Jeder von den 55 Kegelschitten der Fläche Ψ^5 trifft 18 Kegelschnitte dieser Fläche gar nicht, die 36 übrigen Kegelschitte einmal.

Die Trägerebenen solcher drei Kegelschnitte, deren Stützgeraden einen und denselben Geradentripel der Ψ^5 bilden, schneiden sich in einem *einfachen singulären* Punkte der Fläche Ψ^5. Diese Fläche besitzt 165 solche einfache singuläre Punkte.

Provisional photovisual magnitudes of 260 stars near the North Pole

(Prowizoryczne wielkości fotowizualne 260 gwiazd w sąsiedztwie bieguna północnego)

by

E. Rybka

1. Introduction.

The aim of my work, started in 1931 in the Warsaw Astronomical Observatory, was to form a standard system of photovisual magnitudes of all stars brighter than $7^{m}.50$. Such investigations were suggested to me by Profesor H e r t z s p r u n g in 1930 during my stay at the Leiden Observatory with the view mainly, of forming an independent system of photovisual magnitudes to which all existing visual and photovisual system (especially Potsdamer Durchmusterung and Harvard Photometries) might be reduced.

I intended in the first part of my work to give photovisual magnitudes of all stars brighter than $7^{m}.50$ within 10^{0} from the north pole. Observations were executed by me in 1931 and almost performed to the whole extent, being discontinued at the end of 1931 owing to my departure from the Warsaw Observatory to Lwów University in January 1932. A part of the plates only could be measured with the Schilt microphotometer in the Warsaw Observatory during 1931 and in the beginning of 1932. Continuation of measurements in the Warsaw Observatory being afterwards impossible, I decided to publish provisional results from measures on 19 plates, which form about $^{1}/_{4}$ of the whole observational material. Final magnitudes will be published as soon as the remaining plates are measured and reduced.

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2. Outline of the method.

The following plan was adopted for the execution of my work. The photometric scale should be given by a coarse diffraction grating, placed in the front of the objective. Exposures are to be executed with the grating and without it. Each plate contains three sets of exposures, denoted by *A*, *B* and *P* in the present paper. Observations are distributed in declination zones and consecutive fields in each zone are represented by *A* and *B* sets of exposures, centres of them being chosen in such a way, that the right ascension of a field *B* should lie on the frontier of a field *A* without changing declination of centres. Two exposures in each set are taken with the free objective and one with the grating before the objective. The set *P* consists of two exposures of the north pole, one of them being taken with the grating and the second one without it. Each plate contains thus 8 exposures of the same duration, 5 of them being taken without grating and 3 with it. Grating exposures give the photometric scale, the exposures of the north pole being taken for zero-point only. The difference between images obtained without grating and the first order spectra of the same stars is taken, according to Hertzsprung's method, as a standard in the deduction of the photometric scale.

Plates in each zone should form a closed sequence of stars in such a way, that fields *A* and *B* overlap partly on each plate and a field *B* of one plate is taken in the *A* set of exposures of the next following plate. Two neighbouring zones overlap partly also, each star being thus generally taken in two declination zones on 6 plates, containing together 16 exposures of this star taken without grating and disposed in 4 different positions relatively to the centres of plates.

3. Instrumental equipment.

A Zeiss objective of Astro-Petzval type ($O = 12$ cm, $F = 60$ cm) was used for my observations. This objective, existing already many years in the Warsaw Observatory, was provided in 1929 by Carl Zeiss in Jena with the astrocamera and installed on the 162 mm Heyde refractor, used formerly by me for visual estimates of variable stars. The refractor with the astrocamera was installed in the new dome, constructed by the firm Raszewski, Poznań.

The Heyde refractor was used as a guiding telescope and it was provided for that purpose with a driving clock from Gustav Heyde Dresden and with a micrometer, made by Mr. H. Zunderman, chief instrumentmaker of Leiden Observatory. The cross-wire of the micrometer was seen bright on a dark background and was moved in two perpendicular directions,

the displacements being read on milimeter scales attached to the micrometer.

The photometric scale on plates was given by a grating made by Mr. Zunderman. The grating consisted of parallel wires of stainless steel 0.45 mm thick, open spaces between wires being nearly equal to their thickness. The width of the wires was measured in 1931 in the Chief Office of Measurements in Warsaw by the courtesy of this Office. An optical micrometer was used for that purpose, the thread of the micrometer being put tangentially on enlarged images of grating wires. 30 wires were measured and their mean thickness was found to be $l = 0.447$ mm. The width of the whole grating, consisting of 150 wires and 149 open spaces, was 134.05 mm, hence the mean value of one open space was $d = 0.450$ m. It is evident that the grating fulfills the condition $d = l$ well.

Plates were taken through the yellow Wratten filter K3 of the size 9×12 cm, cemented between two glass-plates. The filter made by Eastman Kodak Company was about 5 mm thick and was put in a plateholder before the plate. Wave lengths shorter than $\lambda\,4700$ were cut off completely by this filter, the transmission at wave-length $\lambda\,4700$ and $\lambda\,4800$ being only 2.5% and 10.0% respectively [1].

4. Observations.

Observations were started in February 1931 on Cramer Isonon plates of the size $3^1/_4$—$4^1/_4$ inches. They were made in the focus in the following order:

A_g — exposure of the field *A* with the grating
A_1 — first exposure of the field *A* without grating
A_2 — second exposure of the field *A* without grating
P_0 — exposure of north pole without grating
P_g — exposure of north pole with the grating
B_g — exposure of the field *B* with the grating
B_1 — first exposure of the field *B* without grating
B_2 — second exposure of the field *B* without grating.

The camera was displaced in declination between successive exposures in each set. Distances between A_1 and A_2 exposures were made slightly larger than those between B_1 and B_2 ones, hence both sets of exposures were easily recognised on plates.

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[1]) Wratten Light Filters, Eastman Kodak Company, Rochester N. Y. 1929, p. 26, 64.

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Cramer Isonon plates were of low sensitivity and therefore a 15 min. duration of each exposure was adopted for obtaining on photographs, taken without grating, stars of limiting magnitude $8^{m}.5$. An important defect of Cramer Isonon plates consisted, besides low sensitivity, in very coarse and irregular fog, which rendered distinction of star images and measurements sometimes very difficult.

Soon after my observations were started, Professor Hertzsprung called my attention in a letter to the high sensitivity and good qualities of Eisenberger plates. Two brands of these plates, Flavirid and Ultrarapid hochfarbenempfindlich of the size 9 × 12 cm, were checked by me. Both brands showed much higher sensitivity than Cramer Isonon plates, giving on 5-min. exposures, taken with the free objective, stars almost to $9^{m}.0$. Ultrarapid plates were much less fogged than Flavirid ones, and therefore they were adopted for the continuation of my photometric program. Recently Eisenberger Ultrarapid plates were examined by Stobbe[2]) and the maximum of sensitivity was found near λ 5600.

Instability of focussing of the astrocamera caused some delay in further observations. This defect was removed in June 1931 and to the end of the year 1931 the focussing was satisfactory in almost all cases. All regions photographed on badly focussed plates were taken afterwards once more in good focus.

Cramer Isonon plates were taken in zones + 86° and + 82°. The first of these zones was completed and the second one was lead from $\alpha = 0^{h}$ to $\alpha = 9$ 12^{m}. 15 plates of this brand were adopted for measurements. During a trial period in February and March 1931 exposures on Cramer Isonon plates did not follow strictly the method outlined in Section 2 of the present paper. One plate (Nr. 43) contains exceptionally *A* set of exposures in the zone + 86° and *B* set of them — in the zone + 82°, giving therefore no stars overlapping in both sets. All exposures on Eisenberger plates taken afterwards followed in all details the method described above.

The distance 4° between zones was found afterwards too large, because images could be measured to the distance of 3 cm (2°.9) from the centre only, being in this distance already sensibly out of focus. I adopted therefore for exposures on Ultrarapid plates the distance 3° between zones, plates being taken in complete zones + 87° and + 84°.

Small areas, which could be utilized on plates for photometric purposes, caused that few grating images, needed for the scale, were present on each

[2]) J. Stobbe: Ueber die spektrale Empfindlichkeit photographischer Platten A. N. 251, 65—74. 1934.

plate. Fearing that plates taken with and without grating on the scheme indicated above would not furnish accurate photovisual magnitudes, I decided to make additional photographs of zones + 87° and + 84°, on plates taken with the grating only. 3 exposures of 24 min. duration were made on each plate in the succession of regions *A*, *P* and *B*. The regions were distinguished on plates by different position angles of the grating. Zones + 87° and + 84° were thus completed and 16 plates of the zone +81° from $\alpha = 0^{h}$ to $\alpha = 20^{h}15^{m}$ were still taken in the same manner. On the whole 21 Ultrarapid plates, taken with and without grating, and 36 of them with the grating only were adopted for measurements. The whole number of plates taken from February to November 1931 and adopted for measurements is therefore 72.

Cramer Isonon plates were developed in 5% solution of Rodinal within about 5 min. and Ultrarapid plates in Hydrochinon developer within 3 or 4 min. Development and the beginning of fixation were executed in full darkness. All plates were taken and developed by the author.

5. Measurements.

All plates were measured in a Schilt thermoelectric microphotometer made for Warsaw Observatory by W. C.'t Hart, Rotterdam in 1930. The lamp of the microphotometer was fed by a current of 8 V from an accumulator battery of large capacity The zero point of the galvanometer scale corresponded to the total darkness, when the light from the lamp was shuttered. The fog reading was maintained constantly on 250 mm by the aid of a rheostat. All measurements were executed using the same diaphragm with the diameter 2 mm.

All stars which appeared brighter than a North Polar Sequence star No 8 ($8^{m}.13$) were measured on plates in parallel strips to the distance 3 cm from the centre. Grating images were measured disregarding their brightness.

Each image was measured twice, the fog being put on 250 mm in two different points diametrally opposed to the measured image in the neighbourhood of it. Rectangular coordinates and the set of observations were recorded by the measurer.

Measurements were executed by Dr. L. Orkisz (L. O.) Mr. L. Zeidler (L. Z.) and the author (E. R.) as indicated in the ninth column of Table I. The total number of measurements on 19 plates, used in the present paper, amounts to 4230. Mr. Zeidler's measurements of 5 plates, insufficiently focussed, were not reduced all. These plates were taken afterwards once more. Cramer Isonon plates (from No 30 to 47) were measured from August to December 1931, plates 111, 112, 113 in July 1931 and plates 153 — 161 from October 1931 to February 1932.

Only galvanometer readings between 80 mm and 240 mm were adopted for deduction of magnitudes.

Table I.

Plates.

Nr.	Brand of plates	Date	Sid. Time	Exp. t.	n	Centre A α	Centre A δ	Centre B α	Centre B δ	Meas.	Remark
30	Cr.	1931 Febr. 10	12h 37m — 15h 12m	15m	8	0h 0m	+86°	2h 40m	+86°	E. R.	1.
31	"	Febr. 17	9 2 — 11 37	15	8	2 40	+86	5 20	+86	"	2.
32	"	Febr. 17	13 9 — 15 48	15	8	5 20	+86	8 0	+86	"	
33	"	Febr. 20	8 46 — 11 15	15	8	8 0	+86	10 40	+86	"	3.
34	"	Febr. 20	12 10 — 14 38	15	8	10 40	+86	13 20	+86	"	
37	"	March 13	8 24 — 10 51	15	8	13 20	+86	16 0	+86	"	4.
38	"	March 13	11 3 — 13 29	15	8	16 0	+86	18 40	+86	"	1.
42	"	March 17	8 37 — 10 59	15	8	18 40	+86	21 20	+86	"	5.
43	"	March 17	11 15 — 13 38	15	8	21 20	+86	0 42	+82	"	
46	"	March 18	8 45 — 11 6	15	8	0 42	+82	2 7	+82	"	
47	"	March 18	11 18 — 13 25	15	8	2 7	+82	3 32	+82	L. O.	
111	Eis.	June 16	16 35 — 17 45	5	8	2 46	+84	4 37	+84	L. Z.	
112	"	June 16	17 56 — 18 52	5	8	4 37	+84	6 28	+84	"	
113	"	June 17	17 45 — 18 44	5	8	6 28	+84	8 19	+84	"	
153	"	Oct. 11	21 18 — 22 39	24	3	0 0	+87	3 26	+87	E. R.	
154	"	Oct. 11	23 40 — 1 1	24	3	3 26	+87	6 52	+87	"	
155	"	Oct. 11	1 14 — 2 35	24	3	6 52	+87	10 18	+87	"	
160	"	Oct. 12	0 45 — 2 4	24	3	10 18	+87	13 44	+87	L. O.	
161	"	Oct. 12	2 51 — 4 11	24	3	13 44	+87	17 10	+87	"	

1. Plate very poor. 2. Plate poor. Sky hazy. 3. Last 3 min. of B_2 exposure taken through fog. 4. A_2 exposure rejected; images double on account of a displacement of astrocamera during observation. 5. B_2 exposure rejected, images elongated on the same cause as in 4.

