

**Stars old, very old, and a young one:  
from subgiants to X-ray binaries**

in the

**= Eye of the TIGER =**



**Uwe Wolter**

Hamburger Sternwarte  
Universität Hamburg



A. Borisova, B. Ahringer, D. Engels, B. Freytag, R. Konstantinova-A., B. Stelzer, R. Zamanov

- New! **TIGvival**: Mira and her sisters
- Few **active regions** on the giant OU And
- Weird **disk evolution** and disk structure on X Per
- Tentative: yet another **cyclist**: Eps Eri?
- Usual **summary**

## Doppler Imaging of the Hertzsprung gap star OU Andromedae

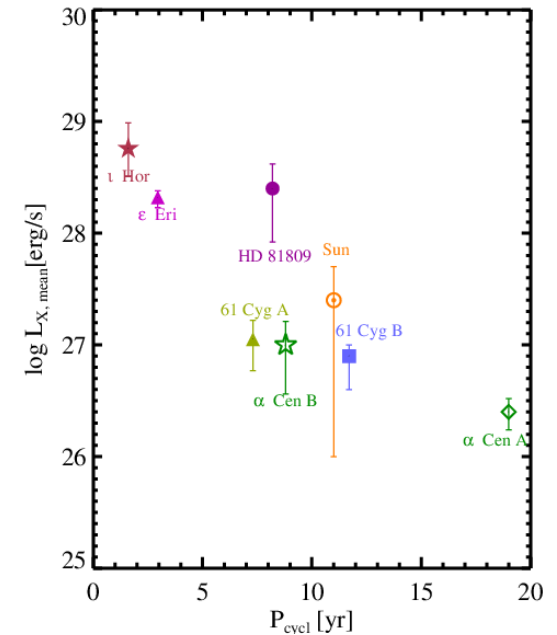
Ana Borisova<sup>1</sup>, Uwe Wolter<sup>2</sup>, Renada Konstantinova-Antova<sup>1</sup>  
and K. P. Schröder<sup>3</sup>

<sup>1</sup> Institute of Astronomy and NAO, Bulgarian Academy of Sciences, BG-1784, Sofia,  
Bulgaria [aborisova@astro.bas.bg](mailto:aborisova@astro.bas.bg), [renada@astro.bas.bg](mailto:renada@astro.bas.bg)

<sup>2</sup> Hamburger Sternwarte, Gojenbergsweg 112, 21029 Hamburg, Germany

<sup>3</sup> Departamento Astronomia, Universidad de Guanajuato, GTO CP 36000, Mexico  
[st0h311@hs.uni-hamburg.de](mailto:st0h311@hs.uni-hamburg.de)

(Borisova+ 2018, BAstJ subm.)



(Coffaro+ 2018, in prep. & 'Madrid')

Mon. Not. R. Astron. Soc. **000**, 1–21 (2002) Printed 14 May 2018 (MN  $\LaTeX$  style file v2.2)

## Prominence activation, optical flare, and post-flare loops on the RS Canum Venaticorum star SZ Piscium

Dongtao Cao,<sup>1,2\*</sup> Shenghong Gu,<sup>1,2,3†</sup> Jian Ge,<sup>4</sup> Tinggui Wang,<sup>5</sup> Jilin Zhou,<sup>6</sup>  
Liang Chang,<sup>1,2</sup> U. Wolter,<sup>7</sup> M. Mittag,<sup>7</sup> J. H. M. M. Schmitt,<sup>7</sup> and V. Perdelwitz<sup>7</sup>

(Dongtao Cao+ 2018, MNRAS subm.)

[ [Previous](#) | [Next](#) | [ADS](#) ]

## X Persei - correlation between H-alpha and X-ray variability

ATel #11373; **R. Zamanov, K. A. Stoyanov, N. Petrov, Y. Nikolov (Institute  
of Astronomy and NAO, Bulgarian Academy of Sciences, Bulgaria), D.  
Marchev (Shumen University, Bulgaria), U. Wolter (Hamburg, Germany)**  
on **1 Mar 2018; 08:53 UT**

Credential Certification: Kiril Stoyanov ([kstoyanov@astro.bas.bg](mailto:kstoyanov@astro.bas.bg))

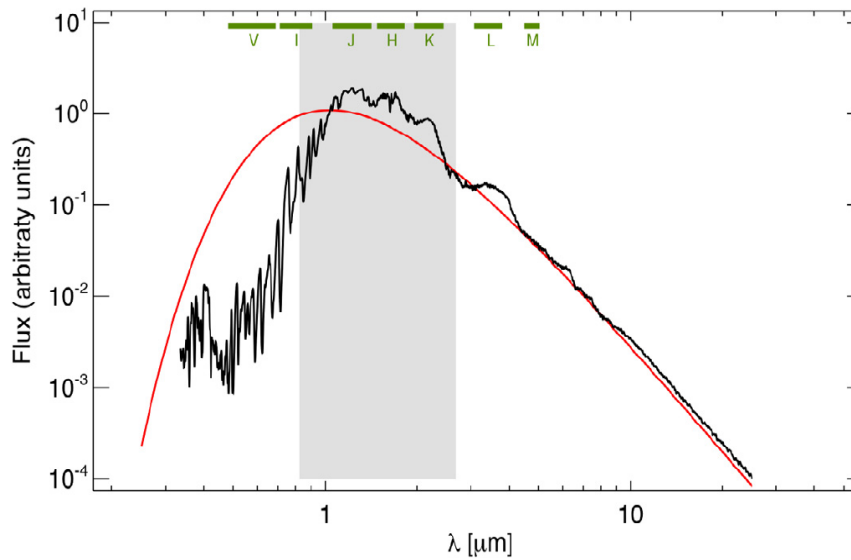
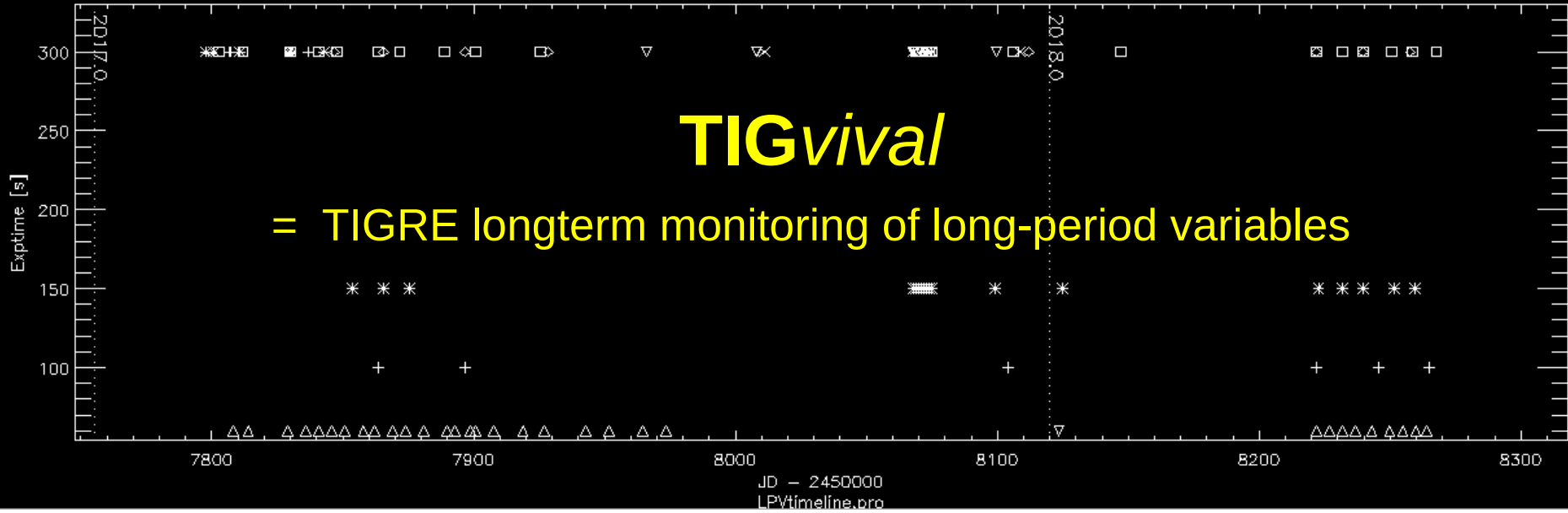
Subjects: Optical, X-ray, Binary, Neutron Star

[Tweet](#) [Recommend 0](#)

