RAPIDLY ROTATING STARS

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Spectroscopic constraints on rotation velocities

- Doppler broadening → $v \sin i$
- For high v → distortion of the stars → gravity darkening
- Disentangle $v \sin i$ → determination of v and i

(FASTROT, Frémat et al. 2005)

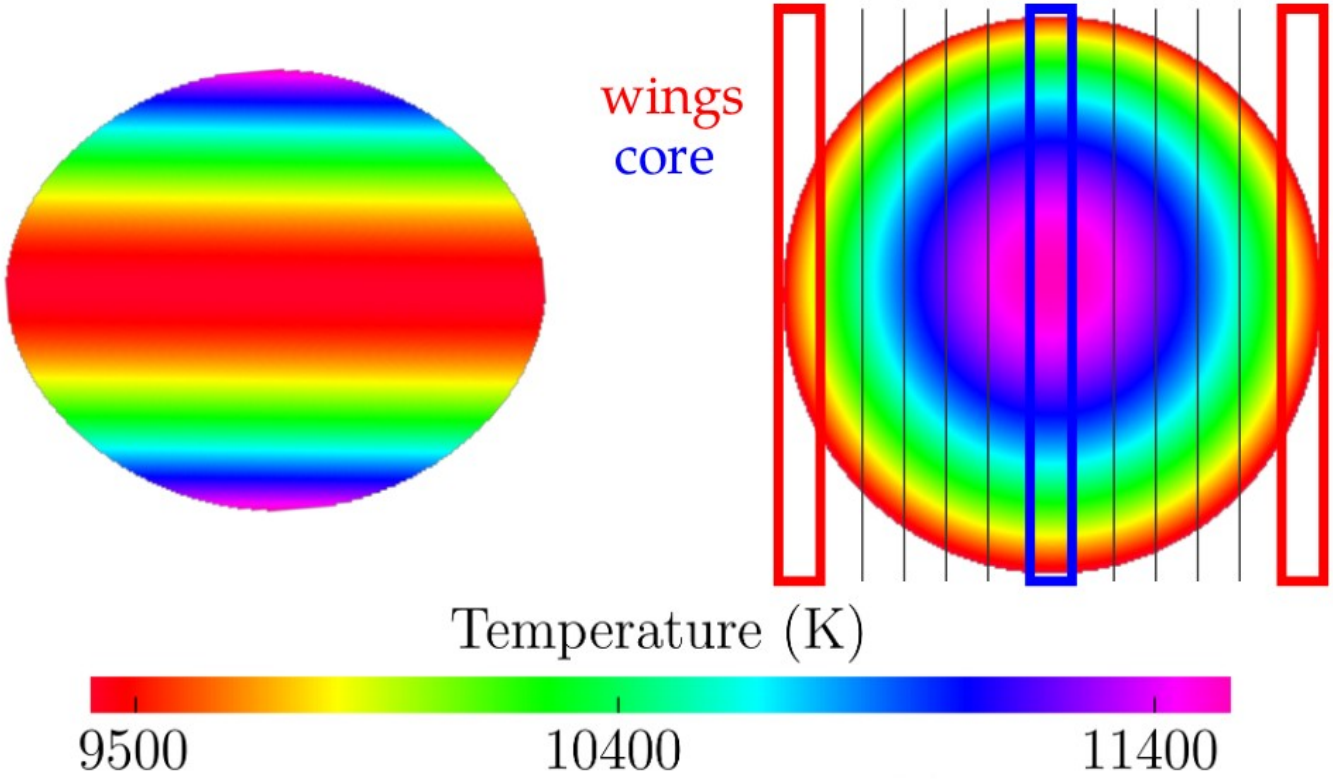
  - Investigate slow rotators mode in rotational velocity distributions and check randomness of rotational axes orientations
  - Provide direct measurements of rotational velocities to constraint theoretical models

