Modeling the activity of young stars from photometric and spectropolarimetric data

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These

Tomography of young stars

CubeSat - SPIRou

Current Work

AP 149: A young, active, Sun-like star

Young Stars

- Pre-main sequence stars and stars recently settled on the main sequence

- Rapid rotation generating strong magnetic fields at the source of a high level of surface activity

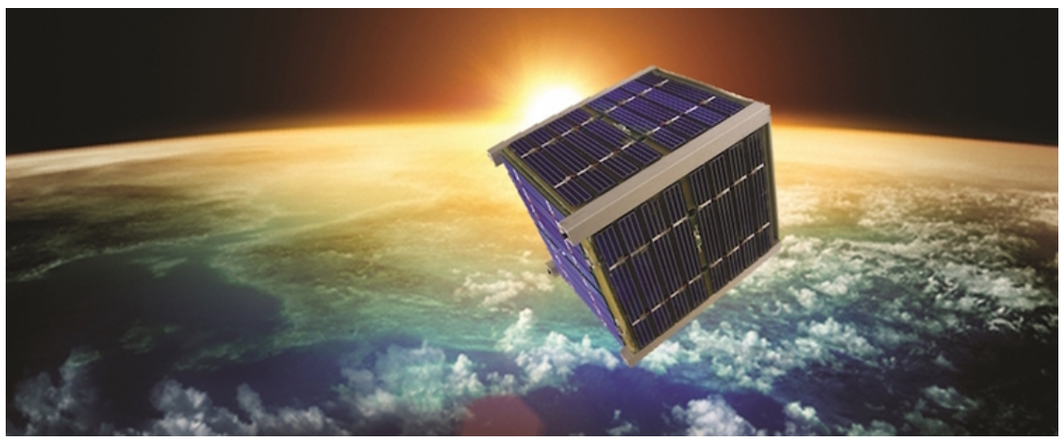
- Key to better understand the early life on the formation and evolution of Sun-like stars and their planets

Tomography

- Imaging by sections
- Zeeman–Doppler Imaging (**ZDI**), reconstruction of brightness and magnetic field maps
- Spatial distribution of prominences

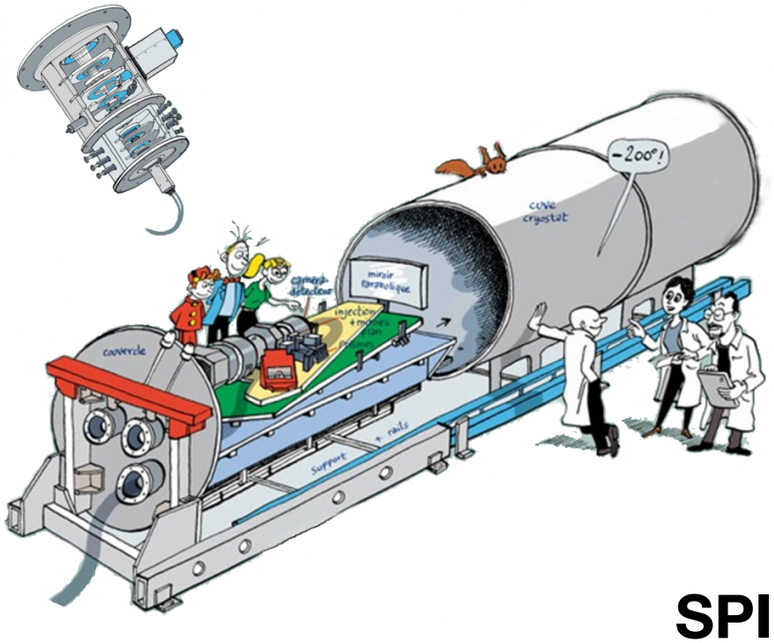
CubeSat - SPIRou

- CubeSat-type satellite, collecting continuous photometric light curves of young stars



