04	1	...		...	
56·49	Ni I	2·10	1	...		2·28	1
57·56	Fe I	1·92	3	...		2·40	2
58·12	Ti I	1·62	1	...		...	
59·30	Ti I	1·92	3	...		2·28	1
61·38	Mn I	2·09	3	...		2·36	0
62·50	Mn I, Ti II	2·64	4	...		2·87	1

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4763·89	Ti II	2·65	3	...		2·85	1
64·56	Ti II	2·43	2	...		2·84	1
65·46	Fe I	2·01	1	...		...	
65·86	Mn I	2·10	1	...			
						2·53	2
66·42	Mn I	2·24	3	...			
68·32	Fe I	2·13	4	...		2·41	1
68·72	...	1·91	1	...		...	
70·00	C I	1·78	3	...		2·37	1
71·48	...	2·11	3	...			
						2·59	2
71·76	C I	1·98	1	...			
72·81	Fe I	2·12	4	...		2·37	1
73·98	Ce II	1·98	4	...		2·34	2
75·90	C I	1·93	1	...		...	
76·30	Fe I	1·83	1	...		...	
77·68	Cr II	1·43	0	...		...	
79·46	...	1·59	0	...			
						2·94	4
79·95	Ti II	2·57	6	...			
81·80	...	...		...		2·24	3
83·40	Mn I	2·36	4	...		2·51	3
83·86	Ce II	1·99	1	...		...	
86·62	Y II	2·54	6	...		2·66	3
88·00	Fe I	...		...		2·20	1
88·77	Fe I	1·94	3	...		...	
89·62	Fe I	2·42	4	...		2·40	2
91·24	Ti II	1·96	4	...		2·34	0
92·52	Cr I	2·30	5	...		2·49	2
97·15	Nd II	1·42	0	...		...	
98·30	Fe I	1·84	1	...			
						1·75	3
98·75	Ti II	2·42	4	...			
99·38	Nd II	1·59	0	...		...	
99·82	Ni I, Fe I	1·89	2	...		2·32	2
4800·68	Fe I	2·04	2	...			
						2·28	2
01·06	Cr I	1·84	1	...			
02·90	Fe I	1·89	4	...		...	
04·50	...	1·64	0	...			
						3·01	4
05·18	Ti II	2·66	5	...			
06·52	...	1·98	2	...			
						2·41	2
07·02	Ni I	1·95	2	...			
08·88	La II	2·16	4	...		2·28	2
10·58	Zn I	2·20	4	...		2·36	1
11·44	Nd II	1·89	2	...		2·11	0
12·31	Cr II	2·34	4	...		2·68	3
13·55	Co I	1·80	3	...		...	
14·61	...	1·70	3	...		...	
15·97	...	1·95	3	...		...	
17·94	Fe I	1·90	3	...		...	
20·50	Ti I, Nd II	1·90	3	...		...	
23·63	Mn I	2·68	3	...		2·79	0

