Rotational velocities of Luminous Blue Variables

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Field of work: Spectroscopy, Rotational Velocities

Luminous Blue Variables (LBVs) are a transient phase in the life of very massive stars, where the stars experience giant outbursts that can lead to mass loss rates of $\dot{M} \simeq 1\, M_{\odot}\,\mathrm{yr}^{-1}$. An example is the eruption of η Carinae, which made it the second brightest star on the sky in the year 1843, giving birth to the Homunculus nebula. In fact, such outbursts of LBVs in other galaxies can be mistaken for supernova explosions, such that LBVs are also called "supernova impostors". These giant outbursts have typically bipolar geometry (see Figure), shrouding the stellar photosphere by the expelled material. Usually, this leads to the spectra showing spectral lines from the nebulae, and not from the star itself.

The physical mechanism(s) leading to the giant outbursts are not known. But it is believed that this is connected to the stars hitting the $\Omega\Gamma$-limit, i.e. they reach the border of stability because a combination of fast rotation (centrifugal forces counteracting gravity) and enormous luminosity close to the Eddington limit (radiation pressure overcoming gravity). While it is clear that LBVs are close to Eddington limit because of their enormous luminosities, their rotational velocities are basically unknown in the literature.

The supervisor of the project has found a possibility to measure rotational velocities, which should be done in the course of the Bachelor thesis for the first time for a number of known LBVs and LBV candidates.

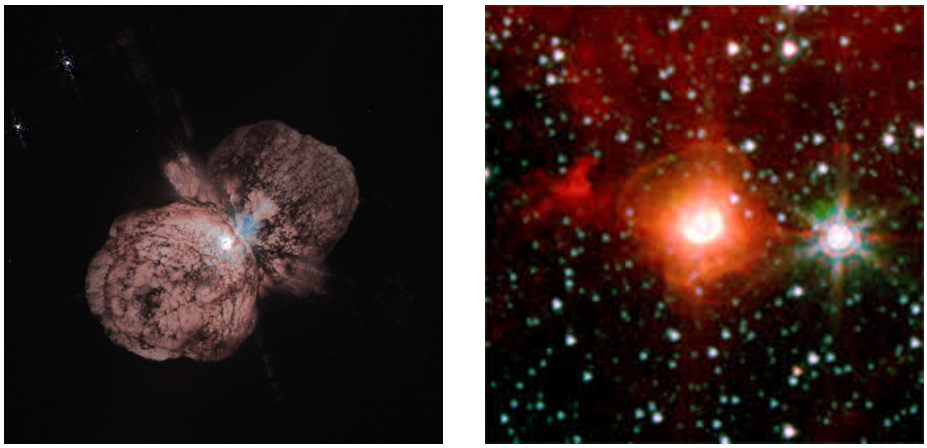

Figure: Examples of bipolar nebulae around the Galactic LBV η Carinae (left) and the LBV candidate HD 168625. Credit: Jon Morse (University of Colorado) & NASA Hubble Space Telescope; NASA/JPL-Caltech/N. Smith (UC Berkeley)

Keywords: very massive stars – luminous blue variables – observatory databases – spectroscopy – rotational velocities

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