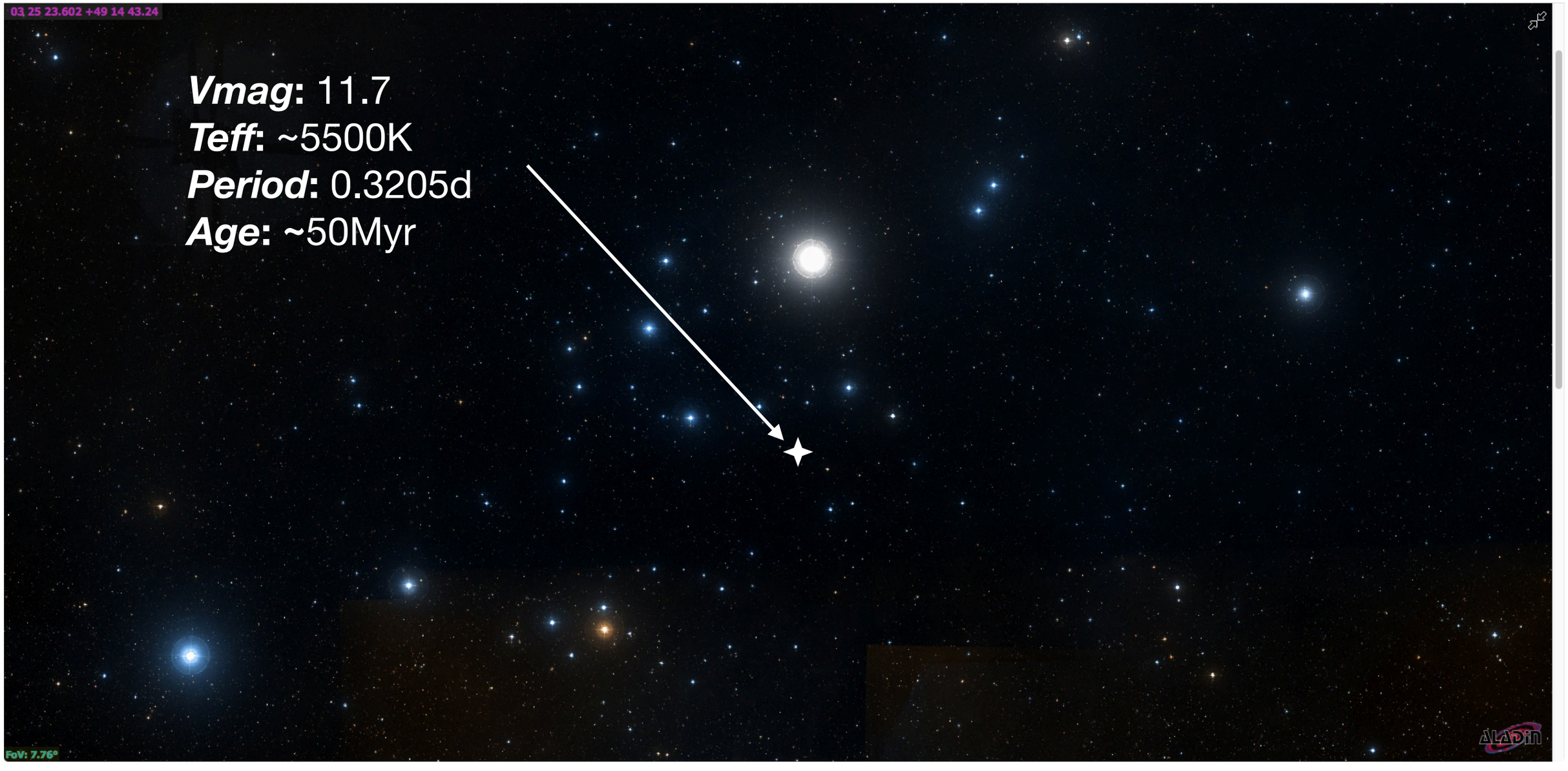
http://www.cubesat.org

- SPIRou, the new generation spectropolarimeter / velocimeter mounted on the CFHT