MODEL: $3\,M_\odot$ star – $\Omega/\Omega_c = 90\%$

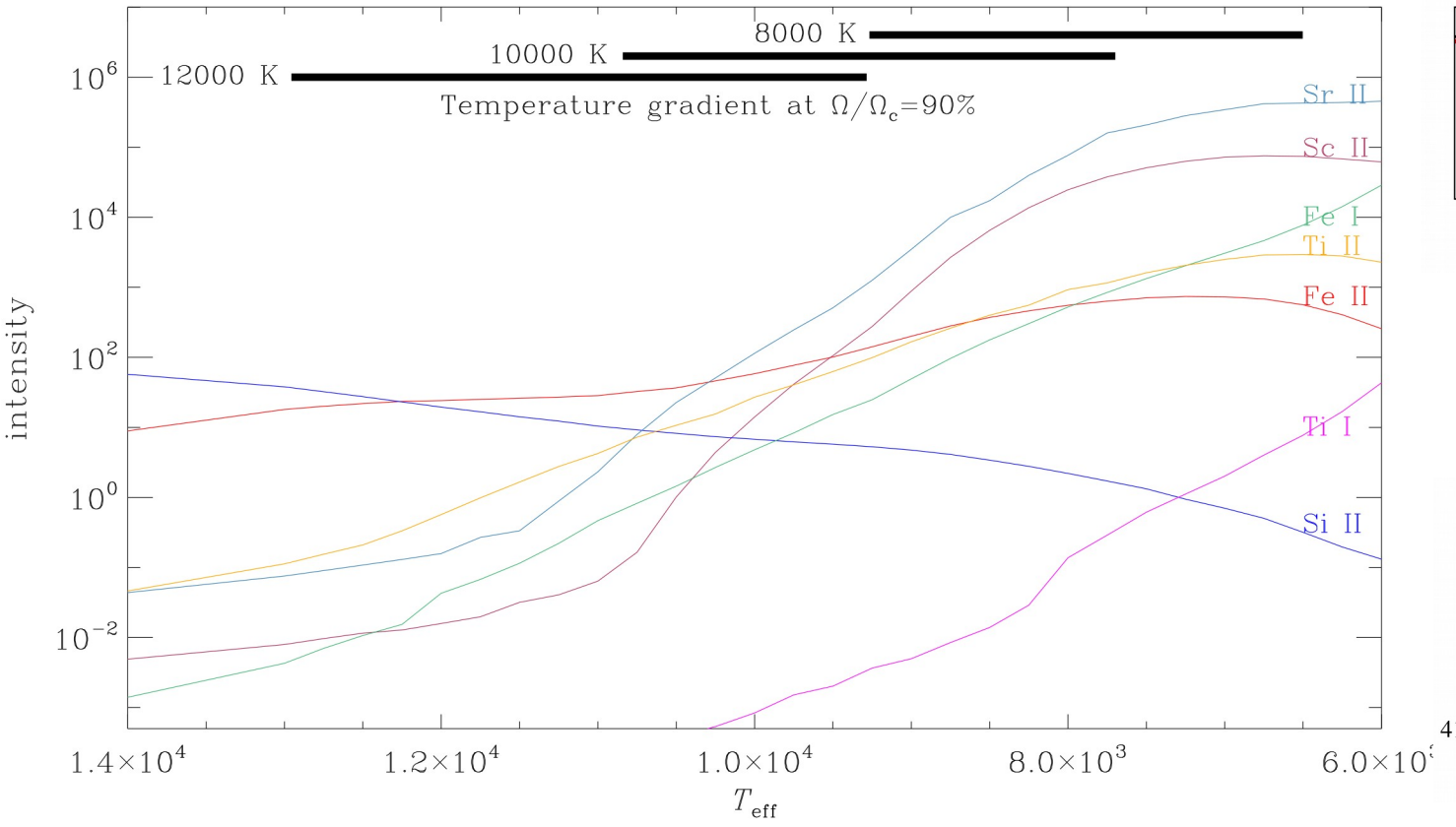
- geometrical deformation, centrifugal acceleration

