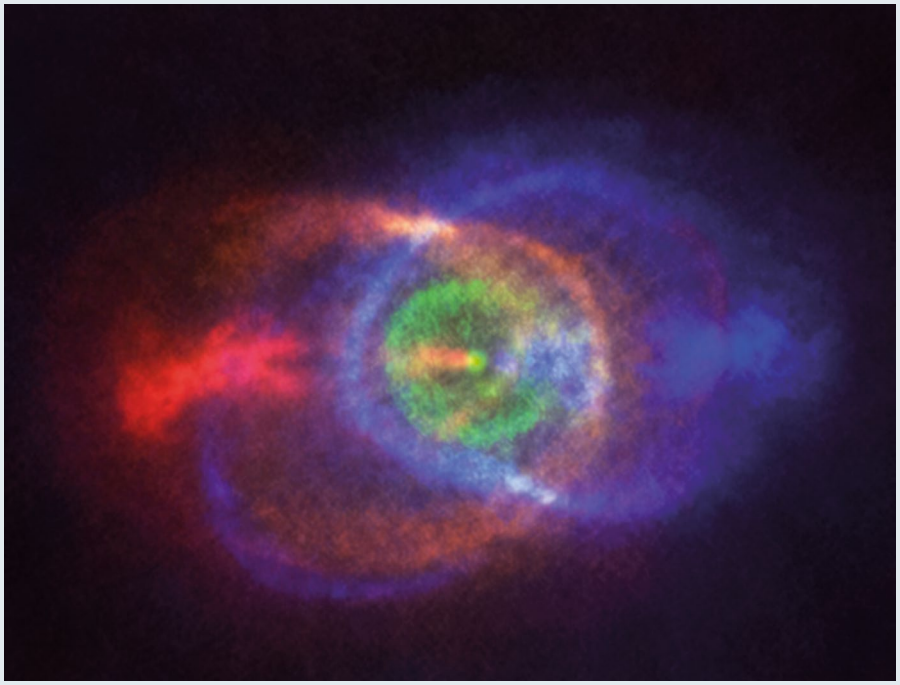
EVOLVED STARS

Stellar death match bursts from the ring

A spectacular display of intersecting arcs and rings (pictured) is the result of two stars fighting it out to the death. The Atacama Large Millimetre/submillimetre Array (ALMA) has observed this circumstellar environment around HD101584, a star that used to be two stars, since one was engulfed by the other. The circumstellar structures, seen in emission from CO molecules and coloured by velocity in the conventional way, are a remnant of the pre-merger tussle.

Hans Olofsson and colleagues (*Astron. Astrophys.* **623**, A153; 2019) have put together a scenario to explain the ALMA observations, which were also supplemented with APEX telescope data. One star of the original binary pair went through an evolutionary transition from main sequence star to red giant, inflating its circumstellar envelope as the star exhausted the hydrogen fuel content of its core. Its envelope grew to encompass the orbit of the lower-mass companion, but instead of the companion spiralling in and merging, the larger star reacted by outbursting, effectively jettisoning its circumstellar envelope. Jets that launched during the outburst added to the intricacy of the situation by punching through the slower-moving circumstellar material, and creating the rings and blobs seen in the image. The resulting structure resembles an hourglass, tilted almost exactly along our line of sight, with a dense ring of material around the waist (in green in the image).

This case is an example of common envelope evolution, where the secular evolution of one star becomes influenced by interaction with a companion. Here the jettison of the primary star's circumstellar envelope effectively terminated its evolution along one of the giant branches (the authors make a case for the red giant branch). The stellar remnant will now continue to evolve as a white dwarf, possibly ionising its circumstellar nebula to become a planetary nebula. At least one in five planetary nebulae have their origin in this kind of common envelope evolution, according to the authors, and red novae may also result. Indeed, HD 101584 is not alone: there are several known examples of stars that share similar characteristics, and one — IRAS 16342-3814 — has been observed with ALMA, but not to the level of kinematic and chemical detail that Olofsson et al. report here. ❐



Credit: ALMA (ESO/NAOJ/NRAO), Olofsson et al. Acknowledgement: Robert Cumming.

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