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COMMUNICATION FROM THE OBSERVATORY AT LEIDEN.

Photographic magnitudes of 658 stars from plates taken mainly by W. H. van den Bos with the 33 cm Leiden refractor, by *Ejnar Hertzsprung*.

In *Annalen van de Sterrewacht te Leiden* **14**, Part I I have collected the principal determinations of colour aequivalents of 734 bright stars within 95° of the North Pole. Among the different determinations of colour aequivalent the colour index or difference between the photographic and visual magnitude is one of the most accurate. Now it is well known, that the visual magnitudes of Potsdam differ about 1·3 times as much from the colour sensitiveness of common photographic plates as the visual magnitudes of Harvard. For this reason the visual magnitudes of Potsdam are specially well fitted for the determination of colour index in combination with photographic magnitudes. I therefore decided to determine photographic magnitudes of as many as possible of the 734 stars mentioned above with the aid of the 33 cm Leiden refractor, which was the instrument at my disposal best fitted for the purpose.

A grating consisting of wires 3·9 mm thick and separated by free spaces of 3·7 mm width was placed in front of the objective. The plates were taken 3·7 mm intrafocal. The aperture of the objective is 33 cm and the focal length 524 cm. The diameter of the intrafocal images therefore was ·23 mm. The light was not evenly distributed in the disc of this intrafocal image and the measurement in the HARTMANN microphotometer therefore difficult, except when during the taking of the plate the atmosphere was very unquiet. The accuracy reached is thus perhaps not so good as it would otherwise have been.

Ilford Monarch plates were used. The distance between the middle of the spectra of the first order and the central image is in the mean ·29 mm, corresponding to a mean effective wavelength of 4223 Å. The extinction for light of this wavelength is ^{m}·44 for each atmosphere passed through. The reduction of the measures has been made with the somewhat higher value ·5 m/atm. because of the frequently misty state of the air. As not many stars south of declination + 8° have been measured the differential correction for extinction seldom exceeds ^{m}·2.

The time of exposure usually was 20^{s}. The circumstance that the objective was between these short exposures protected by the shutter proved to be advantageous against the deposition of moisture on the lens by radiation in moisty air.

The photographic magnitude of a star, the central image of which is at the limit of measurability on ordinary plates, varies approximately from 7^{m} to 8^{m}. The well measurable range is about 3 magnitudes. When possible the spectra of the third and the fifth order were also measured.

The difference in magnitude between the spectra of the first order and the central image was provisionally taken equal to 1^{m}. Afterwards ^{m}·97 was adopted as the most probable value, to which the magnitudes given in the accompanying catalogue correspond.

Supposing the c_2/T values of WILSING to be free from magnitude error, it will be proved below that there is no sensible difference in scale between these photographic magnitudes and the visual ones of Potsdam. This is an advantage for the present purpose, as consequently the simple difference between the two magnitudes may be taken as colour aequivalent.

About 20 stars were usually photographed on each plate. Each star was given 3 exposures, or in special cases 6. In all 149 plates were used. Of these about 3/4 was taken by W. H. VAN DEN BOS, 1/8 by W. J. LUYTEN and 1/8 by the writer. All plates were measured in the HARTMANN microphotometer by the writer, the total number of settings being 38093.

The zero point of each plate was determined by comparison with the photographic magnitudes as calculated from the formula

$$m_{pg} = m_{\text{vis, Harv.}} + \cdot 623 \frac{c_2}{T} - 1\cdot 03,$$

where c_2/T is the mean value given in the Leiden Annals *l. c.* This formula holds for the photographic magnitudes of KING. To fix the zero point in this way stars of the mean photographic magnitude 5^m were used for each plate. Instead of thus basing the zero point on the visual Harvard magnitudes, a trial was made to use a few selected fundamental stars for the same purpose, but this trial was abandoned as the differences from the reduction just mentioned were unimportant. These fundamental stars will be recognisable in the catalogue given at the end of this paper by the high number of plates on which they occur. It was the intention to use *H. R.* 343, 1568, 3662, 4931, 6237 and 7955 as principal fundamental stars. They can all be taken with the opening of the dome turned both north and south.

The mounting of the telescope did not allow to photograph stars nearer than 8° to the North Pole.

From a comparison between the individual results the mean error of a magnitude from a single plate was found to be $\pm {}^m\cdot 08$ and from 3 plates $\pm {}^m\cdot 05$, which may be taken as the general mean error of the magnitudes contained in the catalogue, since, when there are more than 3 plates for any one star, the last plates were generally only added on account of bad agreement between the earlier plates, and no stars of less than 2 exposures have been included. The total weight of the catalogue may therefore be estimated to be $658\,(\pm {}^m\cdot 05)^{-2} = 263200\, m^{-2}$. The total weight of the magnitudes given in the old Draper Catalogue (*H. A.* **27**) is, according to WIRTZ (*A. N.* 4849 and 4863, **203**, 1 and 259; 1916), $10498\,(\pm {}^m\cdot 174)^{-2} = 347000\, m^{-2}$. I consider the accuracy reached as rather satisfactory having regard to the difficulty in measuring the somewhat deformed images in connection with the bad atmospheric conditions at Leiden, still made worse by the neighbourhood of smoking chimneys. Furthermore often stars lying in very different regions of the sky were compared. Finally the method used was very sensitive to small changes in focus relative to the position of the plate. Normally the plate was placed 3·7 *mm* or ·0007 f intrafocal, where f is the focallength. A change of ·00001 f or about ·05 *mm* will therefore affect the size of the intrafocal image by an amount corresponding to ${}^m\cdot 03$ on the wedge of the microphotometer. Nevertheless only very few plates had to be corrected for change in the zero point of the magnitudes during the exposure.

Occasionally neighbouring stars fainter than 5^m on the visual Harvard scale were measured on the plates. This was also done in view of the fact that all the photographically faintest stars of the program were yellow so that it seemed desirable to include at least a few fainter white stars. Besides a few other stars of special interest were added, e. g. λ Cephei showing the Pickering-series of Helium-lines and 61 Cygni.

The reduction of the measures was usually made for each plate separately. Even when two plates had been developed together they did not always show the same gradation. In this respect moonlight, of course, may be a serious disturbing factor.

Besides for differential extinction the magnitudes were corrected for distance of the images from the centre of the plate. This latter correction seldom exceeded a few hundredths of a magnitude. It amounted to $+{}^m\cdot 1$ at a distance of 28 mm from the centre. The positive sign is explained by the fact, that the diameter of the intrafocal images diminishes with increasing distance from the centre owing to the curvature of the field.

The difference in photographic gradation between white and yellow stars was only small (cf. *B. A. N.* **25**, 154) and has been neglected.

The trials I have made to fix the magnitude scale have not yet led to any definite result. The following is a summary of the methods used.

1. The geometrical measurement of photographs of the shadow of the grating gave in the mean $l/(d+l) = \cdot 485$, where d is the diameter of the wires and l the free space between them. This corresponds to a difference of magnitude between the central image and the spectra of the first order of $m_I - m_c = \cdot 915$.

2. From 215 differences between the spectra of the first and of the third order the mean value of the proportion $(m_{III} - m_I)/(m_I - m_c)$ was found to be 2·457. As $m_{III} - m_I$ ought to be $2^m\cdot 386$ in the normal scale, when d and l are equal or nearly so, the correction factor to the provisional magnitudes in this way comes out to be $2\cdot 386/2\cdot 457 = \cdot 971$.

The proportion $(m_c - m_o)/(m_I - m_c)$, where m_o is the magnitude of the image taken without grating before the lens, was, from two plates, on which exposures with and without grating were made next to each other, found to be 1·462 (relat. weight 3) and 1·496 (4) respectively, and in the mean from 4 other plates, which were reduced together, 1·604 (14) or in the general mean 1·563. The bad agreement between the individual values may perhaps be due to small changes in focus, when the grating was put on or taken off. The proportion $(m_{III} - m_o)/(m_I - m_c)$ is thus found to be $1\cdot 563 + 1 + 2\cdot 457 = 5\cdot 020$, while $m_{III} - m_I$ ought to be $4^m\cdot 871$ for $d = l$. The correction factor found in this way therefore is $4\cdot 871/5\cdot 020 = \cdot 970$.

