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COMMUNICATIONS FROM THE OBSERVATORY AT LEIDEN

Further note on the photographic magnitudes of bright northern stars,

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Two series of spectrophotometric magnitudes by HALL are compared with the photographic magnitudes of *B.A.N.* No. 365. Mean values in KING's photometric system of nine series of magnitudes are given for the stars which occur in Miss Güssow's list. Her photo-electric magnitudes seem to be affected by systematic errors which are an irregular function of the right ascension.

In *B.A.N.* No. 365 mean photographic magnitudes have been given for nearly 700 bright northern stars. The material used consisted of photographic magnitudes derived by KING, by HERTZSPRUNG and by THÜRING and of the photo-electric magnitudes of Miss Güssow. These catalogues were all reduced to the photometric system of KING. The mean magnitudes of the main table were then compared with the magnitudes of KIENLE, STRASSL and WEMPE at reciprocal wave-lengths 2·236 and 2·384 and with the ultra-violet and blue magnitudes of COLLMANN. For this purpose formulae were derived by means of which these magnitudes of KIENLE and COLLMANN could be reduced to the system of KING. The reduced magnitudes however were not used in forming the mean values of Table 1, mainly because of the small number of stars involved.

In 1941 HALL published two series of spectro-photometric magnitudes, made at the Sproul and Amherst Observatories[1]). In the present note the relation between m', the mean magnitude of *B.A.N.* No. 365, and HALL's magnitudes at wave-lengths 450 and 500 mμ are given. With the omission of some variable and double stars the following relations were obtained:

$$m' = -\cdot052 + \cdot518\,(m_{456} + m_{505}) + 1\cdot043\,(m_{456} - m_{505}) \quad \text{Sproul}$$
$$\pm 12 \qquad\qquad \pm 70 \text{ m.e.} \quad 45 \text{ stars}$$
$$m' = -\cdot082 + \cdot517\,(m_{450} + m_{500}) + \cdot899\,(m_{450} - m_{500}) \quad \text{Amherst}$$
$$\pm 9 \qquad\qquad \pm 52 \text{ m.e.} \quad 55 \text{ stars}$$

With the aid of these formulae the effective wave-length of m' is found to be 435 and 434 mμ respectively, in close agreement with the value derived from a comparison with the magnitudes of KIENLE.

With the aid of these new data the weight of the photo-electric magnitudes of Miss Güssow, which has not been determined satisfactorily in my first paper, has been re-investigated. The mean square difference between the magnitudes of two series, reduced to the system of KING, has been computed for all possible combinations of the eight available series. Thus 28 values were obtained, from which the square of the mean error of each series has been derived by the method of least squares. The resulting figures are:

	(m.e.)²	m.e.
KING	·0019	± ·044
HERTZSPRUNG	49	± ·070
THÜRING	61	± ·078
GÜSSOW	21	± ·046
KIENLE	10	± ·032
COLLMANN	63	± ·079
HALL (Sproul)	142	± ·119
HALL (Amherst)	76	± ·087

The uncertainty of these figures is considerable, the mean error of (m.e.)² being ± ·0014. The relative weights of the more accurate series are therefore rather uncertain, but it seems clear that HALL's magnitudes are of relatively low weight. HALL himself has remarked that the magnitudes derived from both ends of the spectrum are less accurate than the others. The weight for Güssow comes out smaller than was anticipated in *B.A.N.* No. 365. As will be seen below, these magnitudes seem to be affected by systematic errors.

These eight series together with the measures of BRILL[2]), reduced to the system of KING by means of the formula given by DE VAUCOULEURS[3]) have been combined into mean values, the adopted weights being (m.e.)$^{-2}$. For the mean error of BRILL's catalogue DE VAUCOULEURS' value of $\pm^{m}\cdot051$ has been used. The resulting magnitudes are given in the table for the stars which occur in Güssow's list. The unit of weight corresponds with a mean error of

[1]) *Ap. J.* **94**, 71, 1941.
[2]) *Veröff. Univ. Sternw. Berlin-Babelsberg*, **9**, Heft 2, 1936.
[3]) *Annales d'Astrophysique*, **9**, 222, 1946.

$\pm$ m·1. The deviations of the individual magnitudes from their mean value are given in hundredths of a magnitude. There is a strong indication of a systematic run in the residuals of Miss Güssow's series, which is most pronounced in the first half of the table. The mean square residual computed from the values of the table for stars with weight larger than 14 equals 17·93, which is reduced by 50 per cent to 8·96 if computed from the differences between consecutive residuals. However it seems inadvisable to apply systematic corrections, as the variation of the residuals with right ascension is of a rather irregular character.