Note. First column gives number of plates, the brand of them is indicated in the second column, Cr denoting Cramer Isonon plates, and Eis— Eisenberger Ultrarapid plates. Date refers always to the first half of an observational night. Local Warsaw Sidereal Time of the beginning of the first exposure and of the end of the last exposure is given in fourth column. Fifth column gives the time of each exposure, and the sixth one—the number of exposures on the plate. — Centres of A and B sets of exposures are given in the two next following columns.

6. Reduction of measurements.

The means of two measures of each image were adopted for the deduction of magnitudes. At first corrections, which reduce galvanometer readings to the centre of a plate, should be applied to the adopted means. Considerable difficulties arose in the application of this correction, because it depends not only on the distance from the centre of the plate, but also on the apparent brightness of stars on plates.

Let us denote by G a galvanometer reading, resulting immediately from a measurement, by G_0 a required galvanometer reading of the same star in the centre of the plate, by r the distance of the star from the centre. G may be regarded as a function of G_0 and r

$$G = f\,(G_0, r) \tag{1}$$

I assumed that

$$G = G_0 + br^n \tag{2}$$

where b is a function of G_0 alone and n is the constant exponent depending on the optical properties of the objective; n and b were determined from two special plates taken by me on 22 September 1931. Each of these plates contains 7 exposures of the north pole taken without grating before the objective. The first plate was taken in the hour circle 0^h — 12^h and was moved 1° between succesive exposures, declination of centres being $+87^\circ$, $+88^\circ$, $+89^\circ$, $+90^\circ$, $+89^\circ$, $+88^\circ$, $+87^\circ$ successively. The second plate was taken in the same manner in the hour circle 6^h — 18^h. Images belonging to the same star were located thus in a row with the distance of about 1 cm between successive exposures.

Plates were then measured by me in the Schilt microphotometer. Comparing images of the same star in different distances from the centre, I found at first the value of n

$$n = 2.92 \pm 0.18 \ \text{(m. e.)}$$

Adopting for n the value 2.9, G_0 and b were found for many stars of different brightness on the mentioned plates. I plotted the values of b thus found as ordinates against G_0 as abscissas. Linear dependence of b from G_0 was evident from the plot. Taking thus

$$b = A_0 + B_0\, G_0 \tag{3}$$

where A_0 and B_0 are constant numbers the following values of A_0 and B_0

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were found from 26 stars by the method of least squares:

$$b = -0.00681 + 0.000303\,G_0 \qquad (4)$$
$$\pm\ 52 \quad \pm\ 17$$

1 mm was taken as a unit for galvanometer readings and for the distance r from the centre of the plate. The reduction formula (2) takes therefore the form

$$G = G_0 - 0.0068\ r^{2.9} + 0.000303\ G_0\ r^{2.9} \qquad (5)$$

A special table was constructed, giving corrections $G_0 - G$ in the function of arguments G and r, for each millimeter of r (from 0 mm to 30 mm) and in intervals of 10 mm for G. Correction is positive for all values of $G < 225$ mm and is negative for $G > 225$ mm.

Coefficients in formula (5) depend on focussing, but as all plates, chosen for measurement, ware taken sensibly in the same focus, large differences are not expected in values of these corrections for individual plates. These coefficients, however, may be easily deduced from each photometric plate, on which a sufficient number of stars is exposed twice in different distances from the centre. Such computation was done for some plates and coefficients thus found agreed well with those given in formula (5). In view of this accordance I decided to apply the corrections to the centre directly from the mentioned table, because computations of them for each plate separately would involve considerable unnecessary labor.

Measures corrected to the centre were used for deduction of magnitudes from them. At first a provisional photometric scale was constructed by plotting galvanometer readings of first order spectra as ordinates against the readings of central images used as abscissas. A smooth curve was then drawn between plotted points. If we take an ordinate b corresponding to some abscissa a near the beginning of the curve and afterwards an ordinate c, corresponding to abscissa b etc, then the galvanometer readings $a, b, c, \ldots$ will be equidistant in the photometric scale and differences between their successive values will correspond to the differences in magnitudes between central images and first order spectra. Taking the last difference as $1^{m}.00$ provisionally, a curve may be constructed giving provisional magnitudes from an arbitrary zero point in the function of galvanometer readings G_0.

A true photometric scale was derived, following the proposal of H e r t z s p r u n g[3]), from the assumption that difference between first

[3]) E. H e r t z s p r u n g: Vorschlag zur Festlegung der photographischen Grössenskala. A. N. 186, 177—184. 1910.

order spectra and an image of the same star taken without grating with the same exposure time is $2^{m}.486$. This difference follows from the fundamental formula of the theory of grating

$$\frac{i_n}{I_0} = \frac{\sin^2 \frac{l}{l+d}\, n\pi}{n^2\,\pi^2} \qquad (6)$$

where i_n denotes intensity of an image of n-th order spectrum, I_0 intensity of the image of the same star taken with the free objective, d thickness of of wires, l width of free spaces between them. Putting $d = l$ in formula (6) we have for the first order spectrum

$$\frac{i_1}{I_0} = \frac{1}{\pi^2}\,. \qquad (7)$$

Denoting thus by m_1 a magnitude corresponding to i_1, and by m_0 — a magnitude corresponding to I_0 we have from (7)

$$m_1 - m_0 = 2^{m}.486\,. \qquad (8)$$

This difference, as was indicated by H e r t z s p r u n g (l. c.), is a minimum for $d = l$ and changes very little if the thickness of wires deviates slightly from equality with the width of open spaces. It was shown in section 3, that the grating used by me fulfills the condition $d = l$ very well and therefore the adoption of the difference (8) is wholly justified.

Mean differences in provisional magnitudes between first order spectra and images obtained without grating were formed from exposures $A_1 - A_g$, $P_0 - P_g$, $B_1 - B_g$, for each plate separately. Taking into account also similar differences between central images of grating exposures and images obtained without grating, mean value a of the difference (8) in provisional scale was found for each plate. Then the factor k was given by the proportion

$$k = \frac{2^{m}.486}{a} \qquad (9)$$

with which provisional magnitudes should be multiplied, for reducing them to the true scale. k is sensibly equal to the difference between magnitudes of first order spectra and those of the central images in grating exposures. Taking $2^{m}.486$ as the value of the difference (8) I assumed tacitly that atmospheric conditions remained unchanged during each pair of exposures: $A_g - A_1$, $P_0 - P_g$, and $B_g - B_1$. This was not true for the whole time

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of all exposures on one plate. All exposures from A and B sets were therefore reduced to the zero point of A_2 exposure, systematic differences between A and B sets of exposures being found from overlapping stars in both sets. Zero point on each plate was determined from P exposures of six North Polar Sequence stars: 2*s*, 2*r*, 5, 6, 7 and 3*r*, adopting for mean photovisual magnitudes of these stars according to F. Seares[4]) the value $6^{m}\cdot88$.

Corrections for differential extinction were applied to all stars reducing them to the altitude of the pole ($h = 52^{0}$). Potsdam visual extinction was used for that purpose. In no case differential extinction in the centre of the plate exceeded $0^{m}\cdot04$.

Magnitudes deduced from each plate, consisted of A_2 and P systems. Slight differences may exist between these systems on account of possible changes in atmospheric conditions during A_2 and P_0 exposures. These differences may be found from plates on which North Polar Sequence stars are found in A or B sets of exposures. In this way the photometric system may be expressed in zero point of P exposures.

Plates, taken with the grating only, were reduced assuming for the difference between first order spectra and central images the value $0^{m}\cdot968$. This number was adopted for provisional scale as a mean from laboratory value $0^{m}\cdot988$ and the value $0^{m}\cdot949$, resulting from measures of plates taken with and without grating.

The weight of each exposure taken with or without grating was adopted as a unit. If only the central image of a grating exposure on plates was measured, the weight of a magnitude found from these measures, was adopted as $^1/_2$. — Magnitudes on plates taken with grating only were deduced generally from three images (central image and two spectra.), and therefore weight 2 was given to them. If however only the central image was measured, the magnitude thus obtained was taken with the weight 1. In forming mean magnitudes for each plate weights were taken into account.

A mean error of one observation was found from differences between $A_1 - A_2$, and $B_1 - B_2$ exposures, corrected for systematic errors. Denoting these differences by d, the internal mean error of one observation was found from the formula $\varepsilon = \pm\sqrt{\frac{\Sigma d^2}{2n}}$ where n expresses the number of all stars in A and B exposures together. The mean value of this error from 14 plates is $\pm 0^{m}\cdot07$.

4) F. H. Seares: Revised Magnitudes for stars near the North Pole. Ap J. 56, 97—118 (Mt. Wilson Contributions No 235) Table VII, col. 15.

7. Magnitudes from Cramer Isonon plates. (System C).

Plates 30, 31, 32, 33, 34, 37, 38, 42 and 43 contain regions of the zone $+86^{0}$. The systematic differences between plates being small and uncertain, I decided to disregard them in forming provisional weighted magnitudes. I assumed thus that atmospheric conditions during A_2 and P_0 exposures were unchanged on mentioned plates. Magnitudes from the zone $+86^{0}$ form a reference system for the zone $+82^{0}$.

Regions of the zone $+82^{0}$ are found on three plates (43, 46 and 47). All magnitudes were reduced to the B set of exposures on plate 43, by applying to magnitudes from plates 46 and 47 the corrections $-0^{m}\cdot10$ and $+0^{m}\cdot05$ respectively. Plates of the zone $+82^{0}$ contain only two stars, which are found in the zone $+86^{0}$ too. Systematic differences in zero point between zones $+86^{0}$ and $+82^{0}$ could not be found therefore by direct comparison of overlapping stars, but it was possible to execute this by comparison with magnitudes found afterwards from Eisenberger plates (Sections 8 and 9). I found in this way that no difference in zero point exists between magnitudes of the zone $+86^{0}$ and those of the system of the plate 43 set B. The system of magnitudes of both zones may be regarded thus as a homogeneous one. Magnitudes of the system C are given in Table II, arranged in *B. D.* zones. Mean magnitudes are given in the second column of the table; third column contains weights (w), taken as the sum of observations, the number of plates (n) being given in the fourth column. Residuals taken in the sense magnitude on the plate minus mean magnitude, are given in hundredths of a magnitude in the fifth column and plates, to which residuals refer, are listed in the sixth column in the same order as residuals. No figure is written in the fifth column, when a star is found on one plate only.

8. Magnitudes from Eisenberger Ultrarapid plates, taken with and wihout grating (System E_0).

System E_0 of magnitudes, deduced from Eisenberger Ultrarapid plates taken with and without grating, consists generally of 21 plates, four of them (zone $+84^{0}$) being measured by Mr. L. Zeidler in the summer of 1931. The first of these plates (Nr. 109) showed large unexplained discordances, I decided therefore to omit it in discussion with the intention of remeasuring it once more. Three remaining plates, listed in Table I, were reduced to

Table II.

Photovisual Magnitudes from Cramer's Isonon plates.

System C.

B. D.	mg	w	n	Residuals.	Plates
m	m				
89° 13 7·0	7·06	12	11	— 5 + 12 + 4 0 + 6 — 3 0 — 10 0 0 — 3	30, 31, 32, 33, 34, 37, 38, 42, 43, 46, 47,
88° 4 7·5	6·43	15·5	11	+ 20 — 2 — 9 — 10 + 8 — 13 + 10 — 6 — 3 + 3 + 1	30, 31, 32, 33, 34, 37, 38, 42, 43, 46, 47,
9 8·0	8·29	1	1		46
64 7·5	7·29	14·5	9	— 4 0 + 1 + 9 — 14 + 9 — 6 — 7 + 4	32, 33, 34, 37, 38, 42, 43, 46, 47,
71 6·5	6·27	24	11	— 3 — 8 + 8 + 9 — 12 — 6 + 17 + 15 + 12 — 5 + 10	30, 31, 32, 33, 34, 37, 38, 42, 43, 46, 47,
76 8·0	7·52	14	9	0 + 3 + 4 + 16 — 4 — 9 — 13 + 6 — 9	31, 33, 34, 37, 38, 42, 43, 46, 47,
112 6·5	6·40	15	11	— 17 0 — 2 — 2 + 2 — 16 — 5 + 5 + 15 + 9 0	30, 31, 32, 33, 34, 37, 38, 42, 43, 46, 47,
87° 51 5·0	5·19	21	7	— 6 — 5 + 8 + 5 + 6 + 9 + 16	31, 32, 33, 34, 38, 43, 47,
81 9·2	8·18	1	1		34
83 7·7	7·80	2	1		33
99 8·8	7·90	2	1		34
101 8·0	7·71	1	1		34
104 8·2	8·03	5	2	— 8 + 6	33, 34,
107 6·5	6·25	9	3	+ 15 — 9 — 1	33, 34, 37,
143 7·0	6·98	8	3	— 2 — 1 + 3	34, 37, 38,
180 8·0	8·14	2	1		42
187 8·0	8·04	3	1		42
205 7·5	7·44	3	2	+ 5 — 2	42, 43,
86° 17 7·5	6·26	6·5	2		30, 31,
51 6·0	5·82	9·5	3	0 + 2 — 5	30, 31, 32,
79 7·0	6·54	6	2	— 2 + 4	32, 33,
113 7·2	7·45	1	1		34
126 8·0	7·76	1	1		34
161 7·2	7·31	5	2	+ 8 — 5	33, 34,
170 7·0	7·31	7·5	3	+ 4 — 2 + 1	33, 34, 37,
172 8·2	7·91	3	1		34
176 5·7	6·20	10	3	+ 12 — 6 — 2	33, 34, 37,
182 6·5	7·14	5	2	— 2 + 2	34, 37,
187 7·0	7·68	2	1		34
193 7·5	7·82	2	1		34
201 7·5	7·29	6·5	3	— 3 — 5 + 9	34, 37, 38,
217 6·8	7·09	8·5	3	— 14 + 3 + 11	34, 37, 38,
221 8·1	7·82	5	3	+ 4 + 6 — 7	34, 37, 38,
264 8·5	8·29	2	1		38
269 4·5	4·27	8	3	+ 11 — 3 + 5	37, 38, 42,
272 6·0	5·68	11·5	3	— 10 + 7 — 4	37, 38, 42,
275 8·2	7·64	4	2	+ 1 — 2	38, 42,
277 8,8	7·64	2	1		42

