Record-breaking Faint Satellite Galaxy of the Milky Way Discovered

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Currently, some 50 satellite galaxies to the Milky Way have been identified. About 40 of them are faint and diffuse and belong to the category of so-called "dwarf spheroidal galaxies". Many recently discovered dwarf galaxies, especially those seen in systematic photometric surveys such as the Sloan Digital Sky Survey (SDSS) and the Dark Energy Survey (DES) are very faint with absolute luminosity in the optical waveband below -8 magnitude. However, previous searches made use of telescopes with a diameter of 2.5 to 4 meters, so only satellites relatively close to the Sun or those with higher magnitudes were identified. Those that are more distant or faint ones in the halo of the Milky Way are yet to be detected. We therefore carefully examined the early data of the Subaru Strategic Survey with HSC and searched for very faint dwarf satellites which were overlooked by previous surveys.

By identifying an over density of stars in the sky with characteristic distribution to the old stellar population in the color-magnitude diagram (Fig. 1 and 2), we discovered an extremely faint dwarf satellite galaxy of the Milky Way and named it as Virgo I – the first faint dwarf satellite galaxy located in the direction of the constellation Virgo [1]. Though the absolute magnitude of Virgo I is as faint as −0.8 in the optical waveband, it is identified as a galaxy because it is spatially extended with a radius of 124 light years – systematically larger than a globular cluster with comparable luminosity. The faintest dwarf satellites identified so far was Segue I, discovered by SDSS (−1.5 mag) and Cetus II in DES (0.0 mag). Cetus II is yet to be confirmed, as it is too compact as a galaxy. Virgo I may ultimately turn out to be the faintest one ever discovered. It lies at a distance of 280,000 light years from the Sun, and such a remote galaxy with faint brightness has not been identified in previous surveys.

The Subaru Strategic Survey using HSC will continue to explore much wider areas of the sky and is expected to find more satellites like Virgo I.

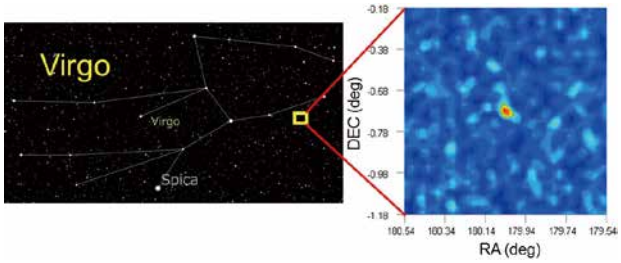

Figure 1: The position of Virgo I in the constellation of Virgo (left) and a density map of Virgo I's member stars in a 0.1 deg x 0.1 deg area (right).

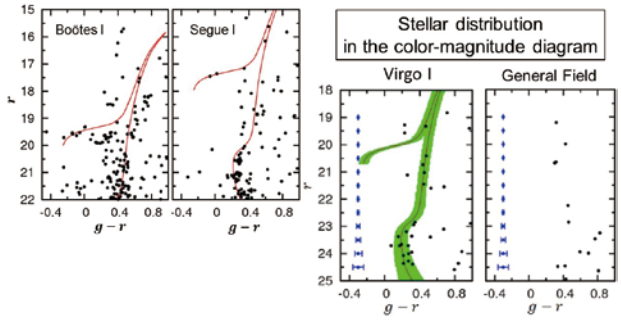

Figure 2: Stars in the color-magnitude diagram. Old stellar populations show a characteristic distribution along the curve seen in the diagram. From left to right: Bootes I, Segue I, Virgo I, and a general field outside Virgo I. The spatial distribution of the stars, which are located inside the green band for Virgo I, is shown in the right panel of Figure 1. Note that stars in a general field outside Virgo I (right panel) show no characteristic feature.

Reference

[1] Homma, D., et al.: 2016, *ApJ*, **832**, 21.