The proportion $(m_V - m_{III})/(m_I - m_c)$ was found to be 1·290, but the spectra of the fifth order are too much elongated to be used for determination of the scale.

3. Consider two stars, for which the provisional magnitudes have been determined. If we were now able to find the provisional magnitude of their combined light it is evident, that the deviaton of this provisional magnitude from the magnitude calculated as if the adopted provisional magnitude scale were correct, will determine the correction factor to that provisional scale.

It is hard to find serious theoretical objections to this method, which on the other hand requires a rather great accuracy of the measures in order to give a reliable determination of scale.

The method may be practically tried with the aid of double stars, where the distance between the two components is equal to the distance of the spectra of the first order from the central image.

As the grating could not be turned in every position angle desired the choice of double stars fit for use was not great. Experiments were made with γ Delphini ($\vartheta = 270°·3$, $\rho = 10''·7$, $\Delta m_{pg} = ·23$) and Σ 401 ($\vartheta = 269°·6$, $\rho = 11''·4$, $\Delta m_{pg} = ·43$). Photographs of these double stars were taken with the grating in two different positions at right angles to each other in such a way that in one position of the grating the spectra of the first order of one component coincided with the central image of the other. The correction factor was thus found from two plates of γ Delphini and one plate of Σ 401 to be in the mean 1·023. But this value is still too uncertain to be considered as a determination of the factor.

In conclusion I consider $^{m}·97$ as the most probable value of the magnitude difference between the spectra of the first order and the central image. The magnitudes given at the end of this paper have been derived using this constant. I still estimate its mean error to be about ± ·03.

The c_2/T values of WILSING (*Potsdam Publ.* Nr. 74, 25, 1919) gave according to least squares for 162 stars the following formula

$$\frac{c_2}{T} = 2·017 + 1.358(m_{L,\,33\,\mathrm{cm}} - m_P) + ·00(m_{L,\,33\,\mathrm{cm}} + m_P)$$
$$\pm ·04 \qquad\qquad \pm ·02 \qquad (\mathrm{m.\ e.})$$

were m_P is the visual Potsdam magnitude. The values of c_2/T given in the last column of the catalogue correspond to this formula. It may be mentioned that the c_2/T values of WILSING occasionally show systematic deviations from the mean colour equivalent for stars situated in the same region. Thus the 5 stars measured by WILSING in Cassiopeia give

	c_2/T Wilsing	mean of all other c_2/T values including L,P	diff.
β Cassiop.	2·80	2·19	+·61
ζ —	1·92	1·32	+·60
η —	3·45	2·63	+·82
γ —	2·16	1.44	+·72
δ —	2·52	1·86	+·66

systematic difference +·68 ±·15 (m.e.)

The mean error of the systematic difference has been calculated under the assumption, that the mean error of a c_2/T value of WILSING is ±·33.

It is supposed that I measured the combined light of the two components of double stars, when the distance was below 3″ and that the components were measured separately, when the distance was above 7″. The following double stars, where the significance of the measures is doubtful, have not been included in the catalogue.

H.R.	Σ		$m_{L,\,33\,\mathrm{cm}}$	number of plates	distance
4259	1487	54 *Le*	4·48	3	6″·48
5385*	1835	— *Bo*	4·95	3	6 ·27
5788*	1954	δ *Sp*	4·08	3	3 ·61
5834	1965	ζ *Co*	4·83	4	6 ·24

A comparison of my provisional magnitudes $m'_{L,\,33\,\mathrm{cm}}$ with the photographic magnitudes of KING (*Harv. Ann.* **76**, N°. 6, 117; 1915) gave according to least squares the formula

$$m_K - m'_{L,\,33\,\mathrm{cm}} =$$
$$+·081 + ·0034\,(m_K + m'_{L,\,33\,\mathrm{cm}} - 7) - ·038\,(c_2/T - 2)$$
$$\pm ·0048 \qquad\qquad \pm ·010 \qquad (\mathrm{m.\ e.})$$

The provisional magnitudes based on the assumption $m_I - m_c = 1^{m}$ therefore show no sensible difference in scale from the magnitudes of KING. The colour equation is also small. When two stars of spectrum A and K respectively ($\Delta c_2/T = 2$) are equal on the scale of $m_{L,\,33\,\mathrm{cm}}$ the K-star will be $^{m}·076 \pm ^{m}·021$ (m. e.) brighter than the A-star on the scale of KING.

The relation between m_K and my definitive magnitudes $m_{L,\,33\,\mathrm{cm}} = ·15 + ·97\, m'_{L,\,33\,\mathrm{cm}}$ is

$$m_K = -·099 + 1·038\, m_{L,\,33\,\mathrm{cm}} - ·038\,(c_2/T - 2)$$

A similar comparison of $m'_{L,\,33\,\mathrm{cm}}$ with the magnitudes of the *Göttingen Actinometry* yielded the formula

$$m'_{L,\,33\,\mathrm{cm}} - m_G =$$
$$+·071 + ·0270\,(m'_{L,\,33\,\mathrm{cm}} + m_G - 10) + ·006\,(c_2/T - 2)$$
$$\pm ·0058 \qquad\qquad \pm ·010 \qquad (\mathrm{m.\ e.})$$

Hence there is no sensible colour equation between the two series. The relation between m_G and my definitive magnitudes $m_{L,\,33\,\mathrm{cm}}$ is

$$m_G = +{\cdot}047 + {\cdot}977\, m_{L,\,33\,\mathrm{cm}} - {\cdot}006\,(c_2/T - 2)$$

The definitive scale of $m_{L,\,33\,cm}$ is therefore intermediate between the scales of Göttingen and KING.

The weight of a single value of c_2/T as derived from the difference between $m_{L,\,33\,cm}$ and m_P is found to be 43 corresponding to a mean error of $\pm\,{\cdot}15$. The total weight of the 631 L,P values of c_2/T therefore is 27133 or, not counting the stars fainter than 5^m on the visual Harvard scale, about 40 percent of the total weight of the c_2/T values given in *Leiden Ann.* **14**. It must be remarked, that the visual Potsdam magnitude has been used both in *Leiden Ann.* **14** in connection with m_G and in the present note with m_L for the derivation of colour equivalents. This double use of m_P has been made for 121 stars. In such cases I should reject the combination G,P and prefer L,P.

In the case of narrow double stars the *HR* number of the preceding component has been given and marked with an asterisk.

Perhaps the most striking fact shown by the present values of c_2/T is, that the very high effective temperatures have disappeared. It seems even doubtful, if c_2/T is really below 1·2 for a single star of the catalogue. A comparison with the direct colour estimates of OSTHOFF tends to show, that I have overcorrected his colours of faint white stars for magnitude equation. I am now inclined to think, that proceeding from bright to faint white stars OSTHOFF first estimates the colour as white, then somewhat yellowish, and finally whiter again. This may account for the discrepancies between the colours of stars of the same spectrum but of different apparent magnitude mentioned in *Leiden Ann. l. c.*, p. 14. It will be one of the most important things in future investigations of this kind to get rid of a possible magnitude error. Perhaps measures of effective wavelengths over a considerable range of apparent magnitude will be fit for this purpose.

The stars showing colours appreciably deviating from what is considered as normal for their spectral types are of special interest. A list of 11 such stars with spectra ranging from *B*0 to *A*2 is given below.