Table II

(continued)

B. D.	mg	w	n	Residuals.	Plates.
m	m				
86° 282 7·0	6·70	8·5	2	— 2 + 2	38, 42,
319 7·0	7·38	5	2	+ 12 — 17	42, 43,
344 6·0	5·58	8	3	— 6 + 4 + 2	30, 42, 43,
347 8·6	7·81	1	1		42,
85° 19 5·0	4·42	7	2	+ 18 — 25	30, 31,
63 6·5	6·64	8	3	+ 16 — 4 0	30, 31, 32,
74 6·0	6·53	6	2	+ 10 — 19	31, 32,
78 7·0	6·73	6	3	— 6 — 7 + 12	31, 32, 33,
80 6·0	6·14	8·5	3	+ 7 + 1 — 7	31, 32, 33,
128 7·5	7·32	1	1		34,
129 8·2	7·40	2	1		33,
161 7·5	7·25	3	2	— 3 + 7	33, 34,
166 8·4	8·13	1	1		34,
183 7·5	7·25	8	3	+ 7 — 12 + 17	33, 34, 37,
214 8·6	7·76	2	1		37,
222 7·0	7·19	4	2	+ 11 — 11	34, 37,
234 7·0	7,72	2	1		34,
235 8·8	8·54	2	1		34,
249 8·0	7·44	6	3	+ 7 — 10 + 2	34, 37, 38,
263 7·2	6·88	4	2	— 5 + 5	37, 38,
269 7·5	6·88	3	2	0 0	37, 38,
294 7·5	7·58	4	2	0 — 1	38, 42,
329 8·4	7·98	5	2	+ 1 0	38, 42,
340 7·5	7·64	7	3	+ 5 + 1 — 6	38, 42, 43,
354 8·0	7·86	3	1		42,
383 5·0	5·21	8	3	+ 10 0 — 9	30, 42, 43,
384 6·5	6·71	6	3	— 2 + 2 0	30, 42, 43,
399 7·5	6·58	6	3	— 4 + 14 — 6	30, 42, 43,
400 8·0	7·62	3	2	— 4 + 2	42, 43,
401 8·0	7·11	5	3	— 1 + 16 — 7	30, 42, 43,
403 7·8	7·00	5	3	+ 2 + 6 — 4	30, 42, 43,
409 8·0	6·71	5	3	— 1 0 + 2	30, 42, 43,
84° 3 8·0	8·04	2	1		46,
34 8·1	7·95	2	1		46,
59 6·0	5·65	9·5	3	— 7 + 2 + 3	30, 31, 32,
78 7·5	7·40	2	1		31,
169 6·0	6·41	4·5	2	+ 11 — 8	32, 33,
186 8·0	7·32	2	1		32,
196 6·0	6·19	9·5	3	— 6 + 7 — 11	32, 33, 34,
206 8·0	7·86	1	1		34,
213 8·3	7·97	1	1		34,
225 6·5	6·36	4·5	2	+ 8 — 10	33, 34,
234 5·0	5·46	4·5	2	+ 10 — 12	33, 34,
252 8·4	7·88	1	1		34,
286 7·0	7·36	4	2	— 2 + 3	34, 37,
307 8·0	7·66	2	1		34,
311 7·5	7·34	2	1		34,
335 7·5	7·06	4	2	— 6 + 6	37, 38,
351 7·7	7·08	2	1		38,

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Table II
(continued)

B. D.	mg	w	n	Residuals.	Plates.
m	m.				
84° 361 7·2	7·24	4	2	+14 −14	37, 38,
371 8·5	7·92	2	1		38,
378 8·2	7·69	2	1		38,
383 7·7	7·24	6·5	2	+ 2 − 2	38, 42,
412 7·5	7·28	4·5	2	+ 4 − 4	38, 42,
451 7·0	6·82	7·5	3	+ 1 − 2 + 4	38, 42, 43,
461 8·5	7·78	7	3	+ 3 + 4 − 9	38, 42, 43,
462 7·0	7·31	7	3	+ 3 − 5 + 4	38, 42, 43,
463 7·2	7·15	7	3	+ 1 + 1 − 3	38, 42, 43,
509 7·2	7·10	3	2	+17 − 8	42, 43,
514 7·3	7·05	3	2	+15 − 7	42, 43,
516 8·0	7·19	3	2	+ 7 − 3	42, 43,
517 6·5	5·93	7·5	3	0 + 4 − 2	30, 42, 43,
83° 9 7·9	7·23	4·5	2	− 1 0	43, 46,
10 9·0	7·90	4	2	− 8 + 8	43, 46,
20 7·0	6·84	6·5	3	+17 − 8 − 6	31, 43, 46,
54 8·9	8·15	4	2	+ 1 − 1	46, 47,
56 8·0	6·65	8·5	2	+ 8 + 5	46, 47,
91 7·3	7·57	2	1		47,
104 5·0	5·60	5	2	+ 5 − 4	31, 32,
114 7·4	7·39	2	1		47,
468 8·2	7·61	2	1		38,
527 7·7	7·63	4	2	+ 1 − 1	38, 42,
530 7·8	7·82	2	1		42,
535 7·4	7·54	2	1		38,
547 6·5	6·90	4·5	2	+ 7 − 5	38, 42,
596 7·7	7·36	3	2	− 9 + 5	42, 43,
603 7·5	6.88	3·5	2	+ 2 − 2	42, 43,
618 7·2	7·16	3	2	− 6 + 3	42, 43,
630 7·0	7·67	2	1		43,
640 5·0	4·90	4	3	+52 + 3 −12	30, 42, 43,
82° 5 8·6	6·22	2	1		46,
14 8.3	7·98	4	2	− 6 + 5	43, 46,
20 6·5	5·53	11	3	+11 − 5 + 1	43, 46, 47,
23 8·4	7·92	8	3	−32 + 4 +25	43, 46, 47,
40 8·6	8·15	6	2	+ 1 − 2	46, 47,
51 7·0	6·62	9·5	4	+20 + 4 − 2 −15	31, 43, 46, 47,
76 8 0	7·08	6·5	2	+10 − 7	46, 47,
82 7·5	7·33	6·5	2	+ 2 − 2	46, 47,
90 8·2	8·01	2	1		47,
113 5·0	5·31	3	1		47,
118 8·6	8·11	2	1		47,
125 8·5	7·89	2	1		47,
728 7·5	7·62	4	2	− 2 + 3	43, 46,
743 (var)	var*)		2		43, 46,
748 7·0	7·26	4·5	2	− 2 + 2	43, 46,

*) See Table VI.

Table II
(continued)

B. D.	mg	w	n	Residuals.	Plates.
m	m				
81° 13 6·5	6·47	5.5	2	− 2 + 1	43, 46,
18 7·6	var*)		3		43, 46, 47,
25 (var)	var*)		3		43, 46, 47,
30 8·3	7·95	8	3	−17 − 1 +19	43, 46, 47,
61 6·8	6·95	10	3	− 3 − 5 +12	43, 46, 47,
67 8·4	7·96	8	3	−14 + 7 − 1	43, 46, 47,
90 8·5	7·90	4	2	+ 8 − 7	46, 47.
96 8·5	8·03	2	1		47,
107 7·4	7·10	6·5	2	+ 2 − 2	46, 47,
112 8·4	8·02	2	1		47,
125 7·9	7·73	2	1		47,
134 7·8	7·34	2	1		47,
135 7·8	7·65	2	1		47,
147 7·5	7·33	2	1		47,
149 8·3	7·90	2	1		47,
150 7·9	7·39	2	1		47,
810 8·1	7·82	2	1		46,
832 8·8	7·88	4	2	−10 +10	43, 46
80° 10 7·9	8·23	2	1		46,
34 8·0	7·61	7·5	3	−13 + 4 + 7	43, 46, 47,
35 7·3	7·21	9	3	− 1 − 2 + 6	43, 46, 47,
36 6·7	6·67	9	3	+ 2 − 4 + 7	43, 46, 47,
38 8·4	8·28	2	1		46,
50 7·4	7·10	9	3	− 3 + 4 − 6	43, 46, 47,
55 7·5	7·10	6.5	3	+10 + 2 −13	43, 46, 47,
57 7·5	7·48	9	3	+12 − 6 + 1	43, 46, 47,
58 6·8	7·10	6·5	3	+ 6 − 4 − 1	43, 46, 47,
64 6·1	6·10	6	2	− 5 + 5	46, 47,
65 6·7	6,92	5	2	+ 3 − 3	46, 47,
70 7·7	7.85	4	2	− 7 + 7	46, 47,
80 8·4	8.02	6	2	+14 − 7	46, 47,
86 5·9	5·84	8·5	2	+ 6 − 3	46, 47,
89 8·0	7·92	4	2	− 9 + 9	46, 47,
97 5·5	5·81	8·5	2	+ 1 − 0	46, 47,
121 7·8	7·55	2	1		47,
125 4·9	5·12	3	1		47,
127 6·8	6·34	2·5	1		47,
129 8·3	8·01	2	1		47,
133 5·7	5·40	3	1		47,
134 7·4	6·97	2	1		47,
140 7·4	7·19	2	1		47,
146 8·0	7·91	2	1		47,
780 7·8	8·14	2	1		46,
784 8·0	8·02	2	1		46,
79° 10 7·0	6.65	4·5	2	+ 9 − 8	43, 46,
19 7·7	7·96	2	1		46,

*) See Table VI.

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Table II

(continued)

B. D.	mg	w	n	Residuals.	Plates.
m	m				
79⁰ 24 6·5	6·70	5·5	2	— 2 + 2	43, 46,
29 6·4	6·30	5·5	2	+ 9 — 8	43, 46,
36 6·5	6·45	2	1		43
51 8·0	7·57	4·5	2	— 8 + 10	46, 47,
61 7·5	7·56	4·5	2	— 7 + 8	46, 47,
63 6·7	6·49	4·5	2	— 6 + 8	46, 47,
75 7·5	7·64	2	1		46,
86 7·0	7·44	4	2	+ 6 — 5	46, 47,
94 7·3	6·62	2·5	1		47,
110 7·8	var *)	2	1		47,
126 8·3	8·03	2	1		47,
799 7·5	7·80	2	1		46,
78⁰ 71 7·3	7·07	4·5	2	+ 14 — 18	46, 47,

the plate 112, applying the corrections — $0^{m}\cdot09$ and + $0^{m}\cdot02$ to magnitudes on plates 111 an 113 respectively. Magnitudes thus found were compared with E_1 system (Section 9), deduced from observations on Eisenberger Ultrarapid plates with the grating only and containing North Polar Sequence stars in the zone + 87⁰. Full agreement in zero point of both systems was found from the comparison (Section 10).

Provisional magnitudes from plates 111, 112 and 113, are given in Table III arranged in B. D. zones. The table is constructed similarly to Table II with the difference only that residuals are given in columns under appropriate numbers of plates. Zero is written when a star was measured on one plate only.

9. Magnitudes from Eisenberger Ultrarapid plates, taken with the grating only. (System E_1).

The magnitudes of *A* and *B* exposures on all plates were reduced to the system of *A* exposure on the midlle plate Nr. 155, the following corrections being applied to the plates:

Plates	153	154	160	161
Corr.	— $0^{m}\cdot07$	— $0^{m}\cdot11$	— $0^{m}\cdot07$	+ $0^{m}\cdot03$.

*) See Table VI.

Stars found on *P* exposures were treated separately, and from comparison of magnitudes on these exposures with the magnitudes of the same stars, found on *A* and *B* exposures, a small correction — $0^{m}\cdot01$ resulted for reduction of the system of *A* exposure on plate 155 to the system of *P* exposures.

Table III.

Photovisual magnitudes from Eisenberger Ultra-Rapid plates.

System E_0.

