THE M_V(RR)-[Fe/H] RELATION FROM THE BAADE-WESSELINK METHOD APPLIED TO FIELD RR LYRAE STARS

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We have applied two slightly different formulations of the Baade-Wesselink (B-W) method : (i) the Infrared Flux (IF) method (Fernley *et al* 1990a), and (ii) the Surface Brightness (SB) method (Cacciari *et al* 1989a), to derive the absolute magnitude of the field RR Lyrae stars UU Cet, RV Phe and W Tuc. The photometric (BVRIJHK) and radial velocity data used in the analysis have been published in Cacciari *et al* (1987, 1989b, 1991) and Clementini *et al* (1990). The Walraven photometry used in the IF method is by Lub (1977). Typical accuracies for individual data points are ±0.01-0.02 mag for the magnitudes and colours, and ±1-2km/sec for the radial velocity data. Excluding RV Phe, which may be affected by Blazhko effects, the results obtained from the IF and SB methods are rather consistent especially when the V−K colour is used in the SB method. For details see Cacciari *et al.* (1991).
The B-W analysis, either SB or IF version, has been previously applied to a number of field RR Lyrae stars by many authors. The most recent compilations are given by Cacciari *et al.* (1991) and Jones *et al.* (1991), and include 24 stars that have been analyzed using infrared data. A least-squares fit weighted both in M_V(RR) and [Fe/H] of the results for these stars (where multiple M_V(RR) estimates have been averaged), leads to a relation between absolute magnitude and metallicity :

$$M_V(RR)=0.19(\pm0.03)[Fe/H]+1.01(\pm0.15)$$

The slope of this relation, however, can vary slightly depending on the criterium adopted to choose the stars and the magnitude determinations to use in the fitting procedure. In fact, since seven stars in the above list have been analysed with both IF and SB methods, and for 8 "problem" stars the absolute magnitude estimates are less accurate (Blazhko effect, high reddening, c-types), we have experimented with the weighting system according to the four different criteria listed below :

All stars (average M_V when multiple)	M_V(RR)=0.19[Fe/H]+1.01	16.1	19.5
All stars (IF results when multiple)	M_V(RR)=0.23[Fe/H]+1.04	16.1	18.6
All stars (SB results when multiple)	M_V(RR)=0.14[Fe/H]+0.98	16.2	20.9
Excluding the 8 "problem" stars	M_V(RR)=0.21[Fe/H]+1.01	15.9	18.8

In the last columns we have estimated the corresponding ages of Globular Clusters using the VandenBerg and Bell (1985) models for Y=0.23 and [Fe/H]=−0.80 (left) and [Fe/H]=−2.20 (right), on the assumption of ΔV(TO-HB)=3.50 and [CNO/Fe]=solar. If there is O-enhancement the ages decrease, [O/Fe]=+0.3 corresponding to a decrease of about 1 Gyr. If the O-enhancement is dependent on metallicity being larger for metal-poor clusters, then also the age spread decreases accordingly.

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