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Chemical abundances of the LMC cluster Hodge 11 and its surrounding field

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Abstract. We have obtained high-resolution *VLT*/FLAMES spectra of a number of giants in the LMC cluster Hodge 11 and the surrounding field. We present results of a detailed model-atmosphere abundance analysis for a variety of elements, including Fe, Ca, Ti, Si, Sc, Ni and Cr.

Keywords. galaxies: abundances, galaxies: star clusters

1. Introduction

The Large Magellanic Cloud (LMC) exhibits an array of star-formation processes and episodes. This galaxy provides an excellent opportunity to study the formation and chemical-enrichment history of similar galaxies in great detail. Additionally, the ΛCMD paradigm of galaxy formation suggests that galaxies like the Milky Way form their halos through the accretion/merger of numerous dwarf satellites. Therefore, understanding the formation history and chemical evolution of the LMC is an important step in understanding these merger events and their role in galaxy formation.

One of the most direct ways to learn about a galaxy's chemical evolution and star-formation history is through the study of its clusters. Coupled with the fact that their ages are relatively easily determined, clusters are excellent tools for deriving the age/abundance relation of the host galaxy. Grocholski *et al.* (2006) present a extensive study using the FORS2 facility and obtained Ca-triplet-based metallicities for a sample of 29 clusters, spanning the full range of ages and abundances (see Figure 1). However, for the LMC a huge gap in the cluster age–metallicity relation is present (see Fig. 1; DaCosta 1991, 2002; Geisler *et al.* 1997) with only one known cluster in it. If we want to investigate the chemical evolution during this period, we must use field stars.

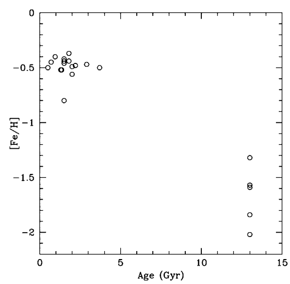

Figure 1. Age/metallicity relation obtained from FORS2 Ca-triplet observations (Grocholski *et al.* 2006) of a sample of LMC clusters.

2. Data and results

The data was obtained with the high-resolution spectrograph FLAMES (GIRAFFE: $R \sim 25\,000$ and UVES: $R \sim 47\,000$) on the *VLT*. The abundances for Fe, Ca and Ti were obtained with an LTE (local thermodynamic equilibrium) model-atmosphere analysis. Ca and Ti (α elements) abundances for Hodge 11 ([Fe/H] $= -1.9$ dex) and field stars are presented in comparison with Pompeia *et al.* (2008) data for the general LMC field (see Figure 2).

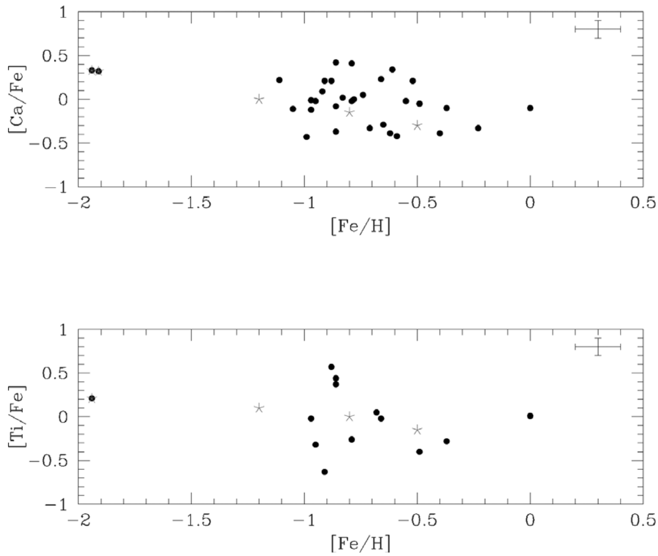

Figure 2. Abundances of Ca and Ti compared to Fe for Hodge 11 and the surrounding field stars. Black dots: our data. The crosses are the mean values for the LMC from Pompeia *et al.* (2008).

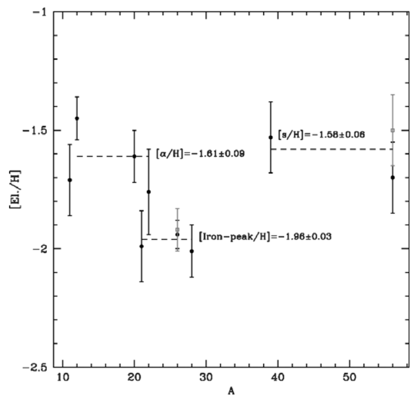

Figure 3. Abundances for Na, α, iron-peak and s-process elements for the cluster Hodge 11. Black and red points are from UVES and GIRAFFE data, respectively.

3. Conclusions and future work

The derived metallicity is in excellent agreement with the Ca-triplet value of the FORS2 sample (Figure 3) and the obtained abundances so far are in good agreement

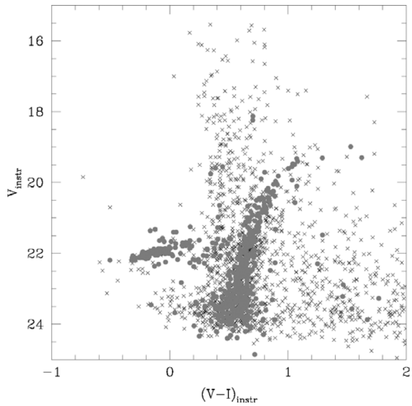

Figure 4. *LCO 1m* telescope wide-field photometry in the NGC 2257 field. Stars within 2′ from the cluster center are indicated by red points.

with the results of Pompeia *et al.* (2008) for the LMC field stars (Figure 2). The next step is to obtain high-resolution spectroscopy of a subsample of clusters. We have data for four (NGC 2257, Hodge 11, NGC 1841, and NGC 1718) with GIRAFFE and UVES (*VLT*/FLAMES). Spectroscopic data will be coupled with deep wide-field photometry obtained with MOSAIC at the *CTIO 4m* to have a homogeneous and complete database and derive atmospheric parameters (an example of wide-field photometry in the field of NGC 2257 is shown in Figure 4, based on data from the *LCO 1m* telescope). These clusters were selected because they span the full range of age (2–13 Gyr) and metallicities (−0.4 to −2.0 dex) of the FORS2 sample. Our goal is to derive abundances for many elements, including Na, α (Si, Ca, Ti), iron-peak (V, Cr, Fe, Ni, Cu), and s-process (Y and Ba). The detailed age/abundance relations for these elements, along with information about the relative contribution from asymptotic giant branch stars and Type I and II supernovae, will be used to help constrain the chemical evolution of the LMC.

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