B. D.	mg	w	n	Residuals on plates 111	112	113
m	m					
89⁰ 13 7·0	7·04	4·5	3	— 2	— 6	+ 7
88⁰ 4 7·5	6·38	4·5	3	+ 1	+ 3	— 4
9 8·0	8·00	3	3	+ 25	— 12	— 13
64 7·5	7·54	3	3	— 6	— 5	+ 11
71 6·5	6·32	7·5	3	+ 17	— 11	— 10
76 8·0	7·53	3	3	— 2	+ 5	— 4
112 6·5	6·49	4·5	3	— 6	+ 11	— 4
87⁰ 51 5·0	5·05	7	3	— 5	+ 11	— 4
86⁰ 39 8·6	7·87	2	1	0		
51 6·0	5·77	5·5	2	— 2	+ 3	
66 8·0	7·88	4	2	0	0	
79 7·0	6·76	2	1		0	
103 8·2	7·84	2	1		0	
113 7·2	7·33	4	2		+ 7	— 7
126 8·0	7·84	2	1			0
85⁰ 41 7·7	7·11	2	1	0		
45 8·6	7·61	2	1	0		
63 6·5	6·57	7	2	— 1	+ 3	
65 8·5	8·46	2	1	0		
74 6·0	6·50	9·5	3	+ 9	+ 3	— 16
75 8·5	8·10	4	2	+ 14	— 14	
78 7·0	6·69	8·5	3	+ 14	+ 3	— 25
80 6·0	6·27	11	3	— 3	+ 9	— 12
81 8·0	7·48	6	2		+ 5	— 9
128 7·5	7·38	2	1			0
84⁰ 34 8·1	7·84	2	1	0		
51 8·7	8·11	4	1	0		
53 8·5	8·14	2	1	0		
59 6·0	5·48	9	2	— 5	+ 11	
78 7·5	7·30	6	2	— 3	+ 6	
88 7·7	7·68	10	3	+ 1	— 13	+ 23
93 8·5	8·12	2	1	0		
97 8·8	8·42	2	1	0		
110 9·0	7·51	2·5	1	0		
135 8·2	7·31	6	2		— 7	+ 3

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Table III

(continued)

B. D.	mg	w	n	Residuals on plates 111	112	113
m	m					
84° 152 8·0	7·64	6	2		−1	+1
168 7·8	7·67	6	2		−7	+3
169 6·0	6·48	7·5	2		−14	+9
186 8·0	7·46	2	1			0
196 6·0	6·30	3	1			0
225 6·5	6·22	2	1			0
83° 54 8·9	8·15	2	1	0		
60 9·0	8·15	2	1	0		
91 7·3	7·60	6	2	−3	+7	
104 5·0	5·20	9	2	−5	+11	
111 8·7	8·36	2	1	0		
114 7·4	7·26	6	2	−2	+3	
118 8·9	8·40	2	1	0		
121 8·5	8·05	4	2	+17	−17	
126 8·5	7·80	4	2	−1		0
137 8·7	8·24	1	1	0		
141 7·1	7·11	8·5	3	−8	+3	+3
149 8.7	7·91	6	3	+8	+5	−13
178 8·9	8·00	6	2		−5	+2
191 8·0	7·83	6	2		−3	+2
207 8·2	7·70	4	2		+4	−4
232 7·0	7·32	2	1			0
233 7·0	6·98	2	1			0
243 8·3	7·93	2	1			0
256 7·2	7·09	2	1			0
262 7·5	7·08	2	1			0
263 8·0	7·96	2	1			0
82° 51 7·0	6·35	2·5	1	0		
82 7·5	7·33	6	2	−2	+3	
90 8·2	8·04	4	1	0		
113 5·0	5·24	8·5	2	−13	+23	
125 8·5	7·60	4	2	+9	−10	
132 8·6	8·04	4	2	+9	−10	
152 7·6	7·47	8	3	+1	+1	−3
177 6·7	6·52	4·5	2		+2	−2
185 8·7	7·95	2	1	0		
194 8·0	7·29	6	2		−1	0
201 5·5	4·95	9	2		−21	+9
213 7·5	7·63	2	1			0
231 8·3	7·78	2	1			0
235 6·5	6·17	3	1			0
253 7·0	6·89	2·5	1			0
81° 107 7·4	6·91	2	1	0		
134 7·8	7·26	2	1	0		
147 7·5	7·48	4	2	−4	+5	
150 7·9	7·69	2	1	0		
194 8·0	7·78	2	1			0
257 7·2	7·27	2	1			0
273 7·6	7·81	2	1			0

Resulting provisional magnitudes are given in Table IV, constructed in the same manner as Table III. Weight 2 is given when central images with both spectra were measured; if magnitude results from a measure of the central image only, weight 1 is given to it.

10. Provisional photovisual magnitudes from all systems.

System E_0 was chosen as a standard to which both other systems C and E_1 should be reduced. Magnitudes of the system E_1, deduced from exposures with the grating only on the assumption of the difference $0^{m}\cdot968$ between first order spectra and the central image, may differ from magnitudes in the system E_0 in zero point and in scale, colour sensitiveness of both systems being the same. 32 stars are common in both systems. Denoting by m_{E_0} and m_{E_1} magnitudes of stars in the systems E_0 and E_1 respectively the following relation was found by the method of least squares

$$(9)\qquad m_{E_0} - m_{E_1} = -0^{m}\cdot001 - 0.025\,(m_{E_1} - 7^{m}\cdot04)$$
$$\pm\;19 \;\pm\; 24 \qquad \text{(m. e.)}$$

Formula (9) shows full agreement in zero point of both systems, as was indicated in the section 8, and a probable existence of a small scale coefficient. Though the scale coefficient is nearly equal to its mean error, I decided to adopt it, because the difference between first order spectra and central images, resulting from this coefficient, $0^{m}\cdot944$, was in accordance with the observational value of $0^{m}\cdot949$ given by plates of C and E_0 system. All stars of E_1 systems, given in Table IV, are reduced to E_0 system by the aid of formula (9) and the combined system (denoted by E) was compared with C system.

Systems E and C should agree in scale, because the method of observations and the instrument in both systems were the same. They may differ however in zero point and in colour sensitivity, the last difference being caused by using different brands of plates in both cases. 85 stars are common to C and E systems. Spectral classes of them were taken from the Henry Draper Catalogue, and colour indices C corresponding to these spectra were taken from table, given by Lundmark in Handbuch der Astrophysik Band V p. 396 (mean colour index). Denoting my m_c magnitudes of the C system, and by m_E those of E system, the following relation was obtained by a least squares solution:

$$(10)\qquad m_E - m_c = -0^{m}\cdot046 + 0^{m}\cdot004\ C$$
$$\pm\;22 \;\pm\; 21 \qquad \text{(m.e.)}$$

Table IV.

Photovisual Magnitudes from Eisenberger Ultra-Rapid plates.

System E_1.

B. D.	mg	w	n	Residuals on plates 153	154	155	160	161
89^0 13 $7^{m}\cdot0$	$7^{m}\cdot12$	20	5	−6	+6	−6	−1	+8
88^0 2 8·8	8·07	8	4		+11	−20	−6	+7
4 7·5	6·45	16	5	−3	+11	+7	+1	−17
9 8·0	8·04	6	5	0	+13	−12	−1	−12
64 7 5	7·47	22	5	+1	+4	−6	−2	+9
71 6·5	6·28	18	5	+8	−6	0	−4	+6
76 8·0	7·51	17	5	−7	−6	−5	+6	+7
104 8·0	8·26	4	2		+4			−4
105 8·5	8·26	1	1		0			
112 6·5	6·49	12	5	+10	−13	+6	+1	−1
114 8·0	8·31	3	3		−12		+23	−11
87^0 12 8·0	7·77	16	5	−8	+15	−5	0	−5
15 8·2	7·95	6	4	−18	+37	+6	+11	
41 7·9	8·01	4	1		0			
51 5·0	5·16	14	4	+10	−16	+10	−10	
79 8·5	8·16	1	1				0	
83 7·7	7·67	7	3		+14	−5	−10	
85 8·5	7·96	1	1				0	
101 8·0	7·70	5	3			+6	−7	+14
104 8·2	7·99	4	3			−6	+3	0
107 6·5	6·33	8	3			+3	+4	−11
143 7·0	6·93	16	5	+17	−3	−3	−10	+2
147 7·9	8·22	3	2				−23	+12
169 8·1	8·40	1	1					0
187 8·0	7·93	6	3		+26	−16		−9
205 7·5	7·38	14	5	0	+15	0	−1	−16
86^0 17 7·5	6·23	6	2	−6	+13			
25 8·8	8·00	2	1		0			
39 8·6	7·70	3	2	+2	−1			
51 6·0	5·63	4	2	+13	−13			
66 8·0	7·87	6	2		+3	−7		
79 7·0	6·54	6	3	+11	−6	−4		
103 8·2	7·80	4	2		+11	−6		
113 7·2	7·36	6	2		+2	−1		
126 8·0	7·81	7	3		+6	−2	−1	
143 8·6	8·09	1	1				0	
152 8·4	7·97	2	2			−14	+15	
154 8·2	7·94	2	2			−9	+9	
161 7·2	7·25	8	3			−5	−1	+8
170 7·0	7·23	8	3			+4	+1	−8
172 8·2	7·93	2	2			−3	+3	
176 5·7	6·24	8	3			+2	+4	−11
182 6·5	7·06	8	3			+3	−2	+2
187 7·0	7·77	8	3			−10	+5	−2
193 7·5	7·85	2	2				+2	−2

Table IV
(continued)

B. D.	mg	w	n	Residuals on plates 153	154	155	160	161
86^0 201 $7^{m}\cdot5$	$7^{m}\cdot33$	6	2				+9	−5
217 6·8	7·13	4	2				+12	−11
221 8·1	7·66	4	1					0
222 8·8	6·97	2	1					0
242 9·0	8·40	1	1					0
256 8·5	8·56	1	1					0
264 8·5	8·64	1	1					0
269 4·5	3·76	2	1					0
272 6·0	5·66	8	3		−5	+14		−6
275 8·2	7·82	2	1					0
282 7·0	6·78	2	1					0
319 7·0	7·47	2	1	0				
344 6·0	5·35	1	1	0				
347 8·6	7·60	4	1	0				
85^0 9 8·3	7·62	2	1	0				
19 5·0	4·24	3	2	−3	+5			
41 7·7	6·99	4	2	+4	−5			
45 8·6	7·81	4	2	−5	+4			
63 6·5	6·46	4	2	+1	−1			
74 6·0	6·46	8	3	−2	−6	+13		
75 8·5	7·98	5	2		+8	−11		
78 7·0	6·65	8	3	+4	−6	+8		
80 6·0	6·20	8	3	+5	−8	+10		
81 8·0	7·55	6	2		+1	−2		
105 8·2	8·07	2	1		0			
128 7·5	7·44	6	2		−6	+3		
161 7·5	7·26	4	2			+5	−5	
183 7·5	7·20	6	3			−7	+5	+3
222 7·0	7·23	4	2				+8	−7
249 8·0	7·36	4	1					0
263 7·2	6·88	4	2				−1	+1
269 7·5	6·93	6	2				−13	+7
294 7·5	7·49	2	1					0
383 5·0	5·07	2	1	0				
384 6·5	6·54	2	1	0				
399 7·5	6·45	2	1	0				
400 8·0	7·37	2	1	0				
401 8.0	6·96	2	1	0				
403 7·8	6·87	2	1	0				
409 8·0	6·54	2	1	0				
84^0 59 6·0	5·39	4	2	+9	−8			
78 7·5	7·53	2	1		0			
88 7·7	7·82	2	1		0			
135 8·2	7·33	4	2		−4	+4		
152 8·0	7·69	3	2		−4	+8		
168 7·8	7·66	2	1		0			
169 6·0	6·67	2	1			0		
225 6·5	6·29	4	2			+12	−11	
234 5·0	5·19	4	2			+8	−9	

Table IV
(continued)

B. D.	mg	w	n	Residuals on plates 153	154	155	160	160
m	m							
84^0 307 8·0	7·54	2	1					0
371 8·5	7·91	1	1					0
378 8·2	7·79	2	1					0
383 7·7	7·22	2	1					0
412 7·5	7·41	2	1					0
517 6·5	5·84	2	1	0				
536 8·2	7·66	2	1	0				

This formula shows full accordance in colour of both systems, i. e. both brands of plates possess the same colour sensitivity. System C and E differ slightly in zero point. Taking for this difference simply the algebraic mean of differences $m_E - m_c$, the correction $-$ 0m·04 was found and it was applied to magnitudes given in Table II.

Magnitudes of systems C and E_1, being thus reduced to one system, represent a homogeneous photometric system. Mean magnitudes of all stars are given in Table V, which is a final result of this paper. Stars were arranged according to their right ascensions; their coordinates were taken mostly from the Greenwich Catalogue [5]). Magnitudes, resulting from three systems, are given in the fifth column, their total weights and number of plates being given in sixth and seventh columns respectively. The eighth column contains differences in hundredths of a magnitude between magnitudes in systems C, E_0, E_1 and those given in the fifth column. Zero is put in the appropriate column, when a star was observed in one system only. Magnitudes given in Table V should be regarded as provisional only, because they are deduced from a small part of the whole observational material.

