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Cluster and Field SFR in the Small Magellanic Cloud

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Abstract. We present preliminary results concerning the properties of 77 clusters and field stars located in a densely populated region centered on NGC269 in the bar of the SMC. The ages of the clusters and field stars are derived. The cluster formation rate peaks at about 100 Myr ago: nearly 50% of the clusters formed in the age interval from 50 Myr up to 200 Myr. Further episodes took place at 400 Myr, 500 Myr and 700 Myr. Star formation rate for the field is inferred from downhill simplex method and is compared to the cluster formation rate.

Key words. CM diagram – field stars– star formation rate

1. Introduction

Local Group (LG) galaxies are the only galaxies for which current observations can resolve sufficiently faint stars, red giant branch or fainter with which one can constrain both the recent and the ancient Star Formation History (SFH) (Harris & Zaritsky 2004). The Large and the Small Magellanic Clouds are the two most massive systems close to the Milky Way. These satellite galaxies corrently contain large gas reservoirs and continue to vigorously form stars. In spite of this, their total metallicities remain low (about 1/10 of the solar one). The detailed study of the gaseous content of the SMC in particular can provide insights into the condensation of molecular clouds, the formation of globular clusters, the effect of early star formation on the interstellar medium and the subsequent triggering of secondary star formation through interstellar shocks (Stanimirović et al. 2004). The star formation histories of both cluster and field stars provide information about the interaction of the two clouds with the Milky Way. In fact theoretical models predict that tidally triggered SF might occur as a result of interactions among the three galaxies. The poorly constrained LMC-SMC orbits are the major source of uncertainty, and the close passage epochs cannot be reliably derived by the models. Therefore deriving the SF episodes in common for SMC and LMC can cast light on the problems. A program has been undertaken to obtain the SFR of both cluster and field stars in the SMC-LMC complex. In this

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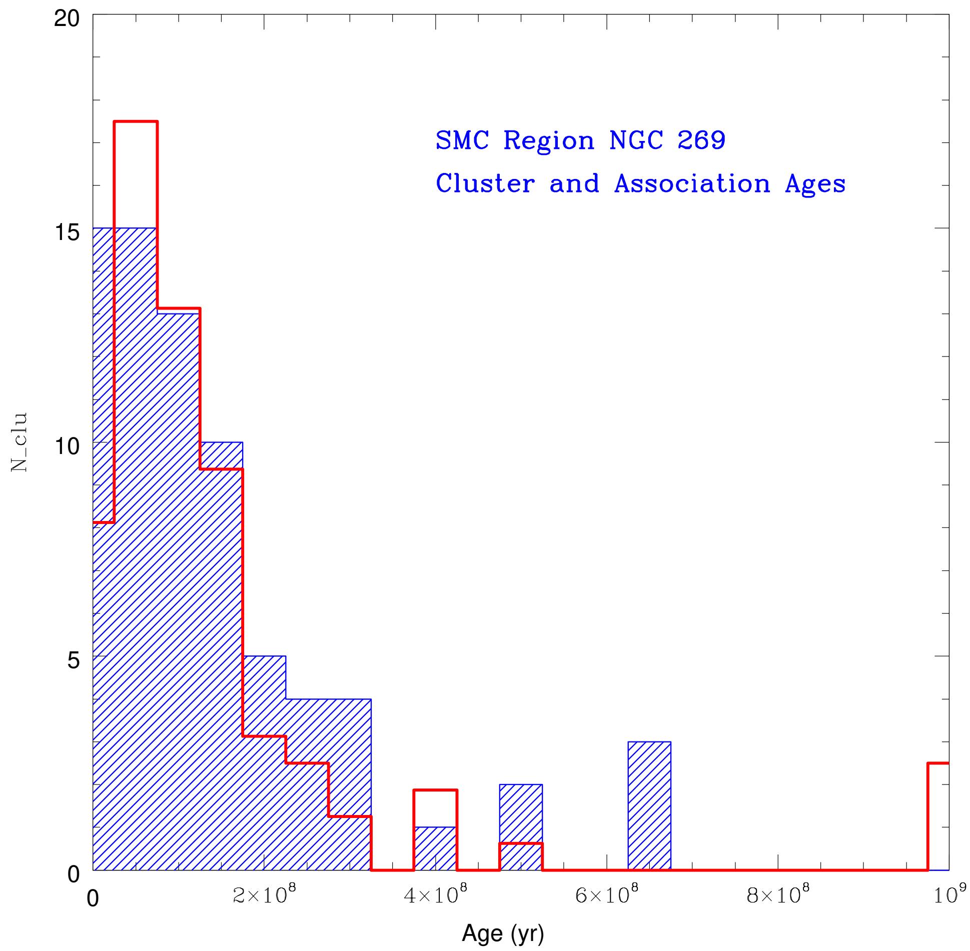

Fig. 1. The age distribution of clusters and young association in the studied field (dashed area) is compared with OGLE data normalized to the same area (heavy solid line) (Pietrzynski & Udalski 1999) (see text for details).

work we present preliminary results concerning the properties of a region centered on NGC 269 at the SW of the SMC Bar. B, V, I images were taken with the WFI at the ESO 2.2m telescope. The field of view is of 15 arcmin^2. More than 100000 stars are found down to V=24.

2. The Formation rates of Clusters and Field stars

The ages of about 70 clusters and associations are derived from isochrone fitting of the Colour-Magnitude diagrams (CMDs), once that the field contamination is removed. Padova isochrones are from Girardi et al. (2000).

