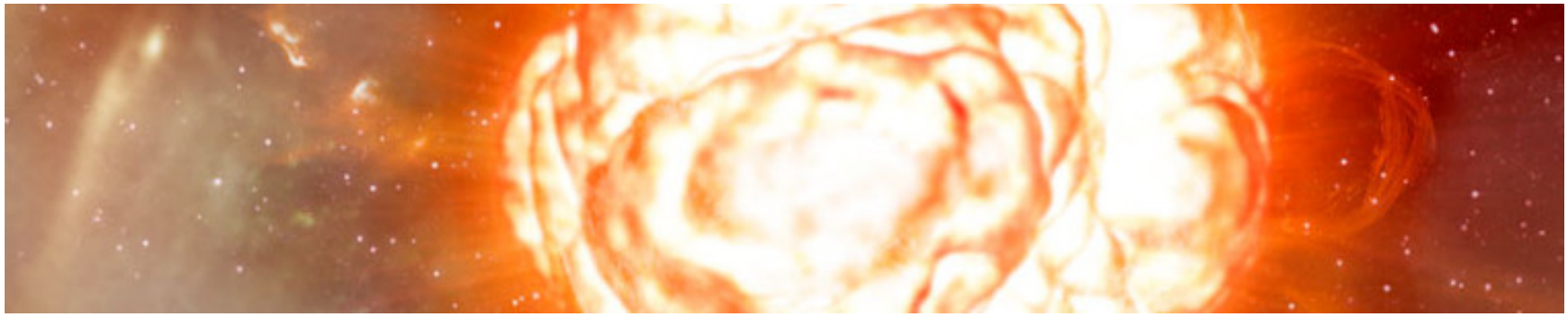

Betelgeuse workshop: linearly polarised spectrum of Betelgeuse

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Paris - September 2016

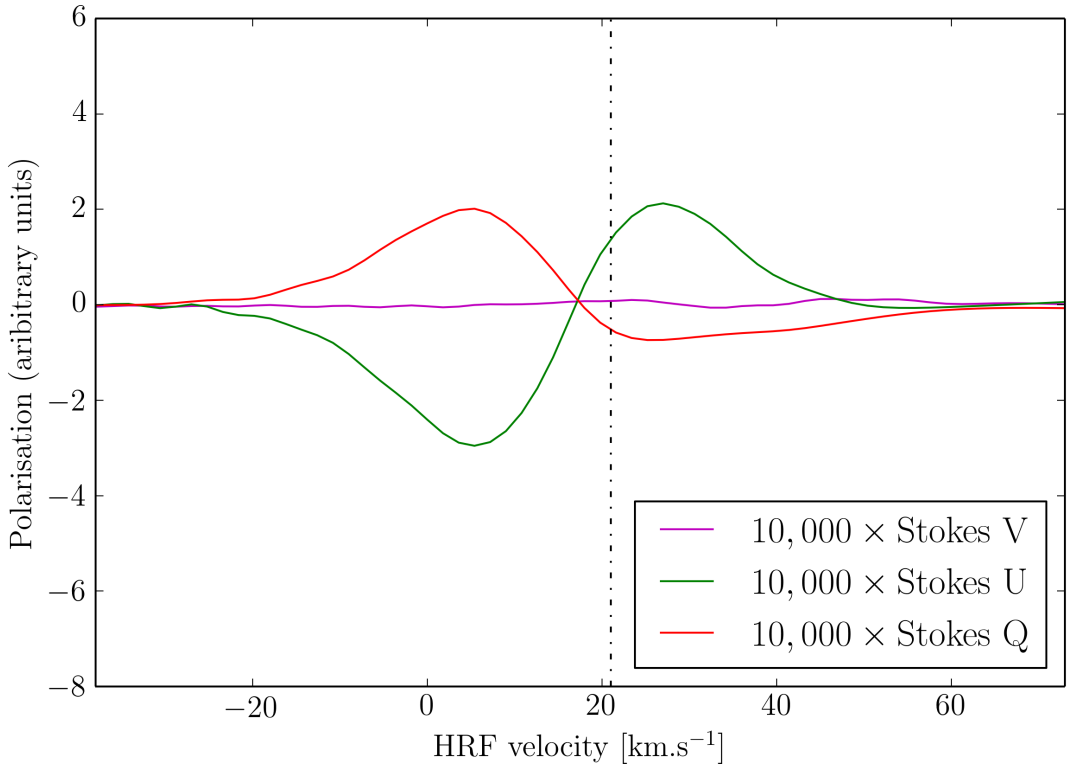
LUPM LABORATOIRE MONTPELLIER UNIVERS & PARTICULES

PNPS Programme National de Physique Stellaire

cnrs

UNIVERSITE MONTPELLIER

Typical polarisation scales for Betelgeuse



Stokes Q & Stokes U

Stokes V

- Strong linear polarisation feature (well above the noise level)
- ➥ Associated to atomic lines
- Non Instrumental
- ➥ **No measurement of continuum polarisation**

