

## COMPARING CATALOGUES OF STELLAR ABSOLUTE MAGNITUDES AND ESTIMATING THEIR ACCURACY

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**ABSTRACT** The accuracy of spectral, photometric and astrometric catalogues of stellar absolute magnitudes of F-subgiants and dwarfs has been estimated from a comparison of the data for stars in common.

### INTRODUCTION

If three or more independent catalogues are available, their external random r.m.s. errors may be estimated from the data residuals for objects in common to them (without resorting to any additional information) after the removal of systematic differences. Kuzmin, Malyuto and Eelsalu (1986) showed how to do this if three catalogues are available and some data may present in only two of the three catalogues. Here we analyse three catalogues of stellar absolute magnitudes based on independent spectral, photometric and astrometric measurements for F-subgiants and dwarfs of normal metal content.

### OBSERVATION DATA

Designations of the catalogues are those attributed to them by the Stellar Data Centre (Strasbourg).

1. *Sp* data – Catalogue No. 3149 of MK standards. MK classes have been transformed into absolute magnitudes by us on the basis of a calibration carried out by Straizys and Kuriliene (1981).
2. *Ph* data – Catalogue No. 5014 of main astrophysical parameters from photoelectrical *uvby* photometry.
3. *Trig* data – Woolley Catalogue No. 5032 of stars within twenty-five parsecs of the Sun. The latter data are inhomogeneous, but the probable error of each value of trigonometric parallax drawn from intercomparison of different data is tabulated in the catalogue. We try to estimate the influence of these inhomogeneities on our analysis of errors of catalogues by considering two separate samples of stars: *Trig* - with  $\sigma(\pi)/\pi(\text{trig}) < 0.176$  and *Trig1* - with  $\sigma(\pi)/\pi(\text{trig}) < 0.120$ . The Lutz-Kelker (1973)'s corrections have been applied to all data.

### ANALYSIS OF THE CATALOGUES

Only stars simultaneously occurring in two or three catalogues are considered. For six stars of low metal content ( $[Fe/H] < -0.3$ ) absolute magnitudes inferred from MK and/or photometric data may be systematically incorrect and we excluded those stars from comparison (estimates of metallicities for all stars in common were either taken from the *Ph* catalogue or estimated from *UBV* data given in the *Trig* catalogue). The triples and couples of stars in common number resp.  $n(Sp, Ph, Trig) = 23$ ,  $n(Sp, Ph) = 7$ ,  $n(Ph, Trig) = 25$ ,  $n(Sp, Ph, Trig1) = 14$ ,  $n(Ph, Trig1) = 6$ . The mean differences between  $M_v$  in the catalogues are  $\delta(Sp - Ph) = 0.16 \pm 0.43$  (30 stars) and  $\delta(Ph - Trig) = 0.12 \pm 0.40$  (48 stars).

After the removal of systematic differences we calculate the variances of data residuals; then we use these variances with optimum weights to deduce the external r.m.s. errors of the catalogues as Kuzmin, Malyuto, Eelsalu (1986) showed. Table explains the results of analysis of the catalogues.

TABLE External Random R.M.S. Errors of  $M_v$  Deduced From the Comparison of the Catalogues

<i>Trig</i> Catalogue	$\sigma_{Sp}$	$\sigma_{Ph}$	$\sigma_{Trig}$
Woolley Catalogue of stars within 25 pc of the Sun			
$\sigma/\pi < 0.176(Trig)$	$0.34 \pm 0.04$	$0.22 \pm 0.03$	$0.32 \pm 0.03$
$\sigma/\pi < 0.12(Trig1)$	$0.32 \pm 0.04$	$0.24 \pm 0.03$	$0.14 \pm 0.02$
Planned Hipparcos Output Catalogue, sample within 25 pc of the Sun	$\sim 0.33$	$\sim 0.23$	$< 0.11^*$

\* The error estimate of  $\sigma_{Trig}$  in the last row of Table 2 was deduced with the well-known formula  $\sigma M_v = 2.17 * \sigma(\pi)/\pi(trig)$  by inserting the anticipated accuracy of Hipparcos parallaxes ( $0''.002$ ).

The variances of the external random r.m.s. errors are limited to 9 to 14 %. This shows that our estimates to the errors are meaningful. The most essential feature of Table is the practical coincidence of estimates to the errors of  $M_v(Sp)$  and  $M_v(Ph)$  calculated with the use of *Trig* and *Trig1* catalogues respectively. It means that we may rely on these error estimates even if the *Trig1* and especially *Trig* catalogues are somewhat heterogeneous.

### CONCLUSIONS AND ANTICIPATED DEVELOPMENTS

The accuracy of spectral, photometric and astrometric catalogues of stellar absolute magnitudes of F-subgiants and dwarfs of normal metal content

has been estimated from a comparison of the data for stars in common. We suppose our estimates to errors to be superior in quality to any previous ones and so to become useful for future studies of stars and our Galaxy. We conclude that the method seems to be productive and deserves further elaboration.

The most promising prospect would be the replacement of the *Trig* catalogue by data from the planned Hipparcos Output Catalogue. Trigonometric parallaxes from Hipparcos combined with the above spectral (*Sp*) and photometric (*Ph*) catalogues allow us to determine the external accuracy of astrometric estimates of  $M_v$  for stellar samples within a certain range of distances from the Sun together with obtaining more accurate estimates of errors of  $M_v(Sp)$  and  $M_v(Ph)$ . Some anticipated results are given in Table. We may treat the *Sp* and *Ph* catalogues as probes for estimating the accuracy of various homogeneous stellar samples from the Hipparcos catalogue. The latter catalogue would provide access to more distant stars; some spectral and photometric catalogues could be involved or extended by including stars of other spectral and luminosity classes.

#### REFERENCES

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