SPIRou
http://spirou.irap.omp.eu/Instrument

AP 149: A young, active, Sun-like star



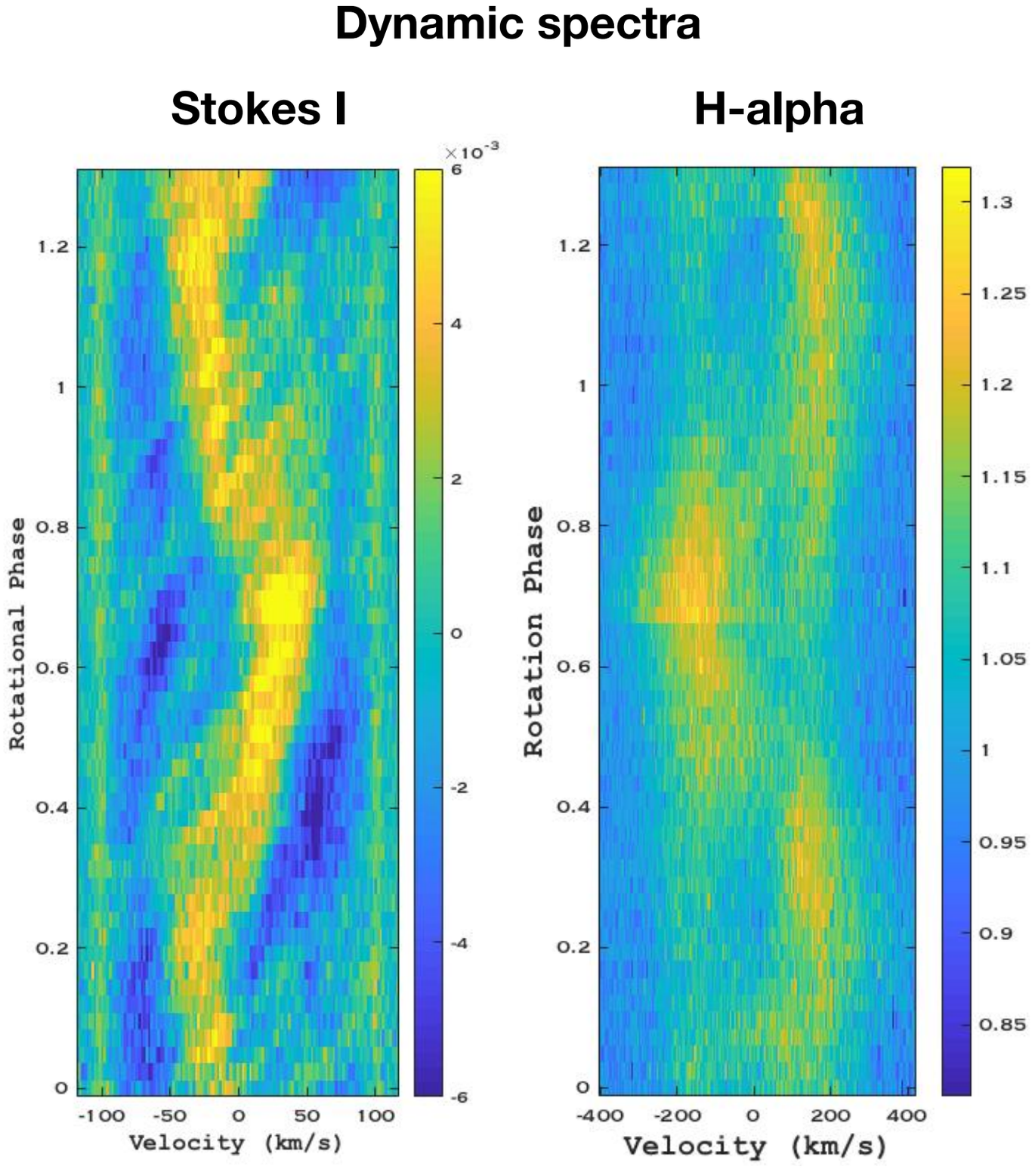
open cluster Alpha Persei (from DSS)

Spectropolarimetric observation

- Two nights with ESPaDOnS@CFHT (29 Nov & 05 Dec 2006)

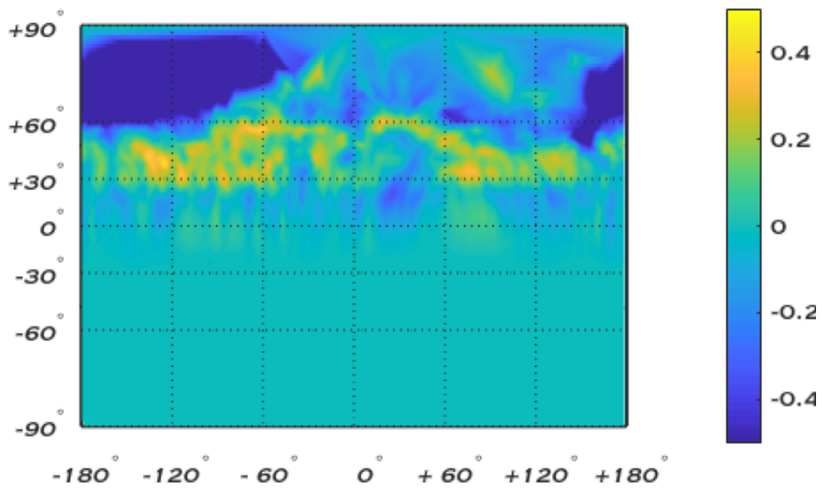
- 28 Stokes I spectra per night / 7 Stokes V spectra

