

Missing Milky Way dark matter

November 9 2010, By Jon Voisey



A composite image shows a dark matter disk in red. From images in the Two Micron All Sky Survey. Credit: Credit: J. Read & O. Agertz.

Although dark matter is inherently difficult to observe, an understanding of its properties (even if not its nature) allows astronomers to predict where its effects should be felt. The current understanding is that dark matter helped form the first galaxies by providing gravitational scaffolding in the early universe. These galaxies were small and collapsed to form the larger galaxies we see today. As galaxies grew large enough to shred incoming satellites and their dark matter, much of the dark matter should have been deposited in a flat structure in spiral galaxies which would allow such galaxies to form dark components similar to the disk and halo. However, a new study aimed at detecting the Milky Way's dark disk have come up empty.

[The study](#) concentrated on detecting the [dark matter](#) by studying the luminous matter embedded in it in much the same way dark matter was originally discovered. By studying the kinematics of the matter, it would

allow astronomers to determine the overall mass present that would dictate the movement. That observed mass could then be compared to the amount of mass predicted of both baryonic matter as well as the dark matter component.

The team, led by C. Moni Bidin used ~300 red giant [stars](#) in the [Milky Way](#)'s thick disk to map the mass distribution of the region. To eliminate any contamination from the thin disc component, the team limited their selections to stars over 2 kiloparsecs from the galactic midplane and velocities characteristic of such stars to avoid contamination from [halo](#) stars. Once stars were selected, the team analyzed the overall velocity of the stars as a function of distance from the galactic center which would give an understanding of the mass interior to their orbits.

Using estimations on the mass from the visible stars and the interstellar medium, the team compared this visible mass to the solution for mass from the observations of the kinematics to search for a discrepancy indicative of dark matter. When the comparison was made, the team discovered that, “[t]he agreement between the visible mass and our dynamical solution is striking, and there is no need to invoke any dark component.”

While this finding doesn't rule out the presence of dark matter, it does place constraints on its distribution and, if confirmed in other [galaxies](#), may challenge the understanding of how dark matter serves to form galaxies. If dark matter is still present, this study has demonstrated that it is more diffuse than previously recognized or perhaps the disc component is flatter than previously expected and limited to the thin disc. Further observations and modeling will undoubtedly be necessary.

Yet while the research may show a lack of our understanding of dark matter, the team also notes that it is even more devastating for dark matter's largest rival. While dark matter may yet hide within the error

bars in this study, the findings directly contradict the predictions of Modified Newtonian Dynamics (MOND). This hypothesis predicts the apparent gain of mass due to a scaling effect on gravity itself and would have required that the supposed mass at the scales observed be 60% higher than indicated by this study.

Source: [Universe Today](#)

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