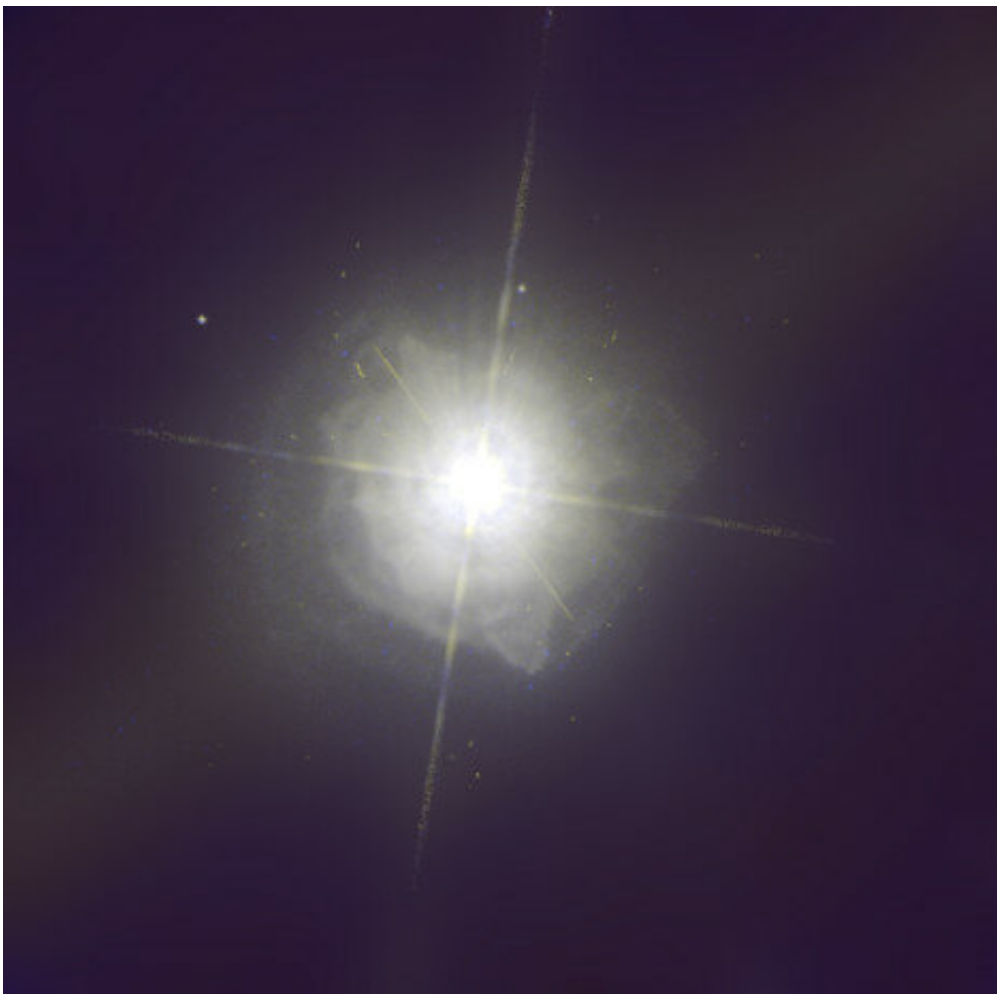


# From supergiant to solar-mass star: Study finds HD 179821 less massive than previously thought

February 8 2019, by Tomasz Nowakowski

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HD 179821. Credit: Hubble Legacy Archive

A post-asymptotic giant branch (post-AGB) star known as HD 179821 turns out to be significantly less massive than previously thought, according to a new study. Using new data from ESA's Gaia satellite, astronomers found that HD 179821 is not a supergiant, which was suggested by previous observations, but is rather a solar-mass star. The finding is presented in a paper published January 28 on arXiv.org.

Discovered about a century ago, HD 179821 (also designated IRAS 19114+0002) is a star in the constellation of Aquila, surrounded by a detached dust shell. The star is currently classified as a post-AGB [supergiant](#) of spectral type G5 Ia.

However, although several spectroscopic observations of HD 179821 have been conducted, the exact [distance](#) to this star remains a subject of debate. Some studies suggest that it is located about 19,500 light years from the Earth, while others cite a much closer distance of some 12,700 light years. Discrepancy in the distance estimates leaves uncertainties regarding the star's mass and evolutionary status.

Gaia's second data release, known as Data Release 2 (DR2), has the potential to resolve such uncertainties as it offers high-precision positions, parallaxes and proper motions for more than 1.3 billion sources in the sky. A team of astronomers led by Mudumba Parthasarathy of the Indian Institute of Astrophysics in Bangalore used DR2 data to obtain the parallax of HD 179821, which allowed them to make new distance calculations.

The parallax of HD 179821 was found to be approximately 0.31 mas. Employing an inference procedure developed by other researchers in 2018, Parthasarathy's team calculated that this value corresponds to a distance of about 9,600 light years. Gaia parallax also allowed them to find that the star is located some 850 [light years](#) below the Galactic plane.

Furthermore, the derived distance and other parameters provided by previous studies, such as spectral type and observed V magnitude, were essential to find the absolute magnitude and bolometric luminosity of HD 179821. These values were estimated to be  $-5.7$  and  $4.3$  respectively.

According to the paper, the derived properties exclude the possibility that HD 179821 is a supergiant star with a mass between 19 and 30 [solar masses](#), which was suggested by observations conducted in recent years.

"The derived  $M_V = -5.7$  clearly establishes that HD 179821 is not a 30 or 19  $M_{\text{sun}}$  post-red supergiant. (...) The bolometric magnitude clearly excludes the possibility, defended by many authors, that it is a very massive (30 to 19  $M_{\text{sun}}$ ) post-red supergiant star," the astronomers underlined.

They concluded that HD 179821 is a post-AGB star of mass in the range of about 0.8 solar masses, an effective temperature of 5,660 K, and a radial velocity of approximately 81.8 km/s. When it comes to the evolutionary status of HD 179821, the astronomers noted that it resulted from an intermediate mass AGB star or from a star that is at the lower limit of a super-AGB star. Its progenitor most likely had an initial main sequence [mass](#) of about four solar masses.

**More information:** M. Parthasarathy. The puzzling high velocity G5 supergiant star HD 179821: new insight from Gaia DR2 data [arxiv.org/ftp/arxiv/papers/1901/1901.08995.pdf](https://arxiv.org/ftp/arxiv/papers/1901/1901.08995.pdf)

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