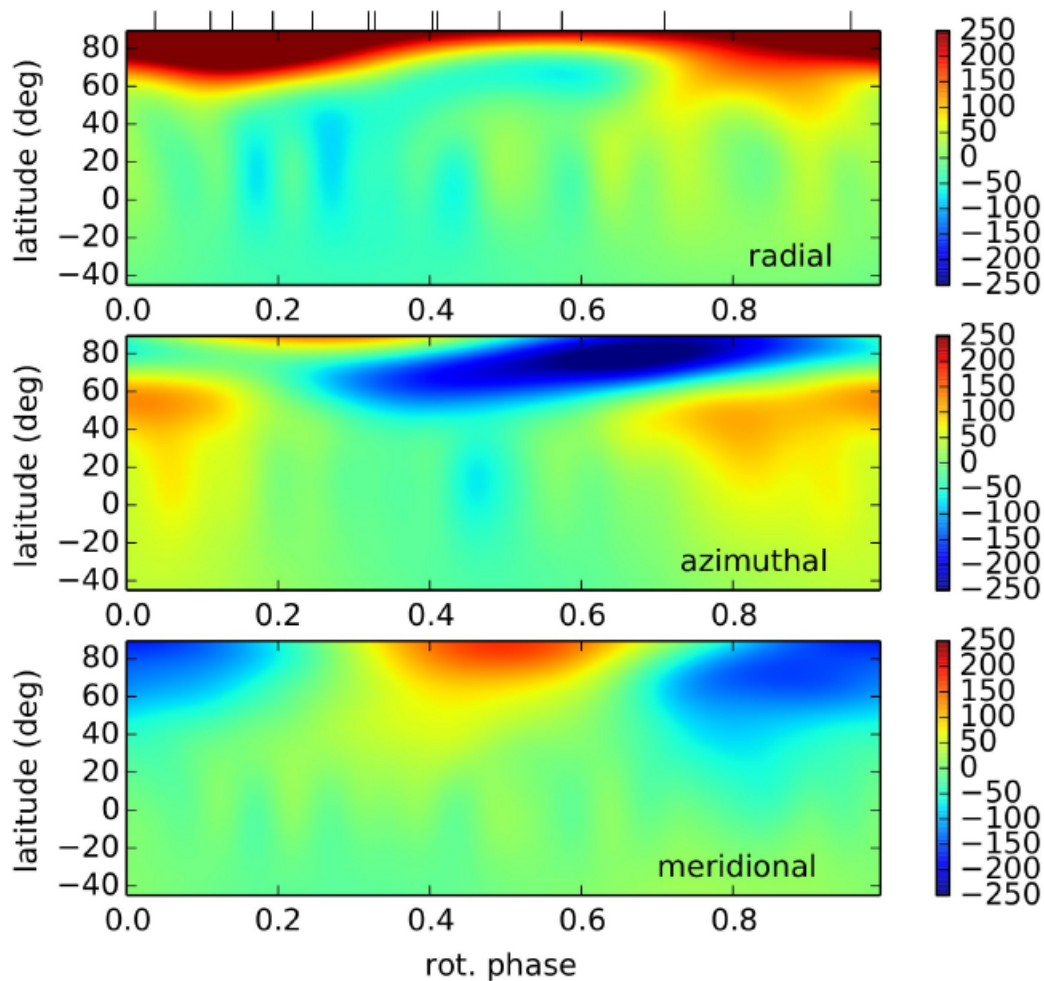
We performed H-alpha spectroscopic observations of the Be/X-ray binary X Per, optical counterpart of the slow X-ray pulsar 4U 0352+30, using the 2.0m telescope of the Rozhen National Astronomical Observatory, Bulgaria and the 1.2m TIGRE telescope located in Mexico.

(Zamanov+ 2018, ATel)

= OLD stars =



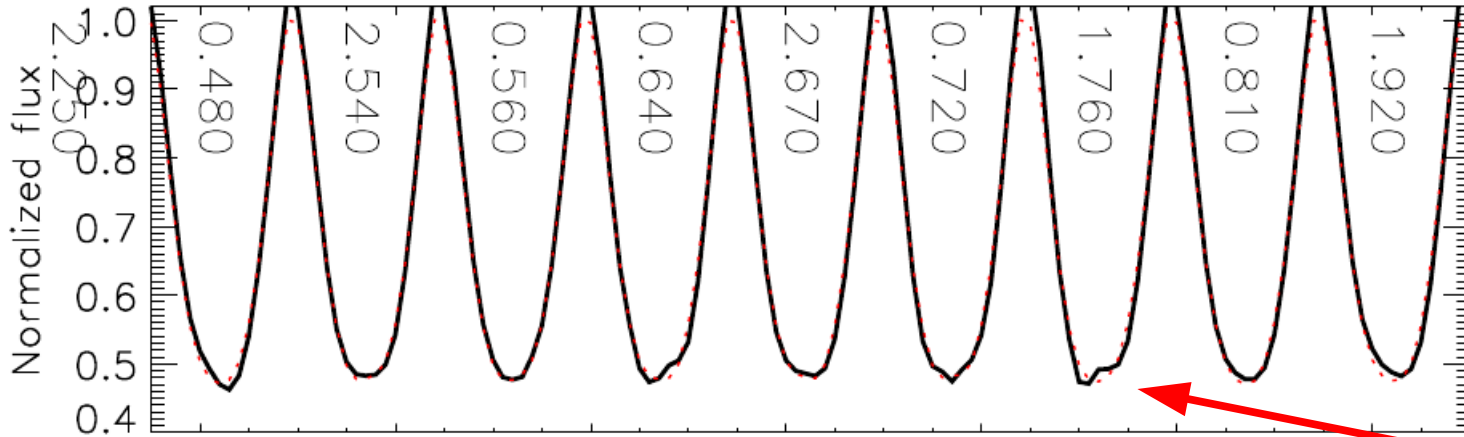
(Bladh & Höfner 2012,  
A&A 546)



Parameter	Value
$V$ , mag	5.86
Distance, pc	$129.7_{-5.5}^{+6.0}$
Sp Type	G1 III
$T_{\text{eff}}$ , K	5360
$L_x$ , $10^{27}$ erg/s	8203
Radius, $R_{\odot}$	9.46
Mass, $M_{\odot}$	2.85
Luminosity, $L_{\odot}$	71.2
$\log g$	2.8
[Fe/H]	-0.07
$v \sin i$ , $\text{km s}^{-1}$	$21.5 \pm 2.1$
$P_{\text{rot}}$ , days	$24.2 \pm$
Inclination, deg	45
Radial velocity, $\text{km s}^{-1}$	-2.47

(Borisova+ 2018, BAstJ subm.)

(Borisova+ 2016, A&A 591)

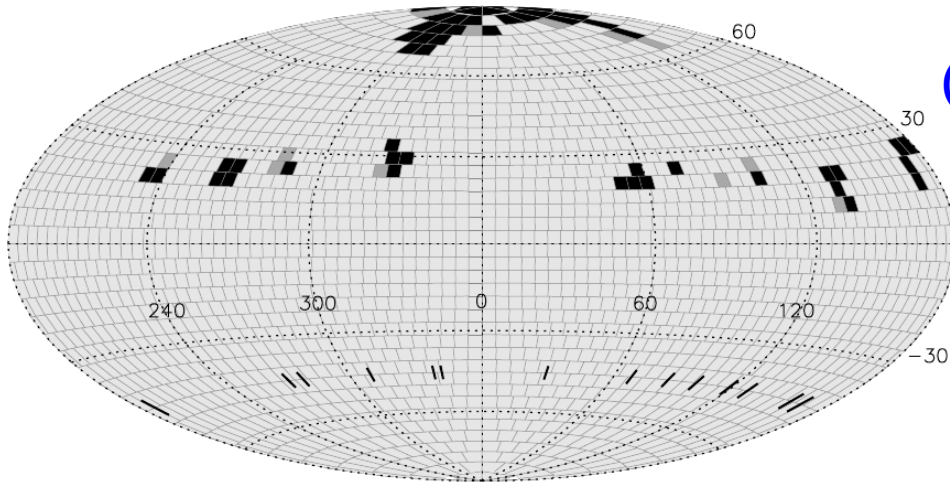
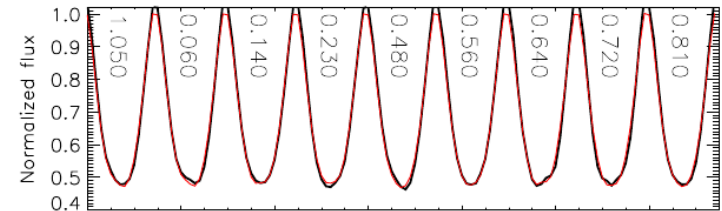


**2015**  
(July-August)



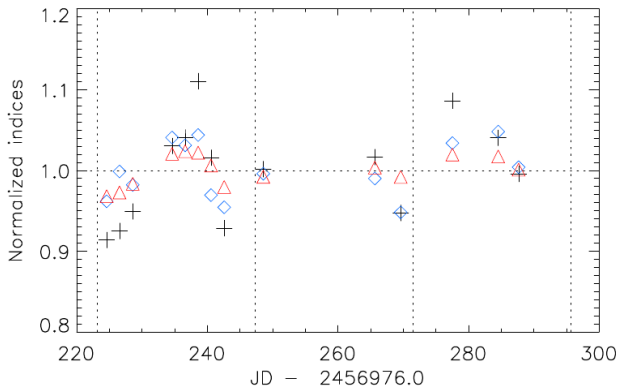
**2015**  
(June-July)

(Borisova+ 2018, BAstJ subm.)