TABLE 1

HR	m_{pg}	p	King	Hertzsprung	Thüring	Güssow	Kienle	Collmann	Hall, Sproul	Hall, Amherst	Brill
21	2·74	31	+ 8	+ 5	+ 4	− 3	− 4	− 2	0	− 8	+ 2
153	3·47	18	− 5	+ 3	− 5	+ 3					− 2
168	3·60	28	− 9	+ 6	+ 7	− 2	+ 4				− 3
219	4·11	19	+ 2	+ 7	− 1	− 2		+ 1			− 2
403	2·89	28	+ 5	0	+ 1	− 3	− 1				+ 1
542	3·25	15	− 3	+ 11	− 7	− 1		+ 6			
590	4·96	7		+ 2		− 1					
604	3·48	12	+ 5		+ 8	− 7					
620	4·95	7		− 2		+ 1					
622	3·21	18	+ 1	− 4	− 3	− 2					+ 6
664	4·07	16	+ 4	− 5		− 3					+ 2
840	4·59	7		0		0					
879	4·74	7		0		0					
937	4·75	18	+ 5	− 5		− 9		+ 10			+ 5
941	4·87	7		+ 3		− 1					
1017	2·39	30	+ 7	− 5	+ 9	− 6	− 4		− 5	+ 2	+ 5
1122	2·95	29	+ 2	− 2	− 8	− 7	+ 4	+ 15			− 3
1220	2·76	26	− 4	+ 2		− 8	+ 9				− 8
1228	4·07	16	+ 1	+ 13		− 3					− 3
1392	4·61	7		0		0					
1457	2·70	20	− 4	+ 16	+ 7	0			+ 3	+ 7	− 10
1620	4·86	7		− 2		+ 1					
1791	1·56	30	− 1	0	− 1	− 4	+ 3		+ 2	+ 7	− 4
2047	5·15	7		− 4		+ 1					
2286	4·85	18	− 1	0	− 17	+ 1					+ 7
2473	4·66	20	+ 4	+ 3	0	+ 3		+ 6		− 25	− 3
2777	3·92	18	− 5	− 4	+ 2	+ 12					− 5
2821	5·03	10		− 6	− 1	+ 4		− 1			
2852	4·65	16	+ 12	− 7		− 1					− 6
2985	4·72	19	+ 1	− 11	+ 6	+ 6		+ 3			− 7
2990	2·34	30	+ 2	− 12	+ 10	+ 4	− 4		− 3	− 3	+ 5
3569	3·46	18	− 6	− 6	+ 6	+ 8					− 1
3579	4·55	8		− 12		+ 6		− 3			
3612	5·88	7		+ 1		0					
3619	4·92	7		− 8		+ 3					
3757	4·14	10		− 8	− 2	+ 4		+ 2			
3775	3·77	20	− 1	+ 5	+ 4	+ 7					
3888	4·24	10		− 3	− 5	+ 3					
4112	5·54	7		+ 1		0					
4295	2·42	30	− 2	+ 1	+ 10	+ 6	− 4				
4301	3·07	30	+ 2	+ 6	+ 6	+ 3	− 5				
4554	2·48	30	− 5	+ 8	+ 9	+ 5	− 1				
4660	3·47	18	+ 3	+ 4	+ 4	0					
4905	1·82	28	+ 2	+ 4		0	− 1				
5191	1·75	30	− 2	+ 2	− 17	− 1	+ 2				
5291	3·66	8		− 4	− 2	+ 2					
5563	3·78	31	− 4	+ 4	− 9	0	+ 5	+ 15			
5735	3·17	14	+ 4	− 1	− 6	− 2					
5986	4·65	16	+ 1	+ 15		0					
6132	3·78	30	+ 6	+ 4	+ 7	+ 1	− 3				
6315	5·49	7		+ 1		− 1					
6396	3·06	14	− 4	+ 1	+ 6	+ 3					
6536	3·88	28	− 2	− 10	+ 6	+ 1	+ 1				
6705	4·02	30	0	+ 9	− 4	− 1	+ 4				
7001	·11	28	− 2	− 19		− 1	+ 1				
7178	3·23	18	− 3	− 2	− 2	+ 4					
7298	4·25	7		− 19		+ 8					
7469	4·97	16	− 1	− 11		+ 4					
7528	2·90	29	+ 1	− 11	0	+ 3	0				
7796	3·01	30	+ 9	+ 10	+ 5	+ 3	− 6				
7924	1·46	30	− 4	− 13	− 7	0	+ 4				
7955	5·22	7		+ 1		0					
7957	4·57	18	+ 1	+ 5	+ 3	− 2					
8162	2·77	27	0	+ 9	− 1	+ 4	− 2	+ 3			
8279	5·19	7		+ 7		− 3					
8494	4·58	16	+ 3	− 3		− 5					
8541	4·70	12	− 1	0		+ 1					
8579	4·46	7		− 1		0					
8622	4·69	16	− 3	− 3		+ 3					
8650	3·95	18	− 3	− 2	+ 2	+ 2					
8830	4·90	7		− 1		+ 1					
9071	4·87	7		+ 5		− 2					