

More dark-matter-deficient dwarf galaxies found

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This figure illustrates structure in the simulated universe, in a box 200 million light-years on each side. It is color coded, using black, green, yellow, pink and white to represent low- to high-density regions, respectively. Credit: NAOC

A team of researchers with members affiliated with multiple institutions in China has found evidence for more dark-matter-deficient dwarf galaxies. In their paper published in the journal *Nature Astronomy*, the group describes their study of dwarf galaxies and how they found some they expected to be dominated by dark matter were not.

As the researchers note, standard cosmological theory suggests that dark matter drives formation of <u>galaxies</u> and the gravity wells in which they form. They note also that dwarf galaxies in the Local Group (those in our part of the universe) are dominated by dark matter. But just two years ago, two dwarf galaxies were observed that appeared to have less dark matter than was expected. Soon thereafter, two more were observed by another team. Now, in this new effort, the researchers have identified 19 dwarf galaxies with amounts of dark matter that do not conform to theory.

The work involved analyzing data from the Arecibo radio telescope to calculate galactic weights—this, the researchers note, can be done by measuring how fast hydrogen moves around them. The higher the speed, the more mass a galaxy has. They next added the mass of the hydrogen and all the of stars (using starlight data) to come up with a total non-dark matter mass for the galaxy. The difference between this number and the total mass was attributable to dark matter. In "normal" cases, just 2 percent of the mass of a dwarf galaxy is made up of non-dark matter. But in their study, they found what they describe as oddballs—one galaxy, for example, weighed in at approximately 14 billion suns, and its total non-dark matter mass made up approximately 27 percent of its total



mass.



An example of the baryonic-dominated dwarf galaxies-UGC7920. Credit: DECaLS-DR8



The researchers report that they analyzed 324 dwarf galaxies and found 19 that had less dark matter than theory has suggested they should. They suggest the "missing" <u>dark matter</u> might be attributed to neighbors pulling it off and keeping it to themselves—but some of the exceptions they found had no neighbors that were near enough to be considered suspects. They further suggest their findings could challenge formation <u>theory</u> as it applies to dwarf galaxies.

More information: Qi Guo et al. Further evidence for a population of dark-matter-deficient dwarf galaxies, *Nature Astronomy* (2019). DOI: 10.1038/s41550-019-0930-9

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