Astronomers detect peculiar features in the stellar halo of dwarf galaxy NGC 300

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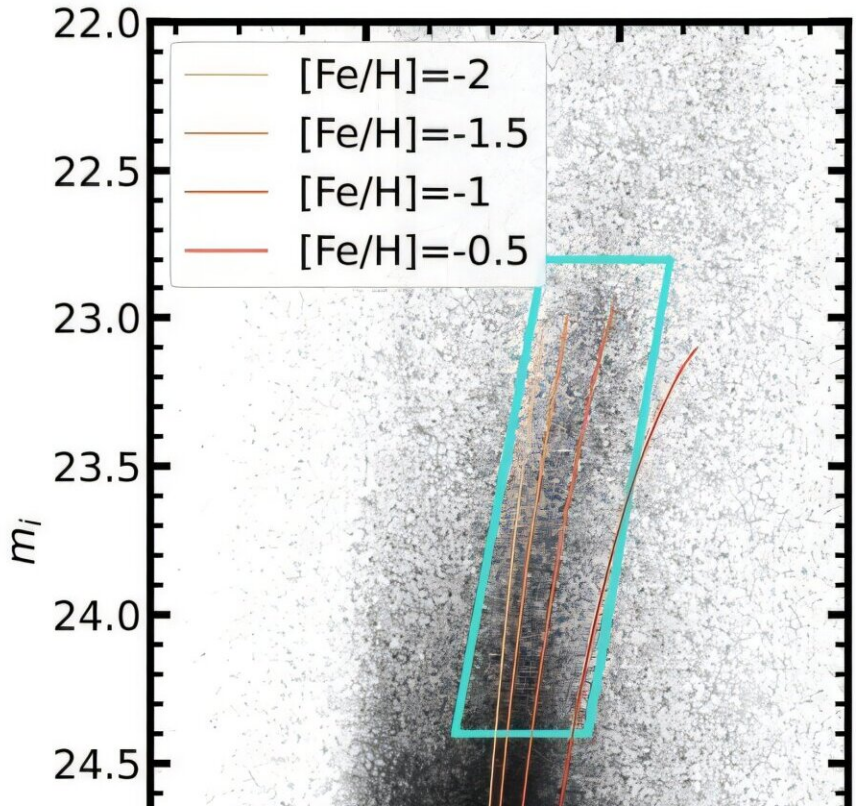

Color-magnitude diagram of a subset of DELVE-DEEP sources in the field of NGC 300. Credit: Fielder et al., 2025.

Using the Cerro Tololo Inter-American Observatory (CTIO), an international team of astronomers have performed deep optical

observations of a dwarf galaxy known as NGC 300. As a result, they detected a stellar stream, shells and a globular cluster in the halo of this galaxy. Their findings were reported Jan. 7 on the pre-print server *arXiv*.

NGC 300 (also known as Caldwell 70 or the Sculptor Pinwheel galaxy) is a dwarf spiral galaxy in the constellation Sculptor, about six million light years away. It has an estimated size of about 110,000 light years and its mass is approximately 2.6 billion solar masses.

Given that NGC 300 lies in a relative isolation, it makes it an ideal candidate for studying its stellar halo without the influence of a nearby massive companion. Moreover, its disk is nearly face-on and exhibits a near-perfect exponential profile.

That is why NGC 300 is one of the targets selected by the DECam Local Volume Exploration survey (DELVE), which is a long-term imaging program conducted with the Dark Energy Camera (DECam) on CTIO's Blanco 4-m telescope. DELVE's DEEP sub-component was designed to image relatively isolated analogs of the Large and Small Magellanic Clouds, with the aim of identifying stellar substructures and probing the hierarchical assembly of dwarf galaxies.

"NGC 300 DELVE-DEEP observations were acquired over the course of 21 nights between July 2021 and July 2023. This includes a total of 14 distinct fields taken as 12 × 300 s g-band exposures and 7 × 300 s i-band exposures per field, which are also supplemented with existing Dark Energy Survey (DES) data to attain the desired depth," a team of researchers led by Catherine E. Fielder of the Steward Observatory in Tucson, Arizona, wrote in the paper.

The observations detected a large, low surface brightness stellar stream extending more than 130,000 light years north from the center of NGC 300. This stream, dubbed Stream N, harbors red giant branch (RGB)

stars notably more metal-poor than stars residing in the galaxy's disk and the inner stellar halo. The astronomers assume that Stream N likely originated from an accretion event.

In the opposite direction to Stream N, a smaller radial protrusion was identified, which received designation Stream S. It is also metal-poor and the researchers link this feature to Stream N as a plausible stream wrap; however, further observations are required in order to verify that assumption.

Furthermore, the study discovered two shell-like structures along the western and southern sides of NGC 300. These shells are more metal-poor than the galaxy's disk and the authors of the paper suggest that they are connected to an accretion event, but they cannot rule out the in situ formation.

The observations also uncovered the presence of a globular cluster in the halo of NGC 300. The newfound cluster, designated NGC 300-GCF25, is also metal-poor, lies between the shells radially in projection, and is estimated to be about 10 billion years old.

More information: Catherine E. Fielder et al, Streams, Shells, and Substructures in the Accretion-Built Stellar Halo of NGC 300, *arXiv* (2025). DOI: 10.48550/arxiv.2501.04089