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Continued*

Wave-length	Identification	*γ Cyg.* log A	wt	*α U. Min.* log A	wt	*ρ Cas.* Log A	wt.
4824·18	Cr II	2·65	3	...		2·95	2
25·58	Nd II	2·25	4	...		2·41	2
29·08	Ni I	2·31	6	...		2·48	2
31·18	Ni I	2·16	4	...		2·40	3
32·75	Fe I	2·21	3	...			
						2·57	2
33·50	...	2·04	2	...			
36·05	Cr II	2·49	6	...		2·71	4
38·58	Fe I, Ni I	1·99	3	...		...	
39·55	Fe I	2·22	3	...			
						2·57	4
40·30	Fe I	2·26	3	...			
41·70	Fe I	1·69	2	...		...	
43·04	Fe I	2·13	4	...		2·30	2
44·11	Fe I	2·01	4	...		...	
45·65	Fe I	1·81	2	...		...	
48·10	Cr II	...		...		2·95	3
49·05	Ti II	...		...		2·64	1
61·34	H β	3·67		...		...	
71·22	Fe I	...		...		2·71	1
72·15	Fe I	...		...		2·71	1
74·12	Ti II	...		...		2·87	4
76·51	Cr II	...		...		2·93	4
78·24	Fe I	...		...		2·40	3
81·58	Fe I	2·23	2	...		...	
82·16	Fe I	2·26	2	...		...	
83·78	Y II	2·73	3	...		3·05	3
84·62	Cr II	2·42	2	...			
						2·45	0
85·41	Fe I	2·28	2	...			
86·28	Fe I	2·22	2	...		2·30	1
87·16	Fe I	2·30	2	...		2·11	0
88·60	Fe I	1·98	1	...			
						2·40	3
89·07	Fe I	2·40	3	...			
90·80	Fe I	2·66	2	...		2·70	1
91·49	Fe I	2·72	2	...		2·76	1
92·80	Fe I	1·98	2	...		...	
93·84	Fe II	2·36	4	...		2·56	3
96·45	Fe I	1·83	3	...		...	
4900·14	Y II	2·73	6	...		2·98	5
03·38	Fe I	2·48	3	...		2·46	3
04·47	Ni I	2·10	2	...		2·15	1
05·10	Fe I	1·74	1	...		...	
06·39	...	1·49	1	...		...	
07·64	Fe I	2·13	3	...		1·90	0
09·22	Fe I	2·07	1	...		2·23	1
10·00	Fe I	2·42	2	...			
						2·56	0
10·58	Fe I	2·31	1	...			
11·18	Ti II	2·54	2	...		2·91	2
11·86	Ni I	2·12	1	...		...	
13·86	Ni I	2·19	3	...		2·28	1
14·46	...	1·93	2	...		...	
15·90	...	1·66	2	...		...	

TABLE 9. OBSERVATIONS OF LINE INTENSITIES IN THE SPECTRA OF SUPERGIANT STARS—*Concluded*

Wave-length	Identification	*γ Cyg.* log A	wt.	*α U. Min.* log A	wt	*ρ Cas.* log A	wt
4917·25	Fe I	1·99	3	...		...	
18·28	Ni I, Fe I	2·30	2	...			
						2·63	2
19·00	Fe I	2·57	2	...			
20·50	Fe I	2·77	3	...		3·00	3
21·01	La II	2·39	2	...		...	
21·78	La II	2·37	1	...		2·51	0
22·30	Cr I	2·15	1	...		...	
23·94	Fe II	2·90	3	...		3·16	4
24·78	Fe I	2·49	2	...		...	
25·57	Ni I	1·98	2	...		...	
27·34	Fe I	2·10	2	...			
						2·08	1
27·87	Fe I	2·05	2	...			
30·30	Fe I	2·07	3	...		...	
32·02	C I	2·05	3	...		2·23	1
33·40	Fe I	2·33	1	...		...	
34·10	Ba II	2·79	3	...		3·00	4
36·25	Cr I, Ni I	2·06	2	...		2·11	1
37·44	Ni I	2·19	3	...		2·20	0
38·19	Fe I	2·14	1	...		...	
38·86	Fe I	2·43	2	...		2·51	2
39·22	Fe I	2·13	1	...		...	
39·76	Fe I	2·34	2	...		2·20	0
42·48	Cr I	2·01	3	...		2·11	0
44·11	...	1·85	3	...		...	
45·63	Ni I, Fe I	2·03	2	...		...	
46·40	Fe I	2·33	3	...		...	
48·64	...	1·80	2	...		...	
49·96	Fe I	2·21	3	...		2·30	2
52·56	Fe I	2·02	2	...		2·30	2
53·20	Ni I	1·93	1	...		...	
54·00	...	1·98	1	...		2·28	2
54·80	Cr I, Fe I	1·99	2	...		...	
57·44	Fe I	2·83	6	...		2·88	4
61·94	Fe I	2·19	3	...		...	
62·56	Fe I	1·86	1	...		...	
65·97	Fe I	2·43	3	...		2·28	1