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The relics of the Sagittarius dSph galaxy: stellar populations and distances in the Main Body and in the Stream

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Abstract. The Bologna wide field survey of the Sagittarius dSph galaxy provides relatively deep (to $V = 23.0$) B,V,I photometry of more than 900000 stars over a total area of 8290 arcmin^2 (2.3 deg^2) in the core of Sgr galaxy. This huge database provides the opportunity of (a) a thorough analysis of the stellar populations inhabiting Sgr, and (b) a robust determination of templates that can be used to study properties of the stars in the huge tidal tails emerging from the disrupting dwarf, *i.e.* the Sgr Stream. Here we describe the main characteristic of the survey and we present some preliminary application to the study of the Sgr Stream.

Key words. galaxies: dwarf-galaxies – galaxies: kinematics and evolutions – Local Group – Sagittarius dSph – Milky Way: halo

1. Introduction

The Bologna wide field survey of the Sagittarius dSph collects deep BVI photometry of four wide fields within the core of the galaxy; it covers a total area of 2.3 deg^2 (with an increase of a factor $\sim$ 23 respect the previous largest survey) and reaches V$\sim$23.5 (Bellazzini et al. 2006a). We plan to provide in the near future accurate templates for same well identified sequences of the CMD of the galaxy (Blue Hb, Red Hb, etc.), as tools to recognise portions of the Stream. Here we briefly present one of the first scientific results of the survey and we outline the ongoing work devoted to the study of the Sgr stream.

2. Population Gradient in the Stream

In Bellazzini et al. (2006b) we presented a quantitative comparison between the Horizontal Branch (HB) morphology in the core of Sgr and in a wide field sampling a portion of its tidal stream (taken from SDSS), located tens Kpc away from the center of the parent galaxy. We find that the Blue Horizontal Branch (BHB) stars in that part of the Stream are five times more abundant that in the Sgr core, relative to Red Clump (RC) stars. The differences in the ratio of

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BHB to RC stars between the two fields is significant at $> 4.8\sigma$ level. This indicates that the old and metal-poor population of Sgr was preferentially stripped from from the galaxy in the past peri-Galactic passages with respect to the intermediate-age metal rich-population that presently dominates the bound core of Sgr, probably due to a strong radial gradient that was settled within the galaxy before its disruption (Chou et al. 2006).

3. Distances along the Stream

An obvious application of the comparison between our decontaminated CMD of Sgr core and the CMDs of portions of the Stream (f.i.: taken from the SDSS) is to obtain distance estimates to the Stream itself by photometric parallax. Several CMD features can be used for this purpose: RC, BHB, Main Sequence (MS); we choose the RC because is easily identified in color-selected Luminosity Functions (LFs) of fields in the Stream and it allows very good *differential* distance estimates out to very large distances (see Fig. 1). To study the distances along the Stream we retrieved SDSS *ugriz* photometry of a series of $5° \times 5°$ fields along the Stream, the same fields used by Belokurov et al. (2006). The effect of interstellar extinction is corrected using the COBE/DIRBE reddening maps (Schlegel, Finkbeiner & Davis, 1998; individual estimates of the extinction for each stars are directly provided in the SDSS catalogue). *g,r,i* photometry is transformed into B,V,I using robust empirical transformations that have been checked to be particularly accurate in the color range typical of RC stars. We select a region in the transformed SDSS CMDs between V$\sim$16 and V$\sim$20 and 0.7<B-V<0.95 (*i.e.*: the observed color range of the RC in the Main Body of Sgr). Stars selected in this way are used to construct LFs, in V and I, that are searched for peaks corresponding to detections of the Sgr Stream (see Fig. 1, where the peak due to RC stars of the Stream is clearly identified). Differential estimates of the distances to any considered portion of the Stream are obtained by comparing the observed position of V (and I) peaks of the LFs to V_{RC} and I_{RC} as measured in the Main Body of Sgr. The absolute distances are finally obtained by adopting $(m-M)_0$=17.10 for the Main Body of Sgr, after