Young epysodes took place a few Myr ago with a peak around 10^7yr. Main burst is evident at 10^8 yr in correspondence with perigalacticon and lasts till 3 10^8 yr (Fig.1).

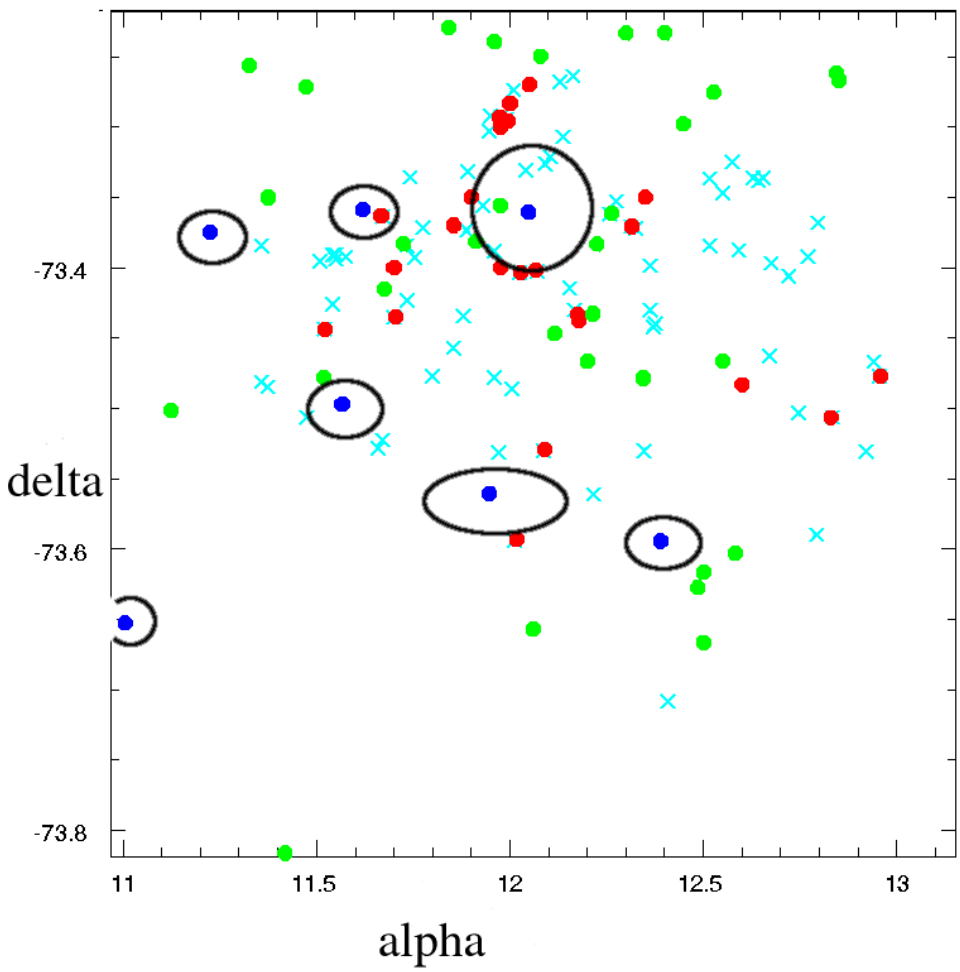

Fig. 2. Distribution of young associations (dark gray dots), HII regions (pale gray dots) and older clusters (crosses) is compared with the approximate location and size of the CO clouds (heavy solid line) from Mizuno et al. (2001)

The comparison with the age distribution inferred from the catalog of Pietrzynski & Udalski (1999) for a larger area shows that the region we are considering is representative of the main body of the SMC.

Comparing the age distribution with the CO cloud catalog by Mizuno et al. (2001) we find that objects younger than 10 Myr are mostly located close the CO emission, while the oldest generation is more evenly distributed (Fig.2). Even if our statistics is rather poor it lends support to the suggestion by Fukui et al. (1999) that young clusters are formed in large groups inside CO clouds. Our result is in agreement with the observations by Rubio et al. (1993) revealing the presence of two main complexes of CO molecular clouds located in the South West and North East area of the bar. The location of Giant Molecular Clouds (GMCs) shows a good spatial correlation with the HII regions and young clusters indicating that cluster formation is ongoing. On the other hand they show little correlation with older cluster or with supernova remnants suggesting rapid dissipation of CO (Mizuno et al. 2001).

The SFR of the field population is derived using the down-hill simplex algorithm to compare the synthetic and observed CMDs. Strong bursts are present at 20 Myr, at 300 Myr, and at 2 Gyr. The average SFR in the region was higher in the recent past (from 200 Myr till now) than at older ages. At earlier epochs (t > 4 Gyr) a significant enhancement happened followed by a more quiescent period. The youngest strong episodes are coincident with the main episodes of the cluster formation.

3. Conclusions

The distribution of young clusters supports the idea that they form inside molecular clouds. The SF of the field population is continuous punctuated by bursts. While almost no clusters are found older than a few 10^8 yr due to disruption effects, the episodes at 200 Myr and 20 Myr are present in the cluster and field distribution. Together with the 2 Gyr event, these episodes are found as well in the LMC (Vallenari et al. 1996). They might be related to external triggering events like the interaction with the LMC and Milky Way (Bica et al. 1996; Harris & Zaritsky 2004).

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