Age and metallicity of globular clusters in the SMC from integrated spectra

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Abstract

Integrated spectra of SMC globular clusters were observed at resolutions of FWHM = 4 to 4.5 Å. The STARLIGHT code is used with 3 sets of Single Stellar Populations to derive their ages and metallicities. By a comparison with the literature, the efficiency of the method is confirmed for intermediate-age clusters.

1. Introduction

Studies of globular clusters in external galaxies is carried out through their integrated spectra. In the case of the Magellanic Clouds, these studies can be improved by a combination of Colour-Magnitude Diagrams, spectroscopy of bright individual stars, and integrated spectroscopy. In this project, we intend to analyse integrated spectra of 12 globular clusters of the Small Magellanic Cloud (SMC), using population synthesis models. Other kinds of studies, involving abundance derivations for individual stars were presented in (e.g. Hill et al. 1997) or using HII regions (Garnett et al. 1995) and planetary nebulae (e.g. Idiart et al. 2007). The star formation history (SFH) of the Small Magellanic Cloud was studied by Harris & Zaritsky (2004), based on a UBV catlog of 6 mil- lion stars located in 351 SMC regions (Zaritsky et al. 1997). They find evidence for a), a significant star formation epoch older than 8.4 Gyr; b) a long quiescent epoch between 3 and 8.4 Gyr; c) a continuous star formation started 3 Gyr ago until the present; d) in period c), 3 main peaks of star formation should have occurred at t = 2.35 Gyr, 4.05 Myr and 65 Myr. In order to verify if the star formation gap (item b) above) is reflected as well in the globular clusters, we analyse the age distribution of intermediate age. We present the analysis of 12 clusters, several of which still have very uncertain determinations of ages and metallicities.

We use the full spectrum fitting code STARLIGHT (Cid-Fernandes et al. 2005) to compare the integrated spectrum of the SMC with three sets of single stellar population (SSP) models, in order to derive their age and metallicity. We obtain ages of these globular clusters that are in the range 10^5 - 10^6 yr, and metallicities of [Z/H] = -1.6 to -0.5. Previously we observed 14 clusters (6 in the SMC and 8 in the LMC), and results were presented in de Freitas Pacheco et al. (1998).

2. Observations

Observations were carried out at the 1.6 m telescope of the National Laboratory for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52 m telescope for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratório for Astrophysics (LNA, Brasópolis, Brazil) and at the 1.52m Laboratóri