Magnitudes of four variable stars, found on three plates of C system, are given in Table VI. Columns, headed by n contain numbers of exposures, on which the magnitudes are based. Magnitudes, resulting from A and B sets on one plate, were given separately.

11. Comparison with Mt. Wilson photovisual magnitudes of North Polar Sequence stars.

Table V contains among other stars 14 stars of North Polar Sequence (N. P. S.). They are listed separately in Table VII in order of their right ascensions. Third column, headed by R, contains magnitudes from Table V,

[5]) Photographic magnitudes of stars brighter than 9m,0 between declination $+75^0$ and the Pole. Royal Observatory Greenwich, 1913.

Table V.

Provisional photovisual magnitudes of 260 stars.

Nr.	B. D.	α 1900	δ 1900	mg	w	number of plates	Residuals C	E_0	E_1
	m	h m		m					
1	84^0 3 8·0	0 10·5	$+84^0$ 24′	8·00	2	1	0		
2	82 5 8·6	0 12·0	82 49	8.15	2	1	0		
3	88 2 8·8	0 16·1	88 53	8·04	8	4			0
4	79 10 7·0	0 20·7	79 30	6·61	4·5	2	0		
5	80 10 7·9	0 24·0	80 49	8·19	2	1	0		
6	85 9 8·3	0 26·2	85 46	7·60	2	1			0
7	82 14 8·3	0 27·8	83 5	7·94	4	2	0		
8	83 9 7·8	0 29·8	84 7	7·19	4·5	2	0		
9	83 10 9·0	0 30·9	84 12	7·86	4	2	0		
10	81 13 6·5	0 32·2	81 57	6·43	5·5	2	0		
11	81 18 7·6	0 41·9	81 25	var*)	—	3			
12	79 19 7·7	0 44·8	79 18	7·92	2	1	0		
13	82 20 6·5	0 45·5	83 10	5·49	11	3	0		
14	82 23 8·4	0 49·9	82 34	7·88	8	3	0		
15	79 24 6·5	0 52·2	80 0	6·66	5·5	2	0		
16	83 20 7·0	0 52·8	84 4	6.80	6·5	3	0		
17	81 25 var	0 53·4	81 20	var*)	—	3			
18	85 19 5·0	0 55·0	85 43	4·36	10	4	+ 2		— 5
19	88 4 7·5	0 55·6	88 29	6·42	36	19	— 3	— 4	+ 4
20	81 30 8·3	0 56·3	81 25	7·91	8	3	0		
21	86 17 7·5	0 59·1	86 37	6.23	12·5	4	— 1		+ 2
22	79 29 6·4	1 0·7	79 29	6·26	5·5	2	0		
23	79 36 6·5	1 7·6	79 23	6·41	2	1	0		
24	80 34 8·0	1 8·5	81 2	7·57	7·5	3	0		
25	80 35 7·3	1 9·7	80 20	7·17	9	3	0		
26	80 36 6·7	1 10·1	80 22	6·63	9	3	0		
27	80 38 8·4	1 14·7	80 50	8·24	2	1	0		
28	87 12 8·0	1 18·1	88 3	7·75	16	5			0
29	82 40 8·6	1 23·1	82 17	8·11	6	2	0		
30	80 50 7·4	1 29·6	80 55	7·06	9	3	0		
31	79 51 8·0	1 35·6	79 45	7·53	4.5	2	0		
32	80 55 7·5	1 38·8	80 23	7·06	6·5	3	0		
33	80 57 7·5	1 39·8	80 53	7·44	9	3	0		
34	86 25 8·8	1 40·3	86 26	7·98	2	1		0	
35	81 61 6·8	1 43·5	81 28	6·91	10	3	0		
36	80 58 6·8	1 44·6	80 25	7·06	6·5	3	0		
37	84 34 8·1	1 45·7	84 15	7·88	4	2	+ 3	— 4	
38	87 15 8·2	1 49·7	88 0	7·93	6	4			0
39	81 67 8·4	1 50·4	82 4	7·92	8	3	0		
40	79 61 7·5	1 55·7	80 11	7·52	4·5	2	0		
41	80 64 6·1	1 57·1	80 49	6·06	6	2	0		
42	80 65 6·7	1 57·9	81 0	6·88	5	2	0		
43	85 41 7·7	1 58·8	85 16	7·03	6	3		+ 8	— 4
44	78 71 7·3	2 1·1	79 13	7·03	4·5	2	0		
45	82 51 7·0	2 1·4	83 5	6.53	12	5	+ 5	—18	
46	79 63 6·7	2 1·4	79 13	6·45	4·5	2	0		
47	80 70 7·7	2 8·6	80 16	7·81	4	2	0		
48	83 54 8·9	2 9·7	83 13	8·12	6	3	— 1	+ 3	

*) See Table VI.

Table V
(continued)

Nr.	B. D.	α 1900	δ 1900	mg	w	number of plates	Residuals C	E_0	E_1
	m	h m		m					
49	88° 9 8·0	2 14·2	+88° 42′	8·03	10	9	+22	−3	−2
50	83 56 8·0	2 20·3	83 23	6·61	8·5	2	0		
51	80 80 8·4	2 23·0	81 12	7·98	6	2	0		
52	85 45 8·6	2 23·4	85 22	7 73	6	3		−12	+6
53	79 75 7·5	2 23·7	79 17	7·60	2	1	0		
54	83 60 9·0	2 31·1	83 27	8·15	2	1		0	
55	86 39 8·6	2 32·2	86 37	7.76	5	3		+11	−8
56	81 90 8·5	2 32·8	81 26	7·86	4	2	0		
57	80 86 5·9	2 33·4	81 1	5·80	8·5	2	0		
58	81 96 8·5	2 41·2	81 26	7·99	2	1	0		
59	79 86 7·0	2 41·8	79 42	7·40	4	2	0		
60	80 89 8·0	2 43·9	80 39	7,88	4	2	0		
61	82 76 8·0	2 54·3	82 31	7·04	6·5	2	0		
62	84 51 8·7	2 55·9	84 28	8·11	4	1		0	
63	80 97 5·5	2 56·2	81 5	5·77	8·5	2	0		
64	84 53 8·5	2 57·7	84 36	8·14	2	1		0	
65	79 94 7.3	3 1·4	79 45	6·58	2·5	1	0		
66	81 107 7·4	3 6·5	81 47	7·02	8·5	3	+4	−11	
67	82 82 7·5	3 8·1	83 10	7·31	12·5	4	−2	+2	
68	84 59 6·0	3 8·6	84 33	5·52	22·5	7	+9	−4	−9
69	81 112 8·4	3 18·2	81 27	7·98	2	1	0		
70	82 90 8·2	3 23·4	83 2	8·01	6	2	−4	+2	
71	83 91 7·3	3 33·7	83 14	7·58	8	3	−5	+2	
72	79 110 7·8	3 33·8	80 0	var*)	2	1			
73	86 51 6·0	3 33·9	86 20	5·75	19	7	+3	+2	−9
74	81 125 7·9	3 36 3	81 14	7·69	2	1	0		
75	81 134 7·8	3 45·5	81 35	7·28	4	2	+2	−2	
76	81 135 7·8	3 45·8	81 17	7·61	2	1	0		
77	80 121 7·8	3 46·3	80 56	7 51	2	1	0		
78	79 126 8·3	3 52·4	79 20	7·99	2	1	0		
79	80 125 7·9	3 53·3	80 25	5·08	3	1	0		
80	80 127 6·8	4 1·1	80 17	6·30	2·5	1	0		
81	81 147 7·5	4 2·0	81 43	7·42	6	3	−13	+6	
82	81 149 8·3	4 3·0	81 11	7·86	2	1	0		
83	81 150 7·9	4 3·6	81 23	7·52	4	2	−17	+17	
84	80 129 8·3	4 4·2	80 10	7·97	2	1	0		
85	83 104 5·0	4 5·0	83 34	5·33	14	4	+23	−13	
86	85 63 6·5	4 5·1	85 17	6·56	19	7	+4	+1	−9
87	82 113 5·0	4 8·0	83 6	5·25	11·5	3	+2	−1	
88	84 78 7·5	4 9·0	84 14	7·36	10	4	0	−6	+16
89	80 133 5·7	4 9.6	80 35	5·36	3	1	0		
90	83 111 8·7	4 11·6	83 57	8·36	2	1		0	
91	80 134 7·4	4 12·0	80 42	6·93	2	1	0		
92	82 118 8·6	4 18·4	82 16	8·07	2	1	0		
93	80 140 7·4	4 19·2	80 40	7·15	2	1	0		
94	85 65 8·5	4 21·4	85 29	8·46	2	1		0	
95	83 114 8·0	4 21·5	83 50	7·28	8	3	+7	−2	
96	80 146 8·0	4 27·2	80 39	7·87	2	1	0		
97	83 118 8·9	4 28·0	83 33	8·40	2	1		0	
98	84 88 7·7	4 33·4	84 42	7·70	12	4		−2	+10

*) See Table VI.

Table V
(continued)

Nr.	B. D.	α 1900	δ 1900	mg	w	number of plates	Residuals C	E_0	E_1
	m	h m		m					
99	83° 121 8·5	4 34·1	+83° 7′	8·05	4	2		0	
100	82 125 8·5	4 37·0	83 1	7·68	6	3	+17	−8	
101	83 126 8·5	4 42·4	83 19	7·80	4	2		0	
102	86 66 8·0	4 46·3	86 10	7·86	10	4		+2	−1
103	82 132 8·6	4 47·8	82 22	8·04	4	2		0	
104	84 93 8·5	4 47·9	85 4	8·12	2	1		0	
105	85 74 6·0	4 56·3	85 50	6·49	23·5	8	0	+1	−2
106	84 97 8·8	4 58·2	84 45	8·42	2	1		0	
107	85 75 8·5	4 59·8	85 37	8·02	9	4		+8	−0
108	83 137 8·7	5 4·9	83 43	8·24	1	1		0	
109	85 78 7·0	5 9·9	85 35	6·68	22·5	9	+1	+1	−2
110	83 141 7·1	5 11·8	83 47	7·11	8·5	3		0	
111	85 80 6·0	5 29·9	85 9	6·20	27·5	9	−10	+7	+2
112	83 149 8·7	5 30 3	83 34	7 91	6	3		0	
113	85 81 8·0	5 34·6	85 16	7·51	12	4		−3	+3
114	84 110 9·0	5 36·6	84 49	7·51	2·5	1		0	
115	81 194 8·0	5 38·4	81 20	7·88	2	1		0	
116	82 152 7·6	5 40·3	82 44	7·47	8	3		0	
117	87 41 7·9	5 45·6	87 20	7·98	4	1			0
118	86 79 7·0	6 8·0	86 46	6·56	14	6	−6	+20	−1
119	82 177 6·7	6 23·4	82 12	6 52	4·5	2		0	
120	84 135 8·2	6 34·1	84 47	7·31	10	4		0	+1
121	82 185 8·7	6 37·1	82 36	7·95	2	1		0	
122	83 178 8·9	6 50·4	83 9	8·00	6	2		0	
123	85 105 8·2	6 51·1	85 54	8·04	2	1			0
124	87 51 5·0	6 53·7	87 12	5·16	42	14	−1	−11	+5
125	82 194 8·0	6 54·6	82 36	7·29	6	2		0	
126	82 201 5·5	7 10 0	82 36	4·95	9	2		0	
127	86 103 8·2	7 11·5	86 35	7·80	6	3		+4	−2
128	84 152 8·0	7 13·7	84 24	7·65	9	4		−1	+2
129	83 191 8·0	7 25·9	83 18	7·83	6	2		0	
130	82 213 7·5	7 27·7	81 55	7·63	2	1		0	
131	81 257 7·2	7 38·9	81 36	7·27	2	1		0	
132	84 168 7·8	7 45·8	84 41	7·66	8	3		+1	−2
133	86 113 7·2	7 52·4	85 59	7·36	11	5	+5	−3	0
134	84 169 6·0	7 53·0	84 21	6·47	14	5	−10	+1	+21
135	82 231 8·3	7 55·1	82 3	7·78	2	1		0	
136	89 13 7·0	7 58·0	88 56	7·08	36·5	19	−6	−4	+4
137	83 207 8·2	8 3·6	83 24	7·70	4	2		0	
138	82 235 6·5	8 5·2	82 44	6·17	3	1		0	
139	85 128 7·5	8 25·3	85 24	7·40	9	4	−12	−2	+3
140	85 129 8·2	8 27·6	85 33	7·36	2	1	0		
141	82 253 7·0	8 28·3	82 36	6·89	2·5	1		0	
142	84 186 8·0	8 35·4	84 16	7·37	4	2	−9	+9	
143	83 232 7.0	8 41·8	83 6	7·32	2	1		0	
144	81 273 7·6	8 42·8	81 40	7·81	2	1		0	
145	83 233 7·0	8 44·5	83 8	6·98	2	1		0	
146	86 126 8·0	8 47·0	85 57	7·79	10	5	−7	+5	0
147	84 196 6·0	8 54·5	84 35	6·19	12·5	4	−4	+11	
148	83 243 8·3	9 3·0	83 2	7·93	2	1		0	
149	84 206 8 0	9 14·9	84 10	7·82	1	1	0		
150	83 256 7·2	9 20·5	83 22	7·09	2	1		0	

