Extended stellar halo detected in the Fornax galaxy

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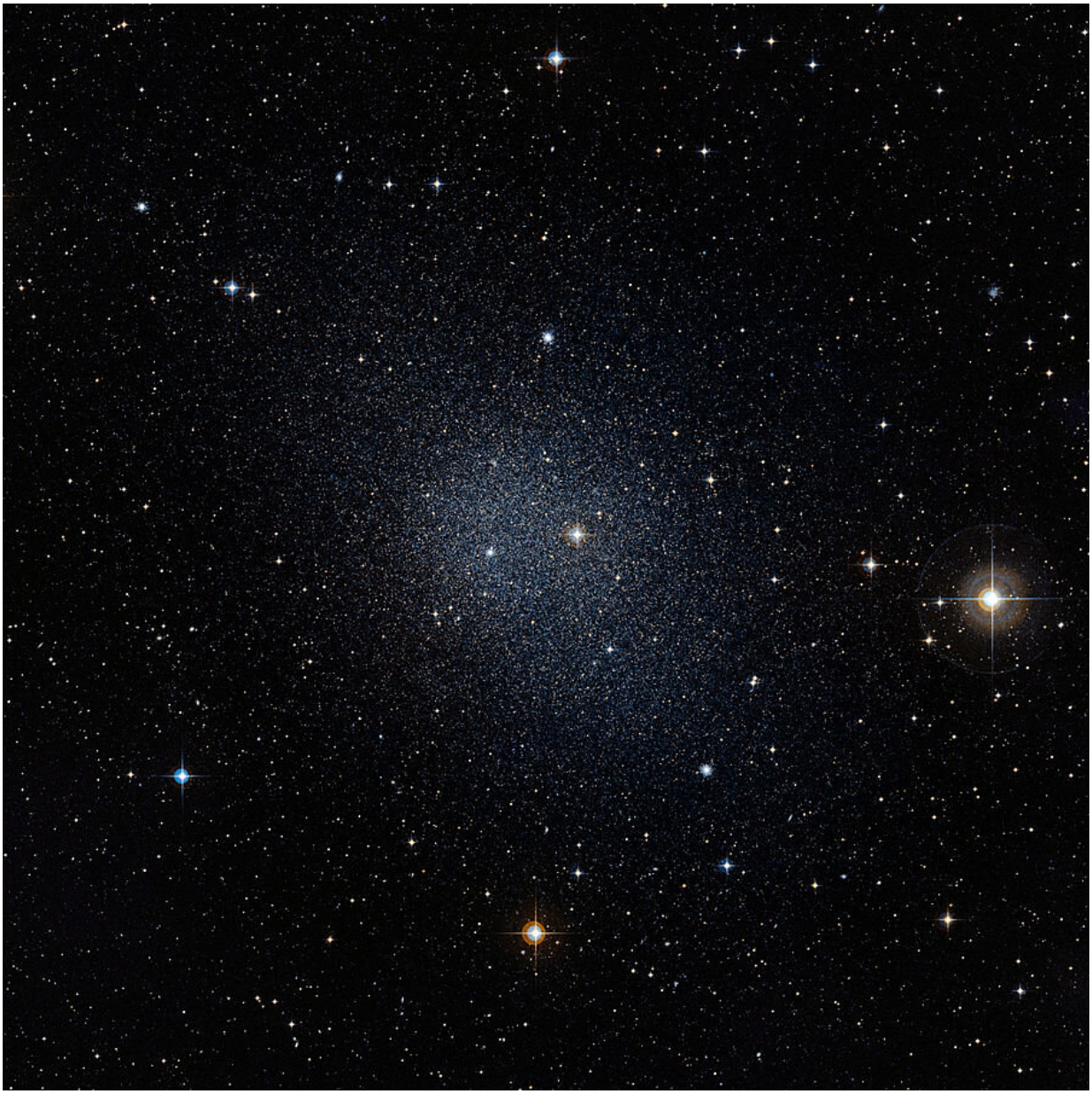

Fornax dwarf spheroidal galaxy. Credit: ESO/Digitized Sky Survey 2.

Using ESA's Gaia space observatory, astronomers have explored the Fornax dwarf spheroidal galaxy. They discovered that this galaxy has an extended stellar halo, spanning more than 17,000 light years. The finding was detailed in a paper published March 3 on the arXiv pre-print repository.

Discovered in 1938, Fornax is the second brightest dwarf spheroidal galaxy (dSph) in the Milky Way halo. The galaxy is located some 460,000 light years away from the Earth and contains six globular clusters.

Recently, a team of astronomers led by Yanbin Yang of Paris Observatory in France, has investigated the stellar structure of Fornax over a relatively huge area (400 square degrees). This was possible thanks to Gaia satellites's homogeneous data quality and full coverage of proper motion measurements. The main aim of their study was to explore the extent of the red giant branch (RGB) stellar population of this galaxy.

"In this paper, we present a case study on Fornax, using Gaia EDR3 [Early Data Release 3] published in December 2020. Thanks to its homogeneous coverage and data quality, we can explore the data over a very large area. Both coverage and calibrations across large field are difficulties for ground-based and mosaic-type observations on dSphs," the researchers explained.

The study identified a break in the density profile of Fornax, what revealed a significant component in this galaxy resembling a stellar halo due to its nearly symmetric morphology. It extends out to 17,600 light

years and its mass is estimated to be about 10 percent of the galaxy's mass. The data also suggest that the Fornax galaxy may extend even farther.

The astronomers suppose that the detected extended stellar halo may be due to the recent expansion of stars in Fornax. However, detailed numerical modeling will be required in order to confirm this hypothesis. They added that such a scenario assumes that the Milky Way halo is filled by diffuse and ionized gas known as the circumgalactic medium (CGM).

The researchers noted that their discovery may have implications for our understanding of other dwarf spheroidal galaxies of the Milky Way. They propose to study such breaks in density profiles of these dSphs.

"With Fornax, almost all dSphs, except Leo II, are reported to display such a break in their density profiles. If this second component of Fornax can be explained as the result of expanding stars, how about the other dSphs?" the authors of the paper wrote.

They added that further studies should focus on identifying the morphologies of the component responsible for the break in their density profile, and whether they are consistent with tidal stripping or alternatively with tidal shocking. This could be verified with internal kinematics via proper motions by Gaia in the future.

More information: Yanbin Yang et al, An extended stellar halo discovered in the Fornax dwarf spheroidal using Gaia EDR3. arXiv:2203.01953v1 [astro-ph.GA], arxiv.org/abs/2203.01953