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COMMUNICATIONS FROM THE OBSERVATORY AT LEIDEN

Remark on the photographic magnitudes in the Yale Zone Catalogue between declinations + 20° and + 30°, by *P. Th. Oosterhoff.*

Photographic magnitudes of the stars in the A.G. zones, which have been re-observed photographically at the Yale Observatory, have been determined by SCHILT between the declinations + 20° and + 30° and between + 50° and + 60°. The results for the first zone have been published in the *Transactions of the Astronomical Observatory of Yale University*, Volumes 9 and 10. Special plates taken for the photometric part of the programme were measured in a thermo-electric photometer. The photometric scale has been fixed with the aid of an objective grating, which was calibrated on stars around the north pole. The difference in magnitude between the central image and the first order spectra was thus found to be 2·60. The zeropoint is based on stars of the *Göttingen Aktinometrie* between + 10° and + 20° declination. The limiting magnitude of the catalogue is slightly fainter than 10^m. The mean error of a catalogue value is given as $\pm\ ^m{\cdot}12$.

C. PAYNE GAPOSCHKIN and S. GAPOSCHKIN have compared these magnitudes with the Harvard photographic magnitudes of bright stars between + 20° and + 25°, which have been published in *Harvard Mimeograms*, Series I, No. 2. The results of this comparison are given in *Harvard Bulletin* No. 902. As the Harvard Catalogue contains stars brighter than $8^m{\cdot}25$, the conclusions refer only to the bright stars in the Yale Catalogue. The authors have subdivided the material in six spectral groups and for each group the regression lines have been computed. It is not easily seen from the equations of these lines, as they stand, whether there exists a colour equation of any importance or not. Moreover some errors have entered the computations. The regression lines from Table 1 for the six different groups intersect at the following values of H and Y:

group	H	Y
B	7·23	7·31
A	7·74	7·74
F	− 7·46	− 7·45
G	7·75	7·75
K	7·71	7·71
M	8·91	8·76

The equations of group F are evidently in error. A change in the sign of the constant ·66 of the second equation would bring the point of intersection to H = 6·68 and Y = 6·59, which still differs rather much from the other groups. For the last group M the point of intersection lies likewise beyond the field covered by the observations and some error must have entered. Corresponding changes must be made in Table II and in the final weighted mean values [1]. The authors conclude that there is no appreciable colour coefficient and that the scales and zeropoints of the two catalogues are essentially the same. They suspect however differences in zeropoint for different fields, but they find no evidence for a systematic change with right ascension. The mean error of the zeropoint of a one-hour group is found to be $\pm\ ^m{\cdot}15$. As the Harvard photographic photometry is believed to be on the international system, the same can therefore be assumed for the brighter stars of the Yale Zone Catalogue.

SCHILT's magnitudes of the fainter stars have been compared by the writer with the photographic magnitudes of stars near the north galactic pole, as determined by MALMQUIST. Although only a small sample of the Yale Catalogue can be investigated in this way, the information gained may prove to have a wider validity. MALMQUIST's magnitudes have been published in two papers [2], the first of which gives the results for stars of declination + 21° to + 28° and the second for stars of declination + 29° to + 38°. The magnitudes in these two catalogues have been derived in rather different ways. In the first paper the scale and zeropoint have been determined from comparisons with the Harvard Standard Region at $\alpha = 12^h$ and $\delta = +\ 31°30'$. The corrections of *Harvard Bulletin* No. 781 were applied in order to reduce the magnitudes to the international system. The field corrections were determined with the aid

[1] It is not clear why the relative weights have been taken proportional to $\sqrt{n}$ instead of to n.