Table V
(continued)

Nr.	B. D.	α 1900	δ 1900	mg	w	number of plates	Residuals C	E$_0$	E$_1$
	m	h m		m					
151	83° 262 7·9	9 26·4	+82° 49′	7·48	2	1		0	
152	87 79 8·5	9 28·0	87 34	8·13	1	1			0
153	84 213 8·3	9 30·8	84 14	7·93	1	1	0		
154	83 263 8·0	9 32·6	83 47	7·96	2	1		0	
155	87 81 9·2	9 38·3	87 45	8·14	1	1	0		
156	87 83 7·7	9 44·0	87 3	7·67	9	4	+9		−2
157	84 225 6·5	9 52·6	84 24	6·30	10·5	5	+2	−8	+1
158	86 143 8·6	9 58·2	86 19	8·06	1	1			0
159	87 85 8·5	10 4·0	87 46	7·94	1	1			0
160	84 234 5·0	10 15·2	84 46	5·34	8·5	4	+8		−10
161	86 152 8·4	10 18·6	86 34	7·95	2	2			0
162	85 161 7·5	10 20·8	84 55	7·23	7	4	−2		+2
163	85 166 8·4	10 31·1	85 16	8·09	1	1	0		
164	86 154 8·2	10 40·7	85 54	7·92	2	2			0
165	86 161 7·2	11 2·5	86 11	7·25	13	5	+2		−1
166	88 64 7·5	11 4·2	88 11	7·48	39·5	17	+3	+6	−2
167	84 252 8·4	11 10·9	83 54	7·84	1	1	0		
168	85 183 7·5	11 24·4	85 15	7·21	14	6	0		−1
169	86 170 7·0	11 28·3	86 10	7·24	15·5	6	+3		−2
170	86 172 8·2	11 40·1	86 5	7·89	5	3	−2		+2
171	87 99 8·8	11 47·4	86 47	7·86	2	1	0		
172	87 101 8.0	11 54·6	87 33	7·68	6	4	−1		0
173	86 176 5·7	11 59·7	86 8	6·20	18	6	−4		+6
174	87 104 8·2	12 8·1	87 29	7·98	9	5	+1		−1
175	87 107 6·5	12 13·9	86 59	6·28	17	6	−7		+7
176	88 71 6·5	12 14·4	88 15	6·27	49·5	19	−4	+5	+3
177	86 182 6·5	12 34·6	86 17	7·08	13	5	+2		−2
178	84 286 7·0	12 37·8	84 12	7·32	4	2	0		
179	86 187 7·0	12 59·7	86 25	7·73	10	4	−9		+5
180	85 214 8·6	13 1·3	84 48	7·76	2	1	0		
181	88 76 8·0	13 4·5	88 11	7·49	34	17	−1	+4	+1
182	85 222 7·0	13 18·6	85 17	7·18	8	4	−3		+4
183	84 307 8·0	13 20·5	84 26	7·58	4	2	+4		−5
184	84 311 7·5	13 26·7	83 49	7·30	2	1	0		
185	86 193 7·5	13 32·4	85 47	7·80	4	3	−2		+3
186	85 234 7·0	13 51·5	85 1	7·68	2	1	0		
187	85 235 8·8	13 56·4	85 41	8·50	2	1	0		
188	86 201 7·5	13 59·6	86 14	7·28	12·5	5	−3		+4
189	86 217 6·8	14 49·6	86 22	7·08	12·5	5	−3		+5
190	84 335 7·5	15 1·7	84 20	7·02	4	2	0		
191	86 221 8·1	15 6·3	85 54	7·72	9	4	+6		−8
192	86 222 8·8	15 9·1	86 17	6·97	2	1			0
193	85 249 8·0	15 9·2	85 31	7·38	10	4	+2		−3
194	87 143 7·0	15 9·4	87 37	6·93	24	8	+1		0
195	87 147 7·9	15 27·2	87 23	8·19	3	2			0
196	85 263 7·2	15 42·5	85 9	6·86	8	4	−2		+2
197	85 269 7·5	15 57·4	85 35	6·90	9	4	−6		+3
198	84 351 7·7	16 1·0	83 55	7·04	2	1	0		
199	83 468 8·2	16 12·2	83 40	7·57	2	1	0		
200	86 242 9·0	16 20·2	86 3	8·36	1	1			0
201	84 361 7·2	16 33·6	83 55	7·20	4	2	0		
202	84 371 8·5	16 58·8	84 50	7·88	3	2	0		+1

Table V
(continued)

Nr.	B. D.	α 1900	δ 1900	mg	w	number of plates	Residuals C	E$_0$	E$_1$
	m	h m		m					
203	86° 256 8·5	17 12·1	+86° 13	8·52	1	1			0
204	84 378 8·2	17 12·3	84 54	7·71	4	2	−6		+6
205	84 383 7·7	17 28·6	84 42	7·20	8·5	3	0		+1
206	86 264 8·5	17 32·6	86 57	8·37	3	2	−12		+23
207	88 105 8·5	17 51·6	88 44	8·23	1	1			0
208	88 104 8·0	17 53·9	88 15	8·23	4	2			0
209	87 169 8·1	18 4·4	87 25	8·36	1	1			0
210	86 269 4·5	18 4·6	86 37	4·15	10	4	+8		−31
211	85 294 7·5	18 7·2	85 41	7·52	6	3	+2		−4
212	86 272 6·0	18 7·8	87 0	5·66	19·5	6	−2		+3
213	83 527 7·7	18 8·7	83 54	7·59	4	2	0		
214	83 530 7·8	18 21·5	83 39	7.78	2	1	0		
215	84 412 7·5	18 24·6	84 37	7·29	6·5	3	−5		+11
216	86 275 8·2	18 26.2	86 32	7·67	6	3	−7		+13
217	83 535 7·4	18 36·4	83 18	7·50	2	1	0		
218	86 277 8·8	18 40·7	86 9	7·60	2	1	0		
219	86 282 7·0	18 47·7	86 35	6·68	10·5	3	−2		+11
220	83 547 6·5	19 4·0	83 46	6·86	4·5	2	0		
221	87 180 8·0	19 14·5	87 10	8·10	2	1	0		
222	88 112 6·5	19 22·5	88 59	6.43	31·5	19	−7	+6	+7
223	85 329 8·4	19 33·9	85 53	7·94	5	2	0		
224	88 114 8·0	19 43·3	88 41	8·28	3	3			0
225	85 340 7·5	20 13·6	85 28	7·60	7	3	0		
226	84 451 7 0	20 14·0	84 23	6·78	7·5	3	0		
227	84 461 8·5	20 22·8	84 47	7·74	7	3	0		
228	84 462 7·0	20 24·5	84 14	7·27	7	3	0		
229	84 463 7·2	20 24·5	84 49	7·11	7	3	0		
230	87 187 8·0	20 25·1	87 38	7·94	9	4	+6		−3
231	85 354 8 0	20 50·1	85 18	7·82	3	1	0		
232	83 596 7·7	20 59·0	83 33	7·32	3	2	0		
233	86 319 7·0	21 19·6	86 37	7·37	7	3	−3		+9
234	83 603 7·5	21 21·6	83 50	6·84	3·5	2	0		
235	83 618 7·2	21 50.4	83 34	7·12	3	2	0		
236	83 630 7·0	22 20·9	84 0	7·63	2	1	0		
237	85 383 5·0	22 21·3	85 36	5·16	10	4	+1		−4
238	85 384 6·5	22 21·7	85 43	6·64	8	4	+3		−9
239	87 205 7·5	22 24·2	87 34	7·38	17	7	+2		−1
240	84 509 7·2	22 27.5	84 33	7·06	3	2	0		
241	84 513 7·3	22 50·1	84 15	7·01	3	2	0		
242	84 516 8·0	22 53·5	84 31	7·15	3	2	0		
243	84 517 6·5	22 53·5	84 50	5·89	9·5	4	0		−2
244	83 640 5·0	22 55·2	83 49	4·86	4·5	3	0		
245	81 810 8·1	23 7·5	82 3	7·78	2	1	0		
246	85 399 7·5	23 24·4	85 52	6·52	8	4	+2		−6
247	85 400 8·0	23 26·3	85 27	7·49	5	3	+9		−13
248	85 401 8·0	23 27·5	86 0	7·04	7	4	+3		−8
249	86 344 6·0	23 27·8	86 45	5·52	9	4	+2		−13
250	85 403 7·8	23 30·4	85 38	6·93	7	4	+3		−6
251	82 728 7·5	23 33·2	82 39	7·58	4	2	0		
252	80 780 7·8	23 38·8	80 45	8·10	2	1	0		
253	84 536 8·2	23 39·	84 55	7·64	2	1			0
254	80 784 8·0	23 42·4	80 49	7·98	2	1	0		

Table V
(continued)

Nr.	B. D.			α 1900		δ 1900		mg	w	number of plates	Residuals. C	E_0	E_1
			m	h	m			m					
255	81°	832	8·8	23	44·0	+82°	14′	7·84	4	2	0		
256	82	743	var	23	51·8	82	38	var *)	—	2			
257	85	409	8·0	23	54·8	86	9	6·64	7	4	+3		—9
258	86	347	8·6	23	57·3	86	29	7·62	5	2	+15		—4
259	82	748	7·0	23	57·6	82	25	7·22	4·5	2	0		
260	79	799	7·5	23	57·6	79	44	7·76	2	1	0		

their weights, given in fourth column, being proportional to weights indicated in Table V. Magnitudes, given by S e a r e s in his International Photovisual system (IPv) [4]), are listed in the fifth column headed hy MW_1. Revised magnitudes of these stars, published recently by S e a r e s [6]) in Table II of his paper, are given in the seventh column of Table VII. Sixth and eighth columns contain differences $R - MW_1$ and $R - MW_2$ respectively. Colour indices C_m, given in last column of Table VII, are taken from Table VIII (col. 17) of S e a r e s' [4]) paper.

Two systems of conditional equations

$$R - MW_1 = d_1 = a_1 + b_1\,(MW_1 - 6^{m}\!\cdot\!44) + c_1\,C_m$$

$$R - MW_2 = d_2 = a_2 + b_2\,(MW_2 - 6^{m}\!\cdot\!44) + c_2\,C_m$$

were solved by the method of least squares with weights given in Table VII, and the following results are obtained:

$$R - MW_1 = -\,0.066 + 0.001\,(MW_1 - 6^{m}\!\cdot\!44) + 0.067\,C_m \qquad (11)$$
$$\pm\,26 \quad \pm\,22 \qquad\qquad \pm\,31 \quad \text{(m. e.)}$$

$$R - MW_2 = -\,0.061 - 0.002\,(MW_2 - 6^{m}\!\cdot\!44) + 0.061\,C_m \qquad (12)$$
$$\pm\,22 \quad \pm\,19 \qquad\qquad \pm\,26 \quad \text{(m. e.)}$$

These equations indicate a full agreement of my scale of magnitudes with that of the International Photovisual system, and a slight difference in colour. Magnitudes, given by S e a r e s in his recent paper [6]), are in close agreement with the International Photovisual system, and may be regarded as improved magnitudes of stars given in Mt Wilson Contributions Nr. 235.

*) See Table VI.

[6]) F. H. S e a r e s: Systematic corrections and an extension of the Polar Sequence. Ap. J. 78 p. 141—155 (Mt. Wilson Contributions No 472) 1933.

Equation (12) may be thus regarded as expressing the relation of my system of magnitudes to that of IPv.

My system differs in zero point from IPv system; about half of this difference is caused by the mean colour ($+\,0^{m}\!\cdot\!51$) of six stars, the mean magnitudes of which (Section 6) was used for the determination of zero point on plates. The remaining part of this difference is due to an error in adopted zero point in the *E* system. A correction $+\,0^{m}\!\cdot\!06$ should be added to magnitudes in Table V if we want to reduce them to the international zero point of IPv system.

Table VI.

Variable stars.

Plate	J. D. hel.	RX Cep. B.D. 81° 18	n	U Cep. B.D. 81° 25	n	SS Cep. B.D. 79°110	n	V Cep. B.D. 82°743	n
	d	m		m		m		m	
43	2426418·513	7·34	2	6·77	2	—	—	6·59	2
46	6419·342	7·50	2	6·80	2	—	—	6·47	3
46	·405	7·45	2	6·81	2	—	—	—	—
47	·448	7·62	2	6·87	2	—	—	—	—
47	·513	—	—	—	—	7·16	2	—	—

Table VII.

Comparison with the Mt. Wilson photovisual system of North Polar Sequence.