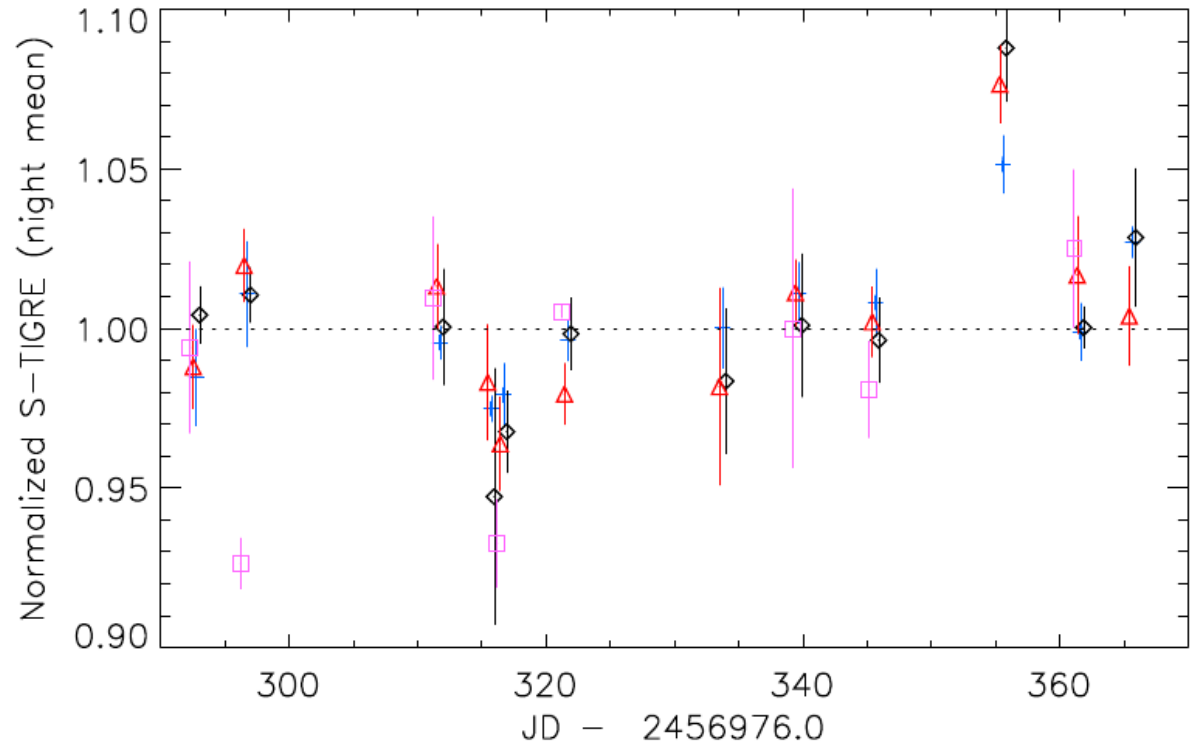


# OU And's chromospheric emission (2015 TIGRE + NARVAL)



**2015 NARVAL  
(June-August)**

(Borisova+ 2018, BAstJ subm.)

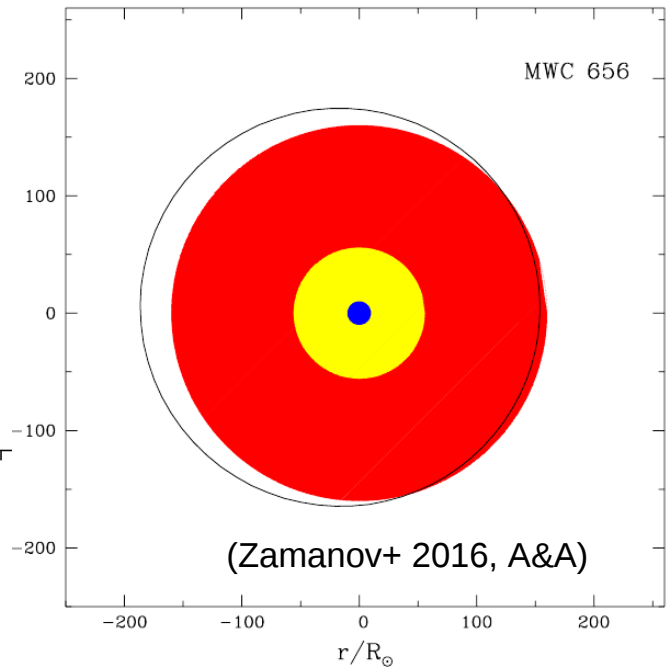
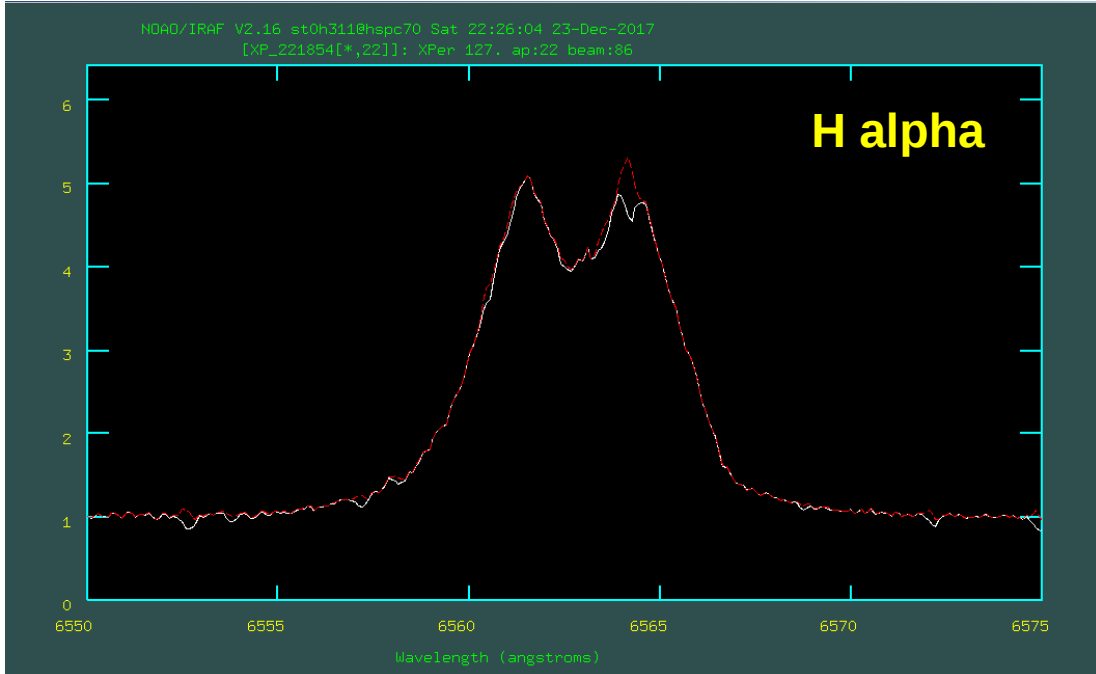


