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The Local Group Dwarf Irregular Galaxy NGC 6822: new insight on its star formation history

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Abstract. We present a new photometric analysis of the Local Group Dwarf Irregular Galaxy NGC 6822 based on archival Hubble Space Telescope Advanced Camera for Surveys images. The data correspond to three fields covering the south-east region of the galaxy; for each field F475W and F814W HST bands are available. For each field an accurate color magnitude diagram (F814W, F475W–F814W) has been obtained. Preliminary hints on the galaxy star formation history are presented based on the comparison with isochrones from “A Bag of Stellar Tracks and Isochrones” (BaSTI) database.

Key words. galaxies: individual (NGC 6822) – Local Group – stars: distances – galaxies: stellar content

1. Introduction

NGC 6822 is a barred dwarf irregular galaxy (dIrr) belonging to the Local Group (LG). This galaxy is one of the nearest dIrr to the Milky Way (MW) and, according to Cannon et al. (2012), it is rich in gas and still active in forming stars.

Several estimates of the metal abundance are found in literature (e. g. Gallart et al. 1996; Tolstoy et al. 2001) and range between $-1.5 \le [Fe/H] \le -0.5$. The reddening estimates show a clear-cut difference between the innermost and outermost regions (e.g. Gallart et al. 1996; Gieren et al. 2006) which spans in the interval $0.1 \le \Delta E(B-V) \le 0.2$. The distance modulus of this dIrr has been estimated by several authors (e. g. Lee et al. 1993; Gallart et al. 1996; Cioni & Habing 2005; Gieren et al. 2006). This spans from $(m-M)_0 = 23.2$ and $(m-M)_0 = 23.6$. The large uncertainty affecting the parameters of this galaxy requires a detailed study on its metallicity, distance, and reddening.

2. Data reduction and results

Our photometric catalog is based on archival *Hubble Space Telescope* (*HST*) data sets collected with the Advanced Camera for Surveys (ACS) [1]. We present here the analysis of three fields, all located in the south east region of the galaxy. For each field four images were available, two for F475W band and two for F814W band. Photometry was performed using DAOPHOT (Stetson 1987). For a detailed description of the data sets and of the fields see Fusco et al. (2012). For each field we obtained a F814W, F475W−F814W color magnitude diagram (CMD). Fusco et al. (2012) show that the two outer fields overlap perfectly and they can be considered as a unique sample. In the same paper, using the same data set, Fusco et al. obtained an estimate of

- the distance to NGC 6822 using the method of the tip of the red giant branch (TRGB), which results $(m - M)_0 = 23.54 \pm 0.05$;
- the absolute reddening in the two fields: $E(B - V)_C = 0.37 \pm 0.02$ and $E(B - V)_E = 0.30 \pm 0.02$ for the central and external fields respectively.

These estimates allowed us to carry out a preliminary study on the populations in this dwarf galaxy.

To investigate the star formation history we used the BaSTI models (Pietrinferni et al. 2004, 2006, available at http://albione.oa-teramo.inaf.it/). The comparison with two theoretical isochrones is shown in Fig. 1. The spread of NGC 6822 RGB (larger than the photometric errors) is associated to a spread in metallicity. A comparison with the isochrones allowed us to identify a range of metallicities between $[Fe/H] = -1.49$ and -1.27 for an assumed age of 12 Gyr. In addition the extended main sequence indicates that this galaxy was still forming stars until a few Myr ago, as proved by the isochrone in the figure.

3. Conclusions

The photometry here presented allowed to give new estimate of the distance and of the reddening and then a preliminary investigation of the populations present in NGC 6822. There is a clear presence of an old/intermediate population, whose metallicity is between $[Fe/H] = -1.49$ and -1.27 and a young population which claims that the star formation activity was still ongoing ≈ 11 Myr ago.

[1] HST proposal GO-12180 P.I. J. M. Cannon.

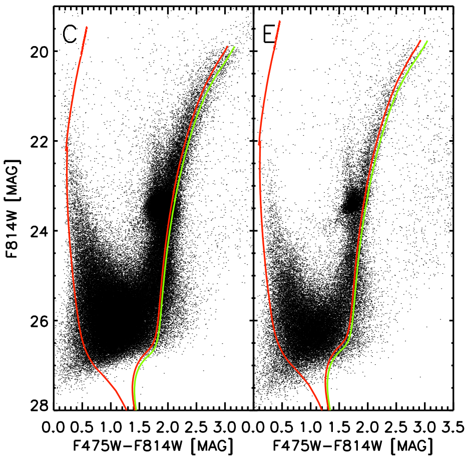

Fig. 1. *Left*: The CMD of the innermost field, C. *Right*: The CMD of the outermost fields, E. Theoretical BaSTI isochrones are superimposed to the data: red lines refer to 11 Myr and 12 Gyr old isochrones with $[Fe/H] = -1.49$, while the green line corresponds to a 12 Gyr isochrone with $[Fe/H] = -1.27$.

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