H.R.		spectrum *HD*	c_2/T *L,P* (weight 43)	Leiden Ann. 14 c_2/T	Leiden Ann. 14 weight	galactic latitude	$\frac{\upsilon_0}{\sin\lambda}$	$\sin^2\lambda$
						°	″/a	
130	*ϰ Cs*	*B*0	1·98	2·10	69	− 1	+ ·08	·83
7763	*P Cy*	*B*0*p*	2·44	2·46	71	0	− ·24	·22
8047	*f*₁ *Cy*	*B*0*p*	2·02	1·99	24	0	+ ·12	·36
1131	*o Pe*	*B*1	2·16	1·75	106	− 17	+ ·17	·89
1843	*χ Ag*	*B*1	2·21	1·93	69	0	+ ·18	·81
2135	*χ*₂ *Or*	*B*2*p*	2·22	2·40	69	0	+ ·15	·60
7977	55 *Cy*	*B*2	2·53	2·82	24	+ 1	+ ·03	·33
8279	9 *Cf*	*B*2	2·19	2·05	75	+ 7	+ ·07	·52
1035	— *Cd*	*B*9	2·30	2·18	76	+ 3	+ ·02	·99
1040	— *Cd*	*A*0*p*	2·49	2·55	86	+ 3	+ ·05	·99
8334	*ν Cf*	*A*2*p*	2·64	2·47	69	+ 5	− ·02	·53

The two last columns relate to the secular parallax of the stars; υ_0 is the component of the annual proper motion directed away from the sun's apex reduced to the apparent vis. Harvard magnitude 0^m; λ is the angular distance of the star from the apex. The median value of $\upsilon_0/\sin\lambda$ is $+\,''{\cdot}08$ annually corresponding to a secular parallax of $+\,''{\cdot}019$. The median absolute magnitude therefore is $5 \log {\cdot}019 = -8^m{\cdot}61$. The mean value of c_2/T for the 11 stars is 2·26, while for our sun it is 2·47. The difference in surface brightness between two black bodies with these values of c_2/T is ${}^m{\cdot}42$. The absolute magnitude of the sun being $-\,{}^m{\cdot}33$ for $c_2/T = 2{\cdot}47$ it would for $c_2/T = 2{\cdot}26$ be $-\,{}^m{\cdot}33 - {}^m{\cdot}42 = -\,{}^m{\cdot}75$. The 11 stars considered are in the mean $8^m{\cdot}61 - {}^m{\cdot}75 = 7^m{\cdot}86$ brighter. If they are radiating like black bodies with the same approximation as our sun, their volume will in the mean be $10^{4{\cdot}7}$ times greater.

The eclipsing variable *β* Lyrae (spectrum *B*2*p*, $c_2/T = 1{\cdot}94$), which on account of its variability has not been treated in the present note, probably also belongs to the same group as the 11 stars here considered. From the spectroscopic and photometric elements of this system a volume about 10^5 times that of our sun is derived. This is in remarkable accordance with the above hypothetical result for the 11 stars.

For comparison it may be added that a similar calculation for the four absolutely bright yellow members of the Hyades (γ, δ_1, ε and ϑ_1 Tauri, mean $c_2/T = 3{\cdot}25$, mean vis. Harv. magn. $3^m{\cdot}86$), for which we have a fair value of the parallax ($''{\cdot}027$), gives in the mean a volume $10^{3{\cdot}1}$ times that of our sun or $10^{1{\cdot}6}$ times less than the 11 stars showing higher effective temperature ($c_2/T = 2{\cdot}26$). Even if the 11 stars were at an average 40 times more massive than the bright yellow Hyades, they would according to the above assumptions not be denser.

Several of the whiter stars here considered have recently (*Ap. J.* **56**, 242; 1922) been classified according to their spectrum by ADAMS and JOY. The following mean values of c_2/T (L,P) were found

spectrum	number of stars	mean value of c_2/T
B 9	12	1·68
A 0	18	1·72
A 1	16	1·80
A 2	18	1·81
A 3	15	1·91
A 4	11	2·14
A 5	8	2·01

These results extend the first part of Table III in *Leiden Ann.* **14**, p. 15, containing stars of the Sun-series (dwarfs) to still whiter stars giving very nearly a linear relation between Mount Wilson spectral class and c_2/T, viz. for spectra *A*, *F*, *G* and *K* respectively $c_2/T = 1{\cdot}75,\ 2{\cdot}20,\ 2{\cdot}65$ and $3{\cdot}10$.

It was for the purpose of comparison with other scales thought desirable to determine also the magnitudes of a few fainter stars in the Plejades on the scale used in the present paper. For this purpose some plates of selected stars in the Plejades were taken with longer exposure times. The results are given in the table below, arranged according to magnitude including the stars contained in the main catalogue.

No.*)	$m_{L,\,33\,cm}$	No.	$m_{L,\,33\,cm}$	No.	$m_{L,\,33\,cm}$	No.	$m_{L,\,33\,cm}$
	m		m		m		m
144	2·87	34	5·50	94	7·50	159	10·49
219	3·66	46	5·58	132	8·57	189	10·66
38	3·69	76	5·71	121	8·72	166	10·74
71	3·85	133	6·34	59	9·02	151	12·29
90	4·20	78	6·43	126	9·22	98	12·47
49	4·26	113	6·79	104	9·81	153	12·60
224	5·05	145	6·93	173	9·89	154	12·78
185	5·40	63	7·35	123	9·99	152	12·81

The star *BD* + 32°1027 of photographic magnitude $6^{m}{\cdot}46$ is not in the Potsdam Photometry. This is evidently due to the misprinted magnitude of this star ($9^{m}{\cdot}5$) in the first edition of the *BD*.

HR or *BD*	name	phgr. magn. $m_{L,\,33\,cm}$	number of plates	colour-index $m_{L,\,33\,cm} - m_P$	c_2/T L, P
15	α Ad	1·97	3	− ·45	1·40
21	β Cs	2·80	4	+ ·24	2·34
39	γ Pg	2·63	3	− ·65	1·13
45	χ Pg	6·72	3	+ 1·72	4·35
63	ϑ Ad	4·68	3	+ ·01	2·03
68	σ Ad	4·59	3	− ·11	1·87
123	λ Cs	4·67	3	− ·26	1·67
130	ϰ Cs	4·35	3	− ·03	1·98
144	— Cs	5·00	2	− ·32	1·58
153	ζ Cs	3·48	4	− ·60	1·20
154	π Ad	4·16	3	− ·36	1·53
163	ε Ad	5·35	3	+ ·83	3·14
165	δ Ad	4·80	3	+ 1·32	3·81
168	α Cs	3·71	3	—	—
179	ξ Cs	4.65	3	− ·43	1·43
193	ο Cs	4·55	3	− ·31	1·60
215	ζ Ad	5·40	4	+ 1·06	3·46
219	η Cs	4·18	4	+ ·46	2·64
224	δ Pi	6·23	3	+ 1·58	4.16
226	ν Ad	4·32	3	− ·48	1·37
244	— Cs	5·51	3	+ ·45	2·63
253	$υ_1$ Cs	6·32	3	+ 1·31	3·80
264	γ Cs	2·09	4	− ·37	1·51
265	$υ_2$ Cs	5·84	3	+ ·98	3·35
269	μ Ad	3·94	3	− ·c9	1·89
271	η Ad	5·52	3	+ ·92	3·27
294	ε Pi	5·38	3	+ ·72	3·00
335	φ Ad	4·10	3	− ·32	1·58
337	β Ad	3·99	3	+ 1·67	4·28
343	ϑ Cs	4·56	19	− ·02	1·99
351	χ Pi	5·89	3	+ 1·17	3·61
352	τ Pi	5·81	3	+ 1·21	3·66
360	φ Pi	5·92	3	+ 1·08	3·48
383	υ Pi	4·71	3	− ·30	1·61
390	ξ Ad	6·09	3	+ 1·05	3·44
399	ψ Cs	6·03	3	+ 1·07	3·47
403	δ Cs	2·90	4	− ·06	1·94
417	ω Ad	5·26	3	+ ·24	2·34
437	η Pi	4.78	3	+ ·71	2·98
442	χ Cs	5·92	3	+ 1·11	3·52

