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A very misinclined magnetic field: The case of the T Tauri star DK Tau M. Nelissen^{1,2}, P. McGinnis¹, D. Rangaswamy¹, C. Folsom^{3,4}, T. Ray¹



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Abstract

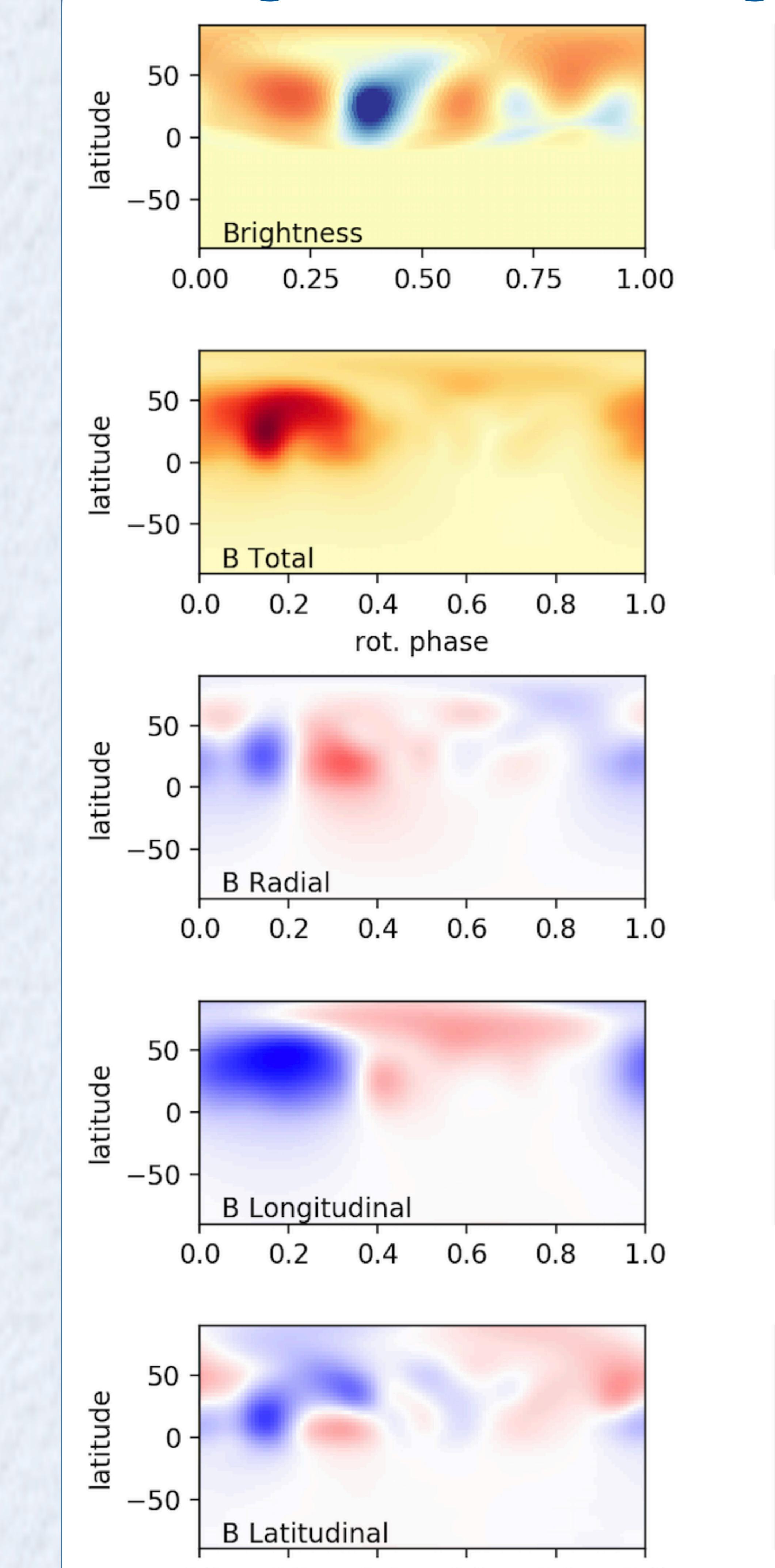
We analyzed nine circularly polarized spectra of DK Tau (a classical T Tauri star), spanning over one rotation cycle and collected in 2010 with the spectropolarimeter ESPaDOnS (at the CFHT). We present a preliminary study of DK Tau's large-scale magnetic field configuration and the distribution of relative brightness across its surface, as well as the variability of its veiling (a signature of accretion). We find that the magnetic dipole is nearly perpendicular to the stellar rotation axis. We also find an anti-correlation of the veiling and the average magnetic field in the line-of-sight, Blos, showing the connection between the accretion and the magnetic field.

Veiling

Accretion shocks add an extra continuum to the stellar one, decreasing the depth (i.e. veiling) of the photospheric lines. We determined the veiling as a function of the wavelength for each spectrum (see Fig. 1 for an example). We then removed its effect from the spectra before using Least-Squares Deconvolution.

