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Searching for RR Lyrae stars in the Canis Major overdensity

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Abstract. The Canis Major overdensity (CMa) was initially proposed to be the remnant of a tidally disrupting dSph galaxy. Since its nature is still subject of debate, the goal of the present work was to conduct a large-scale RR Lyrae survey in CMa, in order to see if there is an overdensity of these stars. The survey spans a total area of ~ 34 sq. deg. with observations in V and R filters, made with the 1.0m Jürgen Stock Schmidt telescope at the National Astronomical Observatory of Venezuela. Current results in a subregion, including spectroscopic observations, show that the small number of RR Lyrae stars found can be accounted for by the halo and thick disk components of our Galaxy.

Keywords. Galaxy: structure, Galaxy: stellar content, stars: variables: RR Lyrae

1. Introduction

The nature of the so-called Canis Major (CMa) overdensity has been the center of a lively debate ever since its discovery (Martin *et al.* 2004, Momany *et al.* 2004). It was originally proposed to be the remant core of a tidally disrupting dSph galaxy, and even though further observational evidence gathered in CMa has supported this view, it also has opened other possibilities for explaining its nature without invoking an origin external to our Galaxy. RR Lyrae (RRL) stars were selected as tracers because they are relatively easily discovered by their variability, are excellent standard candles which enables the determination of accurate distances, and are found in every dwarf satellite galaxy of the Milky Way that has been adequately searched (Vivas and Zinn 2006). The presence or absence of an overdensity of RRLs in the CMa region may then help resolve the nature of this feature.

2. Color-Magnitude Diagram and RR Lyrae Star Search

Multi-epoch observations in V and R filters were made with the 8k x 8k QUEST camera at the 1m Jürgen Stock Telescope at the Venezuelan National Observatory. The survey covers a total area of 34 sq. deg. Here we present the results of the RRL star search in a sub-region of 8.34 sq. deg, and the color-magnitude diagram for a subregion of 17 sq.deg. The saturation and limiting V magnitudes were 13 and 19.5 respectively. The color-magnitude diagram V_o vs $(V-R)_o$ was obtained with psf photometry for a subregion spanning 17 sq. deg. which include ∼130000 stars (Figure 1). No features such as a red clump, red giant branch or horizontal branch are obvious.

3. RR Lyrae star search

Variable stars were detected using a χ^2 test (Vivas *et al.* 2004). RRL star candidates were selected by constraining their $V-R$ colors to the expected range for RR Lyrae stars,

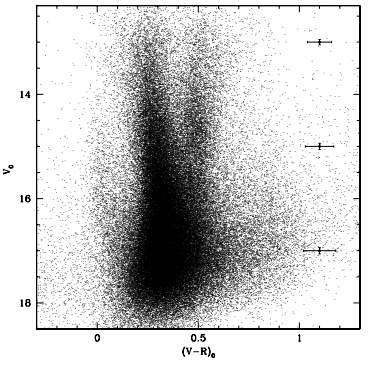

Figure 1. Color magnitude diagram for a 17 sq. deg. subregion in CMa.

and then fitting typical light curve templates (Layden 1998) to the data. The light curves were completed using additional photometric observations from the SMARTS telescopes at CTIO (Chile). Five strong candidates to be RRL stars were observed spectroscopically using the SMARTS 1.5m telescope. Three of these were confirmed as RRL stars using the spectroscopic data. Their radial velocities and metallicities are shown in Table 1.

Star	$D_\odot$ (kpc)	V_{rad} (km/s)	$[Fe/H]$
882	6.2	50	-1.20
18056	5.0	69	-1.0
7701	5.1	180	-1.26

Table 1. Heliocentric distance, radial velocity and metallicities, for the confirmed RRLs.

4. Conclusions

Although the search for RRL stars has not been completed in the whole area, we did not find a large overdensity of these stars in an area of 8.3 sq. deg. The radial velocities and metallicities of the 3 RRL stars in the region are consistent with them belonging to the known components of the Galaxy, halo and thick disk. In particular, star 7701 has the typical properties of the halo population. Stars 882 and 18056 have similar radial velocities which agree with the expectation for the thick disk population. It may be argued that those two stars with similar velocities may belong to a distinct population like a dSph galaxy, with mean [Fe/H]=−1.1. However, until finishing the whole survey that would increase our statistics, we are reluctant to give a definitive conclusion.

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