THE EVOLUTION OF THE RED GIANT CLUMP AND THE STRUCTURE OF THE SMALL MAGELLANIC CLOUD

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The evolution of the red giant clump as a function of age has been investigated by analyzing the color-magnitude diagrams of a number of intermediate-age star clusters in the LMC. We find that the luminosity of the clump decreases systematically until about 1 Gyr. Thereafter, the mean apparent magnitude of the clump in LMC clusters remains constant at V $\sim$ 19.0 $\pm$0.1, although with significant scatter about this value in clusters with ages between 1 and 2 Gyr. The luminosity width of the clump also varies systematically with cluster age, being largest for clusters with ages near 1-1.5 Gyr. For six clusters older than 2 Gyr, the clump shows an intrinsic luminosity spread (defined as the FWHM of the best-fitting Gaussian) of 0.30 $\pm$ 0.07 mag. The systematic behavior of the color of the clump as a function of age was studied in detail by Hatzidimitriou (1991, *M. N. R. A. S.*, **251**, 545).

These results have been used to analyze the line-of-sight structure of the SMC based on the luminosity extension of the red giant clump. CCD photometry of two SMC fields – one in the West and the other in the Northeast – have been obtained with the Las Campanas 1m telescope for this purpose (see the figures below). The lack of bright main sequence stars in both fields indicate that neither contains a significant contribution from a stellar population younger than 1.5-2 Gyr. The red giant clump in the W field is only slightly more extended than expected from the observed vertical width of red giant clump in LMC cluster older than 2 Gyr; in contrast, the clump is significantly extended in the NE field. This implies a line-of-sight depth in the W SMC field of $\lesssim$ 5 kpc, while in the NE field the depth may be as large as 23 kpc, consistent with the recent study of Hatzidimitriou and Hawkins (1989, *M. N. R. A. S.*, **241**, 667; HH) based on photographic photometry. Alternatively, we can interpret the luminosity function of the red giant clump in the NE of the SMC as evidence for two distinct components separated by 12 kpc, and each about 7 kpc thick (HH). There is clear evidence that the NE region of SMC shows considerable depth along the line of sight, perhaps due to a recent tidal encounter with the LMC.

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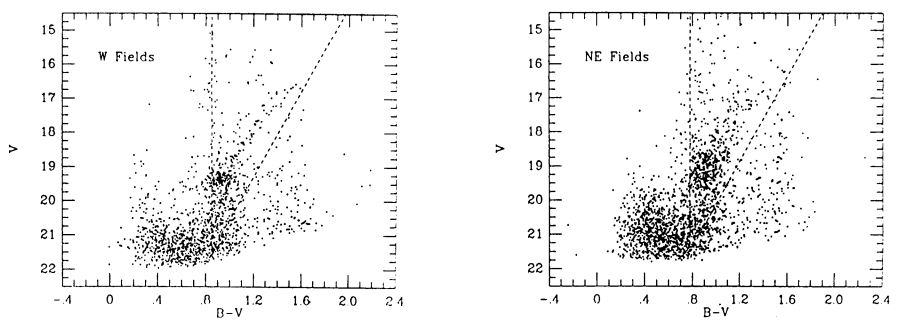

CMDs of the W (left) and NE SMC fields. The large luminosity extension of the clump in the NE field compared to the W field is evident.