**2015 TIGRE (v3)  
(September-Nov.)**

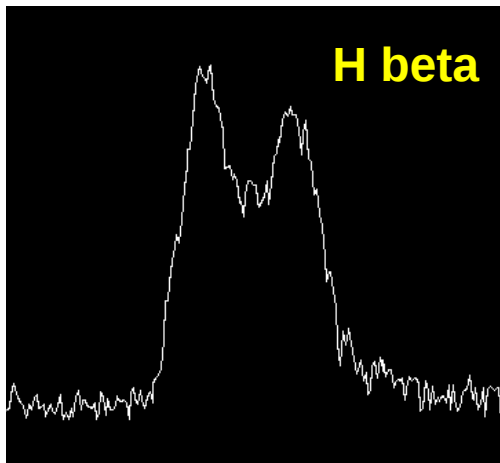




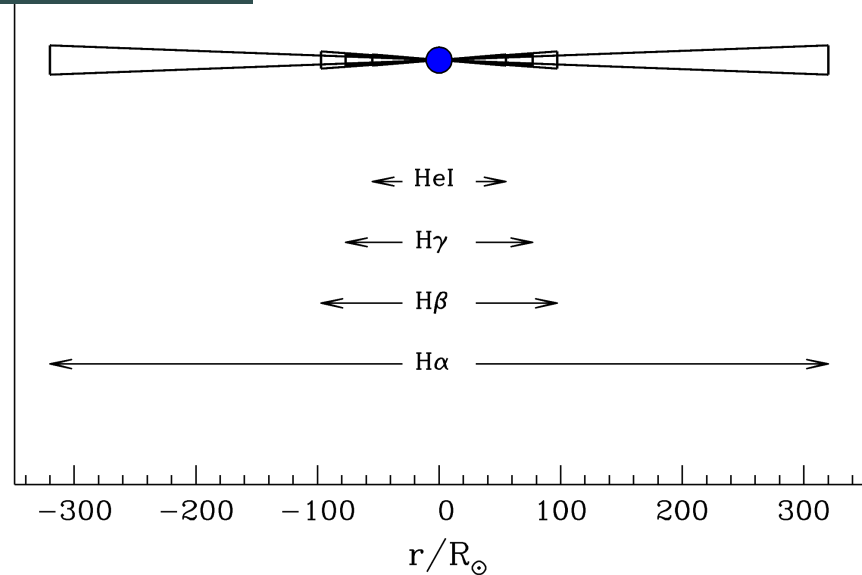
# X Per -- A special HMXRB

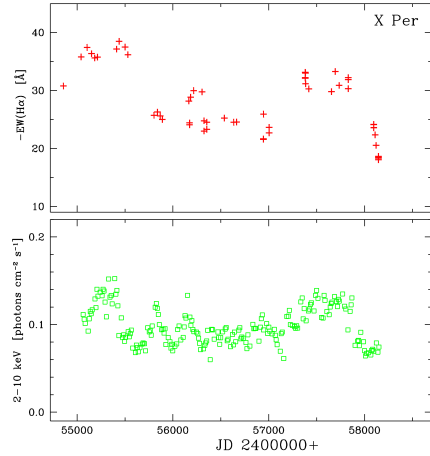


(Zamanov+, A&A in prep.)

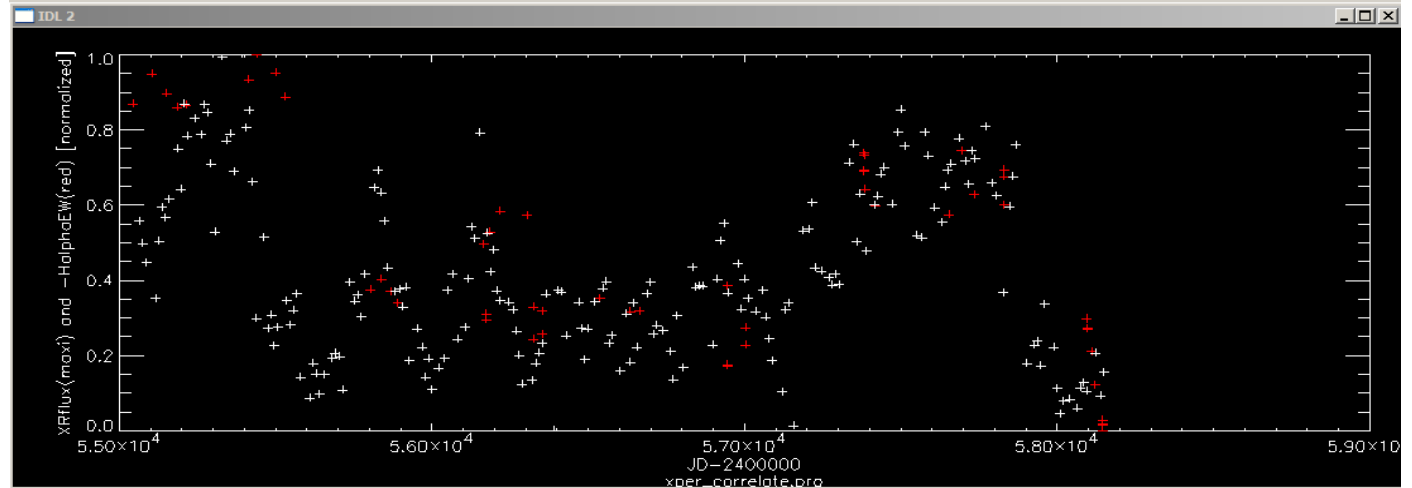
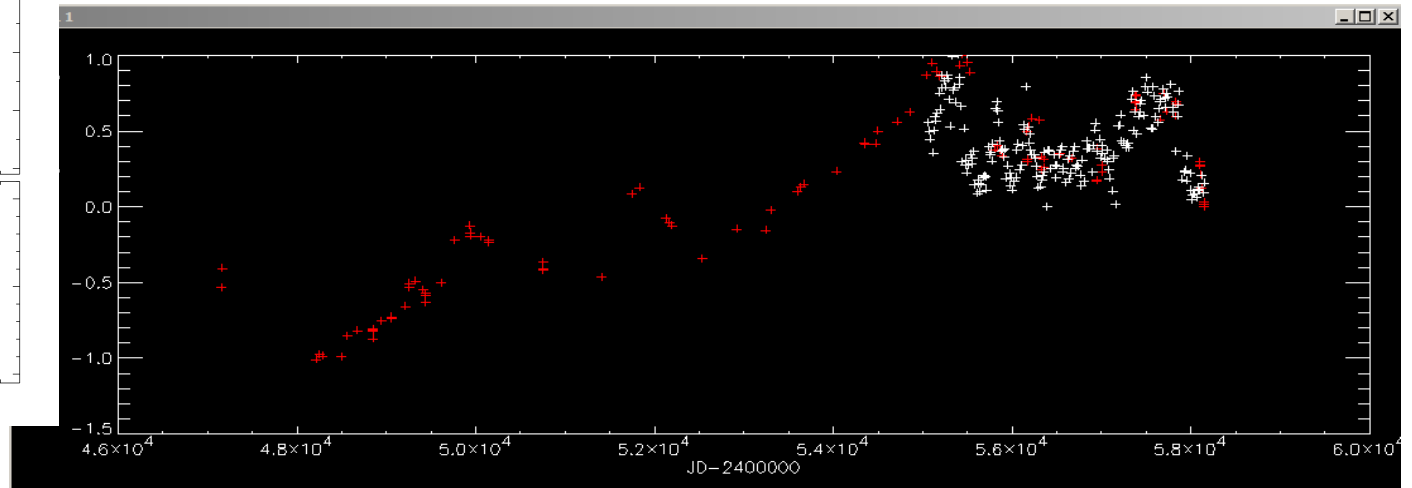


TIGRE's mostly old



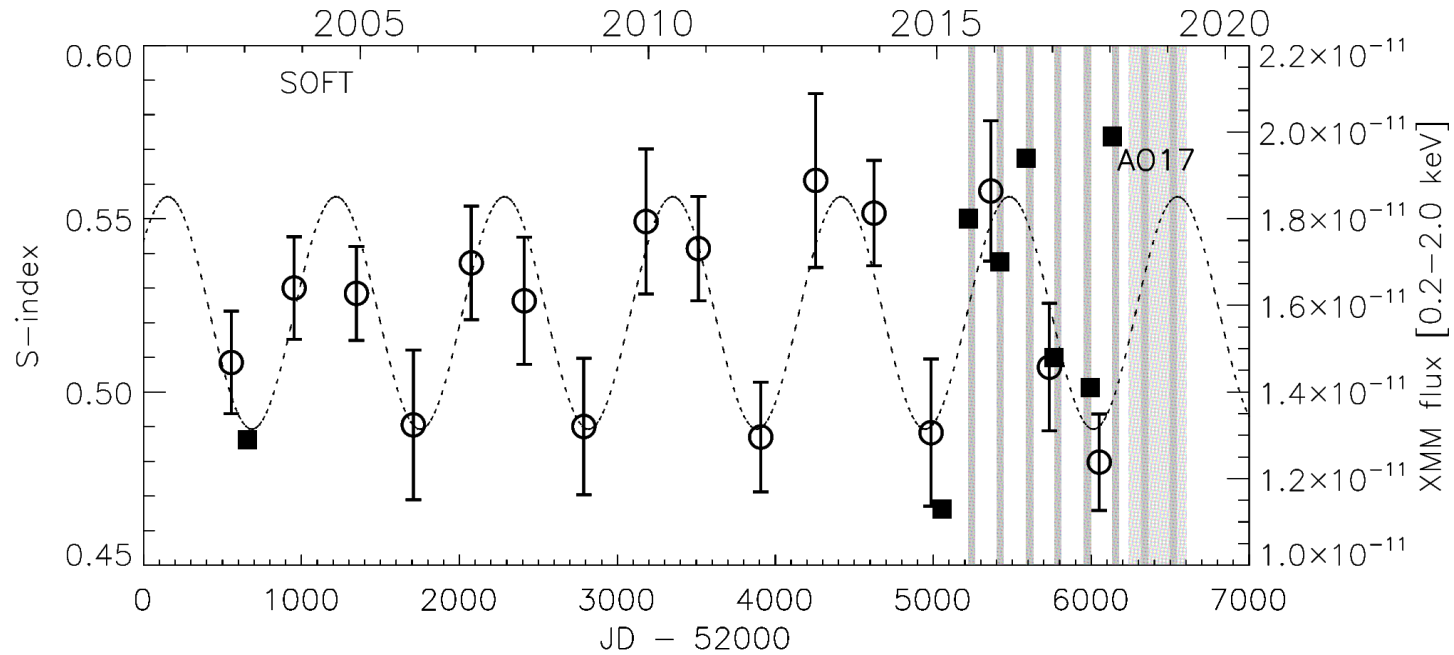


(Zamanov+ 2018, ATel)

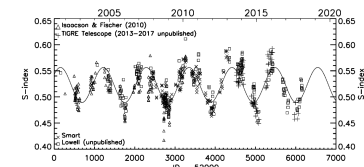


(Zamanov+, A&A in prep.)