N.P.S.	B. D.		R	w	MW_1	d_1	MW_2	d_2	C_m
			m		m	m	m	m	m
5	88°	4	6·42	7	6·45	—·03	6·43	—·01	—0·02
8	88	9	8·03	2	8·13	—·10	8·10	—·07	+0·20
1r	87	51	5·16	8	5·09	+·07	5·06	+·10	+1·54
6	89	13	7·08	7	7·06	+·02	7·11	—·03	+0·06
7	88	64	7·48	8	7·55	—·07	7·53	—·05	—0·13
3s	87	107	6·28	3	6·35	—·07	6·30	—·02	+0·28
2s	88	71	6·27	10	6·30	—·03	6·30	—·03	+0·15
3r	88	76	7·49	7	7·57	—·08	7·55	—·06	+1·61
1	86	269	4·15	2	4·37	—·22	4·37	—·22	+0·03
4	86	272	5·66	4	5·84	—·18	5·83	—·17	+0·09
2r	88	112	6·43	6	6·32	+·11	6·39	+·04	+1·61
4r	88	114	8·28	1	8·27	+·01	8·29	—·01	+0·94
2	85	383	5·16	2	5·28	—·12	5·28	—·12	+0·02
3	86	344	5·52	2	5·56	—·04	5 58	—·06	+0·27

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12. Comparison with Potsdamer Durchmusterung and Yerkes Actinometry.

117 stars of my catalogue are common with stars of Potsdamer Durchmusterung (PD) [7]) and 118 of them with those of Yerkes Actinometry *(Y)*.[8]) They are listed in Table VIII, first column of which refers to numbers in Table V. Differences between my magnitudes, given in Table V, and those of *PD* and *Y* were formed. They are given in third and fifth columns of Table V. The last column of this Table contains colour indices, taken mainly from Doorn's [9]) paper. A few of these indices, not found in Doorn's Table, were taken from Yerkes Actinometry. For two stars (B. D. + 78°71 and + 85°340) colour indices were evaluated according to their spectra, and for that purpose they were put in parenthesis.

Equations (13) and (14) express relations between my magnitudes and those of *PD* and *Y*

$$R - PD = -0^{m}\!.257 + 0.031\ (PD - 6^{m}\!.89) + 0.128\ C \qquad (13)$$
$$\pm 14 \pm 13 \qquad \pm 18 \quad \text{(m.e.)}$$

$$R - Y = +0^{m}\!.009 + 0.008\ (Y - 6^{m}\!.65) + 0.099\ C \qquad (14)$$
$$\pm 13 \pm 14 \qquad \pm 18 \quad \text{(m.e.)}$$

My system of magnitudes agrees well in scale and in zero point with *Y* but shows considerable difference in colour with both system. Positive signs of colour coefficients indicate that isophote wavelenghts, which characterize my photometric system, are shorter than those of *PD* and *Y*. My colour system seems to be intermediate between *PD* and Harvard systems, the statement of this fact, however, will be ascertained when my catalogue is compared with Harvard Photometries. Such comparison as well as investigation of relations to other visual catalogues (Potsdam Polar Durchmusterung [10]) Fessenkoff's [11]) Catalogue etc.) will be executed when

[7]) G. Müller, P. Kempf: Photometrische Durchmusterung des nördlichen Himmels enthaltend die Grössen und Farben aller Sterne der B. D. bis zur Grösse 7. 5. Potsdam Publ. 17. 1907.

[8]) J. A. Parkhurst: Yerkes Actinometry. Ap. J. 36, 169—227. 1912.

[9]) N. W. Doorn: Coolourequivalents of 191 stars near the north pole. B. A. N. No 140. 1927.

[10]) G. Müller: Photometrische Durchmusterung der B. D. Sterne von $7^{m}\!.5$ bis $9^{m}\!.5$ innerhalb der Polarzone + 80° bis + 90°. Bearbeitet und herausgegeben von W. Hassenstein. Potsdam Publ. 26. No 85. 1927.

[11]) B. Fessenkoff: Photometric Catalogue of 1155 stars. Kharkov. 1926.

Table VIII.

Comparison with the Potsdamer Durchmusterung and Yerkes Actinometry.

Nr.	mg	R — PD	R — PD′	R — Y	R — Y′	PD′ — Y′	C
	m	m	m	m	m	m	m
4	6·61	—·15	+·12	+·21	+·21	+·09	—0·07
10	6·43	—·17	+·02	+·18	+·12	+·10	+0·57
13	5·49	—·35	—·08	—·01	—·02	+·06	+0·14
15	6·66	—·20	—·01	+·02	—·03	—·04	+0·41
16	6·80	—·18	+·05	+·14	+·11	+·06	+0·23
18	4·36	—·06	+·10	+·11	—·02	—·12	+1·34
19	6·42	—·28	—·02	—·03	—·04	—·02	+0·05
21	6·23	—·07	+·05	+·09	—·03	—·08	+1·18
22	6·26	—·13	+·01	+·09	—·02	—·03	+1·00
23	6·41	—·05	+·16	+·23	+·18	+·02	+0·44
25	7·17	—·11	+·10	+·03	—·01	—·11	+0 31
26	6·63	—·27	—·02	+·05	+·04	+·06	+0·04
30	7 06	—·24	+·01	+·05	+·04	+·03	—0·05
32	7·05	—·18	+·07	+·20	+·19	+·12	+0·01
33	7·44	—·19	+·03	+·09	+·06	+·03	+0·15
35	6·91	—·02	—·01	+·21	+·01	+·02	+1·89
36	7·06	—·32	—·25	—·04	—·19	+·06	+1·38
40	7·52	—·10	+·12	+·01	—·02	—·14	+0·14
41	6·06	—·22	+·05	+·11	+·10	+·05	+0·08
42	6·88	—·06	+·17	+·11	+·08	—·09	+0·22
44	7·03	—·15	+·08	—·16	—·19	—·27	(+0·13)
45	6·53	+·01	+·16	+·17	+·07	—·09	+0·95
46	6·45	—·10	+·12	+·01	—·02	—·14	+0·14
57	5·80	—·06	+·06	+·13	—·01	—·07	+1·35
59	7·40	+·04	+·28	+·15	+·13	—·15	+0·04
63	5·77	—·21	+·06	+·06	+·04	—·02	+0·16
65	6·58	—·39	—·26	—·01	—·12	+·14	+1·00
66	7·02	—·11	—·07	+·20	+·03	+·10	+1·60
67	7·31	—·01	+·04	+·27	+·10	+·06	+1·54
68	5·52	—·23	—·07	+·07	—·03	+·04	+1·02
71	7·58	—·34	—·10	·00	—·01	+·09	—0·08
73	5·75	—·25	—·01	—·03	—·07	—·06	+0·36
79	5·08	—·24	·00	+·15	+·10	+·10	+0·50
80	6·30	—·21	—·07	+·10	—·01	+·06	+1·01
81	7·42	—·26	—·03	+·07	+·05	+·08	+0·05
85	5·33	—·54	—·21	—·17	—·14	+·07	—0·29
86	6·56	—·18	+·02	+·15	+·09	+·07	+0·52
87	5·25	—·43	—·23	—·22	—·30	—·07	+0·76
88	7·36	—·06	+·02	+·23	+·09	+·07	+1·29
89	5·36	—·20	—·07	+·08	—·05	+·02	+1·33
91	6·93	—·42	—·20	—·17	—·20	·00	+0·17
93	7·15	—·47	—·27	—·07	—·11	+·16	+0·24
95	7·28	—·16	—·05	+·24	+·12	+·17	+1·03
105	6·49	—·23	—·01	+·12	+·08	+·09	+0·32
109	6·68	—·14	+·12	+·04	+·03	—·09	+0·02
110	7·11	—·09	+·15	+·11	+·09	—·06	+0·08
111	6·20	+·01	+·08	+·13	—·04	—·12	+1·61
118	6·56	—·20	—·09	+·11	—·02	+·07	+1·19

Table VIII
(continued)

Nr.	mg	R — PD	R — PD′	R — Y	R — Y′	PD′ — Y′	C
	m	m	m	m	m	m	m
119	6·52	−·32	−·08	−·10	−·12	−·04	+0·13
124	5·16	−·02	+·08	+·21	+·05	−·03	+1·67
126	4·95	−·11	−·01	+·05	−·11	−·10	+1·67
130	7·63	− 13	+·11	−·19	−·20	−·31	−0·09
131	7·27	+·06	+·12	+·35	+·19	+·07	+1·44
133	7·36	−·12	+·02	+·03	−·06	−·08	+0·79
134	6·47	−·21	+·06	+·11	+·11	+·05	−0·02
136	7·08	−·20	+·02	+·12	+·09	+·07	+0·18
138	6·17	−·33	−·05	−·13	−·13	−·08	−0·04
139	7 40	−·20	−·01	+·14	+·09	+·10	+0·38
141	6·89	−·23	+·03	+·16	+·16	+·13	−0·06
143	7·32	+·07	+·18	+·24	+·12	−·06	+1·03
145	6,98	−·16	+·05	−·01	−·05	−·10	+0·30
147	6·19	−·29	−·06	−·07	−·11	−·05	+0·29
150	7·09	−·09	+·12	+·18	+·14	+·02	+0·33
151	7·48	−·20	+·02	−·01	−·03	−·05	+0·08
157	6·30	−·10	−·04	+·17	·00	+·04	+1·64
160	5·34	−·35	−·08	−·05	−·07	+·01	+0·21
162	7·23	−·20	−·06	+·08	−·01	+·05	+0·80
165	7·25	−·17	+·04	+·08	+·05	+·01	+0·21
166	7·48	−·26	−·02	+·03	+·02	+·04	−0·09
168	7·21	−·11	+·02	+·14	+·03	+·01	+0·93
169	7·24	−·22	−·01	+·12	+·08	+·09	+0·27
173	6·20	−·34	−·14	+·05	−·01	+·13	+0·51
175	6·28	−·19	+·02	+·16	+·12	+·10	+0·36
176	6·27	−·23	+·01	+·20	+·17	+·16	+0·27
177	7·08	−·33	−·11	−·04	−·07	+·04	+0·19
178	7·32	−·14	+·04	+·08	+·02	−·02	+0·50
179	7·73	−·24	−·06	+ 03	−·02	+·04	+0·35
182	7·18	−·18	+·01	−·10	−·16	−·17	+0·43
184	7·30	−·12	+·03	+·18	+·10	+·07	+0·70
185	7·80	−·32	−·11	−·16	−·19	−·08	+0·07
186	7·68	−·17	−·08	+·03	−·09	−·01	+1·06
188	7·28	−·22	−·03	+·16	+·11	+·14	+0·38
189	7·08	−·18	−·07	+·07	−·05	+·02	+1·06
190	7·02	+·04	+·10	+·30	+·14	+·04	+1·52
194	6·93	−·15	−·10	+·19	+·02	+·12	+1·56
196	6·86	−·12	·00	+·07	−·04	−·04	+1·03
197	6·90	−·26	−·03	+·08	+·05	+·08	+0·15
201	7·20	−·19	+·02	+·17	+·14	+·12	+0·22
210	4·15	−·53	−·19	−·26	−·24	−,05	−0 08
211	7·52	−·39	−·20	−·07	−·11	+·09	+0·26
212	5·66	−·43	−·17	−·07	−·09	+·08	+0·17
215	7·29	−·17	+·02	+·02	−·03	−·05	+0·36
216	7·67	—	—	+·02	−·11	—	+1·16
217	7·50	+·06	+·17	+·30	+·18	+·01	+1·02
219	6·68	+·04	+·10	+·08	−·09	−·10	+1·63
220	6·86	−·28	−·04	+·03	+·01	+·05	+0·07
222	6·43	−·04	+·02	+·20	+·03	+·01	+1·67
225	7·60	−·20	−·15	−·12	−·28	−·13	(+1·41)
226	6·78	−·29	−·06	−·01	−·04	+·02	+0·15

Table VIII
(continued)

Nr.	mg	R — PD	R — PD′	R — Y	R — Y′	PD′ — Y′	C
	m	m	m	m	m	m	m
228	7·27	−·05	+·16	+·08	+·04	−·12	+0·31
229	7·11	−·16	+·02	+·08	+·01	−·01	+0·54
233	7·37	−·29	−·05	−·06	−·07	−·02	−0·02
234	6·84	−·18	−·09	+·04	−·10	−·01	+1·28
235	7·12	−·20	+·02	+·04	+·01	−·01	+0·21
236	7·63	−·13	+·09	+·17	+·15	+·06	+0·08
237	5·16	−·21	+·11	−·08	−·07	−·18	−0·10
238	6·64	−·08	+·02	+·15	+·02	·00	+1·25
239	7·38	−·16	+·07	−·05	−·07	−·14	+0·07
240	7·06	−·24	−·11	−·10	−·21	−·10	+0·92
241	7·01	−·21	−·11	00	−·13	−·02	+1·14
243	5·89	−·14	−·03	+·15	+·01	+·04	+1·37
244	4·86	+·10	+·22	+·29	+·13	−·09	+1·62
246	6·52	−·30	−·07	+·02	−·01	+·06	+0·25
249	5·52	−·28	−·01	−·02	−·03	−·02	+0·14
251	7·58	+·01	+·11	+·23	+·11	·00	+1·09
259	7·22	−·18	+·05	+·06	+·04	−·01	+0·11
260	7·76	−·03	+·19	−·06	−·09	−·28	+0·09

final magnitudes of Warsaw Photometry are deduced from measures of all plates, mentioned in Section 4 of this paper.