1- Linearly polarised spectrum of Betelgeuse: Origin

Stokes Q & Stokes U

$P_\ell = \sqrt{Q^2 + U^2}$

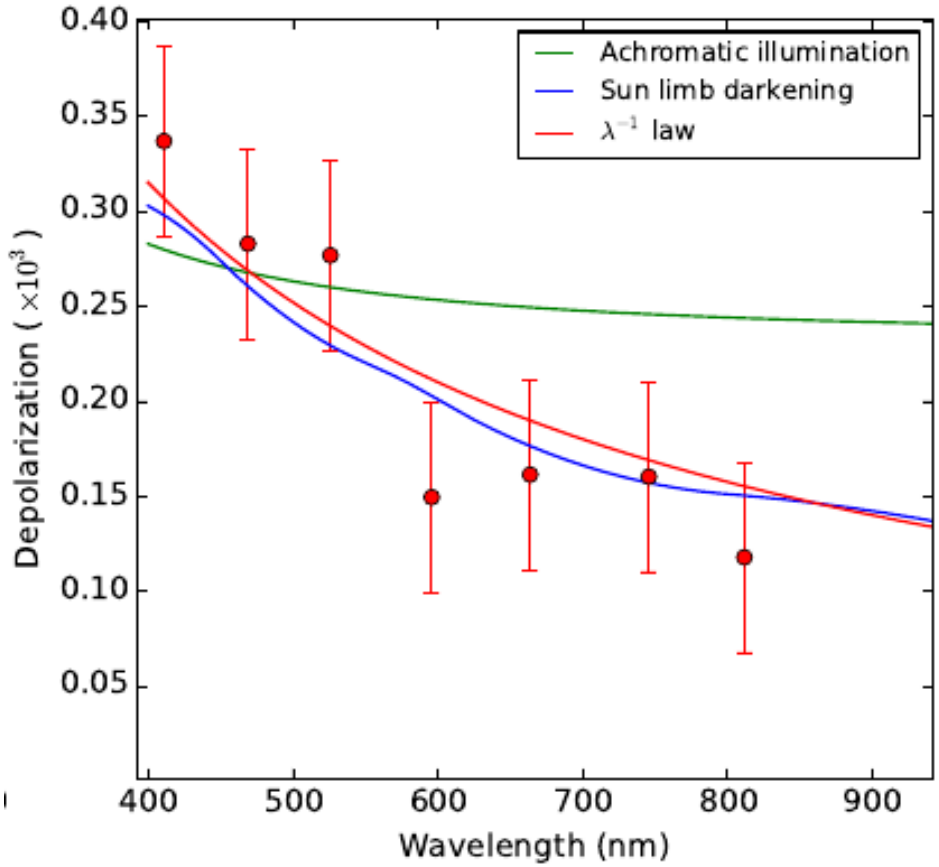
P_ℓ sun

➔ See: ***Aurière et al., 2016***

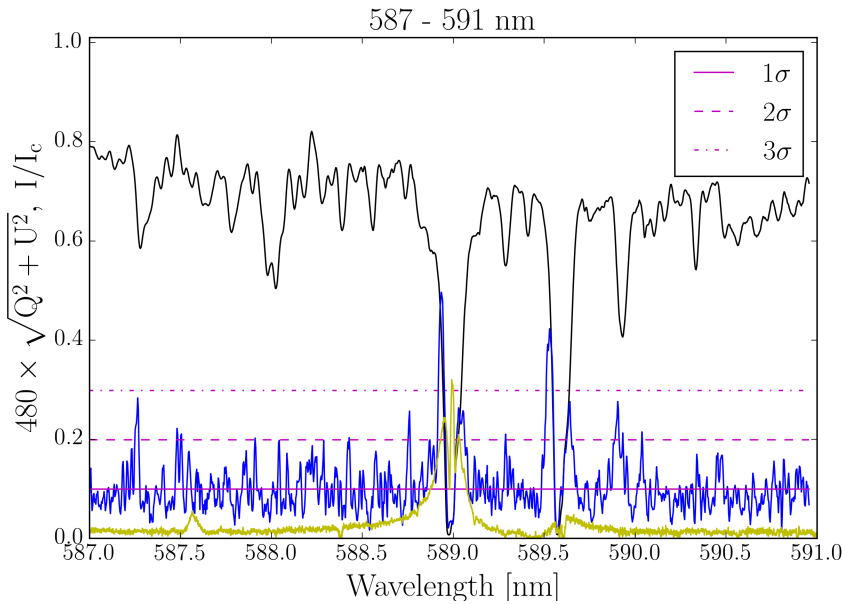
- Non Zeman origin

➥ **The linearly polarised spectrum originates from depolarisation of the continuum**

➔ Amplitude of the Na D1 D2 lines wrt the Solar case



Depolarisation of continuum hypothesis (Aurière et al 16)

