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INVESTIGATING THE OUTSKIRTS OF THE MILKY WAY: THE PISCES OVERDENSITY

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RESUMEN

La sobre-densidad de Piscis fue descubierta como un exceso de estrellas RR Lyrae en datos multi-época de SDSS. Localizada a una distancia de 85 kpc del Sol, es la sub-estructura más distante conocida a la fecha en el halo Galáctico. En este trabajo estudiamos las propiedades de la sobre-densidad de Piscis usando datos espectroscópicos de varias estrellas RR Lyrae observadas con el Telescopio Gemini-Sur. Encontramos que la distribución de velocidades radiales en la sobre-densidad es bimodal, sugiriendo que dos corrientes diferentes están presentes en ese volumen del halo. La gran extensión espacial de ambos grupos sugiere que son sistemas desligados, probablemente restos de una o varias galaxias destruídas por fuerzas de marea. No es claro si los dos grupos cinemáticos tienen el mismo progenitor.

ABSTRACT

The Pisces overdensity was discovered as an excess of RR Lyrae stars in multi-epoch data of SDSS. Located at a distance of about 85 kpc from the Sun, it is the most distant substructure in the Galactic halo known to date. In this work we study the properties of the Pisces overdensity using spectroscopic data of several RR Lyrae stars observed with the Gemini-South telescope. We find that the distribution of radial velocities in the overdensity is bimodal, suggesting that two different streams are present in that volume of the halo. The large spatial extension of both groups suggests they are unbound systems, likely debris of a tidally disrupted galaxy or galaxies. Whether both kinematic groups have the same or different progenitors is unclear.

Key Words: Galaxy: halo — Galaxy: kinematics and dynamics — Galaxy: structure — stars: variables: other

1. INTRODUCTION

Many different techniques and tracers have been used by different groups to discover sub-structures in the halo. Among them, studies using RR Lyrae stars as tracers have the advantage of providing the best possible 3D maps of the streams, since these stars are excellent standard candles. Watkins et al. (2009) and Sesar et al. (2010a) have recently detected independently a significant excess of RR Lyrae stars in the outer halo, at ∼85 kpc from the Sun. This is the most distant substructure discovered in our Galaxy until now. The structure is known as the Pisces overdensity after the constellation in which is located in the sky. This discovery was made by studying the spatial distribution of RR Lyrae stars detected in the SDSS multi-epoch observations of Stripe 82.

To confirm that the Pisces overdensity is indeed a coherent structure we observed spectroscopically several of the RR Lyrae stars in the group. The details of this study may be found in Sesar et al. (2010b).

2. OBSERVATIONS

We used the 8.1 m Gemini-South telescope (Cerro Pachón, Chile) with GMOS to observe 5 RR Lyrae stars in the Pisces overdensity. Bad weather during our run prevent us to observe more targets. Spectra have a resolution of ∼2.5 Å, at 4500 Å. The spectral range, from 3800 Å to 5250 Å, included the Balmer lines (starting at Hβ) and the Ca II H and K lines. We derived radial velocities and metallicities following the methods described in Vivas et al. (2008).

We combined our results obtained for 5 stars with the sample measured by Kollmeier et al. (2009) of 8 RR Lyrae stars in the overdensity. One star was common in both samples and there was good agreement between both works.

3. RESULTS

Figure 1 shows the distribution of radial velocities of the RRLS in the galactic rest frame, $V_{\rm gsr}$ for the complete sample of 12 RR Lyrae stars. It

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