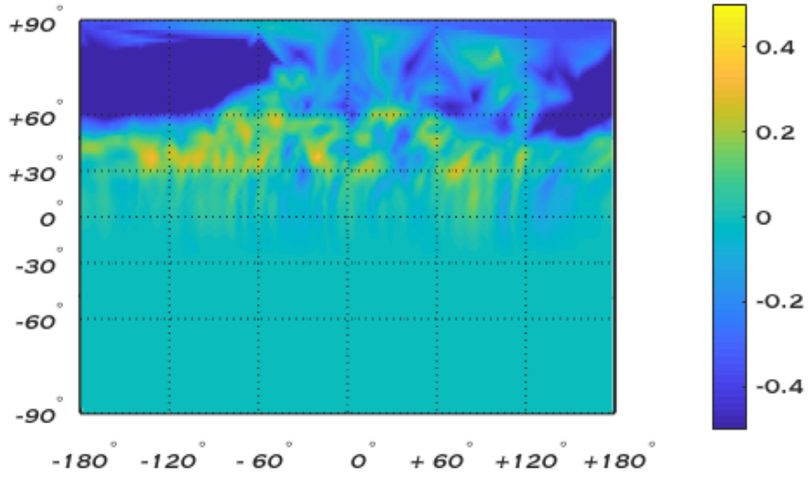
- ZDI (Donati et al. 2006, Folsom et al. 2018)