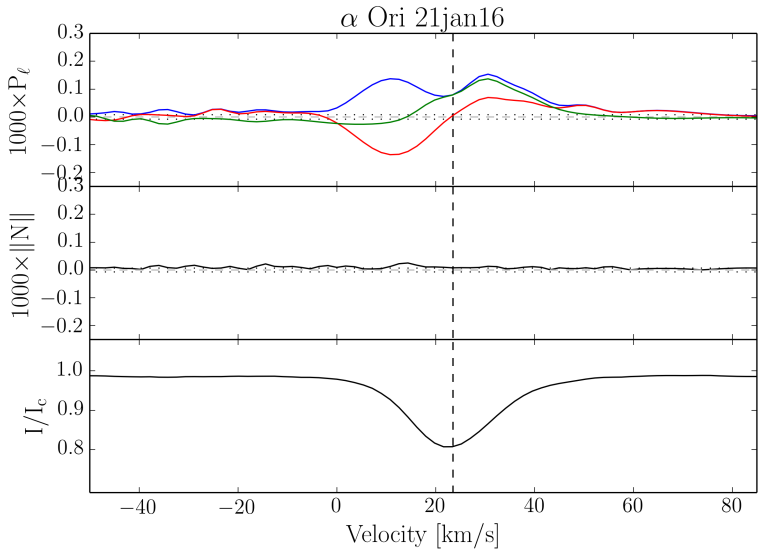


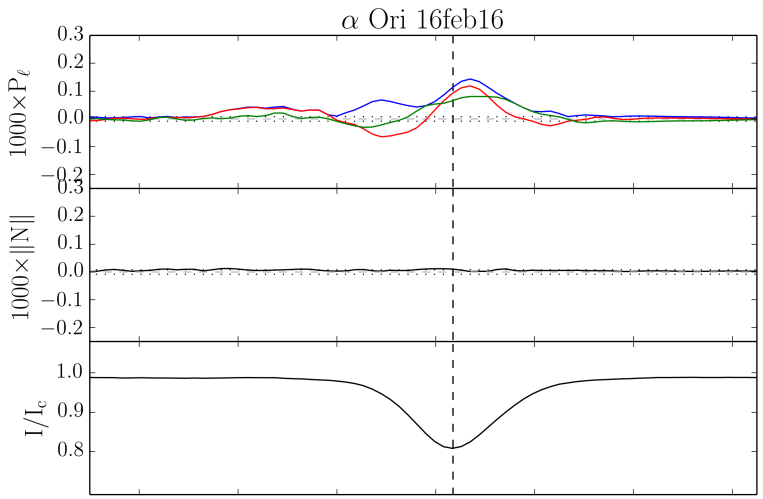
Linearly polarised spectrum of Betelgeuse around the Na doublet

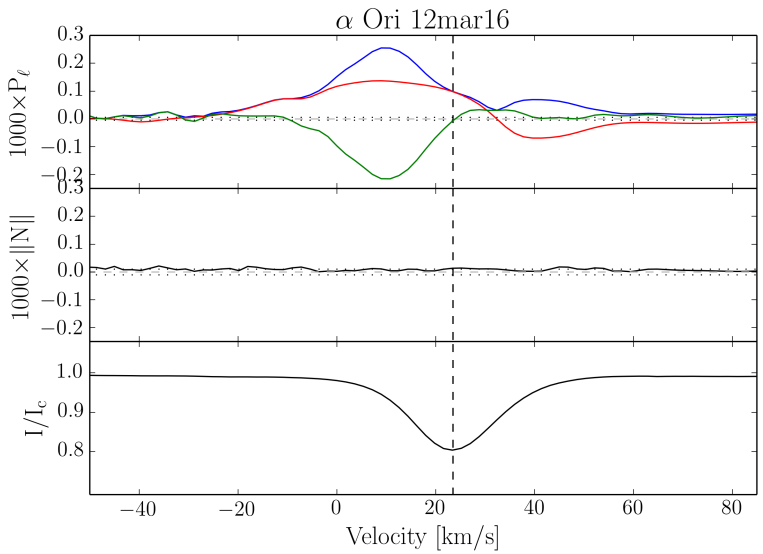
Polarisation in spectral lines

1- Linearly polarised spectrum of Betelgeuse: variability (LSD profiles** view)