My list of magnitudes contains 127 stars brighter than $7^{m}{\cdot}50$ in my scale. 21 of these stars (17%) are not found in *PD*, among them 4 stars brighter than $7^{m}{\cdot}00$.

13. Accuracy of results.

PD and *Y* magnitudes were reduced to my system using formulas (13) and (14). Differences between my magnitudes and those reduced from *PD* and *Y* to my system are given in the fourth and sixth columns of Table VIII under headings $R - PD'$ and $R - Y'$. The seventh column ($PD' - Y'$) gives differences between *PD* and *Y* magnitudes reduced to my system. Taking all stars common to the three catalogues (*R*, *PD* and *Y*) with equal weights the following mean squares of differences were found

	number of stars
$\varepsilon^2_R + \varepsilon^2_{PD} = 0^{m^2}{\cdot}010544$	117
$\varepsilon^2_R + \varepsilon^2_Y = 0.011186$	118
$\varepsilon^2_{PD} + \varepsilon^2_Y = 0.008577$	117

These relations give the following mean errors:

$$(15)\qquad \begin{aligned} \varepsilon_{PD} &= \pm\, 0^{\mathrm{m}}{\cdot}063 \\ \varepsilon_{Y} &= \pm\, 0^{\mathrm{m}}{\cdot}068 \\ \varepsilon_{R} &= \pm\, 0^{\mathrm{m}}{\cdot}081 \end{aligned}$$

All stars common to my catalogue and to those of *PD* and *Y* systems were taken for computation of mean erros (15), disregarding the number of exposures and plates on which my magnitudes were based. These errors therefore do not represent accuracy of magnitudes of stars observed with the frequency required by the method. According to section 2 of the present paper final magnitudes of stars, observed in two zones, should be deduced from at least 16 exposures. Taking from Table V only those stars whose weights (numbers of exposures) are 8 or more, the following mean errors result from 60 stars common to *PD*, *Y* and *R*:

$$(16)\qquad \begin{aligned} \varepsilon_{PD} &= \pm\, 0^{\mathrm{m}}{\cdot}059 \\ \varepsilon_{Y} &= \pm\, 0^{\mathrm{m}}{\cdot}062 \\ \varepsilon_{R} &= \pm\, 0^{\mathrm{m}}{\cdot}058 \end{aligned}$$

Stars used for the calculation of errors (16) are found generally on three or more plates.

Very large corrections, which were generally applied to galvanometer readings of bright stars in reducing them to centres of plates, may influence the accuracy of magnitudes of these stars. My catalogue contains too few stars for a detailed study of errors in different groups of magnitudes. It is evident from Table V that the brightest stars show the largest deviations, as was expected from large corrections applied to these stars in reducing them to the centre of plates. Let us divide 60 stars, which were sufficiently observed, into three groups, according to magnitudes.

Magnitudes	$4^{\mathrm{m}}{\cdot}00 - 5^{\mathrm{m}}{\cdot}50$	$5^{\mathrm{m}}{\cdot}51 - 7^{\mathrm{m}}{\cdot}00$	$7^{\mathrm{m}}{\cdot}01 - 8^{\mathrm{m}}{\cdot}00$
number of stars	8	29	23

First group, containing three stars with largest deviations, is composed of too few stars for determination of a mean error in this group. For the remaining two groups the following mean errors resulted:

$$(17)\qquad \begin{array}{ll} 5^{\mathrm{m}}{\cdot}51 - 7^{\mathrm{m}}{\cdot}00 & 7^{\mathrm{m}}{\cdot}01 - 8^{\mathrm{m}}{\cdot}00 \\ \varepsilon_{PD} = \pm\, 0^{\mathrm{m}}{\cdot}060 & \varepsilon_{PD} = \pm\, 0^{\mathrm{m}}{\cdot}059 \\ \varepsilon_{Y} = \pm\, 0.053 & \varepsilon_{Y} = \pm\, 0.069 \\ \varepsilon_{R} = \pm\, 0.038 & \varepsilon_{R} = \pm\, 0.023 \end{array}$$

There is some indication that the mean error diminishes with the diminishing brightness, the numbers of stars in both groups are, however, too small for decisive conclusion. It seems to me much better to consider 52 stars of both groups together with the result:

$$(19)\qquad \begin{aligned} &5^{\mathrm{m}}{\cdot}51 - 8^{\mathrm{m}}{\cdot}00 \\ \varepsilon_{PD} &= \pm\, 0^{\mathrm{m}}{\cdot}060 \\ \varepsilon_{Y} &= \pm\, 0.061 \\ \varepsilon_{R} &= \pm\, 0.032 \end{aligned}$$

It results from (19) that magnitudes of stars in the interval $5^{\mathrm{m}}{\cdot}51 - 8^{\mathrm{m}}{\cdot}00$ are considerably more accurate in my catalogue than in the Potsdamer Durchmusterung and Yerkes Actinometry. This conclusion refers only to those stars, whose weights are at least 8. Still higher accuracy and a more uniform course of mean errors in the whole observational interval should be expected from observations made with a more suitable objective, when large corrections to the centre of plates will not be necessary.

More detailed study on the relation of Warsaw magnitudes to all existing visual and photovisual systems, and on the accuracy of results will be executed when the remaining plates are measured and reduced.

14. Summary.

1. The aim of the author's investigations is to obtain accurate photovisual magnitudes of all stars brighter than $7^{\mathrm{m}}{\cdot}5$.

2. A 12-cm Zeiss objective was used for preliminary work Exposures were made generally with and without grating and the scale was deduced, according to H e r t z s p r u n g's method, assuming the difference between first order spectra and images taken without grating to be equal $2^{\mathrm{m}}{\cdot}486$. Part of the plates was taken with the grating only before the objective. The zero point was given by the mean magnitude of six stars of North Polar Sequence.

3. 72 plates were obtained by the author in 1931 in Warsaw Astronomical Observatory. 19 of them were measured in the Schilt microphotometer at the same Observatory.

4. The method of observations and of reduction of measures was described. Corrections to the centre of plates were applied in function of apparent brightness of stars and distances from the centre.

5. Three independent photometric systems were formed. Two of them were deduced from exposures taken with and without grating on Cramer Isonon plates (system *C*) and on Eisenberger Ultrarapid plates (system E_0).

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The third system consists of Eisenberger Ultrarapid plates taken with the grating only (system E_1).

6. All systems were reduced to E_0 system and provisional magnitudes of 260 stars thus obtained are given in Table V. They were compared with Mt. Wilson IPv system and full agreement in scale was obtained. The result of comparison:

$$R - MW = -0^{m}\cdot061 - 0.002\ (MW - 6^{m}\cdot44) + 0.061\ C \tag{12}$$

7. Following relations result from comparison with the PD and Y systems

$$R - PD = -0^{m}\cdot257 + 0.031\ (PD - 6^{m}\cdot89) + 0.128\ C \tag{13}$$

$$R - Y = +0.009 + 0.008\ (Y - 6.65) + 0.099\ C \tag{14}$$

8. Mean errors of one magnitude in PD, Y and R systems were computed and for stars between $5^{m}\cdot51 - 8^{m}\cdot00$, which were observed with sufficient frequency by the author, were found:

$$\varepsilon_{PD} = \pm 0^{m}\cdot050, \qquad \varepsilon_{Y} = \pm 0^{m}\cdot061, \qquad \varepsilon_{R} = \pm 0^{m}\cdot032.$$

9. Final results will be obtained, when all plates are measured and reduced.

15. Acknowledgements.

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Lwów
Astronomical Institute of the University
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Prowizoryczne wielkości fotowizualne 260 gwiazd w sąsiedztwie bieguna północnego.

(Streszczenie).

1. Autor zamierza uzyskać z obserwacyj dokładne fotowizualne wielkości wszystkich gwiazd, jaśniejszych od $7^{m}\cdot5$ i wielu słabszych. Praca niniejsza zawiera wstępne wyniki, odnoszące się do gwiazd wpobliżu bieguna północnego.

2. Obserwacje wykonane zostały przez autora w 1931 r. w Obserwatorjum Astronomicznem Uniwersytetu Warszawskiego zapomocą 12 cm objektywu Zeissa. Skalę fotometryczną otrzymano według metody Hertzsprunga, opierając się na własnościach grubej siatki dyfrakcyjnej, którą umieszczano przed objektywem. Podstawę do wyprowadzenia skali stanowiła różnica między natężeniem widma I-go rzędu i natężeniem obrazu tej samej gwiazdy, uzyskanego bez siatki przed objektywem przy niezmiennym czasie ekspozycji. Różnica ta wynosi $2^{m}\cdot486$. Punkt zerowy określono przez średnią wielkość 6 gwiazd Północnego Ciągu Biegunowego.

3. Autor otrzymał z obserwacyj w 1931 r. ogółem 72 płyty; z pośród tych płyt 19 zostało zmierzonych w Obserwatorjum Warszawskiem zapomocą mikrofotometru termoelektrycznego Schilta. Niniejszy artykuł zawiera tymczasowe wyniki, uzyskane z pomiarów tych 19 płyt.

4. Wszystkie pomiary zostały zredukowane do środka płyt; poprawki odczytań galwanometru wyrażono w funkcji odległości obrazu od środka płyty i pozornego jego natężenia. Pozatem uwzględniono systematyczne różnice między poszczególnemi ekspozycjami na płytach.

5. Z pomiarów otrzymano trzy niezależne układy fotometryczne. Pierwszy z nich (C) otrzymano ze zdjęć, wykonywanych naprzemian z siatką i bez siatki na płytach Cramer Isonon. Drugi układ (E_0) został otrzymany tą samą metodą na płytach Eisenberger Ultrarapid. Trzeci zaś układ (E_1) wyprowadzono ze zdjęć, dokonanych wyłącznie z siatką przed objektywem na płytach Eisenberger Ultrarapid.

6. System E_0 wybrano za podstawowy i do niego zredukowano wielkości pozostałych układów. W wyniku otrzymano katalog fotowizualny 260 gwiazd (Tablica V). System fotometryczny, otrzymany przez autora, porównany został z międzynarodowym systemem fotowizualnym z Mt Wilson (poprawione wielkości Searesa z 1933 r.). Porównanie wykazało zupełną zgodę w skali i pewną różnicę w punkcie zerowym oraz w barwie, jak widać z równania:

$$R - MW = -0^{m}\cdot061 - 0.002\ (MW - 6^{m}\cdot44) + 0.061\ C,$$

gdzie *R*, *MW* i *C* oznaczają kolejno wielkości systemu autora, wielkości fotowizualne z Mt Wilson i indeks barwy.

7. Następujące wyniki otrzymano przez porównanie wielkości systemu autora z wielkościami Potsdamer Durchmusterung *(PD)* i Yerkes Actinometry *(Y)*:

$$R - PD = -0^{m}\!.257 + 0.031\,(PD - 6^{m}\!.89) + 0.128\,C;$$

$$R - Y = +0.009 + 0.008\,(Y - 6.65) + 0.099\,C.$$

8. Wielkości gwiazd, zawarte w granicach $5^{m}\!.51 - 8^{m}\!.00$ i dostatecznie często obserwowane przez autora (waga $\geqq 8$), okazały się dokładniejsze od odpowiadających im wielkości w systemach *PD* i *Y*, jak to wskazują następujące wartości błędów średnich porównywanych systemów:

$$\varepsilon_{PD} = \pm 0^{m}\!.060, \quad \varepsilon_{Y} = \pm 0^{m}\!.0.61, \quad \varepsilon_{R} = \pm 0^{m}\!.032.$$

9. Ostateczne wielkości warszawskiej fotowizualnej fotometrji będą opublikowane po dokonaniu pomiarów pozostałych płyt.

Nouvelle méthode pour la détermination des orbites des étoiles doubles têlescopiques.

(Nowa metoda wyznaczania orbit gwiazd podwójnych)

par

Tadeusz Rakowiecki.

On distingue dans un système d'étoile double *l'orbite vraie* du mouvement relatif du compagnon par rapport à l'étoile principale et *l'orbite apparente* donnée par l'observation. L'orbite apparente est la projection ortographique de l'orbite vraie sur le plan perpendiculaire au rayon visuel allant à l'étoile principale. Les quantités qui déterminent la position, la forme et la grandeur de l'orbite et dont la connaissance est suffisante pour le calcul de la position du satellite dans un instant donné s'appèlent les éléments de l'orbite. Pour la voie réelle ils sont suivants:

A. Les éléments mécaniques:

1) P, période ou durée de la révolution complète,

2) T, époque du passage au périastre.

B. Les éléments géométriques:

3) Ω, angle de position de la ligne des noeuds,

4) i, inclinaison de l'orbite sur le plan tangent à la sphère céleste,

5) ω, angle entre la droite étoile principale — périastre et la ligne des noeuds,

6) e, excentricité de l'orbite,

7) a, demi-grand axe de l'orbite.