Dating the Milky Way's disc

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A photograph of the Andromeda galaxy, a spiral like our Milky Way. Astronomers have discovered white dwarf stars in the disc of the Milky Way galaxy, and measured their properties to obtain an age to the disc of at least eleven billion years. Credit: NOAO and the Local Group Survey Team and T.A. Rector; University of Alaska Anchorage

When a star like our sun gets to be very old, after another seven billion years or so, it will no longer be able to sustain burning its nuclear fuel. With only about half of its mass remaining, it will shrink to a fraction of its radius and become a white dwarf star. White dwarfs are common, the most famous one being the companion to the brightest star in the sky, Sirius. As remnants of some of the oldest stars in the galaxy, white dwarfs offer an independent means of dating the lifetimes of different galactic populations.

A globular cluster is a roughly spherical ensemble of stars (as many as several million) that are gravitationally bound together and typically

located in the outer regions of galaxies. The white dwarf stars in the Milly Way's globular clusters reveal an age spread of between eleven and thirteen billion years. By contrast, the thick disk of the galaxy is thought to be older than ten billion years but that figure is not very well constrained. White dwarfs in the disc can be used to refine those age estimates and, since they are closer and brighter to us than those in globular clusters, they can provide more detailed information. However, they are not located in well-defined regions like clusters and so they are also harder to spot.

CfA astronomer Warren Brown and his colleagues used the 6.5-m Multiple Mirror Telescope (MMT) to obtain spectra of fifty-seven white dwarf candidate stars in the disk first discovered in all-sky surveys. Modeling the spectra of these stars revealed a mixture of types (for example, some stars had atmospheres of pure helium and others of pure hydrogen) and also an age for the disc of eleven billion years. The result is consistent with the current age estimates for the thick disc but also suggests that the current minimum age estimate might be increased. Additional measurements are needed to refine the age range, and the scientists predict that large-scale sky surveys now underway will significantly increase the number of non-cluster white dwarfs and enable the determination of their parameters.

More information: Kyra Dame et al. New halo white dwarf candidates in the Sloan Digital Sky Survey, *Monthly Notices of the Royal Astronomical Society* (2016). DOI: 10.1093/mnras/stw2146

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