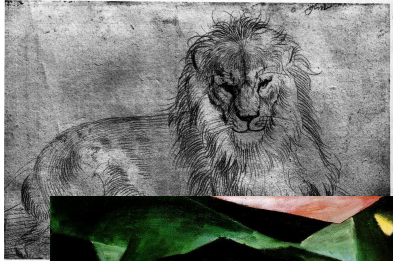
= YOUNG star(s) =



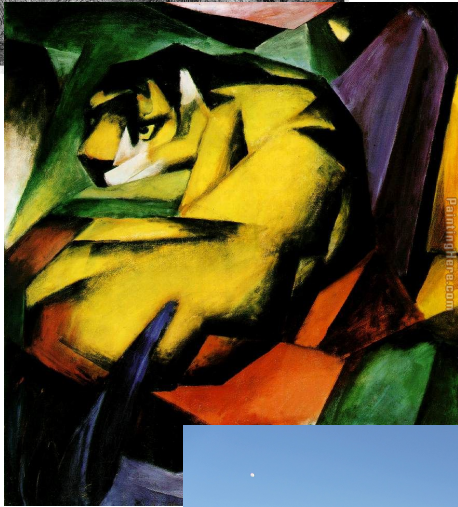
(Coffaro, Stelzer et al., 2018, in prep.)



A. Borisova, B. Ahringer, D. Engels, B. Freytag, R. Konstantinova-A., B. Stelzer, R. Zamanov



(wikimedia)

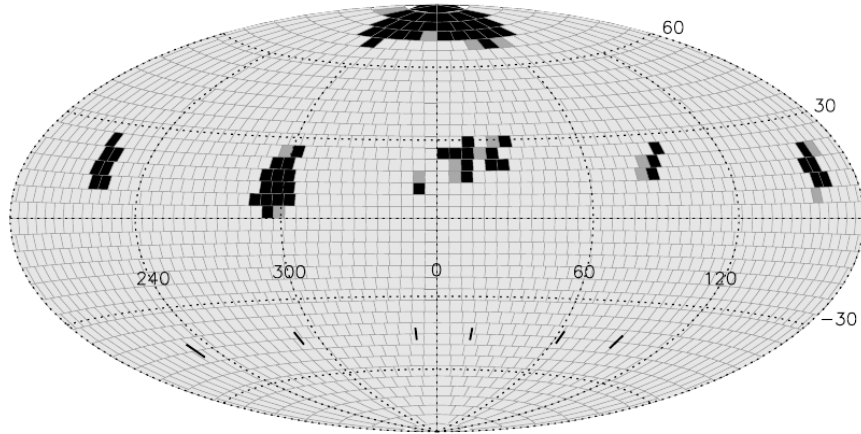


- For >7 years, **TIGvival** plans to monitor >7 long-period-variables and will help gauge LPV-models
- **OU And** hosts a long-lived polar spot, its other active regions regularly evolve on rotational time scales  
→ **Borisova+ 2018, BAstJ** subm.
- The decretion disk of **X Per** seems to undergo occasional 'catastrophes'
- **Eps Eri** looks like a cool candidate for studying activity cycles

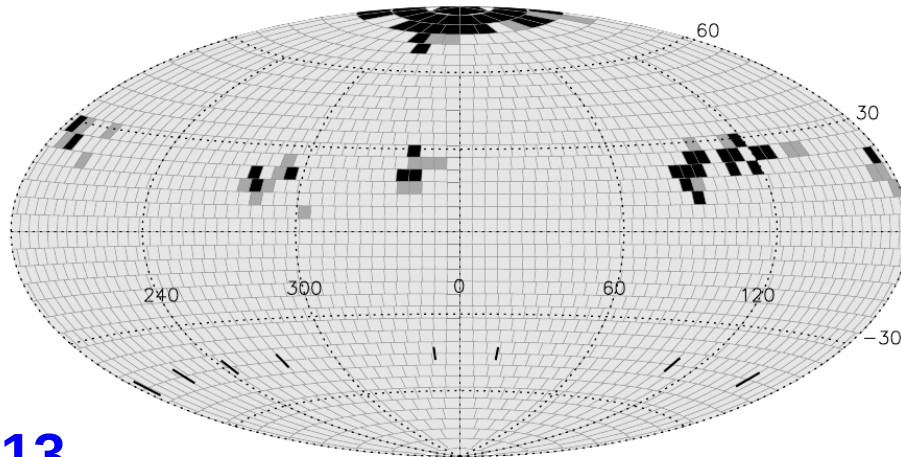
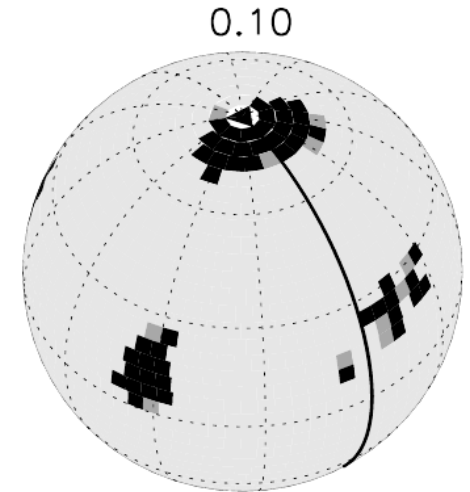


# APPENDIX





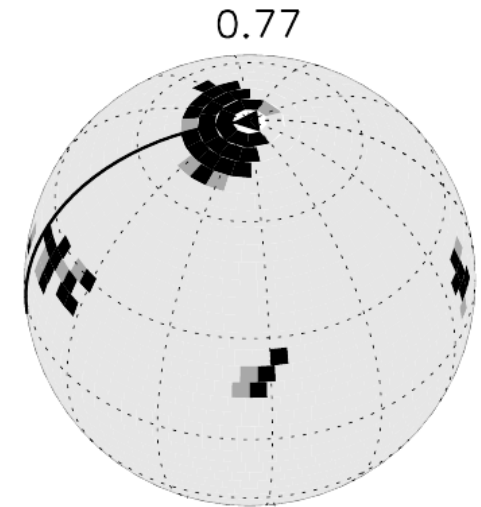
2008

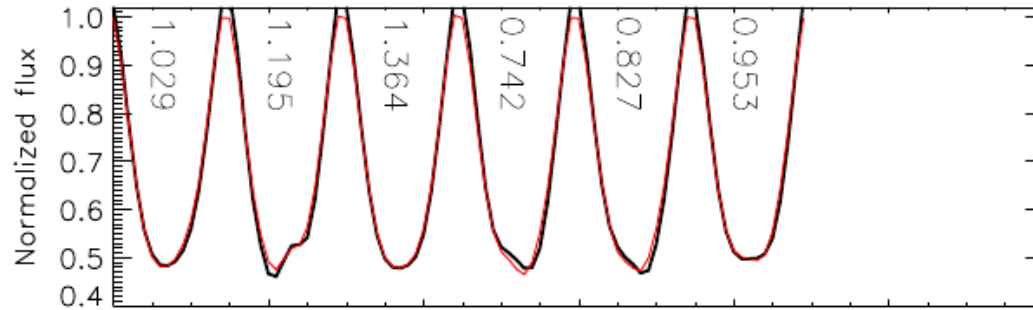


2013

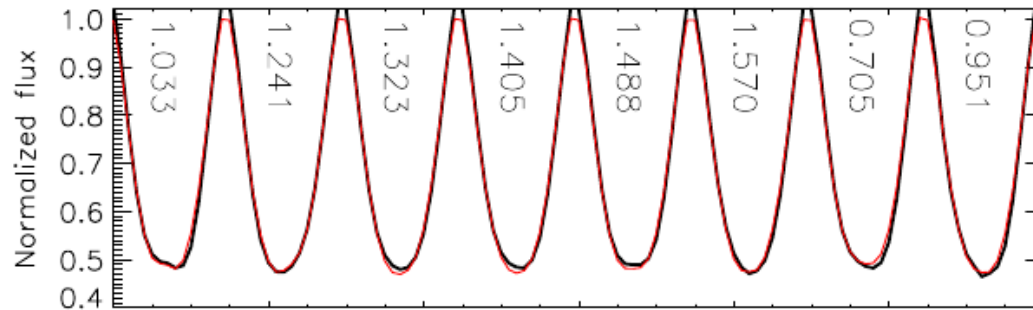
(September)

(Borisova+ 2018, subm.)

