White dwarf-main sequence binary identified in the open cluster NGC 752

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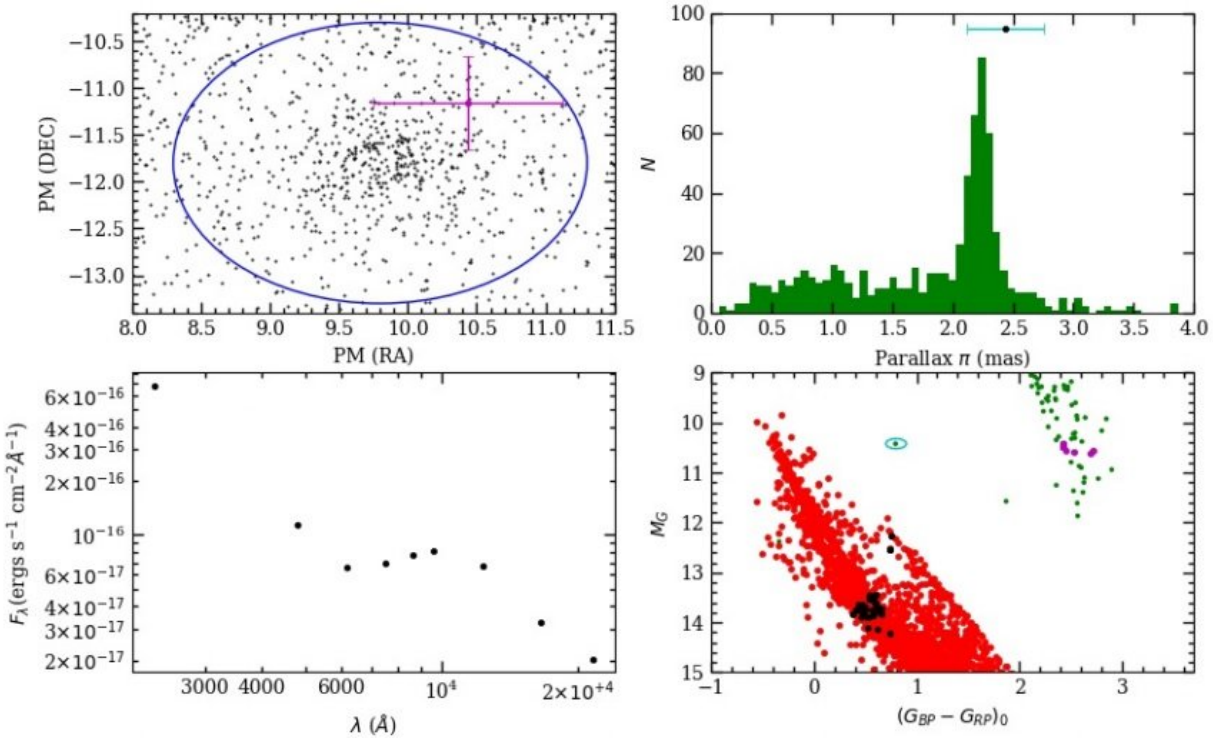

Top left panel: Gaia proper motion cut applied to the NGC 752 field, along with WD candidate values. Top right: Gaia parallaxes for proper motion-selected stars, along with the WD candidate value. Bottom left: SED from GALEX, PanSTARRS, and 2MASS photometry. Bottom right: Color-absolute magnitude diagram for proper motion and parallax-selected NGC 752 member stars (green), and nearby white dwarf stars (red) using Gaia DR2 parallaxes (Gaia Collaboration et al. 2018). Purple and black points are cluster and white dwarf stars whose combined light can reproduce the photometry of the suspected binary (circle). Credit: Buckner and Sandquist, 2018.

Using data provided by Gaia satellite, two American astronomers have discovered a white dwarf-main sequence binary in the open cluster NGC 752. It is the first white dwarf found in this cluster. The finding was detailed by researchers in a paper published August 17 on the arXiv pre-print repository.

ESA's Gaia satellite is a space mission designed for astrometry purposes, mainly to chart a 3-D map of the Milky Way galaxy. The Gaia Data Release 2 (DR2), published in April 2018, provides high-precision measurements, including positions in the sky, parallaxes and proper motions for more than 1 billion sources in our galaxy. The release contains observational data collected by Gaia in a timespan of nearly two years – between July 25, 2014 and May 23, 2016.

Recently, Andrew Buckner and Eric Sandquist, both from San Diego State University, have analyzed the DR2 catalog searching for new stars in NGC 752. Discovered in 1783 and located some 1,300 light-years away from the Earth, NGC 752 is one of the nearest open clusters to the sun. With an estimated age of about 1.5 billion years, the cluster is old enough to host white dwarfs. However, no such objects have been so far detected in this stellar group.

DR2 allowed the researchers identify and pinpoint the position of a new binary, consisting of a main-sequence star and apparently the first white dwarf in NGC 752. The study was complemented by data available in the GALEX, 2MASS and Pan-STARRS surveys.

"Using Gaia Data Release 2 (Gaia Collaboration et al. 2018), we searched a field of radius 2.5 degrees and selected members based on proper motions and parallax. The combination of a proper motion cut and a parallax cut is very effective at eliminating field stars from the sample. After correcting Gaia magnitudes for parallax and extinction, we identified an object that fell nearly midway between the main sequence

(MS) and white dwarfs (WDs) in the color-absolute magnitude diagram, and could plausibly be a WD-MS binary," the astronomers wrote in the paper.

According to the study, the studied object's spectral energy distribution shows evidence of two peaks. This is indicative of the existence of two objects at very different temperatures. The newly detected binary resides approximately 0.56 degrees from the cluster center, which is within the cluster's halo on the sky.

The researchers found that the main-sequence star in the binary is most likely near the K/M spectral type boundary with an absolute magnitude of 10.5. When it comes to the white dwarf—it has an absolute magnitude of 13.6. Moreover, the astronomers noted that the white dwarf probably has an temperature near 6,750 K.

The study conducted by Buckner and Sandquist reveals only basic information about the newly identified binary. Therefore, the researchers underlined that photometric and spectroscopic velocity monitoring is needed to help clarify the real nature of the system. Such observations could also disclose whether or not there has been strong gravitational interactions between the both stars in the past.

More information: Discovery of a White Dwarf-Main Sequence Binary in Open Cluster NGC 752, arxiv.org/pdf/1808.05718.pdf