Stellar Populations as Building Blocks of Galaxies
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The ACS LCID Project: Variable Stars in Tucana and LGS3

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Abstract. We present preliminary results concerning the search for short-period variable stars in Tucana and LGS3 based on very deep HST/ACS imaging. In the one chip per galaxy we studied so far, a total of 230 and 80 candidates variables were found, respectively. For Tucana, we identified 134 of them as RR Lyrae stars (RRL) pulsating in the fundamental mode (RR*ab*), 51 in the first-overtone mode (RR*c*), and 37 in both modes simultaneoulsy (RR*d*), as well as four candidate anomalous Cepheids (AC). In the case of LGS3, we found 45 RR*ab* and 5 RR*c*, plus three candidates RR*d* and five candidate AC. The metallicities obtained from the mean period of the RR*ab* are $[\mathrm{Fe/H}]_{Tuc} = -1.7$ and $[\mathrm{Fe/H}]_{LGS3} = -1.8$.

Keywords. stars: variables: other, galaxies: dwarf, galaxies: individual (Tucana, LGS3)

1. Introduction

Pulsating variable stars play a fundamental role in the study of stellar populations and in Cosmology, as their pulsational properties are traditionally used to determine distances and metallicities, and put constraints on stellar physical properties. Because the pulsations occur at a particular phase of their evolution depending on the star mass, these stars trace the spatial distribution of stellar populations of given ages, therefore highlighting the eventual radial trends across the studied galaxy (e.g., Phoenix: Gallart *et al.* (2004), Leo I: Baldacci *et al.* (2004)). This, in turn, hints on the star formation history and formation mechanisms of the host galaxy.

In a cycle 14 HST/ACS program we obtained, for the first time, very deep ($V \sim 29$) multi-epoch images of five *isolated* dwarf galaxies of the Local Group: the dwarf spheroidals (dSph) Tucana and Cetus, the dwarf irregulars (dIrr) IC1613 and Leo A, and the so-called transition type dIrr/dSph LGS3. See Gallart *et al.* (these proceedings) for an overview of the LCID project, and Monelli *et al.* (these proceedings) for a description of the data and data reduction.

2. Variable stars search and first results

The DAOPHOT/ALLFRAME suite of programs (Stetson 1994) was used to obtain the instrumental photometry of the stars on the individual images. The candidate variables were extracted from the star list using the variability index given by DAOMASTER. Figure 1 (*left & middle panels*) shows the candidate variables in each galaxy, highlighted on a portion of the CMDs centered on the instability strip. Period search for the candidates was done using an implementation of the phase-dispersion minimization method (Stellingwerf 1978) taking into account the information from both bands simultaneously.

We first focused on the candidate variables found on only one chip of the ACS. For Tucana, we found 134 RR*ab* and 51 RR*c* with mean periods of 0.601 and 0.350 days,

† Local Cosmology from Isolated Dwarfs: http://www.iac.es/project/LCID

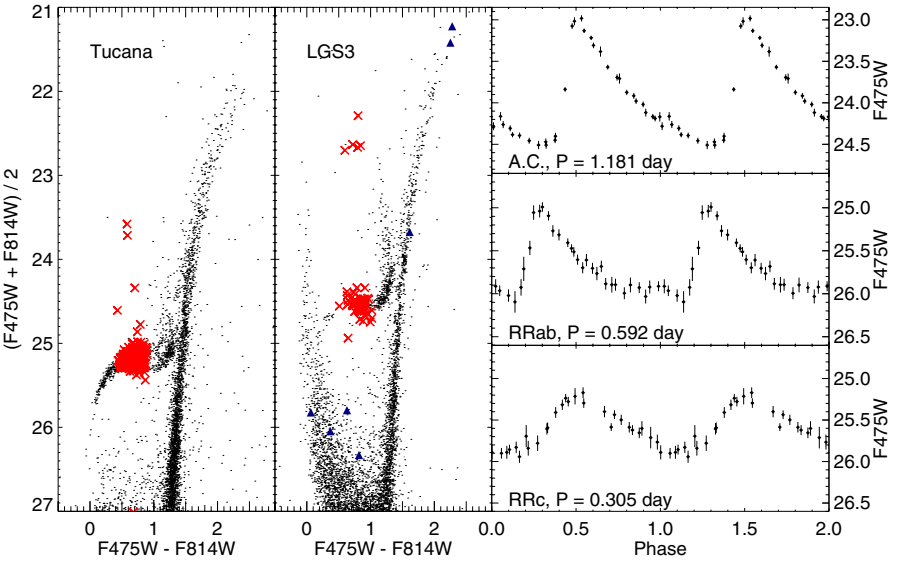

Figure 1. Color-magnitude diagrams of Tucana (*left*) and LGS3 (*middle*). Variables for which a period was found are shown as red crosses. Candidate variables are indicated by blue triangles. *Right:* Light-curves for some variables in Tucana.

respectively, as well as 37 RR*d*. This large percentage of RR*d* (∼17%) is similar to that found by Clementini *et al.* (2006) in the Fornax dSph. The four variables brighter than the HB are most likely AC. Typical light-curves are shown in Fig. 1 (*right panel*).

For LGS3, the small number of datapoints (12 in each band, vs. 32 for Tucana) made uncertain the period estimates, and the particular temporal sampling created strong aliasing. However, the period-amplitude diagram supported our choice of the period. It also showed that the amplitude of the RRL stars is systematically smaller in LGS3 than in Tucana. Although some of the lowest amplitudes are due to the lack of observations at maximum light, this trend has been noted for dSph and globular clusters having a very red horizontal branch (HB) (Pritzl *et al.* 2005, and references therein). Indeed, the HB of LGS3 is mainly red, with RRL stars located near the red edge of the instability strip.

From the mean period of the RR*ab*, we calculated the metallicity of the old population using the relation of Sarajedini *et al.* (2006). We obtained $[\mathrm{Fe/H}]_{Tuc} = -1.7$ and $[\mathrm{Fe/H}]_{LGS3} = -1.8$, which is consistent with the values found through isochrone fitting.

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