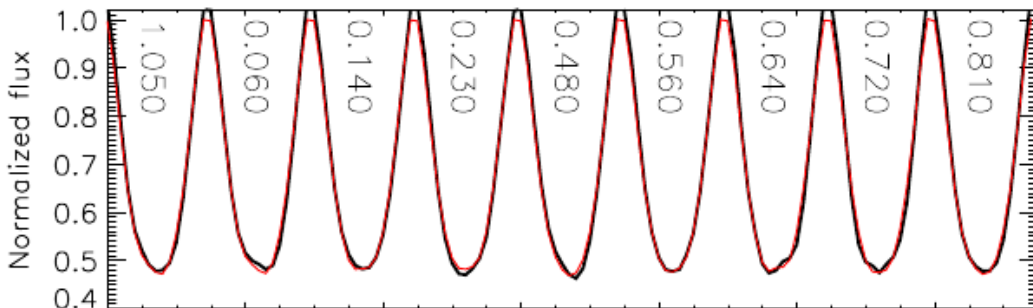




**2008**

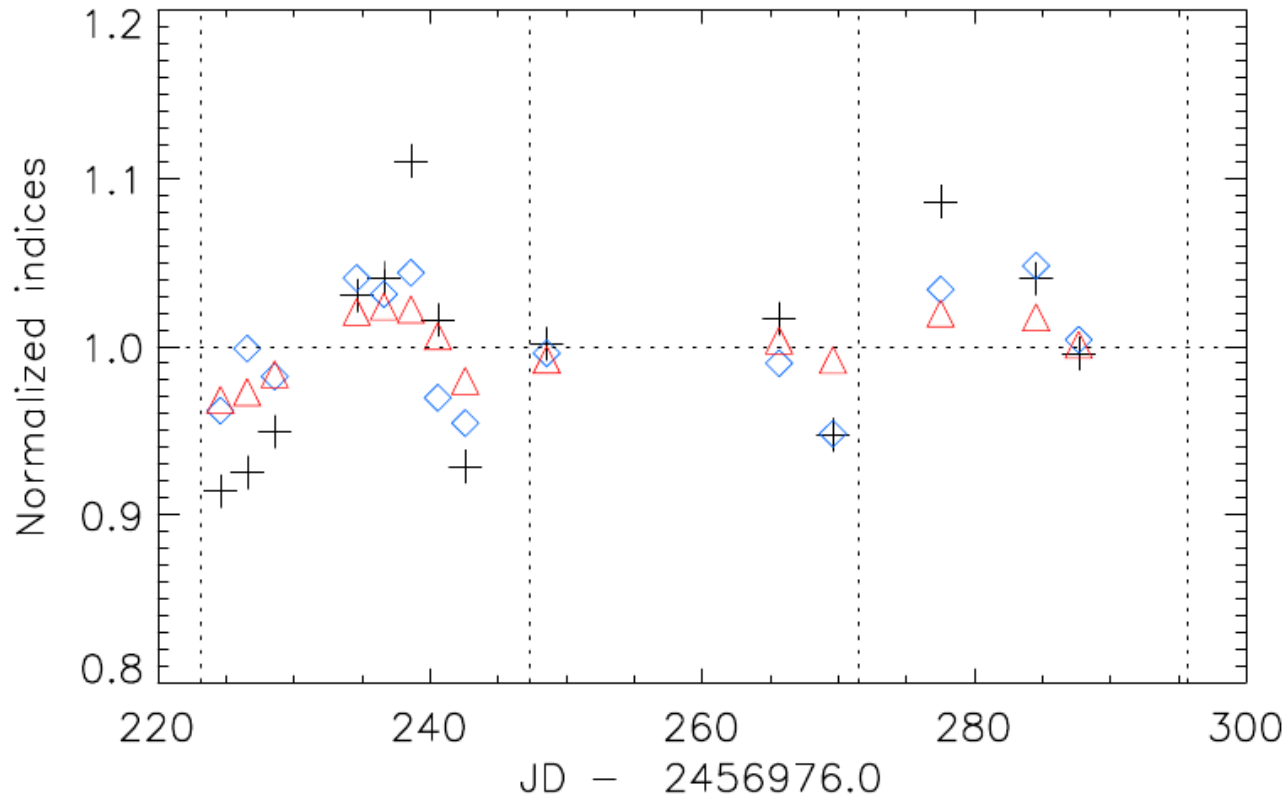


**2013**  
**(September)**

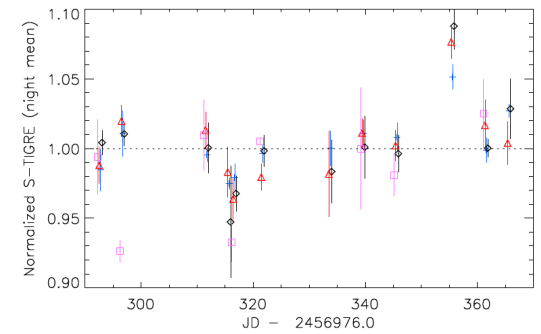


**2015**  
**(June-July)**

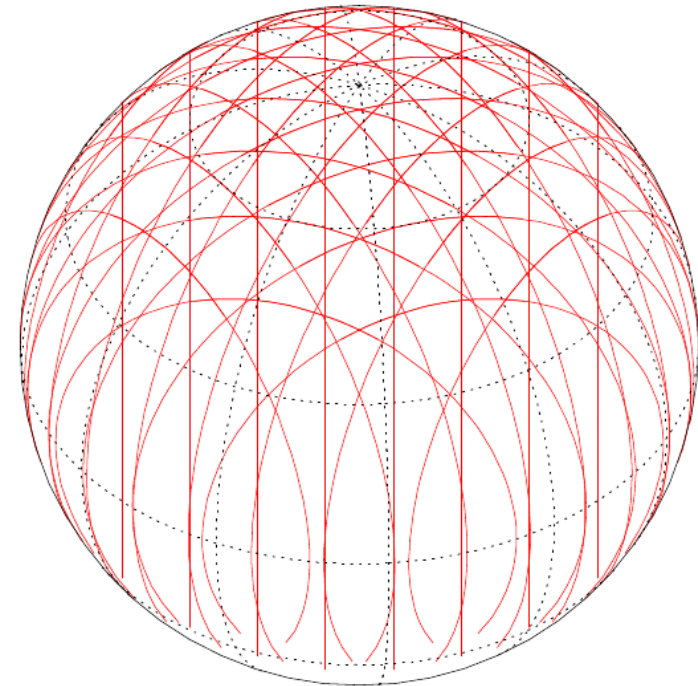
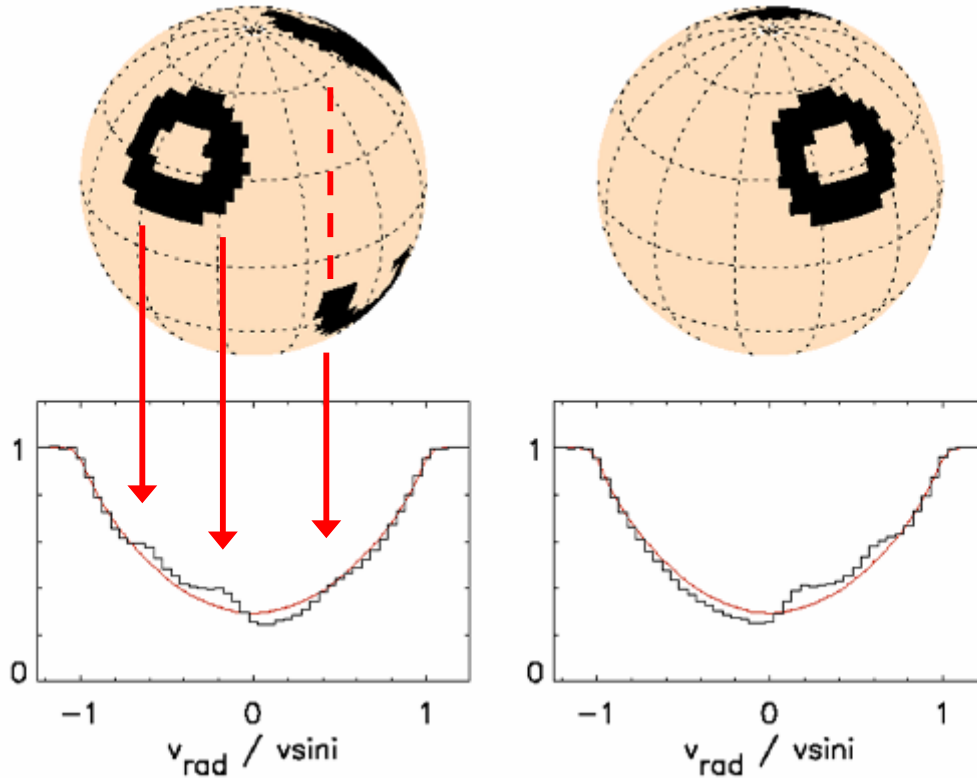