HR or *BD*	name	phgr. magn. $m_{L,\,33\,cm}$	number of plates	colour-index $m_{L,\,33\,cm} - m_P$	c_2/T L, P
458	υ Ad	4·72	4	+ ·44	2·62
464	υ Pe	5·14	5	+ 1·33	3·82
477	τ Ad	4·85	3	− ·37	1·52
489	ν Pi	6·06	3	+ 1·36	3·86
496	φ Pe	4·08	3	− ·19	1·76
510	ο Pi	5·36	3	+ ·80	3·10
533	1 Pe	5·37	3	− ·43	1·43
542	ε Cs	3·33	4	− ·31	1·60
544	α Tr	4·01	3	+ ·37	2·52
545	} γ As	4·43	3	} − ·43	} 1·44
546	} γ As	4·52	3		
549	ξ Pi	5·73	3	+ ·82	3·13
553	β As	2·90	3	− ·12	1·85
569	λ As	5·11	3	+ ·09	2.14
575	A Cs	4·80	3	+ ·08	2·13
580	50 Cs	4·10	3	− ·02	1.99
590	g Pe	4·93	12	− ·29	1.62
603	} γ Ad	3·91	3	—	—
604	} γ Ad	4·84	3	—	—
617	α As	3·39	3	+ 1·20	3·65
620	58 Ad	4·91	3	− ·04	1·97
622	β Tr	3·19	3	− ·11	1·86
649	$ξ_1$ Ce	5·32	4	+ ·62	2·86
664	γ Tr	4·02	3	− ·26	1·67
699	65 Ad	6·63	5	+ 1·80	4·46
707	ι Cs	4·72	3	− ·06	1·94
718	$ξ_2$ Ce	4·23	5	− ·25	1·68
779	δ Ce	3·92	2	—	—
788	12 Pe	5·57	3	+ ·33	2·47
799	ϑ Pe	4·69	3	+ ·36	2·51
801	35 As	4·51	3	− ·41	1·46
804	γ Ce	3·55	2	− ·25	1·68
813	μ Ce	4·62	4	+ ·21	2·30
824	39 As	5·81	3	+ 1·02	3·40
834	η Pe	5·81	4	+ 1·90	4·60
838	41 As	3·54	3	− ·13	1·84
840	16 Pe	4·59	3	+ ·08	2·13
843	17 Pe	6·46	4	+ 1·80	4·46
854	τ Pe	4·79	3	+ ·69	2·95
855	20 Pe	5·85	2	+ ·21	2·30

HR or *BD*	name	phgr. magn. $m_{L,\,33\,cm}$	number of plates	colour-index $m_{L,\,33\,cm} - m_P$	c_2/T L, P
879	π Pe	4·72	3	− ·16	1·80
882	24 Pe	6·40	3	+ 1·30	3·78
887*	ε As	4·68	3	− ·06	1·94
896	λ Ce	4·65	3	− ·31	1·60
911	α Ce	4·57	2	+ 1·68	4·30
915	γ Pe	3·79	4	+ ·62	2·86
932	— Cs	4·96	4	− ·16	1·80
937	ι Pe	4·70	3	+ ·48	2·67
941	ϰ Pe	4·92	3	+ ·94	3·29
947	ω Pe	5·96	4	+ 1·26	3·73
951	δ As	5·59	4	+ ·91	3·25
972	ζ As	4·88	4	− ·21	1·73
985	— Cd	4·69	4	− ·33	1·57
991	— Pe	6·69	8	+ 1·73	4·37
996	ϰ Ce	5·63	2	+ ·40	2·56
999	— As	6·32	3	+ 1·78	4·43
1002	l Pe	5·03	3	− ·15	1·81
1017	α Pe	2·39	4	+ ·23	2·33
1030	ο Ta	4·67	3	+ ·81	3·12
1034	— Pe	4·88	3	− ·35	1·54
1035	— Cd	4·64	4	+ ·21	2·30
1038	ξ Ta	3·76	3	− ·18	1·77
1040	— Cd	5·10	4	+ ·35	2·49
1044	34 Pe	4·64	4	− ·28	1·64
1046	— Cd	5·11	10	− ·15	1·82
1051	— Pe	5·83	3	− ·21	1·74
1052	σ Pe	6·05	3	+ 1·53	4·10
1066	f Ta	5·43	3	+ ·99	3·36
1087	ψ Pe	4·25	3	− ·38	1·50
1122	δ Pe	2·94	4	− ·37	1·51
1129	— Cd	5·71	4	+ ·79	3·09
1131	ο Pe	3·95	3	+ ·11	2·16
1135	ν Pe	4·34	4	+ ·34	2·48
1140	16 Ta	5·50	7	− ·40	1·47
1142	17 Ta	3·69	6	− ·32	1·58
1144	18 Ta	5·58	4	− ·48	1·37
1145	q Ta	4·26	6	− ·35	1·54
+ 23° 512		7·35	5	− ·16	1·80
1148	— Cd	4·72	4	− ·12	1·85
1149	20 Ta	3·85	7	− ·26	1·66

*) EUG.—CH. GAULTIER, *Bull. de la Soc. Astr. de France* **14**, 445; 1900 and *Publ. de l'observ. central Nicolas*, Sér. 2, Vol. 17, Figure 1; 1912.

HR or BD	name	phgr. magn. $m_{L, 33\,cm}$	number of plates	colour-index $m_{L, 33\,cm} - m_P$	c_2/T L, P
1151	21 *Ta*	5·71	4	— ·43	1·43
1152	22 *Ta*	6·43	5	— ·28	1.64
1155	— *Cd*	6·69	4	+ 2·21	5·02
1156	23 *Ta*	4·20	4	— ·14	1·83
+ 23° 536		6·34	6	— ·32	1·58
1165	η *Ta*	2·87	6	— ·22	1·72
1172	— *Ta*	5·40	3	— ·43	1·44
1178	27 *Ta*	3·66	4	— ·26	1·67
1180	28 *Ta*	5·05	4	— ·31	1·60
1203	ζ *Pe*	3·08	4	— ·05	1·95
1204	— *Cd*	4·93	4	— ·27	1·65
1220	ε *Pe*	2·79	3	— ·35	1·54
1228	ξ *Pe*	4·18	3	— ·10	1·88
1256	A_1 *Ta*	5·74	4	+ 1·26	3·73
1261	λ *Pe*	4·41	3	— ·10	1·88
1273	*c* *Pe*	4·18	3	— ·15	1·81
1303	μ *Pe*	5·30	3	+ 1·04	3·43
1306	*f* *Pe*	5·89	3	+ 1·12	3·54
1311	47 *Ta*	5·80	3	+ ·75	3·04
1320	μ *Ta*	4·28	3	— ·26	1·67
1324	*b* *Pe*	4·68	3	— ·18	1·77
1329	ω *Ta*	5·28	5	+ ·08	2·13
1346	γ *Ta*	4·85	3	+ ·87	3·20
1350	*d* *Pe*	4·85	3	— ·15	1·81
1373	δ_1 *Ta*	4·98	3	+ ·82	3·13
1380	δ_2 *Ta*	5·03	3	— ·09	1·90
1387	$\varkappa$ *Ta*	4·45	4	— ·13	1·84
1388	67 *Ta*	5·63	4	+ ·10	2·15
1389	δ_3 *Ta*	4·37	3	— ·17	1·79
1392	υ *Ta*	4·61	3	+ ·09	2·14
1394	71 *Ta*	4·79	3	— ·01	2·00
1396	π *Ta*	5·87	3	+ ·87	3·20
1409	ε *Ta*	4·73	3	+ ·85	3·17
1411	ϑ_1 *Ta*	5·02	3	+ 1·09	3·50
1412	ϑ_2 *Ta*	3·68	3	·00	2·02
1427	— *Ta*	4·96	3	— ·06	1·94
1444	ρ *Ta*	5·01	3	+ ·12	2·18
1454	*e* *Pe*	5·80	3	+ 1·43	3·96
1457	α *Ta*	2·97	3	+ 1·82	4·48
1458	*d* *Ta*	4·47	4	+ ·07	2·11
1473	*c* *Ta*	4·43	3	— ·23	1·71
1478	σ_1 *Ta*	5·32	3	— ·02	1·99
1479	σ_2 *Ta*	4·93	3	— ·01	2·00
1497	τ *Ta*	4·19	3	— ·29	1·62
1542	9 *Cd*	4·27	4	— ·32	1·58
1544	π_2 *Or*	4·45	3	— ·23	1·71
1568	7 *Cd*	4·47	17	— ·23	1·70
1570	π_1 *Or*	4·73	3	— ·21	1·73
1577	ι *Ag*	4·59	3	+ 1·75	4·39
1580	o_2 *Or*	5·49	3	+ 1·27	3·74
1592	4 *Ag*	5·04	3	— ·06	1·94
1603	10 *Cd*	5·04	4	+ ·90	3·24
1605	ε *Ag*	3·83	3	—	—
1612	ζ *Ag*	5·28	4	+ 1·43	3·96
1620	ι *Ta*	4·81	3	— ·09	1·90
1637	9 *Ag*	5·43	3	+ ·27	2·38
1638	11 *Or*	4·68	3	— ·40	1·47
1641	η *Ag*	3·10	4	— ·36	1·53
1676	15 *Or*	5·20	3	·00	2·02
1689	μ *Ag*	5·07	3	+ ·07	2·11

