Spectropolarimetric study of the cool RV Tauri star R Scuti

B. Tessore, A. Lèbre and J. Morin

benjamin.tessore@umontpellier.fr

Laboratoire Univers et Particules de Montpellier

Abstract

Context: With NARVAL@TBL we have initiated in spring 2015 a 2-years campaign dedicated to a sample of cool and evolved stars including pulsating RV Tauri stars. We intend to spectropolarimetrically monitor R Scuti, the prototype of such variable post-AGB targets along its pulsation period.

Aims: We want to confirm surface magnetic field detection with the circular polarization (V) and study the linear polarization (Q/U).

Results: In the first part we confirm the detection of a magnetic field about (0.9 ± 0.5 G) at the luminosity maximum of the star. In the second part, we show our first investigations about linear polarization.

LUPM LABORATOIRE MONTPELLIER UNIVERS & PARTICULES

PNPS Programme National de Physique Stellaire

cnrs

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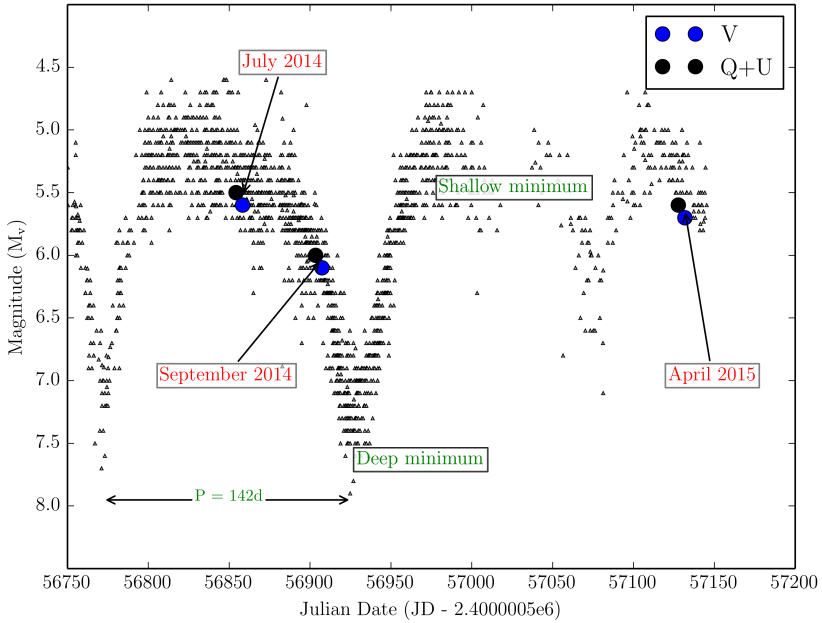
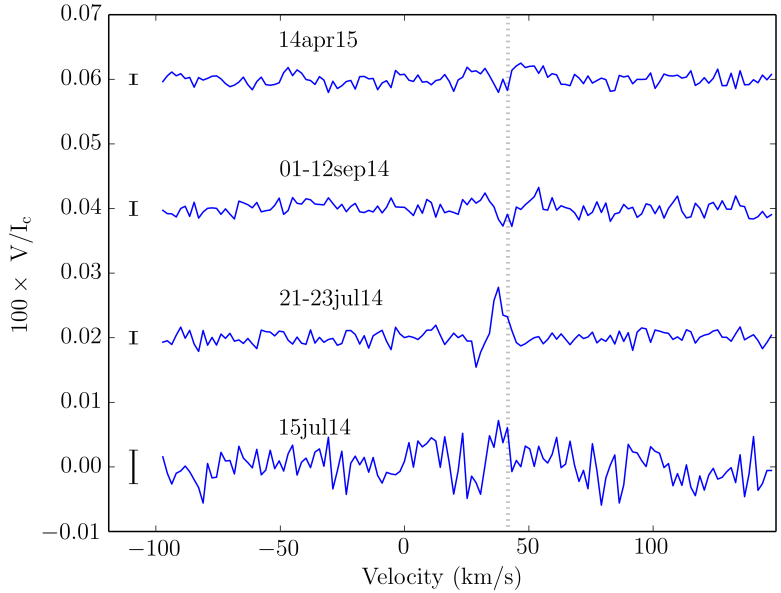


Observations of R Sct along its pulsation period.

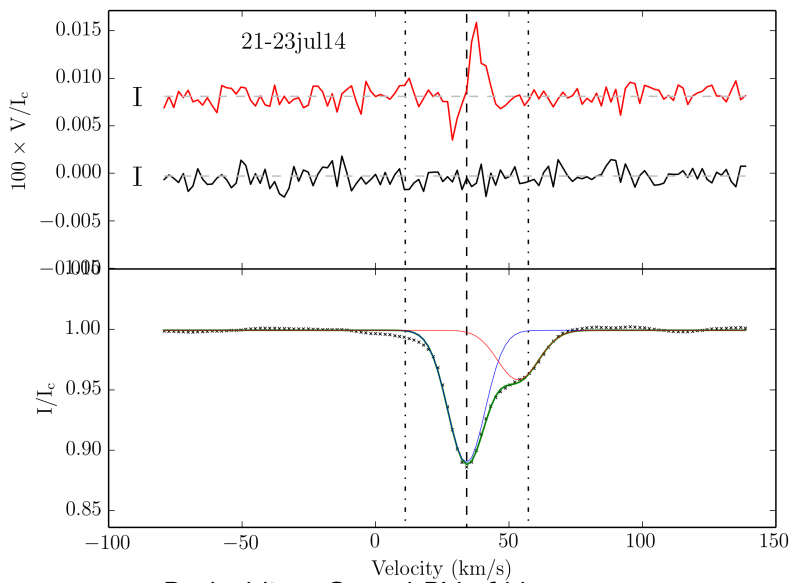


Evolution of circular polarization. The gray dotted line depicts the Radial Velocity (RV) of the spectral line.

