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AM-3: An Intermediate-Age Star Cluster in the Extreme Outskirts of the SMC

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1. Introduction

The faint star cluster AM-3 is one of three such objects discovered by Madore & Arp (1979). AM-1 has since been shown to be one of the most distant of the Galaxy's halo globular clusters, while AM-2 is now recognized as a distant, reddened Galactic open cluster. AM-3, however, has been largely ignored despite the fact that it lies only ~4.5 degrees from the center of the SMC making association with the SMC a possibility. This possibility was strengthened by the results of Irwin (1990) who showed that AM-3 lies (in projection) just within the outermost density contours of the SMC field population.

AM-3 was observed with the CTIO 4m prime focus CCD camera using a TI CCD as detector. Three 300 sec V integrations in 1.″3 seeing and three 500 sec B integrations with 1.″5 images were obtained in photometric conditions. The images were analyzed using ALLSTAR and calibrated in the standard manner. The resulting color-magnitude (c-m) diagram for stars within 22″ of the cluster center is shown in Fig. 1.

2. Results

The c-m diagram of Fig. 1 shows a sparse clump of red giants at V = 19.6 ± 0.1 and the top of the cluster main sequence at V ≈ 22. The magnitude for the clump stars in AM-3 is comparable to those in old and intermediate-age SMC star clusters. For example, in the SMC clusters studied by Da Costa & Hatzidimitriou (1998), the clump magnitudes vary from 19.2 (Lindsay 1) to 19.6 (NGC 121). On this basis the association of AM-3 with the SMC appears confirmed, though a radial velocity for the cluster is required to put the question beyond doubt. The projected distance of AM-3 from the center of the SMC is then ~4.5 kpc, larger than the previous western-most cluster identified (Lindsay 1 at ~3.4 kpc in projection) and larger also than the projected distance (~4.2 kpc) of the eastern-most cluster Lindsay 113.

The age of AM-3 can be constrained through the use of isochrone fits. Fig. 1 shows isochrones from Bertelli et al. (1994) for Z = 0.001 and ages of 4, 6 and 10 Gyr fitted assuming a reddening of E(B–V) = 0.03 mag. The vertical fit of the isochrones was set by matching the V magnitude of the clump stars and the resulting modulus, $(m-M)_V = 19.00$, again supports SMC membership for AM-3. If a higher abundance isochrone set is used (Z = 0.004), the fit is less satisfactory and the implied age is somewhat younger than the ~6 Gyr suggested

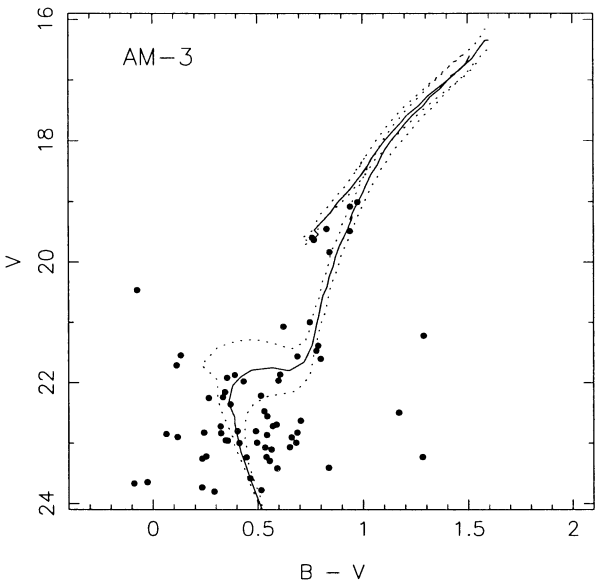

Figure 1. A color-magnitude diagram for AM-3. Superposed are isochrones from Bertelli et al. (1994) for Z = 0.001 placed assuming E(B-V) = 0.03 and $(m-M)_V$ = 19.00. The solid line is for an age of 6 Gyr, while the dotted lines are for 4 (upper) and 10 (lower) Gyr.

by Fig. 1. The best estimate for the age of AM-3 is then ∼5 – 6 Gyr; a more exact determination requires deeper and more precise photometry. Thus AM-3, despite its extreme location relative to the SMC center, is an intermediate-age object. Whether it formed at this radius or is seen near apogalacticon in an elliptical orbit (or even whether it is bound to the SMC) cannot be answered at this time, though the cluster does lie at the outermost HI contour in the map of Mathewson & Ford (1984). Based on comparing the number of AM-3 clump stars to the number of red horizontal branch stars in clusters such as Eridanus or Pal 4, and on adding up the luminosities of the stars in Fig. 1 together with a correction for fainter stars, we estimate $M_V \approx -3.5 \pm 0.5$ mag for AM-3. It is quite probable that this cluster would not have been noticed if it lay closer to the main body of the SMC.

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