# Mapping the movement of white dwarfs of the Milky Way

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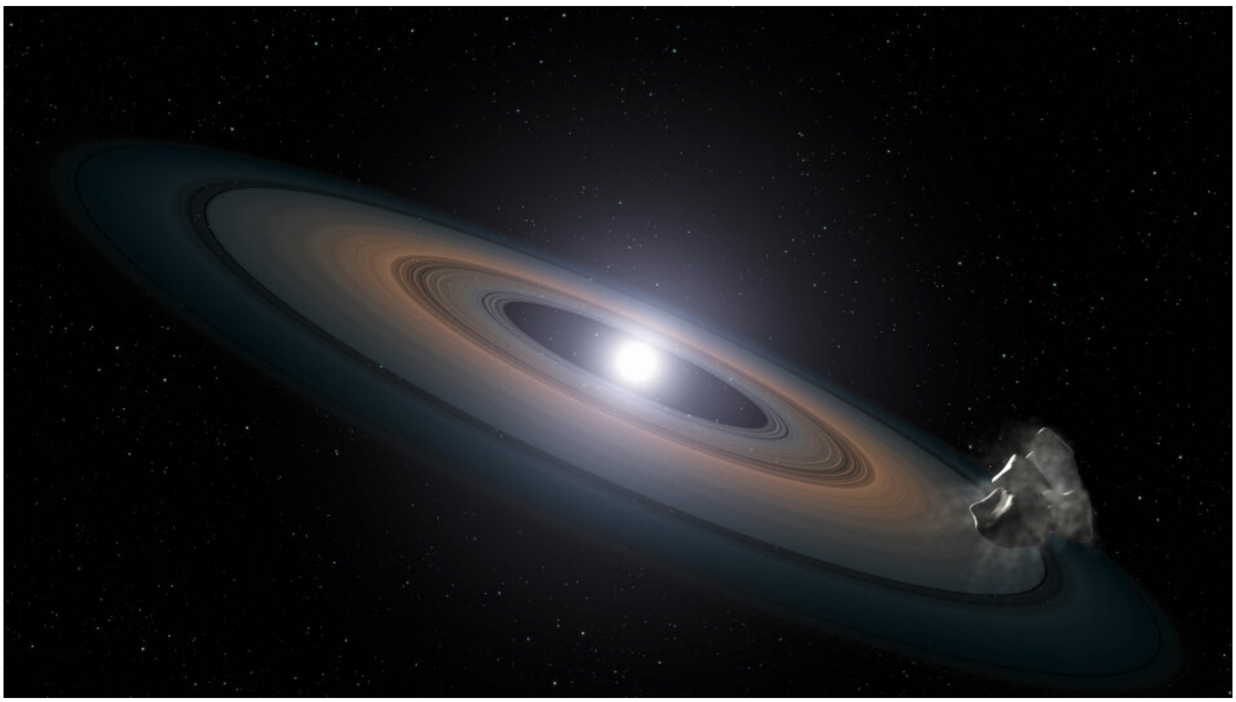

Illustration of a white dwarf . Credit: NASA, ESA, STScI, and G. Bacon (STScI)

White dwarfs were once normal stars similar to the sun but then collapsed after exhausting all their fuel. These interstellar remnants have historically been difficult to study. However, a recent study from Lund University in Sweden reveals new information about the movement patterns of these puzzling stars.

White dwarfs have a radius of about 1 percent of the sun's. They have about the same mass, which means they have an astonishing density of about 1 ton per cubic centimeter. After billions of years, white dwarfs will cool down to a point where they stop emitting visible light, and turn into so-called black dwarfs.

The first white dwarf that was discovered was 40 Eridani A. It is a bright celestial body 16.2 light-years from Earth, surrounded by a binary system consisting of the white dwarf 40 Eridani B and the red dwarf 40 Eridani C. Ever since it was discovered in 1783, astronomers have tried to learn more about white dwarfs in order to gain a deeper understanding of the evolutionary history of our home galaxy.

In a study published in *Monthly Notices of the Royal Astronomical Society*, a research team can present new findings about how the collapsed stars move.

"Thanks to observations from the Gaia space telescope, we have for the first time managed to reveal the three-dimensional velocity distribution for the largest catalog of white dwarfs to date. This gives us a detailed picture of their velocity structure with unparalleled detail," says Daniel Mikkola, doctoral student in astronomy at Lund University.

