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Three Old LMC Globular Clusters

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Abstract. We used deep HST imaging of three LMC clusters, NGC 2257, NGC 1466 and Hodge 11, to determine their ages relative to Milky Way clusters. They all have similar ages to within ± 1 Gyr. For NGC 2257 and NGC 1466, we measured the blue straggler specific frequencies and find them to be similar to those of Galactic clusters.

1. Introduction

With the advent of HST, it is possible to study the LMC globular clusters in similar detail to those in our own Galaxy. We can then probe the formation history of the LMC, placing constraints on the epoch of initial star formation and the duration and nature of globular cluster formation in the LMC halo. Recent results by Olsen et al. (1998), Mighell et al. (1996) and Brocato et al.

(1996) show that the LMC clusters are close in age to the Milky Way clusters, while Testa et al. (1995) argues that NGC 2257 is $\sim$ 2-3 Gyrs younger.

2. Observations and Results

We have V and I WFPC2 photometry extending to $\sim$ 3 magnitudes below the main-sequence turnoff for three old, metal-poor LMC clusters: NGC 1466, NGC 2257 and Hodge 11. We compared their color-magnitude diagrams to those of local Galactic globulars both qualitatively and quantitatively using the ΔV method. We find that these three LMC clusters are as old as the Milky Way clusters. Our photometry probes faint enough magnitudes that the blue straggler sequences are easily visible. We calculated the specfic frequency of the blue stragglers (F_{BSS}) (Bolte et al. 1993) for two of our clusters. We find a F_{BSS} for NGC 1466 of 0.10 and for NGC 2257 of 0.14. These numbers are similar to MW clusters such M3 (0.09) and NGC 5053 (0.14) (see Cohen et al. (1997) and references therein).

3. Discussion

We used the results of the semi-analytic models of galaxy formation of Somerville & Primack (1999) to compare our results with the predictions of hierarchial clustering in a CDM universe. The models gave us the merging and star-formation histories of galaxies inside 10 Local Group-sized halos. We compared the times of the first large-scale star formation of the parent galaxies with those of their satellite galaxies. Although the first subclumps of satellite galaxies cool and collapse later on average than their counterparts for the parent galaxies, a substantial number of LMC-like objects collapse and begin their first starburst within 1 Gyr of their parent's first burst. Thus, the similar ages to Galactic globulars and the LMC clusters are consistent with hierarchial clustering models of galaxy formation, if we assume globular clusters form in the first major starburst. Our blue straggler results show that the blue straggler populations are not affected a large amount if the clusters belong to a different galaxy and that other, internal properties must be important.

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