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Following V509 Cas into the void with FIES

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Yellow hypergiant stars are objects of great interest because they are in an extreme transition phase of evolution, in which the stars have dynamically unstable atmospheres and undergo recurring mass loss outbursts. As post-red supergiants, they are a possible bridge in the evolutionary gap between red supergiant and B[e] supergiant or luminous blue variable phases. On the Hertzsprung-Russell diagram they are located in the upper part near the luminosity limit and in an instability region labelled as the 'yellow evolutionary void'. V509 Cas is a variable yellow hypergiant with an interesting history.

Over the 20th century V509 Cas has travelled into the 'yellow void' and suffered several large-scale eruptions, during which the star's luminosity and temperature rapidly decreased. However, at the start of the 21st century, the star has shown signs of approaching stability (Nieuwenhuijzen et al. 2012). In Tartu Observatory we have monitored the spectroscopic variability of V509 Cas for over 7 years. These observations are complemented by recent FIES measurements with a higher resolution and significantly wider wavelength range.

Could the recent changes in the variability of V509 Cas be a sign of the star reaching a calmer phase? We will characterise the surface movements of the star using FIES for precise radial velocities of strong Si II spectral lines. Also, we evaluate the surface temperature of V509 Cas by relative intensities of temperature sensitive spectral lines and show how the amplitude of short-term temperature fluctuations has decreased. Additionally, thanks to FIES data of [Ca II] lines, we can offer an explanation to the emission components in some absorption lines (e.g. Sc II) that confirms the hypothesis of a disk surrounding the star (Aret et al. 2017). Similar disks have been found around B[e] supergiant stars, is this what the future holds for V509 Cas?

References:
Aret, A., Kolka, I., Kraus, M., Maravelias, G., 2017. The B[e] Phenomenon: Forty Years of Studies, 508, 239
Nieuwenhuijzen H., De Jager C., Kolka I., Israelian G., Lobel A., Zsoldos E., Maeder A., et al., 2012. A&A, 546, A105

Primary author: Ms KASIKOV, Anni (NOT, University of Tartu)

Co-authors: Dr KOLKA, Indrek (Tartu Observatory, University of Tartu); Dr ARET, Anna (Tartu Observatory, University of Tartu)

Presenter: Ms KASIKOV, Anni (NOT, University of Tartu)