- Multi-line extraction (LSD) on multiple spectropolarimetric sequences:
  - S/N $= 40\,000 - 120\,000$
  - Definite Detection at luminosity maximum (21-23 July 14)
- Longitudinal field measurement:

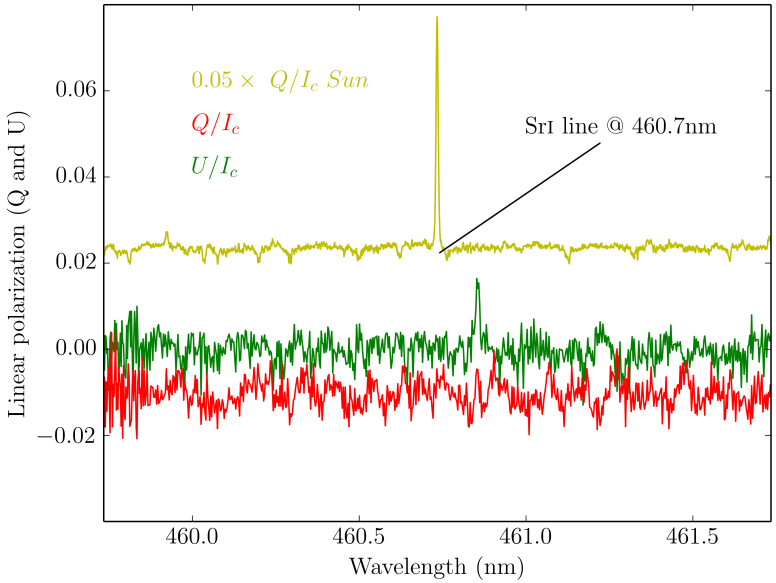
$$B_\ell \propto \frac{\int vV(v)\,dv}{\int [1 - I(v)]\,dv}$$

  - With full I line: $B_\ell = 0.9 \pm 1.8$ G
  - Blue component only: $B_\ell = 0.9 \pm 0.5$ G



Dashed line: Central RV of blue component.

Dot-dashed lines: Integration bounds for B_ℓ.



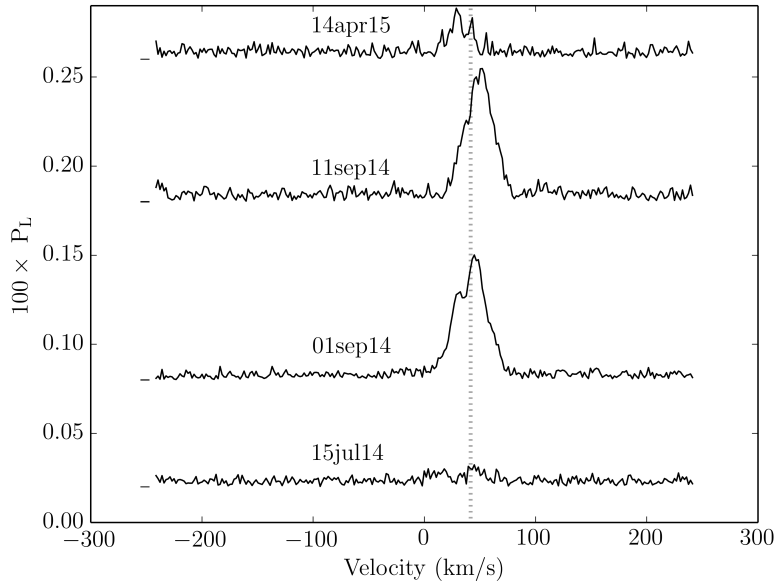
The polarization of the SrI line in the 2nd solar spectrum (Stenflo 2014) and R sct.

- Strong linear polarization in some ↑ individual spectral lines
- Average (of about 1000 lines) signal ↗ detected with LSD
  - ➥ Strongest after luminosity maximum
- The shape of Q and U remains constant →

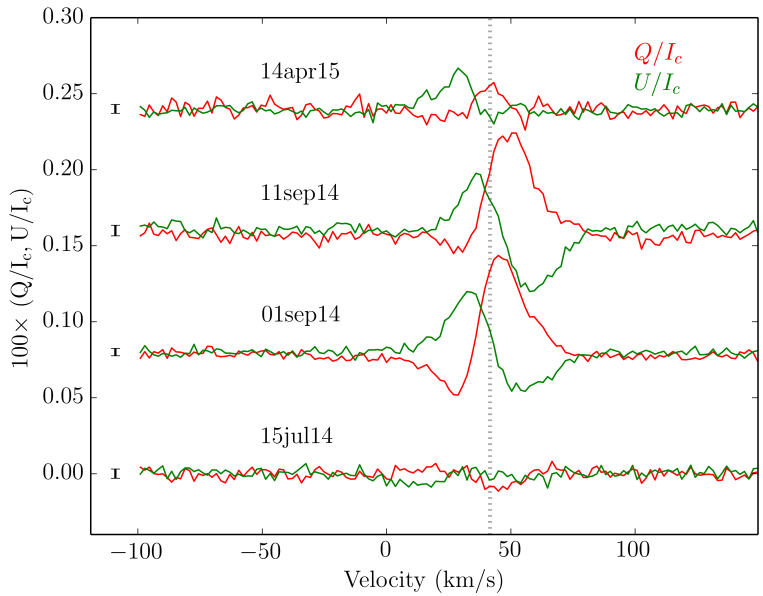
→ Systematic phase-polarization relation?

→ Physical origin of linear polarization?

➥ Unrelated to magnetic field?



Evolution of linear polarization with the phase.



Evolution of linear polarization LSD profiles, with the phase.