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The Formation History of Betelgeuse

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Betelgeuse is a familiar M-type red supergiant and also the tenth brightest star in the sky. Nevertheless, it is also a very peculiar star. Its kinematics and the bow shock around it indicate that it is a runaway star moving at more than 30 km/s relative to the local standard of rest. At the same time, its rotation rates, also supported by the enhanced nitrogen abundances, are too high compared to regular red supergiants. Due to this reason, it was suggested that Betelgeuse was likely initially dynamically ejected as a runaway binary from its birth environment and later merged, producing a rapidly spinning giant. In our study, we use a Monte Carlo approach to model the dynamical interactions in Galactic clusters and a custom binary evolution code to synthesise a mock population of Galactic runaway rapidly spinning red supergiants like Betelgeuse. We compare the synthesised population to the observed samples of runaway O and B stars and runaway supergiants and find that the statistics of stellar populations in the solar neighbourhood indeed support the idea that Betelgeuse formed through a binary merger. It is quite possible that one needs to take this recent merger history into account when explaining its recent dimming.

Primary authors: BOBRICK, Alexey (Lund University); Dr RADDI, Roberto (Universitat Politecnica de Catalunya); Dr CHATZOPOULOS, Emmanouil (Louisiana State University); Dr CHURCH, Ross P. (Lund University); Prof. DAVIES, Melvyn B. (Lund University); Prof. FRANK, Juhan (Louisiana State University)

Presenter: BOBRICK, Alexey (Lund University)

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