THE LUMINOSITY-METALLICITY RELATION FOR RR LYRAE STARS AND ITS IMPLICATIONS FOR THE ASTRONOMICAL DISTANCE SCALE

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Abstract. The surface brightness version of the Baade-Wesselink method, has been applied to 7 field RR Lyrae stars with metallicity ranging from [Fe/H]= -0.2 to -1.5. V magnitudes, V-R and V-I colors and CORAVEL radial velocities were used, and the analysis was performed over a restricted phase range in order to avoid the complications caused by the pulsating atmospheres. The combination with previous results of the B-W method, which used comparable criteria (Jones, Carney, & Latham, 1988, preprint; Jameson, Fernley, & Longmore 1987, in press M.N.R.A.S; Cohen & Gordon 1987, Ap.J.,318, 215) leads to the following relation between the absolute luminosity and metallicity:

$$M_V = (1.0 \pm 0.05) + (0.17 \pm 0.05)\ [Fe/H]$$

This relation is in very good agreement with the preliminary results found by Liu and Janes (this volume). The application of the above relation to the RR Lyraes in M31 and the Magellanic Clouds leads to distance moduli of $(m-M)_o$ = 24.21 ± 0.20 for M31, $(m-M)_o$ = 18.26 ± 0.20 for the LMC, and $(m-M)_o$ = 18.85 ± 0.20 for the SMC, and the distance to the galactic center turns out to be approximately 7.2 kpc. From the absolute magnitude of the RR Lyraes and adopting a constant visual magnitude difference between the RR Lyraes and the turn-off ΔV = 3.55 (Buonanno 1986, Mem.S.A.It.,57, 333), we estimate ages of 18.8 and 15.7 Gyr for globular clusters of metallicity [Fe/H] = -2.2 (e.g. M92) and [Fe/H] = -0.8 (e.g. 47 Tuc) respectively, using the age-turnoff luminosity relation derived by Sandage (1982, Ap.J.,252, 553) or 20.9 and 16.9 Gyr using Buonanno's relation.

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