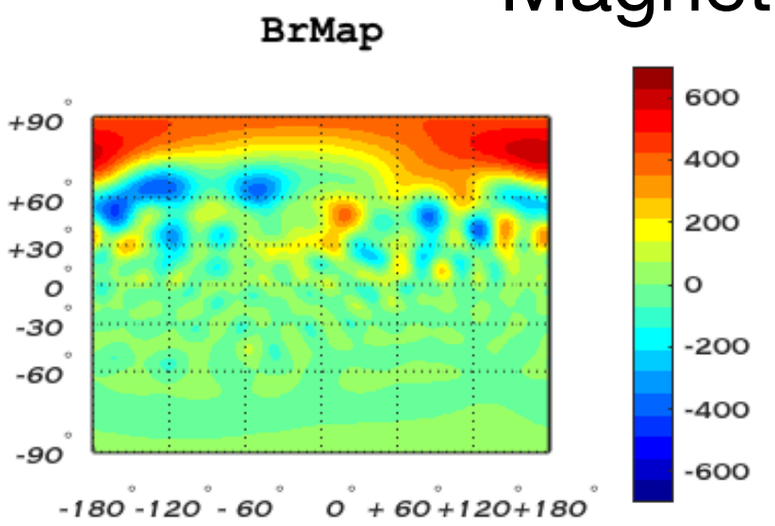


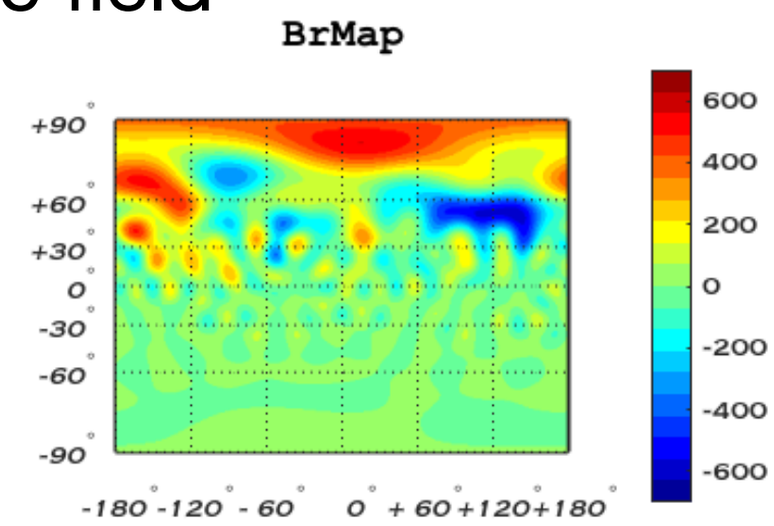
Magnetic field

Brightness

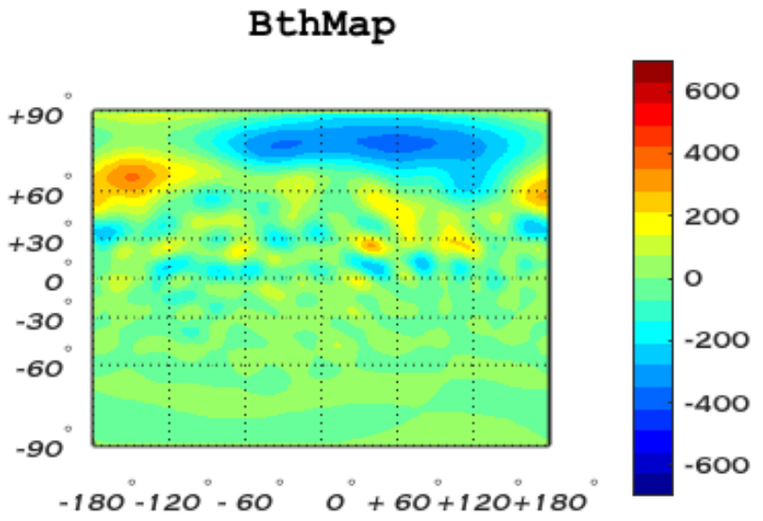