HR or BD	name	phgr. magn. $m_{L, 33\,cm}$	number of plates	colour-index $m_{L, 33\,cm} - m_P$	c_2/T L, P
1708	α *Ag*	1·04	4	+ ·61	2·84
1726	16 *Ag*	6·04	3	+ 1·49	4·04
1729	λ *Ag*	5·39	3	+ ·56	2·78
1791	β *Ta*	1·59	4	— ·42	1·45
1810	*o* *Ta*	4·72	3	— ·33	1·57
1843	χ *Ag*	5·06	3	+ ·14	2·21
1845	119 *Ta*	6·87	3	+ 2·33	5·18
+ 32° 1027		6·46	2	—	—
1876	φ_1 *Or*	4·25	3	— ·43	1·43
1907	φ_2 *Or*	5·20	3	+ 1·00	3·38
1910	ζ *Ta*	2·80	3	— ·49	1·35
1946	126 *Ta*	4·73	3	— ·39	1·50
1995	τ *Ag*	5·48	3	+ ·78	3·08
2010	134 *Ta*	4·82	3	— ·28	1·64
2011	υ *Ag*	6·66	3	+ 1·83	4·50
2012	ν *Ag*	5·33	3	+ 1·15	3·58
2029	ξ *Ag*	5·01	11	— ·14	1·83
2034	136 *Ta*	4·62	3	— ·22	1·72
2047	χ_1 *Or*	5·09	3	+ ·44	2·61
2077	δ *Ag*	4·94	13	+ 1·02	3·40
2084	139 *Ta*	4·74	3	— ·28	1·64
2088	β *Ag*	2·01	4	— ·20	1·75
2091	π *Ag*	6·42	3	+ 2·08	4·84
2095	ϑ *Ag*	2·66	4	— ·21	1·72
2124	μ *Or*	4·37	3	+ ·01	2·03
2134	1 *Ge*	5·19	3	+ ·82	3·13
2135	χ_2 *Or*	4·95	3	+ ·15	2·22
2159	ν *Or*	4·28	3	— ·34	1·56
2198	f_1 *Or*	4·79	3	— ·40	1·48
2199	ξ *Or*	4·29	3	— ·31	1·60
2209	— *Cd*	4·69	3	— ·27	1·65
2219	$\varkappa$ *Ag*	5·47	3	+ ·91	3·25
2238	2 *Lx*	4·39	3	— ·26	1·67
2286	μ *Ge*	4·89	3	+ 1·83	4·50
2343	ν *Ge*	3·99	3	— ·43	1·43
2421	γ *Ge*	1·99	4	— ·35	1·54
2456	*S* *Mo*	4·39	3	—	—
2470	12 *Lx*	4·89	2	— ·11	1·87
2473	ε *Ge*	4·72	3	+ 1·51	4·07
2478	30 *Ge*	5·92	3	+ 1·35	3·85
2484	ξ *Ge*	3·84	3	+ ·21	2·30
2527	— *Cd*	6·23	3	+ 1·51	4·07
2540	ϑ *Ge*	3·70	3	— ·14	1·83
2560	15 *Lx*	5·32	2	+ ·79	3·09
2564	*e* *Ge*	5·05	3	+ ·27	2·39
2585	ψ_{10} *Ag*	4·93	3	— ·23	1·71
2697	τ *Ge*	5·94	3	+ 1·35	3·85
2751	— *Lx*	5·10	3	— ·06	1.94
2763	λ *Ge*	3·71	3	— ·04	1·96
2777	δ *Ge*	3·85	3	+ ·16	2·23
2818	21 *Lx*	4·58	3	— ·22	1·72
2821	ι *Ge*	4·95	3	+ ·99	3·36
2845	β *Ca'*	2·78	3	— ·42	1·45
2852	ρ *Ge*	4·51	3	+ ·11	2·17
2854	γ *Ca'*	5·97	3	+ 1·67	4·28
2864	6 *Ca'*	5·98	3	+ 1·22	3·67
2905	υ *Ge*	5·86	3	+ 1·68	4·30
2930	*o* *Ge*	5·28	4	+ ·20	2·29
2946	24 *Lx*	4·99	2	— ·19	1·76
2973	σ *Ge*	5·42	6	+ 1·04	3·43

HR or BD	name	phgr. magn. $m_{L, 33\,cm}$	number of plates	colour-index $m_{L, 33\,cm} - m_P$	c_2/T L, P
2985	$\varkappa$ *Ge*	4·59	3	+ ·84	3·16
2990	β *Ge*	2·26	3	+ ·75	3·03
3067	φ *Ge*	5·00	4	— ·25	1·68
3173	27 *Lx*	4·73	4	— ·27	1·65
3249	β *Cc*	5·28	3	+ 1·54	4·11
3275	31 *Lx*	6·00	4	+ 1·79	4·45
3323	*o* *Ur*	4·24	3	+ ·81	3·12
3403	π_2 *Ur*	5·99	3	+ 1·24	3·70
3449	γ *Cc*	4·56	4	— ·34	1·56
3461	δ *Cc*	5·17	5	+ 1·13	3·55
3474	} ι *Cc*	6·52	5	— ·60	1·21
3475		5·12	5	+ ·94	3·30
3569	ι *Ur*	3·35	4	— ·05	1·95
3572	α *Cc*	4·43	3	— ·13	1·84
3576	ρ *Ur*	6·70	3	+ 1·74	4·38
3579	10 *Ur*	4·37	3	+ ·25	2·36
3594	$\varkappa$ *Ur*	3·64	3	— ·22	1·72
3612	— *Ur*	5·83	3	+ 1·04	3·43
+ 38° 1999		7·10	2	+ ·26	2·37
3616	σ_2 *Ur*	5·37	3	+ ·31	2·44
3619	*f* *Ur*	4·76	4	+ ·09	2·14
3624	τ *Ur*	5·09	3	+ ·29	2·42
3662	*e* *Ur*	5·00	16	+ ·01	2·03
3690	38 *Lx*	3·94	5	— ·04	1·96
3705	40 *Lx*	5·05	5	+ 1·67	4·28
3731	$\varkappa$ *Le*	5·94	5	+ 1·28	3·76
3751	— *Dr*	6·18	2	+ 1·76	4·41
3757	*h* *Ur*	4·00	3	+ ·14	2·21
3771	*d* *Ur*	5·49	3	+ ·69	2·96
3773	λ *Le*	6·21	5	+ 1·71	4·34
3775	ϑ *Ur*	3·77	5	+ ·28	2·40
3799	26 *Ur*	4·50	5	— ·28	1·64
3800	10 *Le'*	5·65	4	+ ·85	3·17
3809	— *Lx*	6·05	4	+ 1·07	3·47
3834	2 *Sx*	6·21	2	+ 1·31	3·80
3852	*o* *Le*	4·21	3	+ ·33	2·46
3873	ε *Le*	4·00	4	+ ·78	3·08
3888	υ *Ur*	4·14	4	+ ·13	2·19
3894	φ *Ur*	4·58	4	— ·16	1·80
3905	μ *Le*	5·39	4	+ 1·31	3·80
3950	π *Le*	6·62	2	+ 1·86	4·55
3974	21 *Le'*	4·68	3	— ·03	1·98
3975	η *Le*	3·59	4	— ·23	1·71
3980	*A* *Le*	6·17	3	+ 1·65	4·26
3982	α *Le*	1·36	3	— ·37	1·51
4031	ζ *Le*	3·81	3	+ ·08	2·13
4033	λ *Ur*	3·54	3	— ·14	1·83
4054	40 *Le*	5·30	3	+ ·21	2·30
4069	μ *Ur*	5·01	3	+ 1·72	4·35
4072	— *Ur*	4·92	3	— ·28	1·64
4090	30 *Le'*	5·00	3	+ ·04	2·07
4100	31 *Le'*	5·21	3	+ ·88	3·21
4112	36 *Ur*	5·46	11	+ ·34	2·48
4132	— *Ur*	4·96	3	— ·06	1·94
4133	ρ *Le*	3·67	3	— ·31	1·60
4166	37 *Le'*	5·55	3	+ ·65	2·90
4247	46 *Le'*	4·97	3	+ 1·04	3·43
4248	ω *Ur*	4·57	3	— ·41	1·47
4295	β *Ur*	2·37	3	— ·26	1·66
4300	*b* *Le*	4·38	3	— ·24	1·69