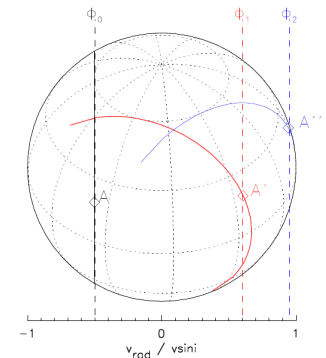
**2015 NARVAL**  
(June-August)

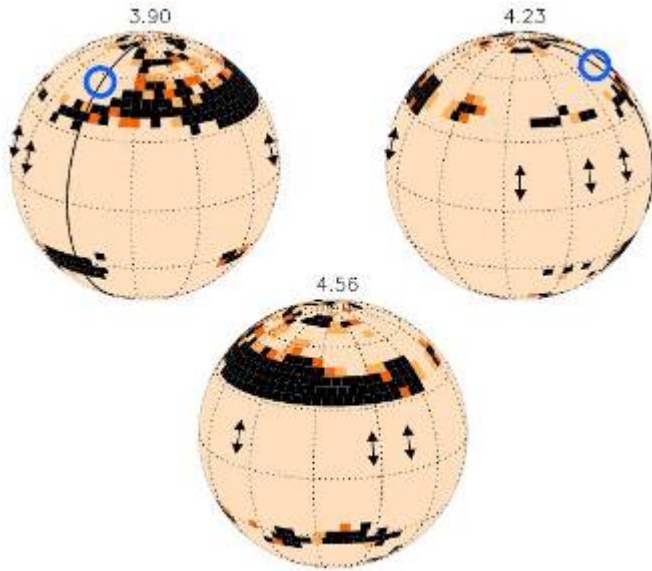


**2015 TIGRE**  
(September-Nov.)

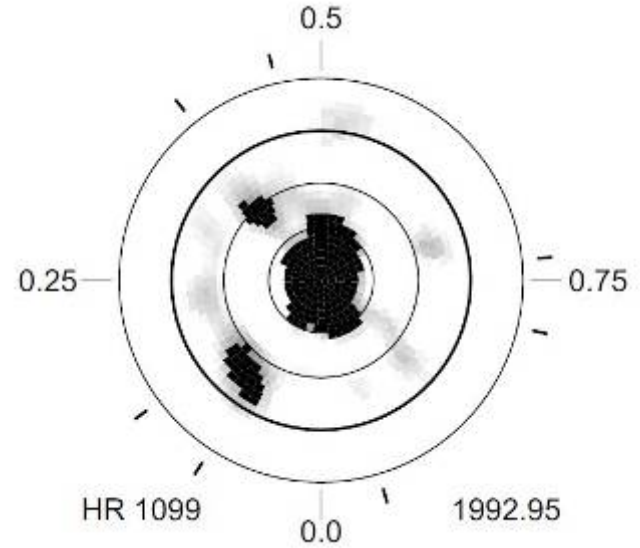


Deutsch 1958, Falk & Wehlau 1974, Goncharski et al. 1982  
 Vogt & Penrod 1983, Rice, Wehlau & Khoklova 1989  
 Donati, Semel & Praderie 1989; Piskunov & Kochukhov 1992  
 Kürster, Schmitt & Cutispoto 1994; Rice & Strassmeier 2003  
 Wolter & Schmitt 2005





**BO Mic** (Wolter et al. 2008, A&A 520)

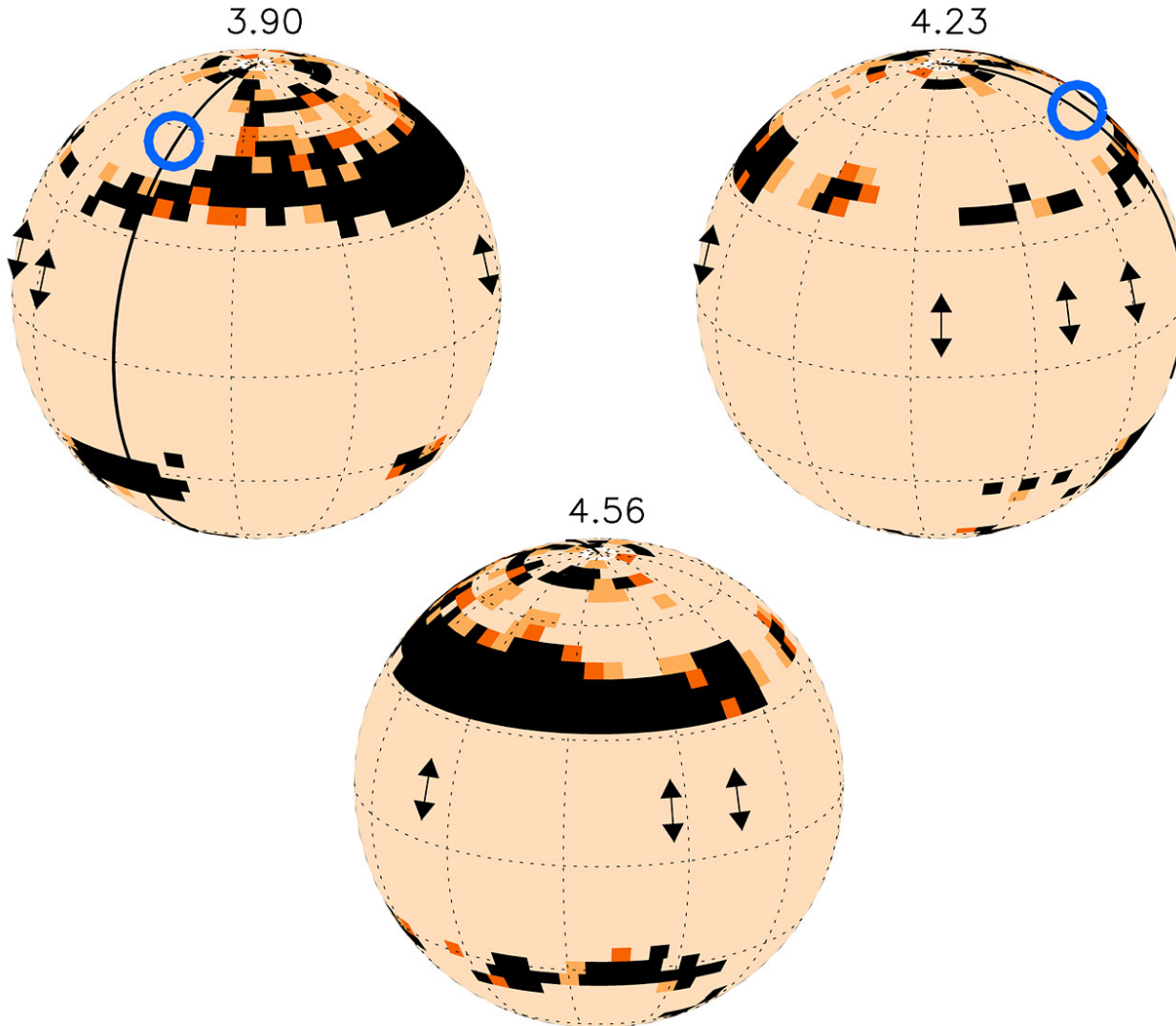


**HR 1099 1981-92**  
(Vogt, Hatzes et al. 1999, ApJS 121)

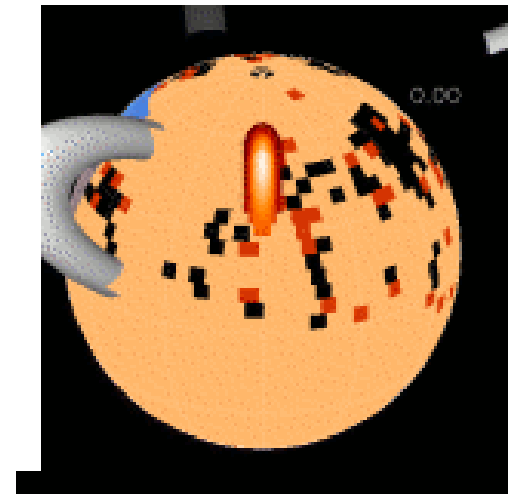
**Publications titled  
„Polar spot“ (ADS)**

Why rapid rotators have polar spots  
(Schüssler & Solanki 1992,  
A&A 264)

“.. a spot which essentially  
straddles the pole”  
BY Dra, HR 1099  
(Vogt 1981, Vogt & Penrod 1983)