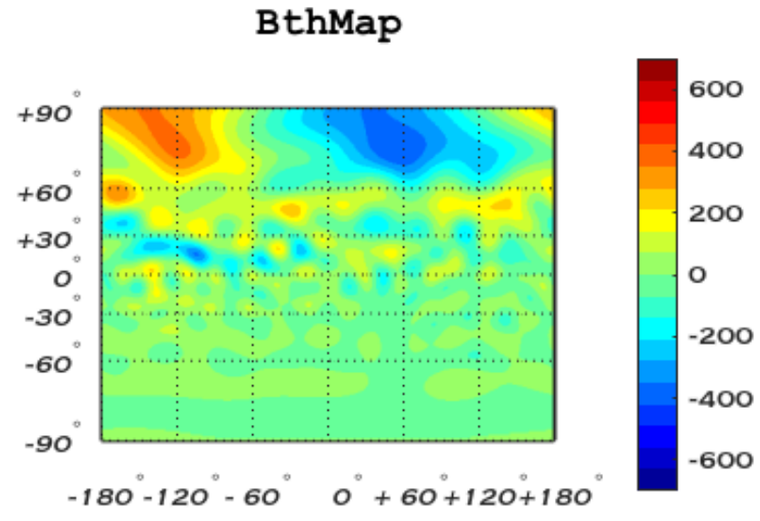


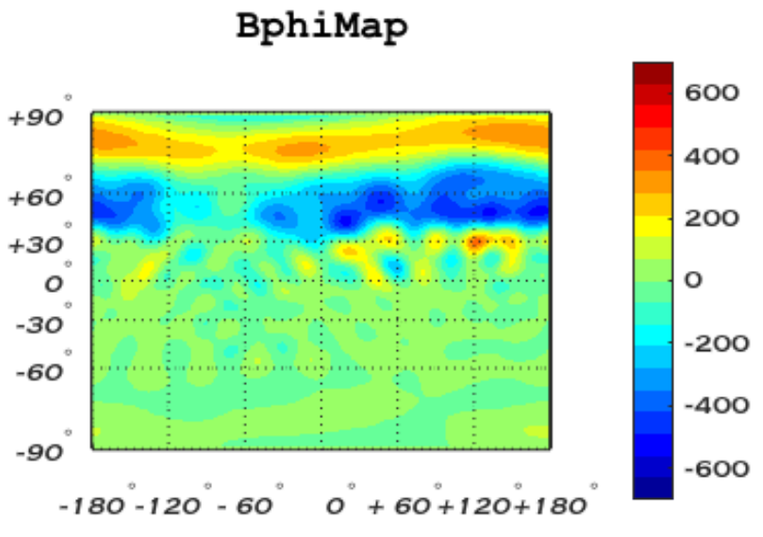


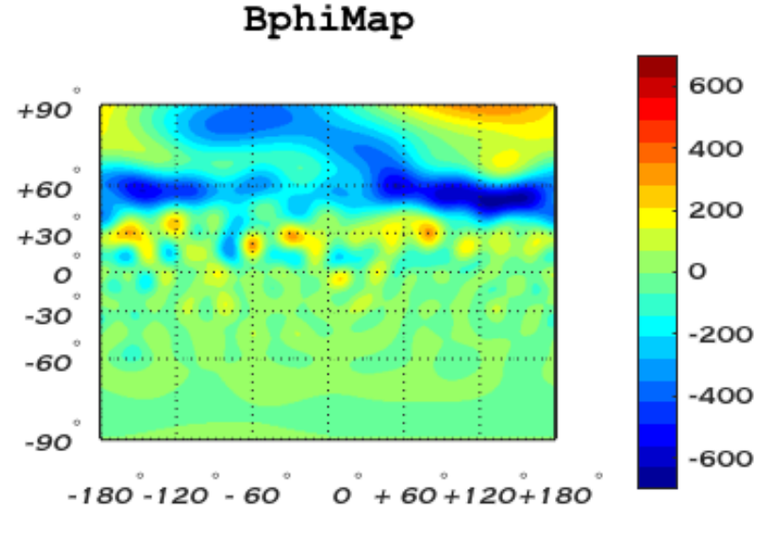


poloidal field









