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## **Correction to Pickering's reduction of the C. P. D. to the Harvard photographic system**

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The zeropoint corrections have then been applied to all the magnitude differences considered in this note. Finally mean values have been computed of the corrected differences for certain intervals in brightness, which leads to the following table:

Magnitude	$\Delta m$	$n$
6.00—6.99	— .05	22
7.00—7.99	— .01	85
8.00—8.99	+ .02	215
9.00—9.99	+ .01	371
10.00—10.99	+ .00	278
11.00—11.99	— .01	30

It is clear that the scales are practically identical.

The mean error of a difference Be—BG after cor-

rection for colour equation and zeropoint error has been computed for stars in the interval from BG = 8.5 to BG = 10.00. For the first twelve areas the mean error is  $\pm .14$  and for the remaining twelve areas  $\pm .18$ . Especially in the latter areas we have noticed some systematic variations of the difference Be—BG with the position in the area. These errors sometimes amount to some tenths of a magnitude and the larger mean error derived for these areas is probably due to them. The internal mean error of a magnitude in BELJAWSKY's catalogue may be estimated to be about  $\pm .10$ , but of the colour and zeropoint corrections which are necessary for a reduction to the international system only the first seems to be determined with some certainty.

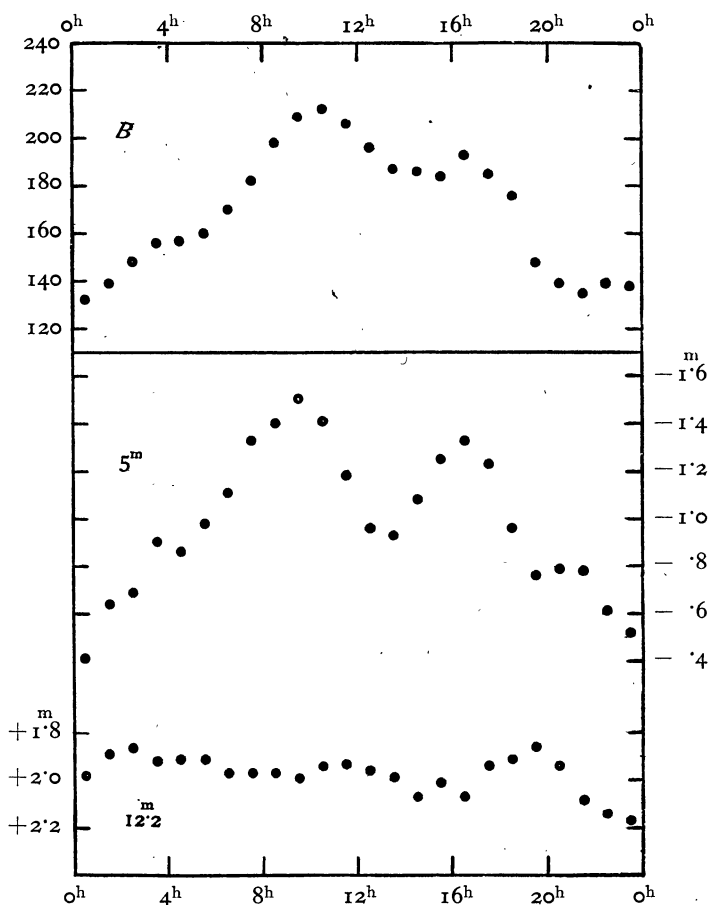
### Correction to PICKERING's reduction of the C.P.D. to the Harvard photographic system, by *P. Th. Oosterhoff*.

Attention is drawn to an error in PICKERING's reduction of the C.P.D. magnitudes, which only affects the faintest stars. New figures are given which should replace the last parts of his Tables 5 and 6. Reasons are given why HALM's reduction for the zones from  $-33^\circ$  to  $-57^\circ$  is probably systematically more correct.

PICKERING has derived some tables by means of which the magnitudes of the *Cape Photographic Durchmusterung* can be reduced to the Harvard photographic system. This reduction consists of a scale correction and of zeropoint corrections which are given for each plate of the C.P.D. separately.

In his first investigation <sup>1)</sup> PICKERING has compared the C.P.D. magnitudes with the Harvard visual magnitudes of *H.A.* 50 and 54, the latter being reduced first to the photographic system by means of the colour indices which correspond with the spectral types. This investigation, which was carried out for the first six hours of right ascension, proved the scale of the C.P.D. to be considerably in error. A factor of about 1.4 will reduce it to the Harvard scale. PICKERING's corrections are given in his Table 3, from which it is seen that they have only been determined for stars brighter than C.P.D. magnitude 9.3. This method does not give any information for the fainter stars.