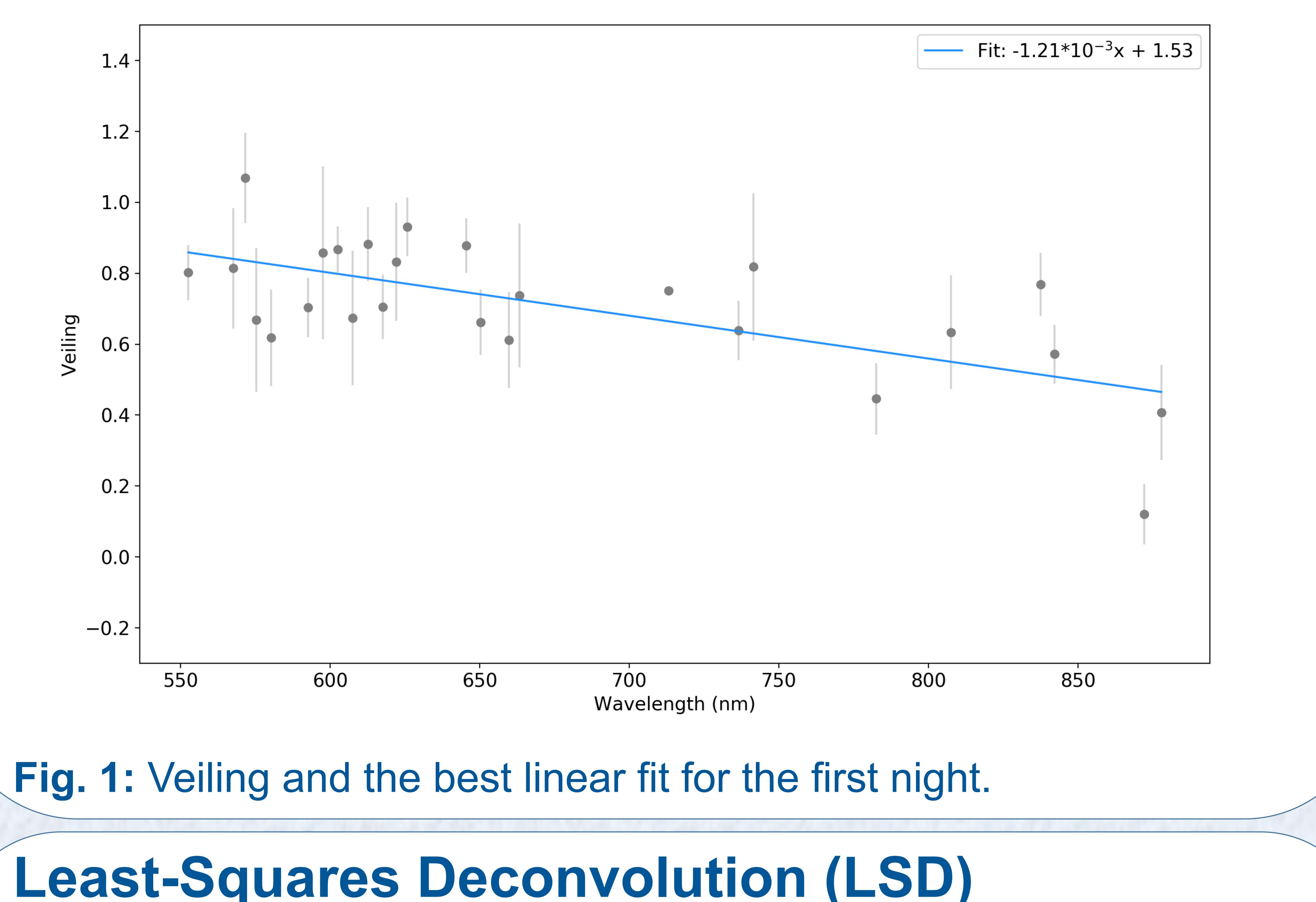
Brightness & Magnetic Maps

- 0.75 - 0.50



In Fig. 3, DK Tau's spherical surface is 2.00- 1.75 - 1.50 - 1.25 - 1.00 represented as a strip of latitude over rotational phase (used as a proxy for longitude). Different colors mean + 0.25different brightnesses in the first plot, and different magnetic intensities in the $\begin{array}{c}
 2000 \\
 - 1750 \\
 - 1250 \\
 - 750 \\
 - 500 \\
 - 250 \\
 - 0
\end{array}$ next plots. The last three plots show the • radial (B_r),

DK Tau 2455544.97974



• longitudinal (meridional, Bθ) and

• latitudinal (azimuthal, B_{\u03c0}) fields.

- 1500 - 1000 - 500 DK Tau is seen nearly pole on (its rotation axis is inclined by 13° with $\begin{bmatrix} -1000 \\ -1500 \end{bmatrix}$ respect to the line-of-sight) [4].

DK Tau's magnetic field is very inclined: - 1500 we find that the magnetic dipole is nearly - 1000 perpendicular to the rotation axis of the -1000 star, the maximum field is situated close to the equator.

- 1500 - 1000 We find that hot spots are also located - 500 near the equator. This is because the magnetic field is so inclined, the accretion shocks are occurring close to

LSD is a cross-correlation technique that adds the signatures from hundreds of photospheric lines in order to get a better S/N [1].

1.00	[
		0.572	
	0.75 -	0.572	

	0.0	0.2	0.4	0.6	0.8	1.0		
rot. phase							the magnetic poles.	

Fig. 3: Brightness & magnetic field (in Gauss) across the stellar surface.