***acquired during our Large Program with the Narval instrument*



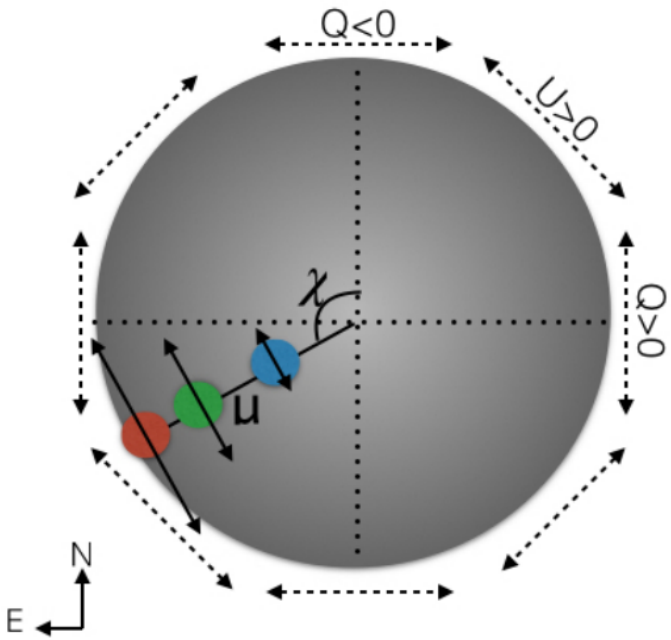


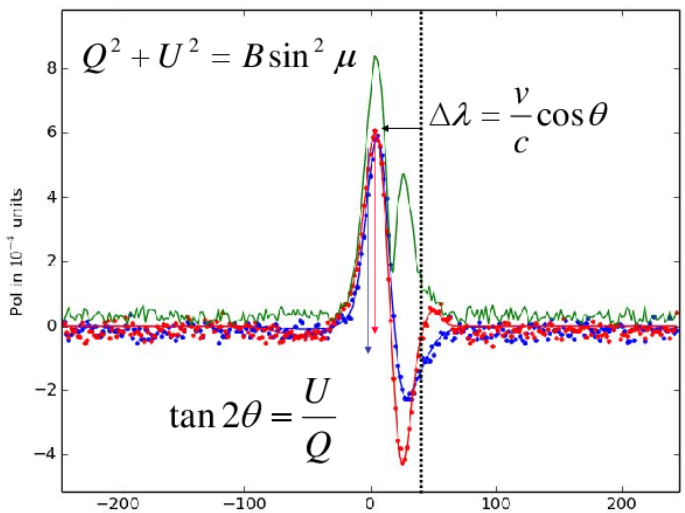


- Variability on months / weeks
  - Consistent with convective time scales
- Linear polarization induced anisotropies
  - Imaging bright spots ?

Mapping bright spots on the stellar disk

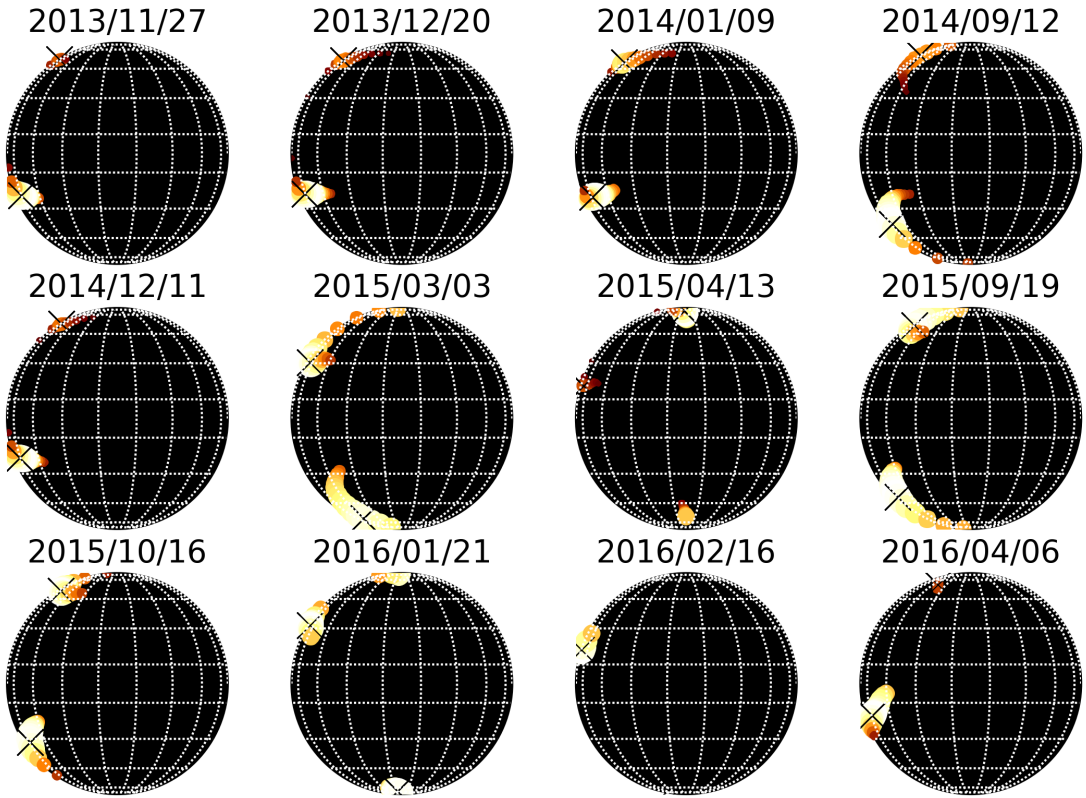
- ➔ If we see linear polarisation ➔ scattering ➔ surface inhomogeneities
- ➔ One maximum in P_ℓ equals one hot spot
- ➔ From the ratio U & Q we infer the angle of position on the disk: χ
- ➔ From the position of the peaks we infer the distance from disk centre: μ
- ➔ From the sum $\mathrm{Q}^2 + \mathrm{U}^2$ we infer the Brightness of a spot: B