**BO Mic (Speedy Mic)**  
(Wolter+ 2008)

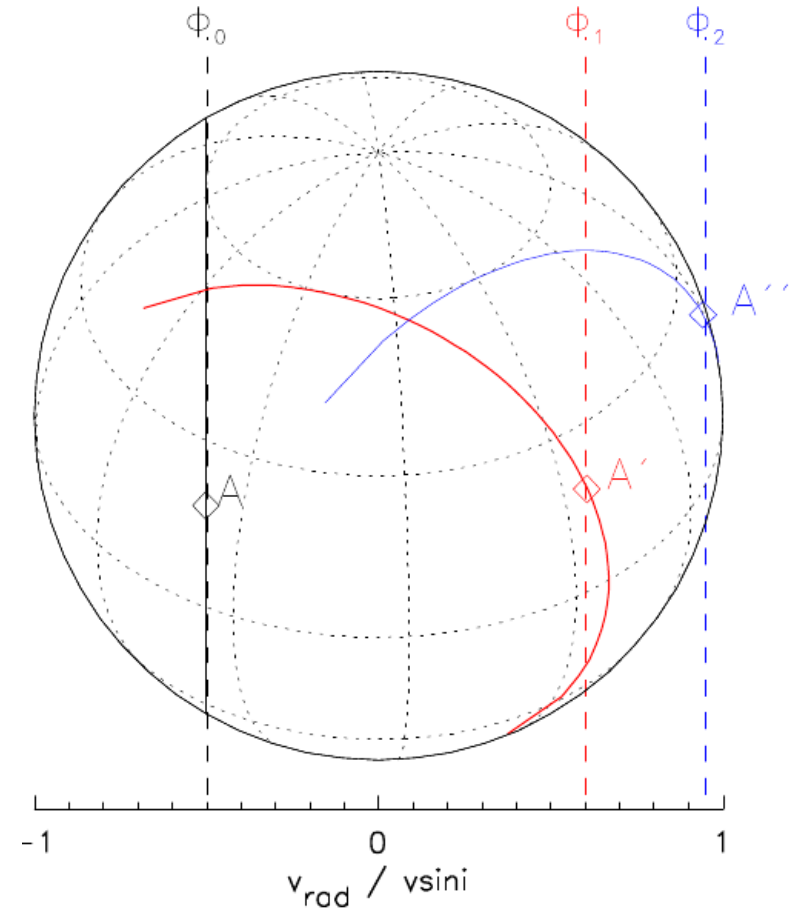
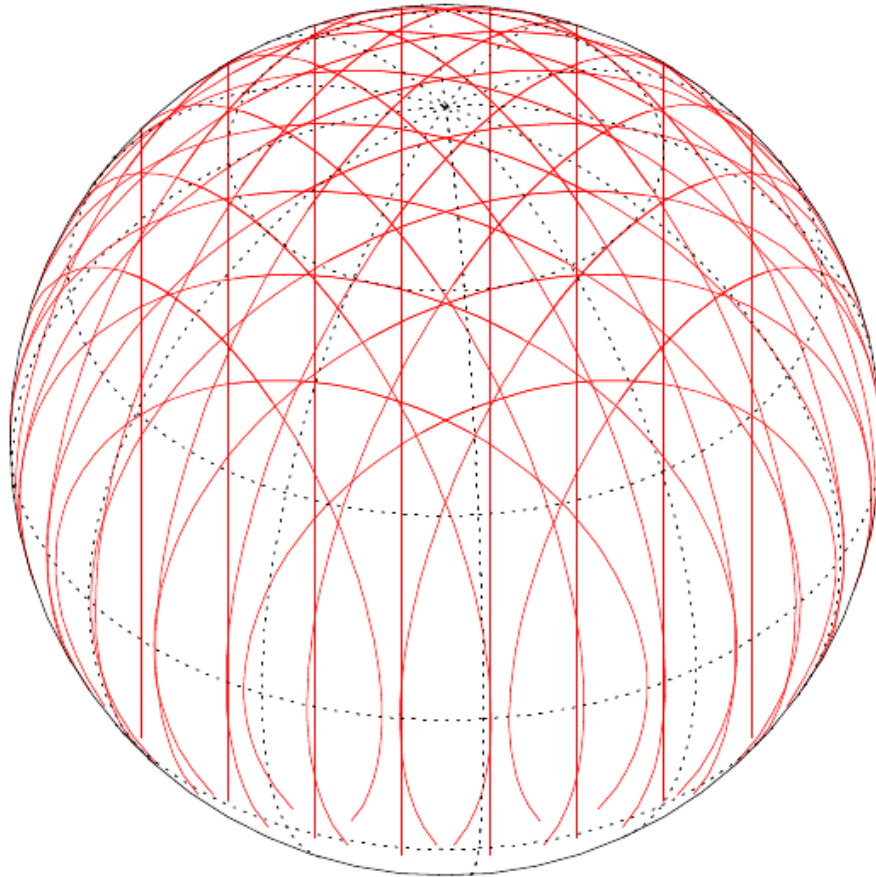




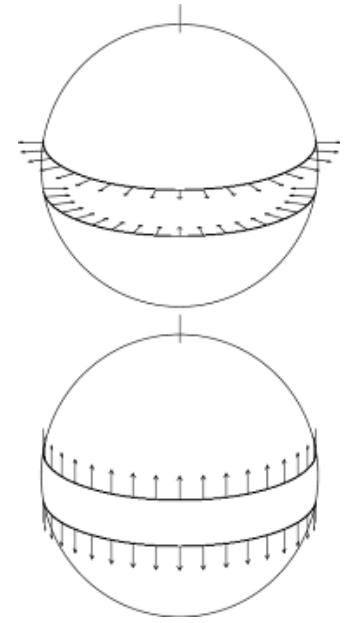
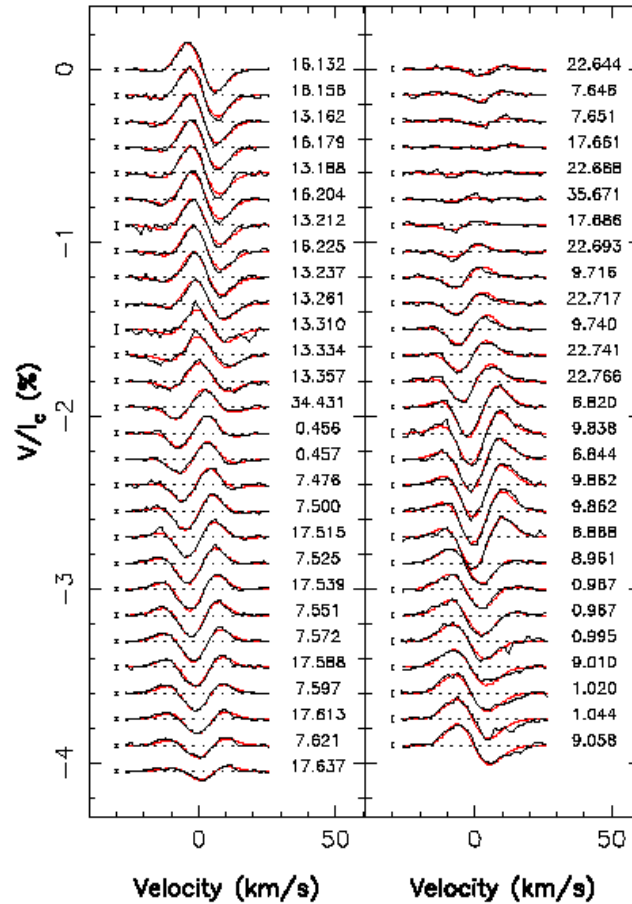
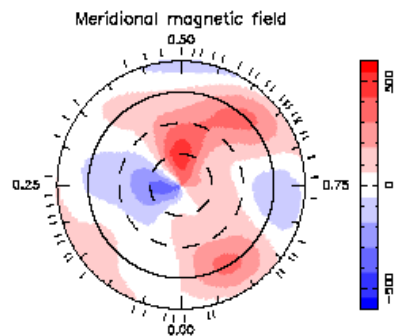
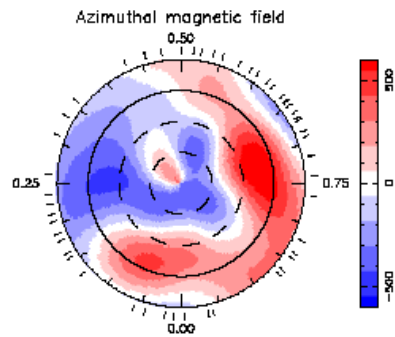
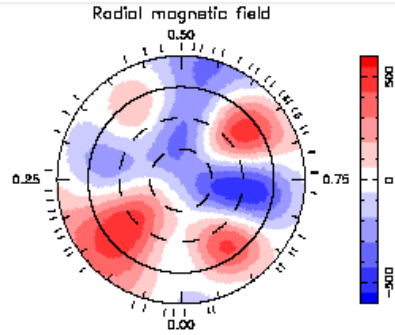
# The DI resolution grid



TIGRE



(Wolter & Schmitt 2005, A&A 435)



$$V = I$$

(Piskunov & Kochukhov 2002)

**tau Sco (B0.2 V, V= 2.8 mag)**

**ZDI**

(Donati & Landstreet 2009, AR&A 47)