TURNOFFS AND AGES OF GLOBULAR CLUSTERS

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The way to arrive at (even relative) ages for globular clusters involves the determination of their (relative) distances. We would like to see a theory which would fit the absolute magnitudes of RR Lyrae stars as determined from observations (Sandage effect). We have examined a sample of 17 CM diagrams of galactic globular clusters, 11 of which were observed at ESO and reduced with the program, ROMAFOT and 6 of which were taken from the literature. In Fig. 1 the difference in bolometric magnitude between the turnoff point and the location of the zero-age horizontal branch (ZAHB), ΔV^{RR}_{TO} (bol) is plotted versus [Fe/H]. It turns out that $\Delta V^{RR}_{TO} \simeq \Delta V^{RR}_{TO}$ (bol) + 0.1 = 3.56 ±0.15. We are faced with the problem of determining how the horizontal branch scales with metallicity in order to understand the constant value of 3.56 in this relation.

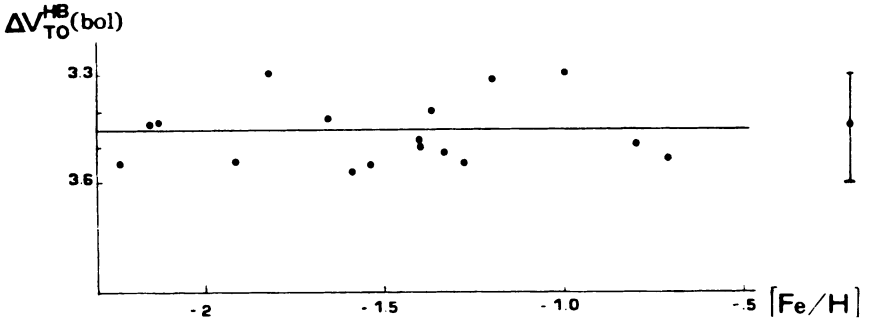

Fig. 1. The difference in bolometric magnitude between the turnoff point and the location of the ZAHB is plotted versus [Fe/H].

In studying the relative distances to the globular clusters we do the following: 1. We assume for one single cluster that the absolute magnitude is known and determine a distance modulus $(m - M)_v$ (possibly with a shift in the zero point). 2. We shift the lower main sequence of this cluster to the blue to take into account interstellar

J. E. Grindlay and A. G. Davis Philip (eds.),
The Harlow-Shapley Symposium on Globular Cluster Systems in Galaxies, 635–636.

reddening. The main sequence of the reference cluster remains fixed in the M_V, $(B-V)_o$ plane. 3. We displace all the CM diagrams according to their reddening. 4. The CM diagrams are shifted in (B-V) color to adjust for differences in metallicity. 5. We determine relative distances by superimposing the lower main sequences. M^{RR}_V remains determined (with the quoted zero point error).

Sandage was the first to suggest this procedure in 1970. To carry out point 4 we used the following relation:

$$\Delta(B-V) = 0.38\Delta([Fe/H])^2 + 0.197\Delta[Fe/H]$$

interpolated using the models of **VandenBerg and Bell**. The fit to the distribution of the derived HB "absolute" magnitudes versus metallicity gives us a slope:

$$\Delta M^{HB}_V/\Delta[Fe/H] = 0.34.$$

This slope, together with the derived constancy of ΔM^{RR}_{TO}, strongly suggests a constant age for all the clusters in our sample.

The internal errors (calibrations, reddening, metallicity, level of the branches, estimate of the turnoff point, etc.) do not generally affect our conclusions since these are based on the properties of the sample as a whole. External errors (for example, an error in the models resulting in a metal-dependent color shift (cf. the first equation above) could alter our conclusions significantly.

https://doi.org/10.1017/S0074180900043412 Published online by Cambridge University Press