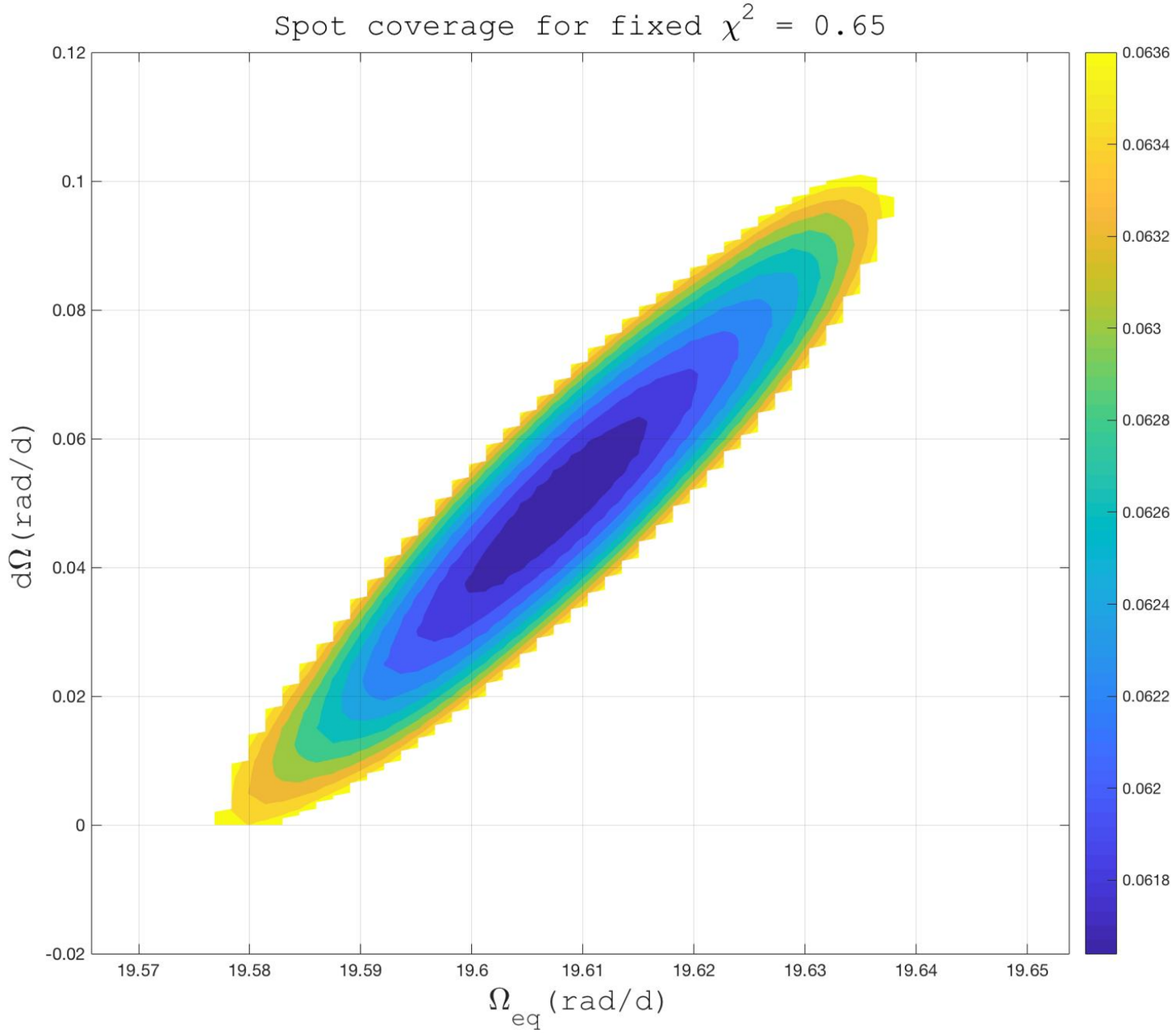
toroidal field

29 Nov 05Dec

Differential rotation

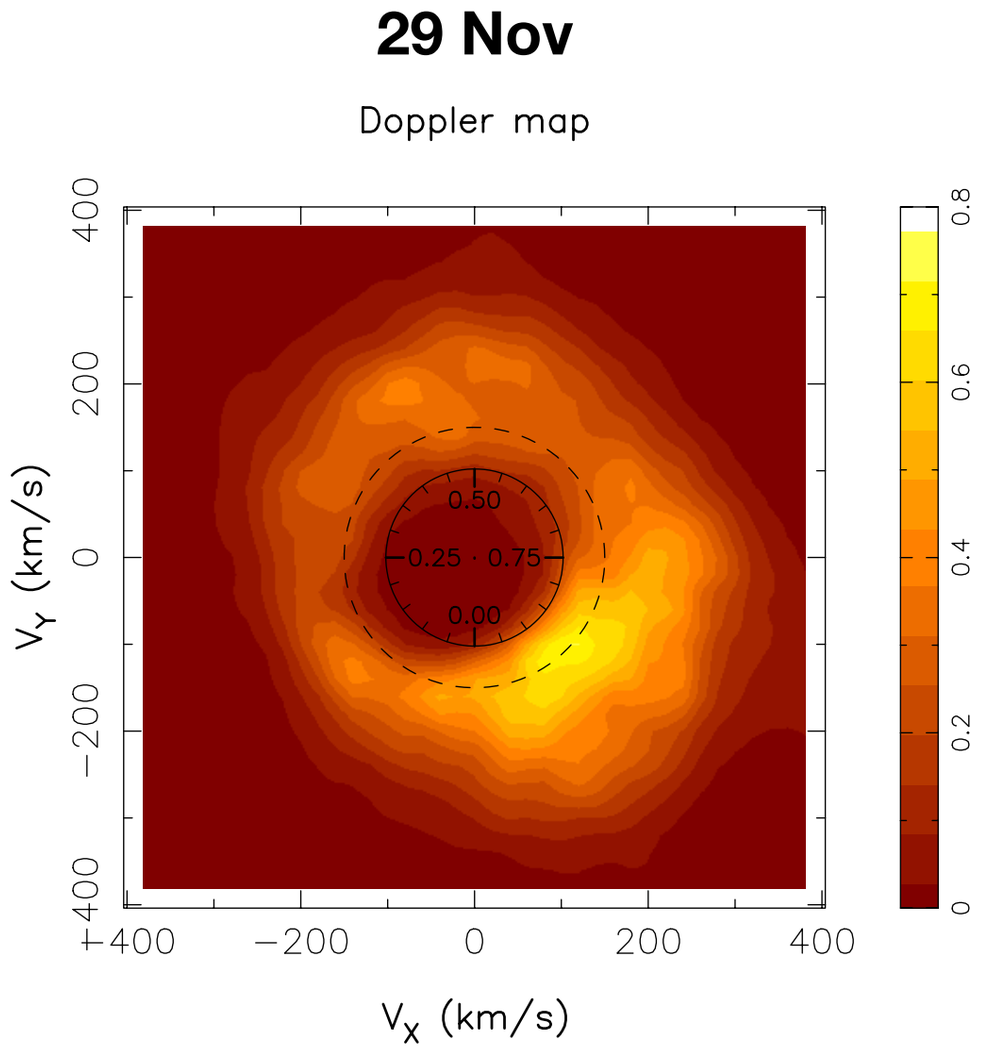
dΩ = 0.0500 (0.0004) (rad/d)