HR or *BD*	name	phgr. magn. $m_{L, 33\,cm}$	number of plates	colour-index $m_{L, 33\,cm} - m_P$	c_2/T *L*, *P*
4301	α *Ur*	3·13	3	+ 1·09	3·50
4310	χ *Le*	4·97	3	+ ·09	2·14
4335	ψ *Ur*	4·33	3	+ 1·07	3·47
4357	δ *Le*	2·78	3	— ·14	1·83
4359	ϑ *Le*	3·41	3	— ·17	1·79
4362	72 *Le*	6·54	4	+ 1·87	4·56
4374*	ξ *Ur*	4·41	3	+ ·49	2·68
4377	ν *Ur*	5·19	3	+ 1·57	4·15
4380	55 *Ur*	4·76	3	— ·18	1·78
4399	ι *Le*	4·32	2	+ ·10	2·15
4434	λ *Dr*	5·82	3	+ 1·98	4·70
4517	ν *Vg*	5·82	2	+ 1·62	4·22
4518	χ *Ur*	5·06	4	+ 1·21	3·66
4527	93 *Le*	5·05	3	+ ·31	2·44
4534	β *Le*	2·23	3	— ·39	1·49
4554	γ *Ur*	2·49	4	— ·19	1·76
4589	π *Vg*	4·70	2	— ·17	1·79
4608	ο *Vg*	5·25	3	+ ·95	3·31
4660	δ *Ur*	3·42	3	— ·10	1·88
4697	11 *Cm*	5·89	4	+ 1·01	3·39
4707	12 *Cm*	5·29	4	+ ·27	2·38
4716	5 *Ca"*	5·79	4	+ ·79	3·09
4737	15 *Cm*	5·63	3	+ 1·14	3·57
4785	8 *Ca"*	4·82	4	+ ·36	2·51
4787	κ *Dr*	3·69	3	— ·41	1·46
4789	23 *Cm*	4·78	4	— ·34	1·57
4791	} 24 *Cm*	6·76	4	—	—
4792		6·27	4	—	—
4828	ρ *Vg*	4·94	4	— ·17	1·79
4905	ε *Ur*	1·81	3	— ·35	1·54
4914	} 12 *Ca"*	5·94	3	—	—
4915		2·83	3	—	—
4920	36 *Cm*	6·62	4	+ 1·84	4·52
4931	78 *Ur*	5·32	11	+ ·19	2·28
4932	ε *Vg*	3·97	2	+ ·86	3·18
4954	41 *Cm*	6·56	4	+ 1·61	4·20
4968*	42 *Cm*	4·85	5	+ ·31	2·44
4983	43 *Cm*	4·84	5	+ ·39	2·55
5017	20 *Ca"*	4·98	5	·00	2·02
5054	} ζ *Ur*	2·33	6	—	—
5055		4·12	6	—	—
5062	*g Ur*	4·22	5	+ ·04	2·06
5110	— *Ca"*	5·37	6	+ ·26	2·37
5112	24 *Ca"*	4·84	6	— ·12	1·86
5127	25 *Ca"*	5·05	5	+ ·03	2·06
5154	83 *Ur*	6·58	3	+ 1·94	4·65
5185	τ *Bo*	4·93	5	+ ·19	2·28
5191	η *Ur*	1·70	3	— ·56	1·26
5200	υ *Bo*	5·87	5	+ 1·80	4·46
5219	— *Ca"*	6·62	2	+ 1·72	4·36
5226	*i Dr*	6·41	3	+ 1·63	4·23
5235	η *Bo*	3·25	2	+ ·17	2·25
5291	α *Dr*	3·54	3	— ·30	1·61
5304	*d Bo*	5·32	4	+ ·20	2·29
5321	4 *Ur'*	6·41	3	+ 1·47	4·01
5328	} κ *Bo*	7·05	12	—	—
5329		4·73	15	—	—
5340	α *Bo*	1·30	2	+ 1·06	3·45
5350	ι *Bo*	4·93	6	— ·05	1·95
5351	λ *Bo*	4·24	5	— ·16	1·80

HR or *BD*	name	phgr. magn. $m_{L, 33\,cm}$	number of plates	colour-index $m_{L, 33\,cm} - m_P$	c_2/T *L*, *P*
5360	— *Bo*	6·21	3	— ·26	1·67
5361	*A Bo*	6·04	4	+ 1·06	3·46
5370	20 *Bo*	6·28	4	+ 1·20	3·65
5404	ϑ *Bo*	4·54	3	+ ·16	2·24
5429	ρ *Bo*	5·02	4	+ 1·27	3·74
5430	5 *Ur'*	5·94	3	+ 1·57	4·15
5435	γ *Bo*	3·11	3	— ·23	1·70
5447	σ *Bo*	4·74	4	+ ·04	2·07
5477*	ζ *Bo*	3·84	2	— ·20	1·75
5490	34 *Bo*	6·67	3	+ 1·76	4·41
5502	ο *Bo*	5·63	4	+ ·79	3·09
5505*	ε *Bo*	3·38	2	+ ·72	3·00
5544	ξ *Bo*	5·41	3	+ ·60	2·83
5563	β *Ur'*	3·82	3	+ 1·56	4·13
5589	— *Ur'*	6·39	3	+ 1·65	4·26
5600	ω *Bo*	6·54	4	+ 1·50	4·05
5602	β *Bo*	4·47	4	+ ·77	3·06
5616	ψ *Bo*	5·93	5	+ 1·29	3·77
5618	*i Bo*	5·45	3	+ ·50	2·70
5681	δ *Bo*	4·45	5	+ ·86	3·18
5733	} μ *Bo*	4·60	14	·00	2·02
5734		7·18	5	+ ·50	2·71
5735	γ *Ur'*	3·10	3	— ·24	1·69
5744	ι *Dr*	4·62	3	+ 1·10	3·51
5747	β *Co*	3·86	4	— ·04	1·96
5774	ν_2 *Bo*	4·99	5	— ·22	1·72
5778	ϑ *Co*	3·91	5	— ·53	1·30
5793	α *Co*	2·13	3	— ·45	1·41
5842	ι *Sp*	4·41	3	— ·41	1·47
5849	γ *Co*	3·72	4	— ·26	1·67
5854	α *Sp*	3·96	3	+ 1·08	3·48
5867	β *Sp*	3·64	3	— ·20	1·75
5868	λ *Sp*	5·03	3	+ ·41	2·57
5879	κ *Sp*	6·02	3	+ 1·92	4·62
5889	δ *Co*	5·43	3	+ ·65	2·90
5899	ρ *Sp*	6·39	4	+ 1·50	4·05
5901	κ *Co*	5·95	3	+ ·92	3·27
5903	ζ *Ur'*	4·36	3	— ·16	1·80
5914	χ *He*	5·16	3	+ ·38	2·54
5933	γ *Sp*	4·27	3	+ ·20	2·29
5947	ε *Co*	5·53	3	+ 1·23	3·69
5960	— *Dr*	5·19	8	·00	2·02
5971	ι *Co*	4·79	3	— ·46	1·39
5972	π *Sp*	4·67	4	— ·39	1·49
5982	υ *He*	4·56	3	— ·42	1·45
5986	ϑ *Dr*	4·71	3	+ ·47	2·65
6018	τ *Co*	5·85	3	+ ·87	3·20
6023	φ *He*	4·08	3	— ·38	1·50
6092	τ *He*	3·62	4	— ·55	1·27
6093	σ *Sp*	5·11	3	+ ·10	2·15
6095	γ *He*	3·90	3	— ·07	1·92
6103	ξ *Co*	5·93	3	+ ·92	3·27
6117	ω *He*	4·51	3	— ·25	1·68
6130	— *Dr*	6·69	2	+ ·85	3·17
6132	η *Dr*	3·78	3	+ ·79	3·09
6146	*g He*	6·33	3	+ 1·26	3·73
6148	β *He*	3·81	3	+ ·80	3·10
6159	*h He*	6·62	3	+ 1·69	4·31
6161	*A Dr*	4·90	3	— ·28	1·64
6168	σ *He*	4·13	3	— ·33	1·57

