DETERMINATION OF THE APPARENT V MAGNITUDES

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Abstract. *V* photoelectric magnitudes are determined on an independent basis. Correlation with *V* sequence of the *UBV* system confirms the coincidence of the two definitions. Comparisons with the *Catalogue of Bright Stars* revealed that more than 40% of BS stars have an apparent *V* magnitude with a probable error of $0^m.1$.

1. Introduction

The Geneva Observatory Photometry has seven pass-bands. The observations and their reductions have been made in view of determining six colour indices with accuracy. No apparent magnitude has yet been published in this photometry. One of the pass-bands corresponds to the *V* band of the *UBV* photometry. Rufener and Maeder (1970) have described a method for establishing sequences of *V* magnitudes. This is done in an independent manner, only one constant has to be chosen to adjust the sequence obtained to an arbitrary scale. A first system of 240 standard stars covering the Northern and Southern Skies was established in this manner. Following this, a procedure was developed to extract the *V* magnitude from all the observations already made in the Geneva System. A first step was the treatment of those nights for which it was possible to compute the instantaneous extinction. These are more than 100 nights during which rising (*M*) and descending (*D*) extinction stars were observed. A reduction according to the method described by Rufener (1964) gave accurate magnitudes which were correlated with the first standard system. A compilation of these results produced a second standard system of about 500 stars to be used for the second step. This was the treatment of all observations made with a constant air mass and without measurements of extinction. This part of the work is not yet completed. A procedure that we will describe later on allows a weighted correlation of these observations. An intermediary compilation of all the magnitudes available at present has allowed us to obtain at least two measurements of *V* magnitude for about 1400 stars. We have compared this list with two sets of *V* magnitudes in literature. The object is to check whether the definition of *V* by Geneva is comparable to that of the *UBV* system. This question was already partly answered when Rufener and Maeder (1970) determined sequences of *V* magnitudes for the Pleiades and Praesepe clusters which were in very good agreement with those already published. The inner accuracy of the Geneva *V* magnitudes has not yet been analysed in detail; nevertheless, an average standard deviation of $0^m.01$ is characteristic for the average values of three measurements of stable stars that are easy to measure.

2. Comparison with the BS Magnitudes

In the BS catalogue (*Bright Stars Catalogue*, Hoffleit 1964), one finds an estimate of the visual magnitude belonging to one of the three following groups:

B. Hauck and B. Westerlund (eds.), Problems of Calibration of Absolute Magnitudes and Temperature of Stars, 298–301.

(a) The photoelectric V magnitude of the UBV system (57% of stars).

(b) The visual magnitude of the first edition of the catalogue, corrected by E. Rybka in view of getting a better correspondence with the V system. This magnitude is accompanied by the suffix R (26% of stars).

(c) The visual magnitude of the first edition, with the suffix H (17% of stars).

For the stars of each of the above-mentioned groups, we have computed correlations of the type: $V^* = a_1[V] + a_0$, $[V]$ being here the Geneva V magnitude. Two standard deviations have been computed: σ_1, the standard deviation of the differences $\Delta_1 = [V] - V$ and σ_2, the standard deviation of the differences after correlation: $\Delta_2 = V^* - V$.

A. CASE OF THE PHOTOELECTRIC MAGNITUDES

Table I gives a summary of the correlation parameters obtained for a few selections made in group A. The supergiants, which are often variable, have been excluded from the first three samples.

TABLE I

Correlation parameters for photoelectric magnitudes

Selection criteria	Nb. of stars	σ_1	σ_2	a_0	a_1
Stars with indice $(B_2 - V_1)$ < -0.05 (blue stars)	92	$0^m.017$	$0^m.017$	-0.010	1.002
Stars of spectral type earlier than K	337	$0^m.020$	$0^m.020$	-0.023	1.005
K and M stars	134	$0^m.030$	$0^m.025$	-0.061	1.009
No selection	508	$0^m.024$	$0^m.023$	-0.031	1.006

The mean value of the correlated magnitudes being close to 5, one notices that the coincidence of the zeros of the sequences is good. The fact that the slopes are slightly larger than unity does not seem to signify an error in linearity, but would rather be related to the spectral type of the stars. Indeed, the relative frequency of the deviations $\Delta_1 = [V] - V$ exceeding $0^m.04$ is distinctly greater for K and M type stars. Let us point out that the consultation of the USNO (1970) UBV catalogue shows that there are several dispersed determinations of V for almost all stars having a large Δ_1. The one figuring in the BS is often extreme, and the choice of a favorable determination would allow the reduction of the majority of larger Δ_1 to a normal value.

B. CASE OF MAGNITUDES WITH SUFFIX R

The stars of this group are distributed over the whole Northern Hemisphere and are of mixed spectral types. Their V magnitudes are little dispersed since they have values between $5^m.2$ and $6^m.7$ with an average value close to $6^m.0$. The computed correlation

parameters are in Table II. We deduce that the magnitudes with suffix R are too low, the mean error is

$$\bar{\Delta}_R = 0^m.10 \pm 0^m.08 .$$

C. CASE OF MAGNITUDES WITH SUFFIX H

The stars of this group are mainly distributed in the Southern Hemisphere. Like in group B, the range of their V magnitudes is small ($5^m.3$ to $6^m.6$) and has a mean value close to $6^m.0$. After having computed the correlations (see Table II), we find that these magnitudes are on an average too large. The mean error is

$$\bar{\Delta}_H = - 0^m.08 \pm 0^m.09 .$$

TABLE II

Correlation parameters for R and H magnitudes

Group	Nb. of stars	σ_1	σ_2	a_0	a_1
Suffix R	99	$0^m.133$	$0^m.082$	0.424	0.913
Suffix H	29	$0^m.138$	$0^m.091$	0.433	0.942

3. Comparison With the 'Gliese' Magnitudes

V magnitudes of the UBV photometry are given in the *Catalogue of Nearby Stars* published by Gliese (1969). We have our own estimate of V for 161 stars of magnitudes 1 to 10 of this list. The parameters of the computed correlation are

$$\sigma_1 = 0^m.025 \qquad \sigma_2 = 0^m.024 \qquad a_0 = - 0.016 \qquad a_1 = 1.003 .$$

The average magnitude of this sample being close to $5^m.5$, we observe again a good adjustment of scale. It is difficult to explain the calculated value of the coefficient $a_1 = 1.003$. The suppression of the stars having magnitudes smaller than $4^m.0$ does not reduce this small difference to unity, thus it does not arise from a lack of linearity due to saturation of the Geneva System. As for the large deviations $\Delta_1 = [V] - V$, these cannot be reduced with a colour equation.

4. Conclusions

At the present we retain the conformity of our V magnitudes with those of the UBV system. The zeros of both scales coincide. The correlations established here give a slope slightly larger than 1.0. The one computed by Rufener and Maeder (1970) for Praesepe gave 1.0, whereas the Pleiades gave a value slightly smaller than 1.0. Because of the very small improvement observed between σ_1 and σ_2, one must not attribute too great an importance to these small deviations. The characteristic standard deviation ob-

served during the comparisons made above ($\sigma_1 = 0.020$ to 0.025) is of the same order as the one obtained by Johnson *et al.* (1966) when they compared the V observations made at Catalina with the original V observations; the photoelectric equipment (filter and cell) being the same. The only case where a standard deviation of $0^m.01$ was observed for correlations of our V magnitudes with other determinations occurred during comparisons with the V sequences of superior quality given in literature for Praesepe and the Pleiades.

More than 40% of the BS (edition 1964) stars have a visual magnitude with a probable error of a tenth of a magnitude.

References

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