NEW MAIN-SEQUENCE LUMINOSITY FUNCTIONS FOR GLOBULAR CLUSTERS

Robert D. McClure, Peter B. Stetson, James E. Hesser and Graham H. Smith

Dominion Astrophysical Observatory

William E. Harris

McMaster University

Don A. VandenBerg

University of Victoria

We report new results from a program which is aimed at obtaining deep CCD photometry for a sample of relatively nearby globular clusters having a wide range of metallicities. The CCD cameras on the CFHT 3.6 m, CTIO 4 m and KPNO 4 m telescopes have been used over the past 4 years to obtain deep exposures in regions of a number of clusters. In order to avoid the severest crowding, all of our observations have been obtained at distances of greater than $\sim$ 5 core radii from the cluster centers. The images have been analysed by using the DAOPHOT point-spread-function fitting routines.

The primary result of these investigations has been the determination of cluster V, B–V color magnitude diagrams, a number of which have now been published. Typical total integration times per filter are $1 - 1.5^{hr}$. One of the main uses to which these data have been put involves comparisons with the theoretical isochrones of VandenBerg and Bell (1985). This aspect of our program is described in the review by VandenBerg in this symposium.

A further feature of this deep photometry which has yielded surprising results is the main sequence luminosity functions (LF's) obtained. Our earliest results have been discussed by McClure *et al.* (1986) [see also the review by Hesser, this symposium], who compared LF's for deep CCD CMD's both from their own work and from the literature. That study suggested that the power-law index x of the main-sequence mass function correlates with cluster metallicity, with the most metal rich clusters having the flattest LFs.

In this paper we add new data for M 92, M 12, and NGC 6362 to those of McClure *et al.* (1986). The LF's for these clusters are shown in Fig. 1 as solid lines, with the cluster metallicity displayed in brackets. The M 15 and 47 Tuc LF's are shown for comparison by dashed lines. [The [M/H] values are means of those values compiled by Pilachowski (1984), Zinn and West (1984), and Webbink (1985).] Fig. 2 is a plot of the power-law x index versus metallicity [M/H]. The clusters discussed by McClure *et al.* (1986) are shown as filled circles, the new data as open circles. Whereas McClure *et al.* (1986) derived x values by simple eye

J. E. Grindlay and A. G. Davis Philip (eds.),
The Harlow-Shapley Symposium on Globular Cluster Systems in Galaxies, 485–486.

comparison of the data with isochrone predictions in LF plots, we have adopted a more quantitative approach in the present work. We have measured the number of observed stars in the magnitude bins $M_V = 4.25 - 5.75$ and $5.75 - 8.25$, taken their number ratio, and compared them with the predictions of a simple power-law mass spectrum. (VandenBerg and Bell's isochrones were used to determine the appropriate mass intervals corresponding to the adopted M_V bins.) Consequently, the x values appearing in Fig. 2 are somewhat different from those in McClure *et al.* (1986), typical differences being 0.5, the estimated uncertainty in the determination. As can be seen, the correlation between x and [M/H] is still clearly evident among the cluster sample available to McClure *et al.* (1986). The addition of the three new clusters in the present work still preserves a correlation, but with some scatter. Considering the errors in both the x and [M/H] determinations, however, we cannot say whether the scatter has physical significance.

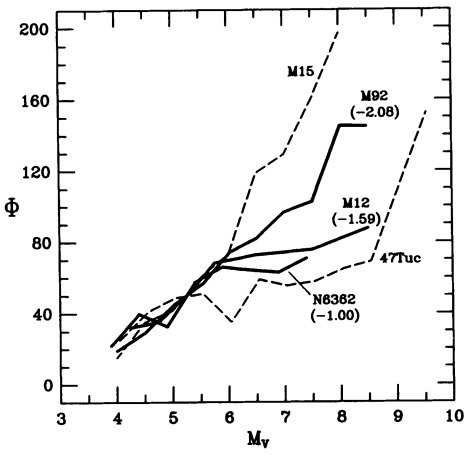

Fig. 1. LF's from three unpublished CMD's are compared with those for M 15 and 47 Tuc as displayed by McClure *et al.* (1986). For the data points illustrated, corrections have been made for field star contamination and incompleteness. The latter is always less than ~ 30%.

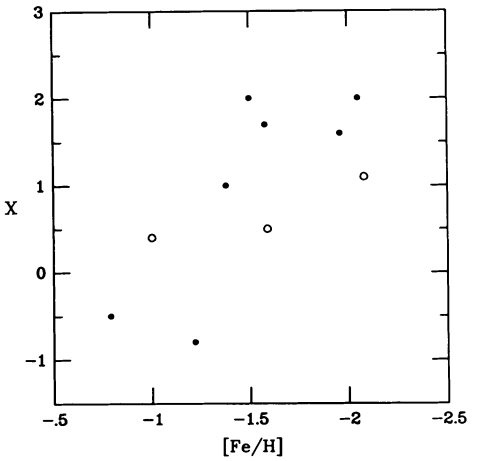

Fig. 2. The power-law index, x ($dN \propto m^{-(1+x)}dm$), computed as described in the text, is shown versus metallicity.

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