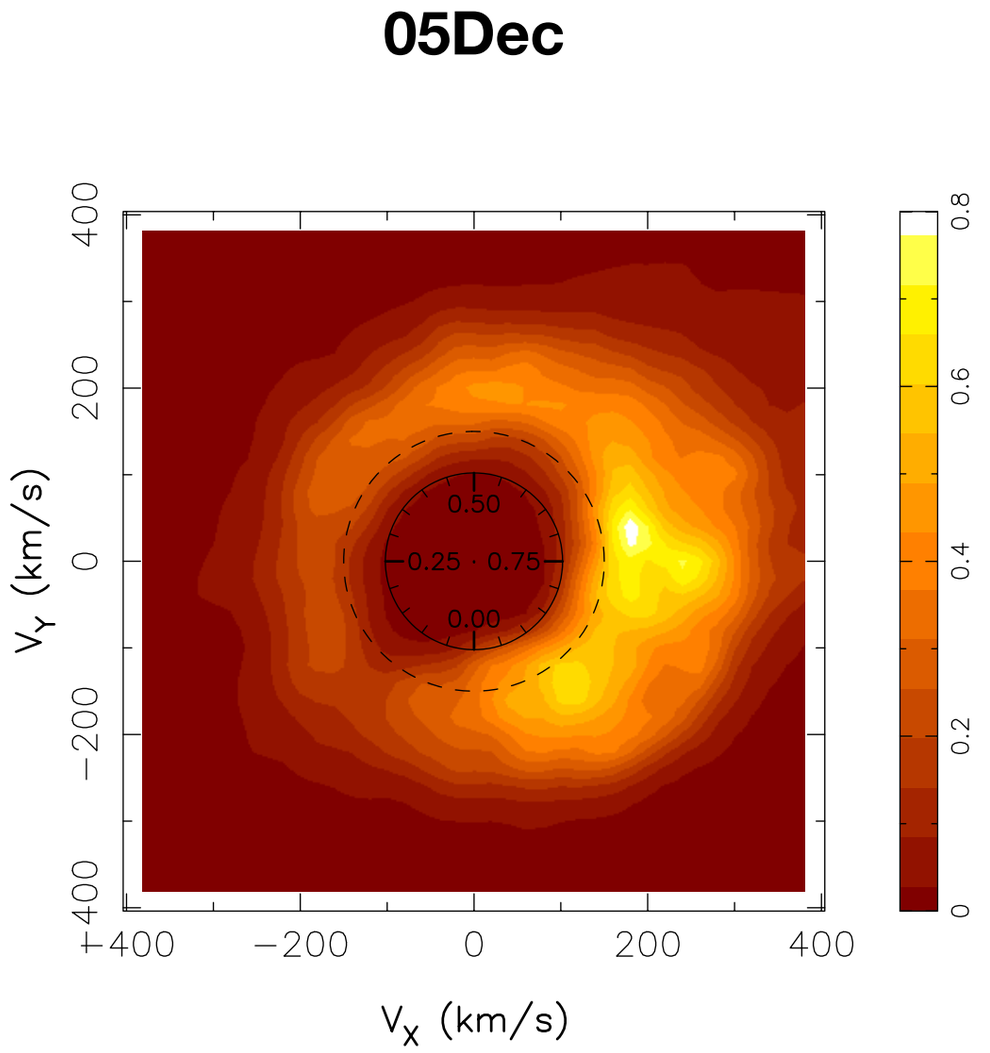
Ωeq = 19.604 (0.018) (rad/d)



Prominences

- Cool, dense gas trapped in closed magnetic loops
- Modeled from tomography of H-alpha line profiles (Donati et al. 2000)





Conclusions

- Tomography of AP 149, the rapidest rotating star studied with ZDI

- First prominence map and magnetic map obtained together - crucial for modeling prominence system

- First estimation of differential rotation

Perspectives

- CFHT proposal for 4 consecutive nights to study short-term prominence evolution.
- Compare prominence distribution/dynamics with models
- Simulate wind model
- Estimate mass loss and angular momentum loss due to coronal ejections and wind

Thank you for attention !