

## Linear spectropolarimetry

A new window for the study of the surface dynamics of RSG stars

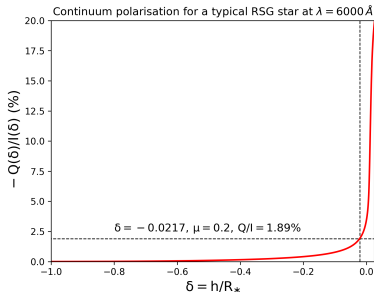
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### Abstract

**Context:** Red supergiant (RSG) stars are massive cool evolved stars. They undergo a prodigious mass loss and are considered as one of the main recycling agents of the interstellar medium. However, the mechanisms triggering this mass loss, convection, pulsations, magnetic fields and related mechanisms, are not fully constrained yet.

**Aims:** Using spectropolarimetric observations we want to bring further our view of the outer layers dynamics of RSG stars.

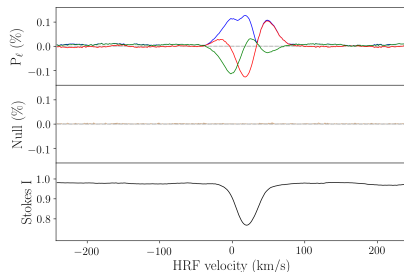
**Results:** Owing to the fact that linear polarisation is seen because of the presence of surface inhomogeneities attributed to convective cells, the surface brightness of three well known RSG stars has been reconstructed from spectropolarimetric observations. For two of them, CE Tau and Betelgeuse, comparison with interferometric observations shows good agreements.



- Continuum of RSG stars is polarised
- lines depolarise it, just like they do for the unpolarised continuum
- This polarisation vanishes for centro-symmetric disk
- Narval does not measure continuum polarisation
- we measure the continuum signal depolarised by lines

→ This signal is seen in individual lines as well as in LSD profiles (*Aurière et al. 16*)

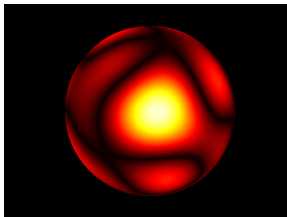
Giant convective cells at the photospheric level of RSG stars are responsible for this non zero, disk-integrated, linear polarisation (*Aurière et al. 16, Mathias et al. 18*)



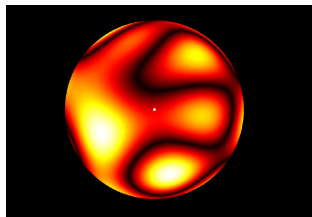
Mean LSD profile of  $\mu$  Cep. Top:  $Q, U, P_\ell$ .

Middle: Null. Bottom: mean line.

- It is possible to link observations with the surface brightness (*Lopez Ariste in prep*) hundreds of observations with Narval (about 500 for Betelgeuse, 300 for  $\mu$  Cep and 200 for CE Tau since 2015) allow to follow the temporal evolution of the surface dynamics of our stars



Surface brightness of CE Tau  
(*Tessore et al. in prep*), to compare with  
interferometric observations of  
*Montargès et al. 18*



Surface brightness of Betelgeuse  
(*Lopez Ariste et al. in prep*), to compare with  
interferometric observations of  
*Montargès et al. 16*



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PHOTOSPHERIC IMAGING



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3 - 6 July 2018

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