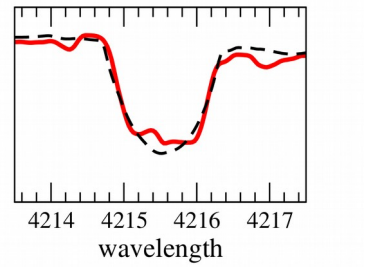
$\Rightarrow$ non-uniform surface gravity and temperature

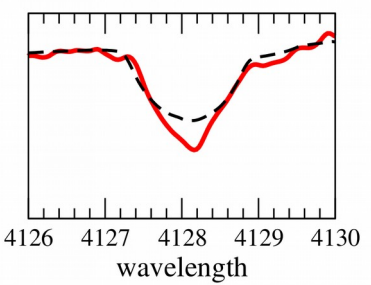
$i = 90°$ $i = 5°$



Line intensity versus T_{eff}



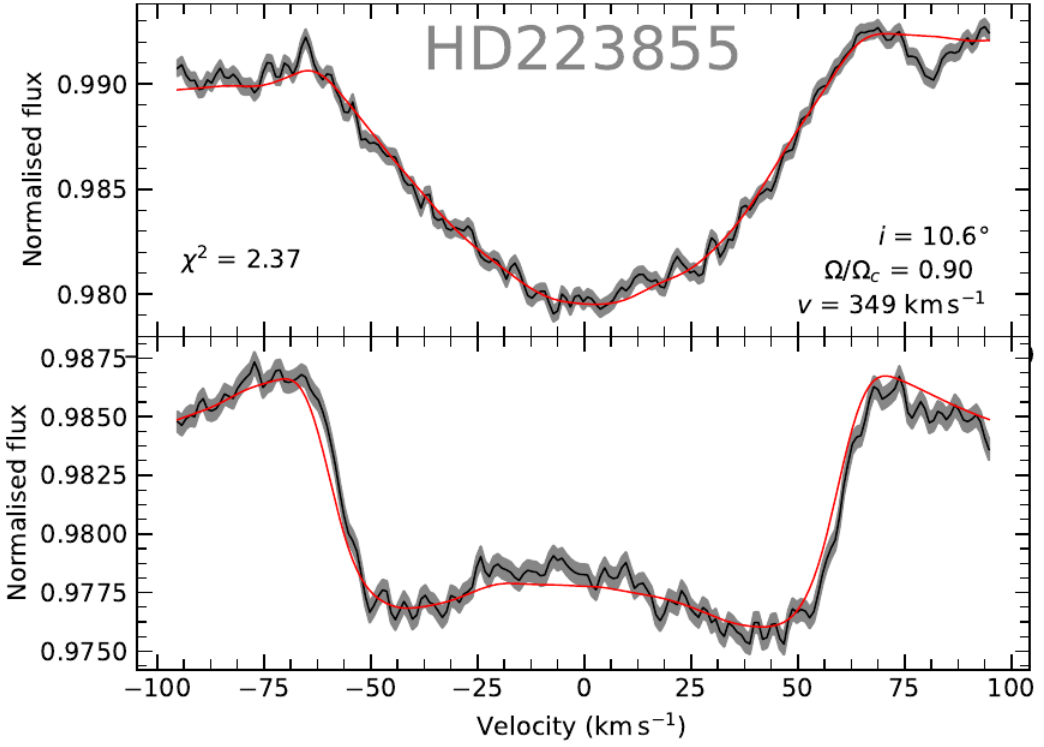




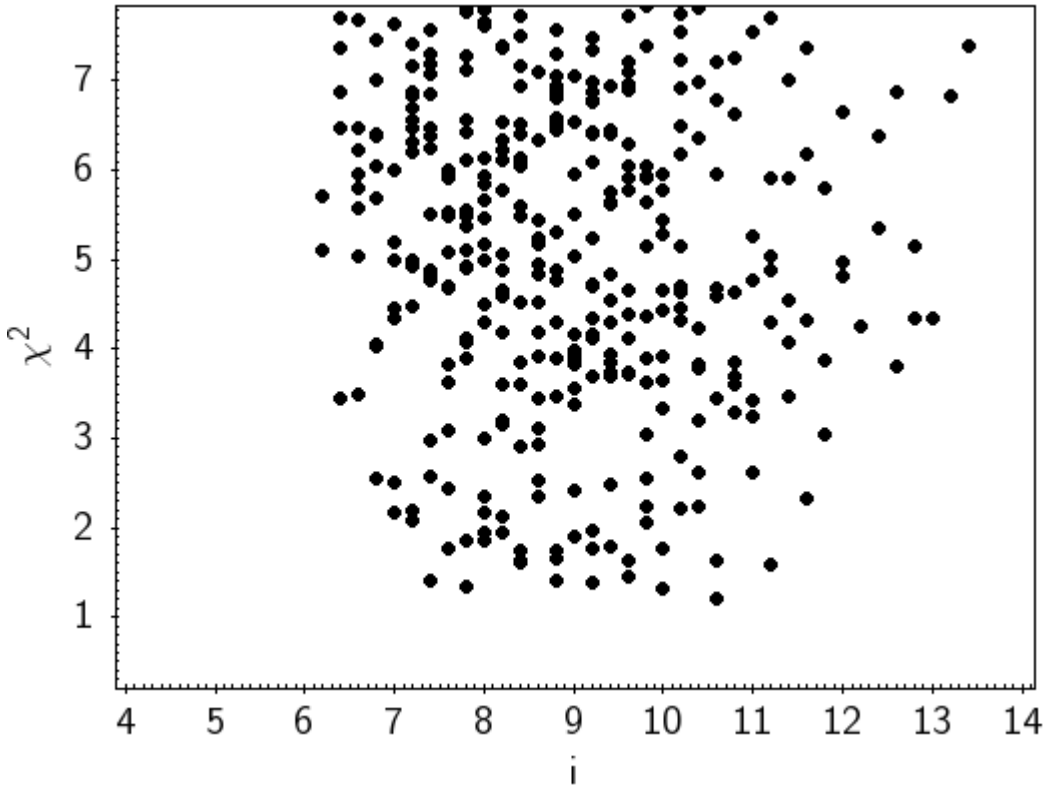
Search for GD signatures

- Compare mean profiles of flat-bottomed lines and pointy lines with a grid of models (FASTROT, Frémat et al. 2005)