Aurière et al 2016. *A. López Ariste's model.*

Hot spots model: 1- variation with time



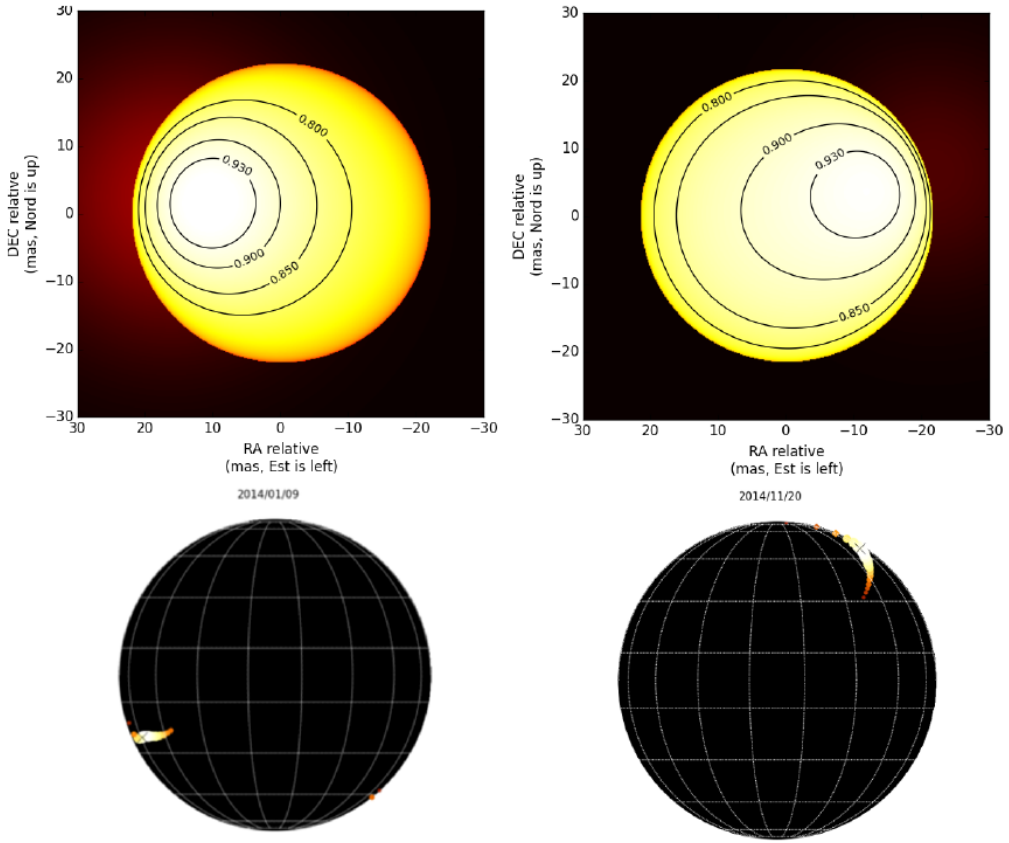
Variation with time of the inferred position of bright spots.

Hot spots model: 2- Comparison with Interferometry

- Simultaneous observations with VLTI and Narval (left January 2014 / right November 2014)

➥ spectropolarimetric hot spots model consistent with interferometric hot spots models!

Spots localised in the same quadrant



Interferometric reconstructions (Montargès et al. 2016) vs spectropolarimetric reconstructions (Aurière et al. 16)