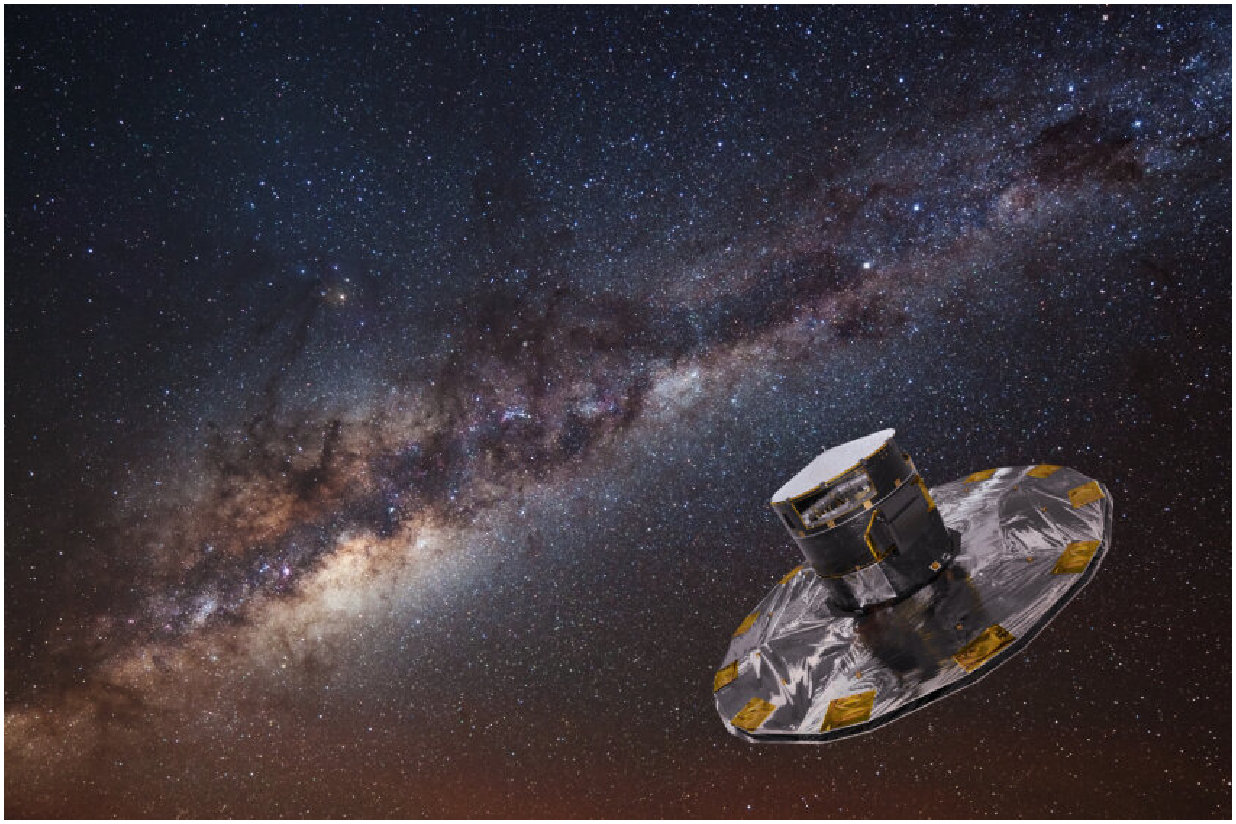

Illustration of Gaia with the Milky Way in the background. Credit: ESA/ATG Medialab, ESO/S. Brunier

Thanks to Gaia, researchers have measured positions and velocities for about 1.5 billion stars. But only recently have they been able to completely focus on the white dwarfs in the solar neighborhood.

"We have managed to map the white dwarfs' velocities and movement patterns. Gaia revealed that there are two parallel sequences of white dwarfs when looking at their temperature and brightness. If we study these separately, we can see that they move in different ways, probably as a consequence of them having different masses and lifetimes," says Daniel Mikkola.

The results can be used to develop new simulations and models to continue to map the history and development of the Milky Way. Through an increased knowledge of the white dwarfs, the researchers hope to be able to straighten out a number of question marks surrounding the birth of the Milky Way.

"This study is important because we learned more about the closest regions in our galaxy. The results are also interesting because our own star, the sun, will one day turn into a white dwarf just like 97 percent of all stars in the Milky Way," concludes Daniel Mikkola.

**More information:** Daniel Mikkola et al, The velocity distribution of white dwarfs in Gaia EDR3, *Monthly Notices of the Royal Astronomical Society* (2022). [DOI: 10.1093/mnras/stac434](https://dx.doi.org/10.1093/mnras/stac434)

Provided by Lund University