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BVR photometry of the Sculptor dwarf spheroidal galaxy

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Abstract. We present accurate B, V, R photometry of the Sculptor dwarf spheroidal galaxy. The data have been collected with the Wide Field Imager available at 2.2 m ESO/MPI telescope and cover an area of about 100×40 $arcmin^2$ around the Sculptor center. The final catalogue includes 100,000 stars. We found that blue and red Horizontal Branch stars present different radial distributions. This finding supports previous results. Moreover, we present a preliminary comparison between theoretical predictions for H and He burning phases and observational data.

Key words. Stars: abundances – Stars: Populations – Cosmology: Dwarf Galaxies

1. Introduction

The Sculptor dSph galaxy is one of the closest companion of our Galaxy, it is found at high galactic latitude (b=-83) and at a distance of 79 ± 4 kpc (Mateo 1998). Sculptor was the first dwarf galaxy to be discovered, (see Shapley 1938) and it has long been believed to have experienced a relatively simple star formation. However the discovery of neutral gas associated with this galaxy (Carignan et al., 1998, 2003) and the photometric analysis of Hurley-Keller et al., (1999) and Babusiaux et al., (2005) suggests the occurence of multiple stellar populations.

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2. Observation and results

Current data were collected with the Wide Field Imager available at the 2.2 m ESO in different runs between August and December 2002. The CCD is a mosaic of eight chips covering a total field of 33x34 $arcmin^2$. We have collected 84 mosaic images which cover an area of about 100x40 $arcmin^2$. The color magnitude diagram, the richest ever obtained (fig.1), shows some interesting features: a very broad RGB, high number of stars above the main sequence, and a well populated HB in Blue, Red and RRLyrae regions. We have studied the radial distribution of the RHB and BHB and we confirm previous results of Hurley-Keller et al., (1999) and Babusiaux et al., (2005): i.e. RHB stars are more centrally con-

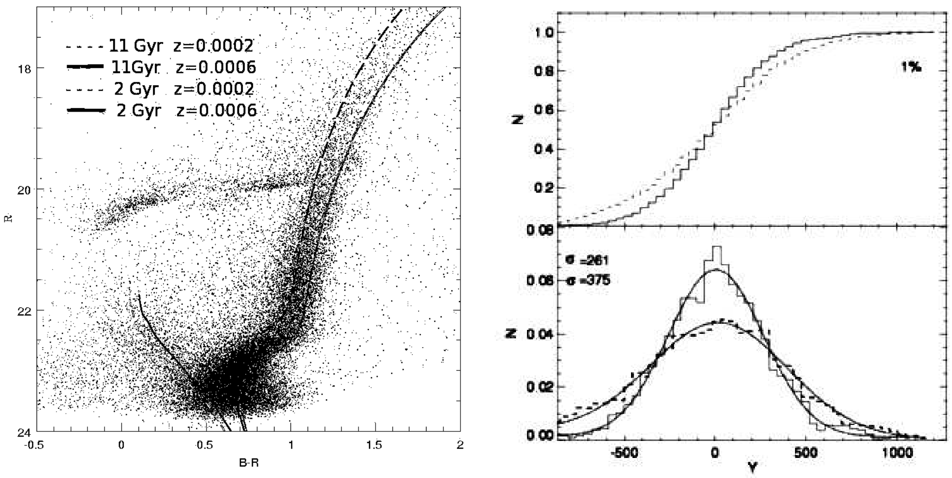

Fig. 1. The best fit with isochrones (on the left) of the Cassisi's group, chosen parameters are pointed out on the figures, and (on the right) radial distributions of blue and red HB: above the cumulative radial distribution with the result of the Kolmogorov-Smirnov test, below the DEC distribution of the Sculptor's stars with gaussian fits.

centrated that the BHB stars (fig.1). Moreover we have investigated the color spread of the RGB and we have found that photometric and calibration errors cannot explain such a spread. On the other hand the spread in magnitude of the RGB bump, clearly detected in our data, confirm that we have a metallicity spread in Sculptor's populations. Finally, we have performed fit with isochrones and ZAHBs of Cassisi's group (priv. comm.). The comparison between theory and observations (fig.1) indicates the occurence of three different populations: an old populations showing a spread in metallicity of about 11 Gyr and a younger population of about 2 Gyr. The fit with ZAHBs suggests two different working hypotheses: the first suggests the presence of an old population with a spread in metallicity, the second suggest the presence of a young population mixed with the old one. The first hypothesis is in contrast with the observed peculiar radial distribution of HB, while the second can easily accounts for both the gradient in the radial distribution of blue and red HB, the spread in colour of the RGB and the spread in magnitude of RGB bump.

3. Conclusions

We have found that Blue and Red HB have two different radial distributions, starting by this point we have searched presences of multiple populations (different both in age and metallicity) using isochrones of Cassisi's group. We have found that data suggest the presence of a old population with a metallicity spread and a younger population of about 2 Gyr.

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