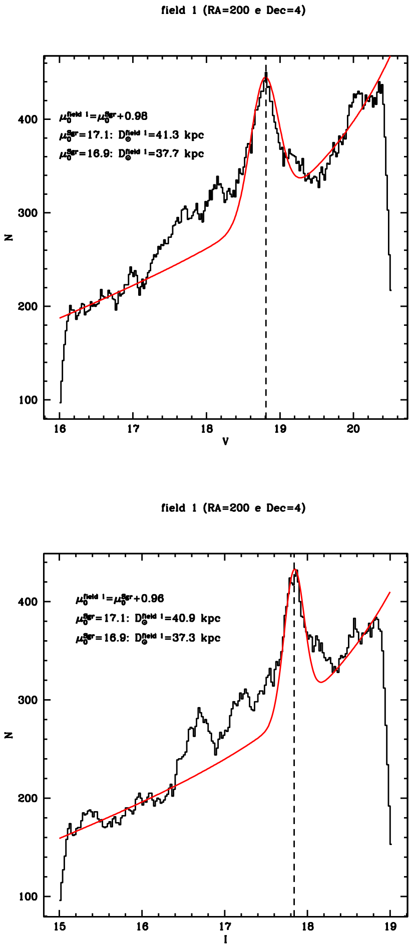

Fig. 1. Luminosity functions (LFs) of one of the analyzed Stream fields. The LFs are modeled as the sum of a *smooth* component - due to populations in the Galactic field - that is fitted with a function of the form a·x+b·exp(x)+c, and a peak associated with the narrow overdensity provided by the Stream, that is fitted with a gauss distribution. The observed positiom of the V and I peaks in the considered Stream fields are compared with V_{RC} (I_{RC}) as measured in the Main Body of Sgr, thus providing two indipendent estimates of the distance to a given portion of the Stream. The agreement between two indipendent estimates is excellent (typically better than ~ 1-2 Kpc)

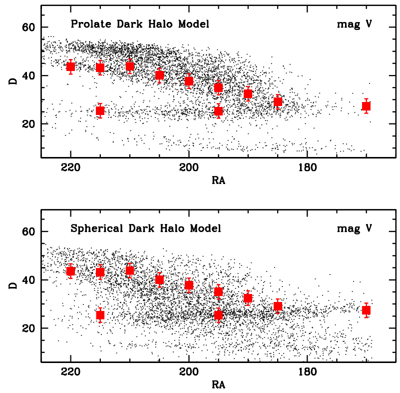

Fig. 2. Distance estimates along the Stream as a function of RA (see Belokurov et al. 2006). The 3-dimensional structure of this branch of the Stream is traced very clearly and accurately: this can provide very powerful constraints on dynamical models of the disruption of Sgr galaxy. Here the observed RA - distance trend (filled squares) is compared with the predictions of N-body models of Sgr (small dots) provided by Law et al. (2005). In case 1 the progenitor of Sgr orbits within a Galactic Dark Halo whose shape is prolate, while in the case 2 the Dark Halo is spherical. While this cannot be considered a straightforward indication in favor of one model, the comparison clearly demonstrates the potential of our measures to constrain the dynamical history of Sgr.

Monaco et al. (2004). Some preliminary results are shown in Fig. 2, compared to the predictions of N-body models of Sgr (with two different assumptions on the shape of the Galactic Dark Halo: prolate and spherical). It is interesting to note that in some fields there are hints of a double RC peak, that seem to correspond to different wraps of the Stream in some model, but these results have to be checked carefully in order to avoid spurious detection.

4. Future Works

The above result must be considered as preliminary; we are currently checking the possible sources of errors and uncertainties in the analysis. In the meanwhile we are also tracing the population gradients, as in Bellazzini et al. (2006b), and the behaviour of the stellar density along the Stream.

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References

Bellazzini M., et al. 2006a, A&A, 446, L1
Bellazzini M., et al. 2006b, A&A, 457, L21
Belokurov, V., et al.. 2006, ApJ, 642, L137
Chou, M.-Y., et al. 2006, ApJL, submitted [arXiv:astro-ph/0605101]
Law, D.R., Johnston, K.V., & Majewski, S.R. 2005, ApJ, 619, 807
Monaco, L., Belllazzini, M., Ferraro, F.R., & Pancino, E. 2004, MNRAS, 353, 874
Schlegel, D.J., Finkbeiner D.P., & Davis, M. 1998, ApJ, 500, 525