For this reason PICKERING has used a different method in his second paper <sup>2)</sup>. Here he employed the photographic magnitudes of the Harvard Standard Regions as comparison material. The new scale corrections, given in the third column of Table 3, run quite parallel to those formerly derived, which are shown in the fifth column. But they show a systematic zeropoint difference of .22, at least for that part of the table for which the corrections are well determined. The original definition of the photographic zeropoint has been that the mean photographic magnitude for stars of spectral type A0 between 5.5 and 6.5 apparent



magnitude should equal the mean Harvard visual magnitude. In the present case the zeropoint determination of the first method is a direct one and should be preferred to the second method, especially as the

<sup>1)</sup> *H.A.* 76, No. 12, 1915.

<sup>2)</sup> *H.A.* 80, No. 13, 1917.

magnitudes of the Harvard Standard Regions in the  $-45^\circ$  and  $-75^\circ$  zones have been given with some reserve. This is what PICKERING has actually done and in Figure 1 he has plotted the scale corrections from his first paper and the corrections derived by the second method after application of the systematic difference  $+ .22$ . In the accompanying text it is stated that the corrections of the third column of Table 1 have been plotted, which is evidently a mistake, as the corrections given in the figure were taken from the seventh column of Table 1.

For the faintest stars in the C.P.D. scale corrections have been determined from special measures of such stars on plates of the Harvard Standard Regions. The resulting corrections are given in Table 3. The mean values for C.P.D. magnitudes 10.0 and 10.5 are to be found in the last two lines of the second part of this table. These two corrections have been plotted by PICKERING in Figure 1, but as they also were derived from a direct comparison with the Harvard Standard Regions, they should have been corrected for the systematic difference  $+ .22$ . The scale corrections for the faintest stars, as given in Tables 5 and 6, are consequently too small. The last part of Table 5 should be replaced by:

Correction	Magnitude
1.4	9.5 to 9.6
1.5	9.7 „ 9.8
1.6	9.9
1.7	10.0 „ 10.1
1.8	10.2 „ 10.3
1.9	10.4 „ 10.5
2.0	10.6

And the last part of Table 6 should read as follows:

C	P	C	P
9.5	10.9	10.1	11.8
9.6	11.0	10.2	12.0
9.7	11.2	10.3	12.1
9.8	11.3	10.4	12.3
9.9	11.5	10.5	12.4
10.0	11.7	10.6	12.6

The zeropoint corrections given by PICKERING were derived for each plate separately with the aid of stars of C.P.D. magnitude 8.5. They show a pronounced systematic variation with the right ascension, as is clearly demonstrated by PICKERING's Figures 2 and 3.

Reduction constants for the C.P.D. have also been derived by HALM in the zone between  $-33^\circ$  and  $-57^\circ$ <sup>1)</sup>. He has compared the C.P.D. with a number of selected fields in the  $-45^\circ$  zone, the magnitudes of which are based on his magnitudes around the South

Pole. They seem to agree closely with the international system. His corrections generally confirm those derived by PICKERING, but there are reasons to believe that they are systematically better. HALM has shown<sup>1)</sup> that the scale correction depends on the right ascension in such a way that the faintest stars of the C.P.D. need a zeropoint correction which is the same for all right ascensions, whereas the zeropoint correction for the brightest stars has a range of more than a magnitude. It is interesting to note that this variation in the scale of the C.P.D. magnitudes has been caused by a similar variation in KAPTEYN's reduction constant  $B$ , while the original diameter measures are practically free of such an effect. In the accompanying figure I have plotted mean values of  $B$  for each hour in right ascension for the zones  $-40^\circ$ ,  $-45^\circ$  and  $-50^\circ$ . The mean values of  $B$  are given in the second column of the following table and they have been smoothed by combining three neighbouring values into one.

$\alpha$	mean $B$	smoothed	$\alpha$	mean $B$	smoothed
0	130	132	12	192	196
1	127	139	13	185	187
2	160	148	14	185	186
3	156	156	15	187	184
4	153	157	16	181	193
5	162	160	17	211	185
6	164	170	18	163	176
7	183	182	19	154	148
8	199	198	20	128	139
9	212	209	21	134	135
10	215	212	22	144	139
11	210	206	23	140	138

In the lower part of the figure the zeropoint corrections for the bright and for the faint stars according to HALM have been given for the sake of comparison. The variation in the scale is evidently strongly correlated to the variation of  $B$ . The secondary maximum in the variation of  $B$  near 16 hours would have been more pronounced, if a discordant value of  $B$ , namely 116, of a badly guided plate would have been omitted. As PICKERING has applied a single scale correction for the whole of the C.P.D. and thereafter has determined the zeropoint corrections which were used for bright as well as for faint stars, it seems that for the bright stars the systematic variation with the right ascension has not been fully removed, whereas the magnitudes of the faint stars have been overcorrected. The reduction for the C.P.D. magnitudes near 8.5 should be correct, as the zeropoint corrections were determined by means of stars of this brightness. HALM has based his reduction on the original diameter measures, which are practically free of this systematic error and his reduction should therefore be systematically correct for all magnitudes.

<sup>1)</sup> *Magnitudes of stars contained in the Cape Zone Catalogue*, Table B, London, 1927.

<sup>1)</sup> *M.N.R.A.S.* 74, 600, 1914.