Stellar Populations as Building Blocks of Galaxies
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A photometric and spectroscopic study of the stellar populations in the Large Magellanic Cloud

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Abstract. In the last years we started a long-term project devoted to obtain a complete photometric and spectroscopic screening of the stellar populations of the LMC globular cluster system and surrounding fields. The ultimate goals of this project are as follows:

• The definition of reliable and homogeneous cluster metallicity and age scales from high quality, high resolution spectra and color-magnitude diagrams.

• The detailed study of the chemical abundance patterns of iron-peak, alpha-, s- and r-process elements, in order to constrain the star formation and chemical enrichment timescales of both the cluster and field populations and check for possible self-enrichment in the clusters.

Keywords. stars:abundances — galaxies: Magellanic Clouds — galaxies: star clusters — techniques: spectroscopic — techniques: photometric

1. Chemical Abundance analysis

We present the results of the chemical analysis of giant stars located in four intermediate-age LMC clusters, namely NGC 1651, 1783, 1978 and 2173, and based on UVES@FLAMES high-resolution (R∼40000) spectra (Ferraro *et al.* (2006) and Mucciarelli *et al.*, in preparation). The main results are summaryzed in the following:

• We derive [Fe/H]=-0.30±0.04, -0.35±0.03, -0.38±0.03 and -0.51±0.04 dex for NGC 1651, 1783, 1978 and 2173, respectively. All clusters show a very high homogeneity in their iron content, the overall scatter being ⩽0.07 dex and entirely accounted for by internal errors.

• Each cluster exhibits a nearly solar [α/Fe] abundance ratio consistent with the measurements in the LMC disk (Pompeia *et al.* (2006)), although the overall spread in the latter is relatively large.

• The [iron-peak/Fe] abundance ratios are roughly solar, as in the Milky Way and suggests that the production of these elements well-tracks that of iron.

• The [s-process/Fe] abundance ratios has a bimodal behaviour: the light s-process elements (Y and Zr) are clearly deficient while the heavy ones (Ba, La, Nd) are enhanced with respect to the solar proportion. Also the [Eu/Fe] abundance ratio, which is a good tracer of the r-process occurrence, is enhanced in the LMC ([Eu/Fe]∼+0.30 dex).

These abundance patterns seem to suggest that the chemical enrichment of the LMC occurred on a relatively long timescale, with AGB stars and type Ia SNe being important contributors.

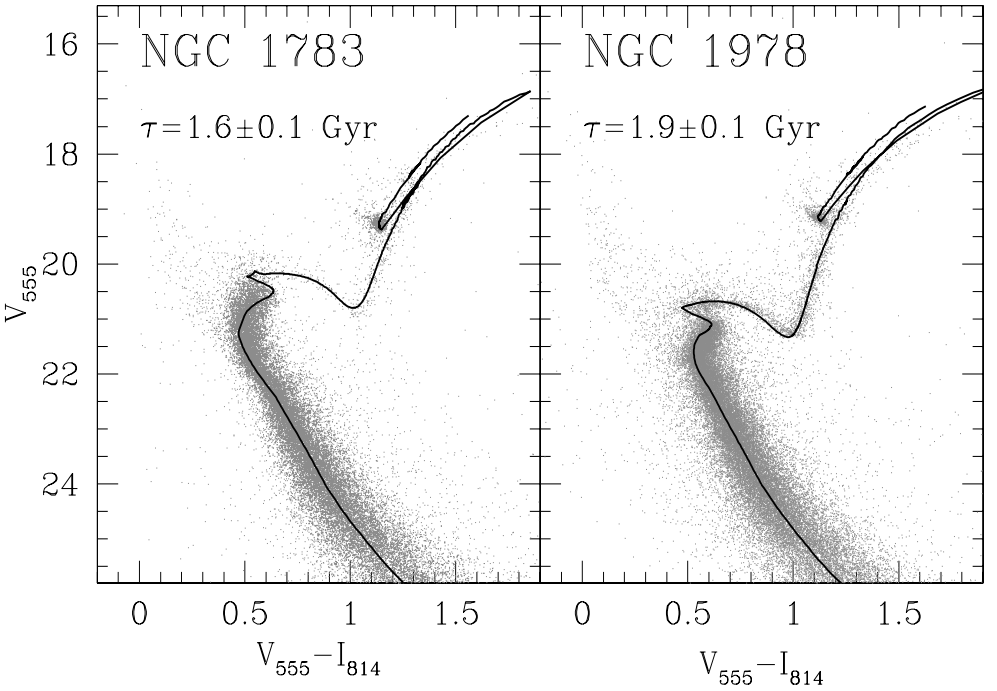

Figure 1. The ACS@HST CMD of the LMC clusters NGC 1783 (right panel) and NGC 1978 (left panel) with overplotted the best-fit isochrones from Castellani *et al.* (2003).

2. Towards a new age scale for the LMC clusters

The precise estimate of the global metallicity [M/H] is a key-element in order to derive the correct age of a stellar population. By using the [Fe/H] and [α/Fe] ratios obtained from our chemical analysis, we can obtain a reliable estimate of the global metallicity for any cluster in our dataset. These metallicities, coupled with high-quality HST photometry of the Turn-off region and updated sets of theoretical isochrones, can provide accurate ages for a significant number of pillar LMC clusters to properly define a homogeneous age scale. Here, we present the results for NGC 1783 (in preparation) and NGC 1978 Mucciarelli *et al.* (2007): in Fig. 1 the ACS@HST CMD for both clusters are reported with the best-fit isochrones. For NGC 1783 the isochrone that best-fit both the morphology and star counts is the Pisa Evolutionary Library (PEL) with a strong overshooting efficiency (Λ_{OS}=0.25) and an age of 1.6 Gyr. For NGC 1978 the best-fit PEL isochrone has a lower overshooting efficiency (Λ_{OS}=0.10) and an age of 1.9 Gyr.

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