

Stellar Stream and Halo Structure of the Andromeda Galaxy Revealed by Subaru Hyper Suprime-Cam

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The halos of galaxies preserve fossil records of galaxy formation through hierarchical assembly and past accretion events. The halo of the Andromeda galaxy (M31) is a complementary target to the Milky Way as it can be observed in perspective from the center to the halo. However, the detail of the M31 halo is still veiled due to its large distance.

We have carried out a wide and deep survey for 9.2 deg² field in the north-west (NW) halo of the Andromeda galaxy (M31) using Hyper Suprime-Cam on the Subaru Telescope. Our survey goes deep enough to probe red clump (RC) stars, which are numerous and make distinct feature in the color-magnitude diagram, and allows us to investigate the detailed structure and the stellar population of the NW Stellar Stream which is known to exist in this field.

From the distance estimate based on the RC magnitude, it is likely that the NW Stream is located ~70 kpc behind the main body of M31. A numerical simulation incorporating this distance estimate sets a strict constraint on the orbit of the NW Stream. The detailed structure of the NW Stream which is traced by the number density distribution of RC stars is revealed. The cross-sectional shape of the stream is well represented by a Gaussian with FWHM of 25 arcmin (5.7 kpc), with a slight skew to the south-west direction. The shape along the stream is revealed to be complicated: in addition to a significant gap, numbers of bumps and dips are found along the stream (see Figure 1). It is expected that future numerical simulation which reproduces the orbit and the shape of the NW Stream will reveal the nature of the NW Stream as well as the properties of the halo of M31.

We also found a distinct stellar population other than that comprising the NW Stream in the south part of our survey field from the analysis of the color-magnitude diagram. This finding suggests that a substructure which is more extended and diffuse than the NW Stream do exist in our survey field. Follow-up observations are necessary to address the nature of this diffuse substructure.

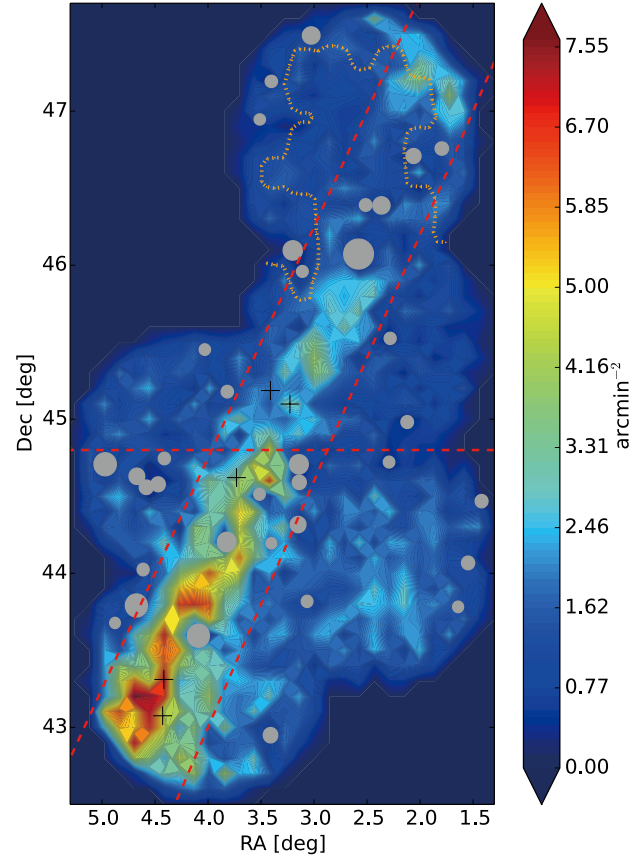


Figure 1: The number density distribution of RC stars. The number density decreases from the south-east to the north-west and a significant gap is also found. The diffuse substructure suggested in the text is seen as a diffuse hump of number density at the south-west part outside the stream. The gray circles represent the masked regions by bright stars and the crosses represent globular clusters which are suggested to be associated with the NW Stream.

Reference

[1] Komiyama, Y., et al.: 2018, *ApJ*, **853**, 29.