HR or *BD*	name	phgr. magn. $m_{L, 33\,cm}$	number of plates	colour-index $m_{L, 33\,cm} - m_P$	c_2/T *L*, *P*
6212	ζ *He*	3·47	4	+ ·31	2·44
6220	η *He*	4·49	3	+ ·73	3·01
6223	*g Dr*	6·22	3	+ 1·27	3·74
6237	— *Dr*	5·21	11	+ ·17	2·25
6254	52 *He*	4·90	3	— ·14	1·83
6281	ι *Op*	4·21	2	— ·35	1·54
6299	κ *Op*	4·60	2	+ 1·24	3·70
6315	*h Dr*	5·40	3	+ ·45	2·64
6319	20 *Dr*	6·78	3	+ ·10	2·15
6324	ε *He*	3·86	4	— ·30	1·61
6355	60 *He*	5·06	3	+ ·04	2·08
6396	ζ *Dr*	3·00	3	— ·45	1·41
6410	δ *He*	3·06	4	— ·40	1·47
6418	π *He*	4·76	4	+ 1·44	3·97
6436	*e He*	4·45	4	— ·33	1·58
6526	λ *He*	5·91	4	+ 1·29	3·77
6536	β *Dr*	3·74	4	+ ·73	3·01
6554	ν_1 *Dr*	5·10	6	— ·08	1·91
6555	ν_2 *Dr*	5·10	6	— ·06	1·94
6556	α *Op*	2·22	3	— ·32	1·58
6588	ι *He*	3·50	4	— ·53	1·30
6596	ω *Dr*	5·20	3	+ ·15	2·22
6623	μ *He*	4·11	3	+ ·49	2·68
6636	} ψ *Dr*	5·01	3	+ ·08	2·13
6637		6·30	3	+ ·28	2·40
6688	ξ *Dr*	5·14	7	+ 1·19	3·63
6695	ϑ *He*	5·23	3	+ 1·28	3·75
6703	ξ *He*	4·65	3	+ ·77	3·06
6705	γ *Dr*	4·11	3	+ 1·64	4·23
6707	ν *He*	4·69	5	— ·03	1·98
6713	93 *He*	6·01	3	+ 1·29	3·77
6770	71 *Op*	5·77	2	+ ·96	3·32
6771	72 *Op*	3·93	3	— ·07	1·92
6779	ο *He*	3·71	5	— ·35	1·54
6787	102 *He*	4·04	4	— ·56	1·27
6868	106 *He*	6·71	3	+ 1·68	4·30
6872	κ *Ly*	5·61	3	+ 1·10	3·51
6895	109 *He*	5·15	3	+ 1·09	3·50
6920	φ *Dr*	4·19	3	— ·35	1·54
6923	*b Dr*	5·07	3	— ·19	1·77
6927	χ *Dr*	4·17	3	+ ·42	2·59
6945	42 *Dr*	6·23	3	+ 1·23	3·69
6978	*d Dr*	5·45	3	+ ·41	2·57
7001	α *Ly*	—·07	3	— ·45	1·41
7051*	ε *Ly*	4·85	3	— ·15	1·81
7053*	5 *Ly*	4·74	3	— ·18	1·77
7056	} ζ *Ly*	4·58	3	— ·15	1·81
7057		5·99	3	— ·19	1·77
7061	110 *He*	4·59	5	+ ·15	2·22
7064	— *Ly*	6·16	3	+ 1·06	3·46
7069	111 *He*	4·35	3	— ·07	1·92
7125	ο *Dr*	6·06	3	+ 1·28	3·76
7131	δ_1 *Ly*	5·36	4	— ·59	1·22
7133	113 *He*	5·33	3	+ ·62	2·86
7137	— *Dr*	5·90	4	+ ·74	3·02
7139	δ_2 *Ly*	6·16	4	+ 1·79	4·45
7157	*R Ly*	5·83	3	—	—
7176	ε *Al*	5·14	4	+ ·86	3·18
7178	γ *Ly*	3·14	3	— ·41	1·46
7180	υ *Dr*	6·09	4	+ 1·04	3·43

HR or *BD*	name	phgr. magn. $m_{L, 33\,cm}$	number of plates	colour-index $m_{L, 33\,cm} - m_P$	c_2/T *L, P*
7235	ζ *Al*	2·89	3	— ·43	1·43
7298	η *Ly*	3·98	3	— ·70	1·07
7301	1 *Sa*	5·59	2	— ·34	1·56
7306	1 *Vp*	4·58	3	— ·40	1·48
7310	δ *Dr*	4·16	3	+ ·84	3·16
7314	ϑ *Ly*	5·72	3	+ 1·20	3·65
7328	κ *Cy*	4·84	7	+ ·89	3·22
7352	τ *Dr*	5·90	4	+ 1·48	4·03
7358	3 *Vp*	4·87	4	— ·46	1·39
7371	π *Dr*	4·64	3	— ·16	1·80
7372	2 *Cy*	4·73	4	— ·37	1·52
7405	6 *Vp*	6·11	3	+ 1·68	4·30
7417	{ β *Cy*	4·34	3	+ 1·18	3·62
7418		4·95	3	— ·65	1·14
7420	ι *Cy*	3·92	3	— ·05	1·95
7426	8 *Cy*	4·43	4	— ·45	1·41
7437	9 *Vp*	4·78	3	— ·42	1·45
7462	σ *Dr*	5·56	4	+ ·69	2·95
7469	ϑ *Cy*	4·79	3	+ ·19	2·28
7478	φ *Cy*	5·71	3	+ ·93	3·28
7479	α *Sa*	5·12	3	+ ·60	2·83
7488	β *Sa*	5·47	3	+ ·85	3·17
7525	γ *Al*	4·41	3	+ 1·33	3·82
7528	δ *Cy*	2·74	3	— ·44	1·42
7536	δ *Sa*	5·24	3	+ 1·38	3·89
7546	ζ *Sa*	4·99	3	— ·24	1·69
7557	α *Al*	·95	3	— ·17	1·78
7565	12 *Vp*	4·66	3	— ·47	1·38
7582	ε *Dr*	4·96	3	+ ·97	3·33
7592	13 *Vp*	4·42	3	— ·33	1·57
7595	ξ *Al*	5·90	3	+ 1·05	3·44
7613	22 *Cy*	4·66	3	— ·49	1·35
7615	η *Cy*	4·87	3	+ ·79	3·09
7619	ψ *Cy*	4·98	3	— ·13	1·84
7635	γ *Sa*	5·34	3	+ 1·51	4·07
7653	15 *Vp*	4·76	3	— ·13	1·84
7685	ρ *Dr*	6·14	3	+ 1·41	3·93
7708	b_2 *Cy*	4·78	4	— ·45	1·41
7724	ρ *Al*	4·98	3	— ·14	1·83
7730	30 *Cy*	4·89	3	— ·05	1·95
7735	31 *Cy*	5·24	3	+ 1·30	3·78
+46° 2883		6·80	3	— ·58	1·24
7736	b_3 *Cy*	5·14	4	— ·08	1·91
7739	— *Vp*	4·62	3	— ·46	1·39
7740	33 *Cy*	4·43	7	— ·11	1·87
7744	23 *Vp*	6·01	5	+ 1·33	3·83
+27° 3668		6·53	3	— ·43	1·44
7750	κ *Cf*	4·34	3	— ·29	1·62
7751	32 *Cy*	5·88	5	+ 1·72	4·35
7763	*P Cy*	5·35	3	+ ·31	2·44
7796	γ *Cy*	3·10	3	+ ·62	2·86
7806	39 *Cy*	6·07	3	+ 1·42	3·94
7834	41 *Cy*	4·48	4	+ ·16	2·24
7844	ω_1 *Cy*	4·87	3	— ·22	1·72
7850	ϑ *Cf*	4·48	3	+ ·14	2·21
7852	ε *De*	4·00	3	— ·39	1·49
7866	47 *Cy*	6·53	3	+ 1·74	4·38
7871	ζ *De*	4·83	4	+ ·09	2·14
7882	β *De*	4·22	3	+ ·20	2·29
7891	29 *Vp*	4·80	3	— ·24	1·69

