PHOTOGRAPHIC PHTOTOMETRY OF 4500 STARS IN M 30

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We present B and V photometry of ~ 4500 stars (V < 21.3 mag) within the region 2'.1 < r < 10' centered on the southern globular cluster M 30 (NGC 7099), from two sets of four plates of the 4 m CTIO (CT) and the 2.5 m Dupont (LC) telescopes (Piotto 1986). Instrumental magnitudes (applying INVENTORY to PDS scans) are calibrated by four CCD exposures from the ESO 1.5 m Danish telescope. Our results removed the disagreement between previous photometry (Alcaino and Liller 1980) and the isochrones published by VandenBerg (1983).

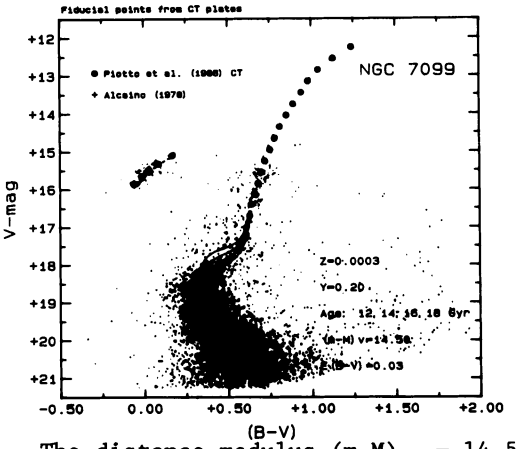

Fig. 1. CM diagram of M 30 showing all 4500 stars from CT plates. Fiducial points (full dots) are compared to the theoretical isochrones published by VandenBerg and Bell (1985).

The distance modulus $(m\text{-}M)_V$ = 14.5 ±0.1, is computed assuming M_V (RR Lyrae) = 0.6 mag. From the CM diagram plotted in Fig. 1, we estimated that m_{VTO} = 18.6 ±0.1 mag and $(B\text{-}V)_{TO}$ = 0.36 ±0.06 mag. The metallicity, [Fe/H] = -1.9 ±0.3, is computed through the de-reddened color index (Webbink 1985) using $(B\text{-}V)_{0,g}$ = 0.71 ±0.03 mag. With this value the isochrones (VandenBerg and Bell 1985) fit the data better than with [Fe/H] = -2.13 given by the index Q_{39} (Zinn 1985) providing an age of (17 ±4)x10^9 yr (model errors are included, as in Renzini, 1986).

The number of Milky Way stars contaminating the luminosity function (Fig. 2, left) is taken from Ratnatunga and Bahcall's (1985) tables. Crowding effects are estimated by determining the relative

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number of stars per magnitude interval lost by INVENTORY among those randomly added to some fields sampling the cluster radially and by reproducing the star counts of King et al. (1968). The two methods give similar results, leading to a corrected luminosity function almost identical for the two sets of plates, in spite of their different resolution. This function, compared to other clusters after normalization to 50 stars between M_V = 5 and 5.5 mag, to avoid evolutionary effects (Fig. 2, left) runs between those of Ω Cen ([Fe/H] = -1.6) and M 15 ([Fe/H] = -2.1). McClure et al. (1986) have pointed out that the most metal-poor globular clusters have the steepest mass function. The theoretical luminosity function, obtained using VandenBerg and Bell's (1985) isochrones with Z = 0.0003 and a mass function $\xi(m) = \xi_o m^{-(1+x)}$, is compared with the observations in the right panel of Fig. 2. To the limit of our photometry the theoretical curves do not allow discrimination of the value of the index x; there is only a marginal indication for the range 1.5 to 2.5.

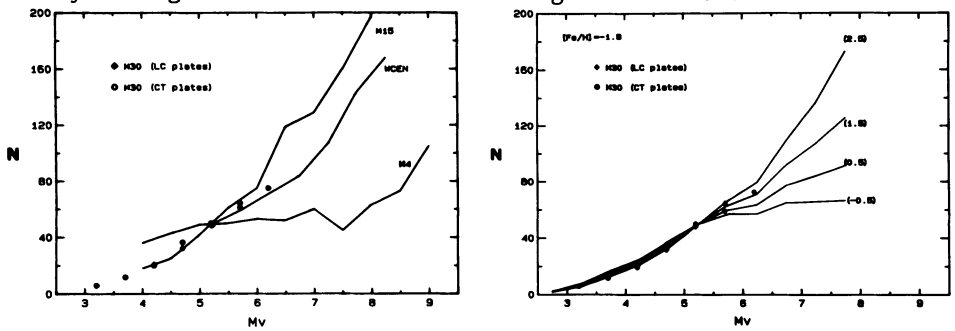

Fig. 2. Luminosity function of M 30 (left) compared with ω Cen (Ortolani 1986). M 15 and M 4 (McClure et al. 1986) and (right) with theoretical functions obtained form VandenBerg and Bell's (1985) isochrones (Z = 0.0003, Y = 0.2) using a power-law mass function with different values of the index x.

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