[2] *Medd. Lund*, Ser. II, No. 37, 1927.
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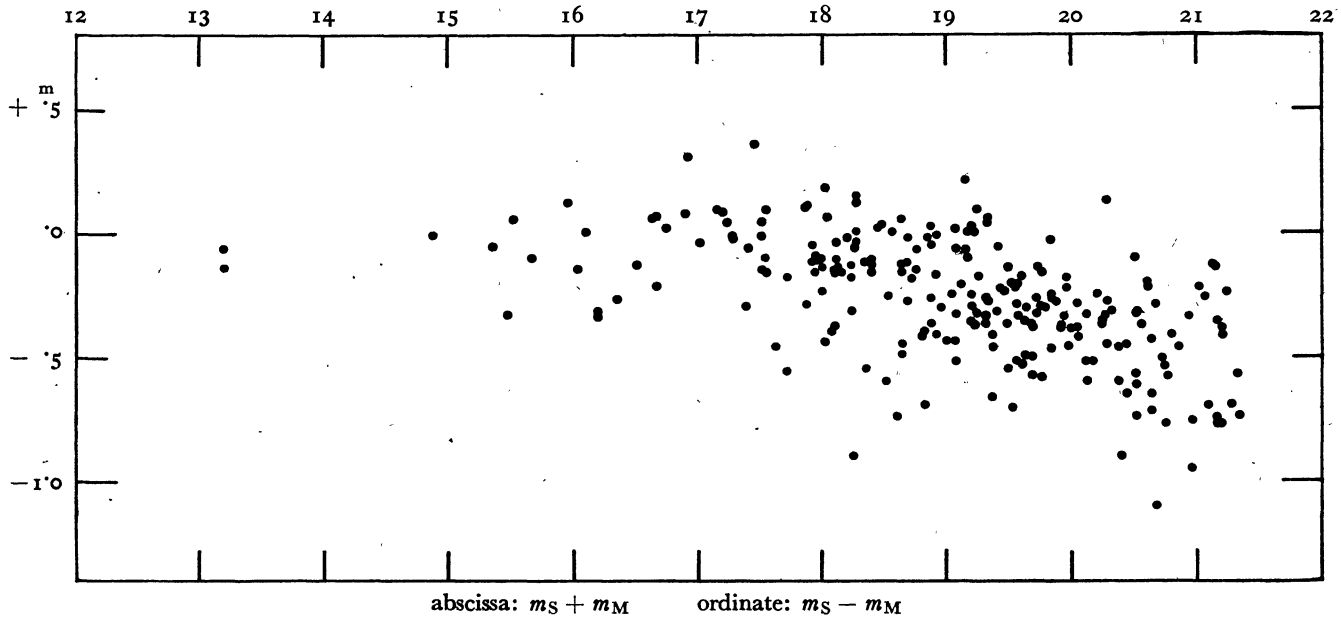
of the Paris and Oxford Astrographic Catalogues and a Polar Sequence plate indicates that no colour equation exists. The mean error of a catalogue value is given as about $\pm$ m·13. Those magnitudes of the second paper, which will be used for a comparison with the Yale Zone Catalogue, are based on two series of plates. The first series has been compared directly with the Polar Sequence and provides magnitudes between 5m·5 and 13m. The second series, yielding magnitudes between 9m·5 and 14m·5, has been taken with an objective grating, the difference between the central image and the first order spectra being m·98. The resulting magnitudes are of high precision and the mean error of a catalogue value is about $\pm$ m·04.

From MALMQUIST's catalogues 203 and 33 stars respectively have been used for the comparison with SCHILT's values. In the accompanying figure the differences $(m_S - m_M)$ have been plotted as ordinate against the sums $(m_S + m_M)$ as abscissa.

It is evident that the dots in this diagram are not



scattered around a straight line. It seems that for values of $(m_S + m_M)$ smaller than 18 the points can be represented by a horizontal line, which means that for stars brighter than 9m the two scales are practically identical. This confirms the conclusion from *Harvard Bulletin* No. 902, that for the brighter stars the scale of the Yale Zone Catalogue is concordant with the international system. For the fainter stars however there appears to be a considerable divergence between the two scales, SCHILT's magnitudes being systematically too small relative to MALMQUIST's values. The 33 stars from MALMQUIST's second and more accurate catalogue show this effect as clearly as the remaining 203 stars from his first catalogue. As MALMQUIST's two scales were determined in different and independent ways, it seems very likely that the scale of the Yale Zone Catalogue is in error for the faint stars. Another factor which corroborates this supposition is the manner in which SCHILT has determined his scale. With a difference of 2m·60 between central image and first order spectra it seems hardly possible to construct an accurate reduction curve. This fact may well cause systematic errors, which probably are largest near the ends of the reduction curve.

Two provisional solutions of the type: $m_S = a + b\, m_M + c\, C$ have been made for the stars with $m_M < 8{\cdot}95$ and with $m_M > 8{\cdot}95$. C represents the colour index used by MALMQUIST, which for nearly all the present stars has been deduced from the spectral type. The coefficient c was found to be: ·13 $\pm$ ·08 and ·00 $\pm$ ·04 respectively. In view of its insignificance this coefficient has been omitted in the final solutions, which give the following results:

$$m_S + m_M < 18{\cdot}00 \qquad n = 46$$

$$m_S - m_M = -\,{\cdot}063 + {\cdot}010\,(m_S + m_M - 16{\cdot}82)$$
$$\pm\,25 \quad \pm\,23 \text{ (m.e.)}$$

and

$$m_S + m_M > 17{\cdot}99 \qquad n = 190$$

$$m_S - m_M = -\,{\cdot}317 - {\cdot}123\,(m_S + m_M - 19{\cdot}52)$$
$$\pm\,15 \quad \pm\,16 \text{ (m.e.)}$$

If our conclusions are correct and if they should apply to the entire zone, the magnitudes of the Yale Zone Catalogue fainter than 8m·7 can be reduced to the international system by the equation:

$$m = -\,2{\cdot}38 + 1{\cdot}28\, m_S$$