  → determine *v* and inclination



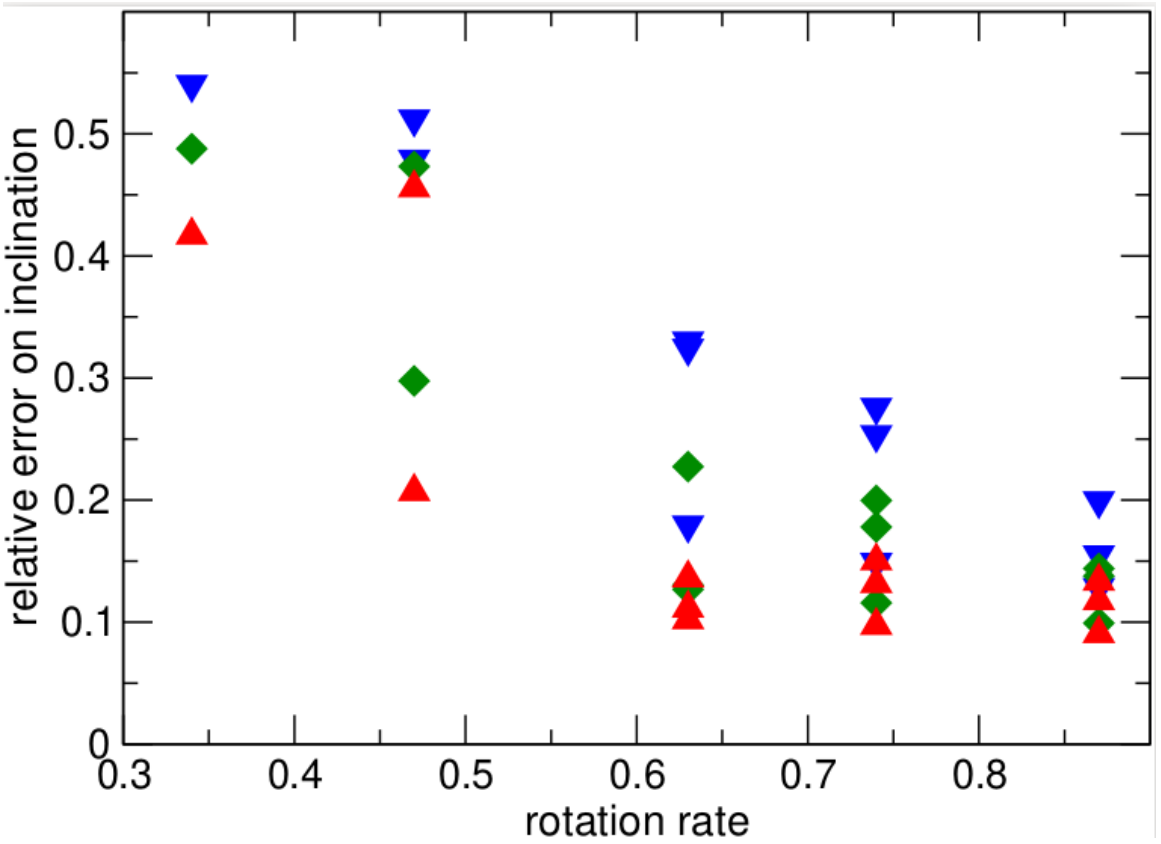
Search for GD signatures



Comparison with a subset of the grid of models:
- subrange in T_{eff}
- subrange in $v \sin i$
- full range in logg [3.5, 4.2]

Results from the best fit

Tests on simulated data



Simulations:

T_{eff} = 9500 K, log g = 4,

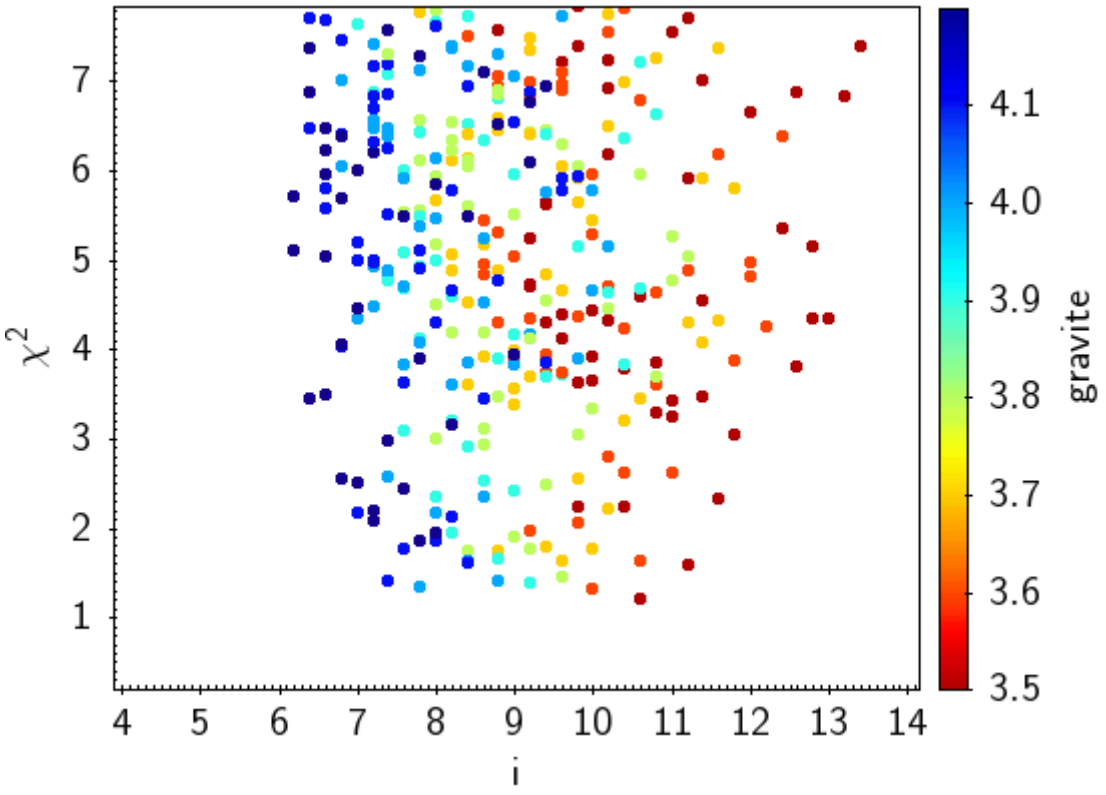
$v \sin i$ = 20–60 km/s

$i < 30°$

Different (v, i)

SNR: **400**, **600**, **800**

Tests on simulated data



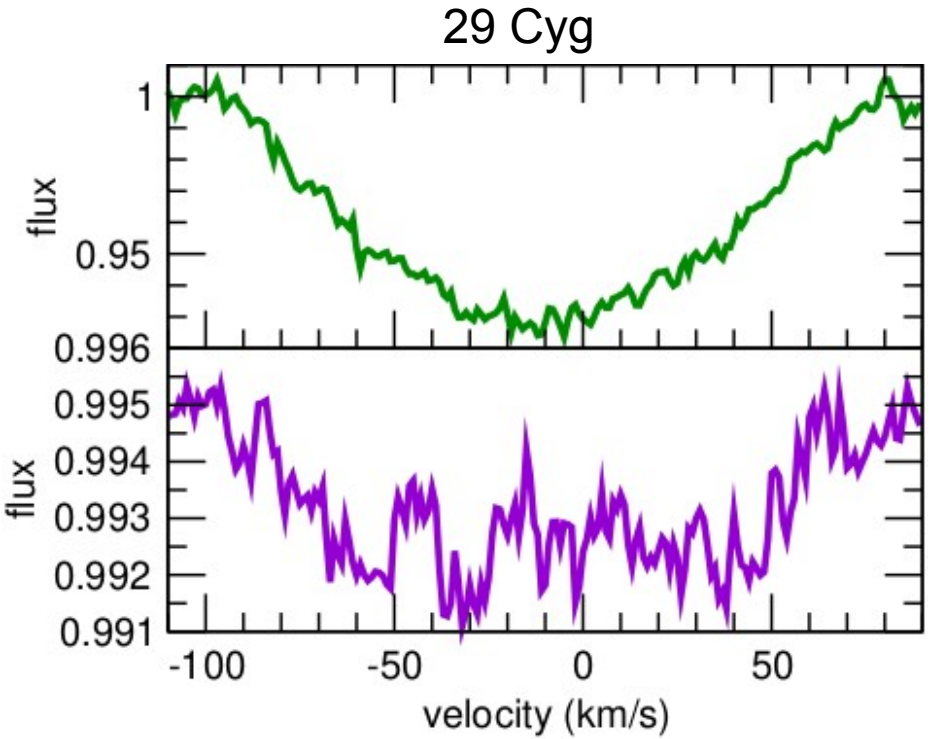
Degeneracy
between *i* and log *g*

Need of strong constraints on log *g*
→ retrieve and model the Balmer profiles in SOPHIE spectra

Constraining asteroseismic studies

Analysis of bright δ Scuti stars

- Observational programme started on SOPHIE (OHP)
- Constraints from spectroscopy:
  - fundamental parameters: Teff, log g, vsini, abundances
  - constraints on v, i → distortion
  - Line profile variations → mode identification
- Theoretical modeling: oscillation spectra, visibilities, periodic patterns



On going work

- Spectroscopic analysis
  - Tune the reduction of SOPHIE spectroscopic data to retrieve Balmer profiles
    - Correct for instrumental response using standard star
    - Correct for scattered light contamination

- Asteroseismic analysis
  - Collect more data (SOPHIE)
  - Joint analysis of 29 Cyg