HR or *BD*	name	phgr. magn. $m_{L, 33\,cm}$	number of plates	colour-index $m_{L, 33\,cm} - m_P$	c_2/T *L, P*
7899	— *De*	5·90	3	— ·40	1·48
7906	α *De*	3·90	3	— ·24	1·69
7924	α *Cy*	1·34	3	— ·25	1·68
7928	δ *De*	4·80	3	+ ·26	2·37
7942	52 *Cy*	5·47	3	+ 1·01	3·39
7947	{ γ *De*	5·73	3	—	—
7948		5·54	3	—	—
7949	ε *Cy*	3·72	3	+ 1·00	3·37
7955	— *Cf*	5·18	19	+ ·51	2·71
7957	η *Cf*	4·60	3	+ ·96	3·31
7963	λ *Cy*	4·43	3	— ·43	1·43
7977	55 *Cy*	5·33	4	+ ·38	2·53
7995	31 *Vp*	5·54	3	+ ·74	3·02
8001	57 *Cy*	4·68	3	— ·29	1·62
8028	ν *Cy*	4·03	3	— ·07	1·92
8047	f_1 *Cy*	4·95	3	·00	2·02
8079	ξ *Cy*	5·83	3	+ 2·03	4·77
8085	{ 61 *Cy*	6·71	5	+ 1·27	3·74
8086		7·74	3	+ 1·65	4·26
8089	f_2 *Cy*	6·48	3	+ 1·88	4·57
8097	γ *Eq*	5·12	4	+ ·46	2·64
8098	6 *Eq*	6·19	3	— ·15	1·82
8115	ζ *Cy*	4·47	3	+ 1·02	3·40
8123	δ *Eq*	5·16	3	+ ·48	2·67
8130	τ *Cy*	4·16	3	+ ·26	2·37
8143	σ *Cy*	4·37	3	— ·13	1·84
8146	υ *Cy*	4·32	3	— ·27	1·65
8162	α *Cf*	2·85	3	+ ·07	2·11
8173	1 *Pg*	5·42	3	+ 1·18	3·62
8225	2 *Pg*	6·53	3	+ 1·91	4·61
8238	β *Cf*	3·09	3	— ·39	1·49
8252	ρ *Cy*	5·01	3	+ ·77	3·06
8255	72 *Cy*	6·22	4	+ 1·24	3·70
8279	9 *Cf*	5·19	3	+ ·13	2·19
8301	π_1 *Cy*	4·63	3	— ·31	1·60
8308	ε *Pg*	4·27	3	+ 1·51	4·07
8309*	μ *Cy*	5·02	4	+ ·30	2·43
8313	9 *Pg*	5·65	3	+ 1·25	3·71
+28° 4171		7·29	2	—	—
8315	κ *Pg*	4·61	3	+ ·37	2·52
8317	11 *Cf*	5·89	3	+ 1·21	3·66
8334	ν *Cf*	4·94	3	+ ·46	2·64
8335	π_2 *Cy*	4·09	3	— ·35	1·54
8343	14 *Pg*	5·02	3	— ·42	1·45
8402	ο *Ag*	4·58	3	—	—
8413	ν *Pg*	6·53	3	+ 1·46	4·00
8414	α *Aq*	4·07	3	—	—
8417	ξ *Cf*	4·79	3	—	—
8430	ι *Pg*	4·22	4	+ ·22	2·32
8449	27 *Pg*	6·74	3	+ 1·01	3·39
8450	ϑ *Pg*	3·70	4	— ·38	1·50
8454	π *Pg*	4·77	4	+ ·31	2·44
8465	ζ *Cf*	5·26	5	+ 1·66	4·27
8468	24 *Cf*	5·88	3	+ ·93	3·28
8469	λ *Cf*	5·35	4	+ ·01	2·03
8485	— *La*	6·11	6	+ 1·56	4·14
8494	ε *Cf*	4·51	23	+ ·15	2·22
8498	1 *La*	5·84	3	+ 1·52	4·08
8518	γ *Aq*	3·78	3	—	—
8520	31 *Pg*	4·83	4	— ·32	1·58

HR or *BD*	name	phgr. magn. $m_{L, 33\,cm}$	number of plates	colour-index $m_{L, 33\,cm} - m_P$	c_2/T *L, P*
8522	32 *Pg*	4·79	4	— ·22	1·72
8523	2 *La*	4·42	4	— ·30	1·61
8528	— *La*	6·25	3	— ·39	1·49
8538	3 *La*	5·59	4	+ 1·00	3·38
8539	π *Aq*	4·50	3	— ·10	1·88
8541	4 *La*	4·65	3	— ·09	1·90
8549	— *La*	6·24	3	— ·54	1·28
8551	35 *Pg*	5·94	3	+ 1·03	3·42
8558*	ζ *Aq*	4·17	3	—	—
8572	5 *La*	6·30	5	+ 1·82	4·49
8579	6 *La*	4·40	3	— ·31	1·60
8585	7 *La*	3·82	3	— ·12	1·86
8597	η *Aq*	3·95	3	—	—
8606	— *La*	6·22	3	— ·26	1·67
8613	9 *La*	4·88	4	·00	2·02
8622	10 *La*	4·61	4	— ·45	1·41
8632	11 *La*	6·02	4	+ 1·44	3·97
8634	ζ *Pg*	3·36	3	— ·38	1·50
8641	ο *Pg*	4·70	3	— ·32	1·58
8650	η *Pg*	3·95	3	+ ·73	3·00
8665	ξ *Pg*	4·81	3	+ ·42	2·59
8667	λ *Pg*	5·21	3	+ 1·02	3·40
8684	μ *Pg*	4·58	3	+ ·72	3·00
8694	ι *Cf*	4·72	4	+ 1·04	3·43
8717	ρ *Pg*	4·96	3	— ·12	1·86
8762	ο *Ad*	3·57	3	— ·43	1·43
8773	β *Pi*	4·41	3	— ·25	1·68
8775	β *Pg*	4·50	3	—	—
8780	3 *Ad*	5·92	3	+ 1·12	3·54
8781	α *Pg*	2·47	4	— ·73	1·03
8795	55 *Pg*	6·47	4	+ 1·85	4·53
8796	56 *Pg*	6·36	3	+ 1·41	3·94
8797	1 *Cs*	4·80	4	— ·17	1·79
8819	π *Cf*	5·34	4	+ ·80	3·10
8830	7 *Ad*	4·85	3	+ ·19	2·28
8852	γ *Pi*	4·69	3	+ ·61	2·84
8860	8 *Ad*	6·83	4	+ 1·87	4·56
8872	ο *Cf*	5·77	4	+ ·87	3·20
8880	τ *Pg*	4·84	3	+ ·19	2·27
8905	υ *Pg*	5·14	3	+ ·44	2·61
8911	κ *Pi*	4·99	3	— ·20	1·75
8916	ϑ *Pi*	5·54	3	+ 1·06	3·46
8923	70 *Pg*	5·56	3	+ ·88	3·21
+57° 2747		7·10	5	— ·14	1·84
8926	— *Cs*	4·74	7	— ·39	1·49
8961	λ *Ad*	4·91	3	+ ·97	3·33
8965	ι *Ad*	4·19	3	— ·29	1·62
8969	ι *Pi*	4·73	3	+ ·45	2·63
8974	γ *Cf*	4·54	4	+ 1·11	3·52
8976	κ *Ad*	4·05	3	— ·39	1·49
8984	λ *Pi*	4·70	2	— ·08	1·91
8997	78 *Pg*	6·01	3	+ ·94	3·29
9045	ρ *Cs*	5·98	3	+ 1·06	3·46
9052	— *Cs*	6·24	2	— ·04	1·97
9059	— *Cs*	6·10	2	+ ·54	2·75
9064	ψ *Pg*	6·57	3	+ 1·77	4·42
9071	σ *Cs*	4·87	3	— ·25	1·68
9072	ω *Pi*	4·54	3	+ ·29	2·41