Cosmic Magnetic Fields:
From Planets, to Stars and Galaxies
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Direct detection of a magnetic field on the surface of slowly rotating giant stars

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Abstract. We present first results of the magnetic survey of a sample of slow rotating giant stars for which an X-ray emission or variations of CaII H& K lines have been already detected.

Keywords. Stars: late type – stars: magnetic fields

1. Observations

Using the twin spectropolarimeters NARVAL (Telescope Bernard Lyot, Pic du Midi, France) and ESPaDOnS (Canada France Hawaii Telescope) and the LSD technic (Donati *et al.*, 1997), we undergo a sensitive program of detection and measurement of magnetic fields at the surface of slowly rotating single giants for which an X-ray emission (Huensch *et al.* 1998, Schroeder *et al.* 1998, Tarasova *et al.* 2002) or variations of CaII H & K lines (Choi *et al.*, 1995) have been already detected. The selected giant stars have $vsini < 5km/s$ or rotational periods greater than 60 days. They are intermediate mass (1.7 - 3.5 $M_\odot$ giants or subgiants, situated near the base of the RGB, in the left part of the X-ray dividing line (Gondoin, 1999).

Table 1 gives information for the part of our sample stars for which magnetic measurements were performed.

2. First results

Up to now Stokes V signal is significantly detected on 12 slow-rotating single giants of our sample and the inferred longitudinal magnetic field B_l is measured to be of the order of a few G.

EK Eri appears to host a surface magnetic field with an extraordinary strength. This supports the suggestion of Stepień (1993) and Strassmeier *et al.* (1999) that EK Eri could be the descendant of a strongly magnetic Ap star. Modeling the magnetic field of EK Eri using the ZDI inversion model of Donati *et al.* (2006), we obtained a mean surface magnetic field of 270 G (Aurière *et al.*, 2008). Figure 1 shows Stokes V at its maximum as well as the fit of its variations with our model (photometric period of 306.9 d).

Definitive detection of the surface magnetic field of Pollux was obtained using both ESPaDOnS and NARVAL's observations. The Stokes V polarization signal is as weak as $2x10^{-5}$ of the continuum. Figure 1 shows the LSD Stokes V profile obtained when averaging all the obtained spectra during one year.

Table 1. Slow rotating giant stars detected with ROSAT and with magnetic measurements performed. L_x values are by Gondoin (1999), or calculated using the ROSAT fluxes (Huensch *et al.* 1998).

Name	HD	Sp	vsini (km/s)	P d	L_x (10^{27}erg/s)	$\|B_l\|^{max} + 3\sigma$ $\leqslant$ G
iot Cap	203387	G8III	7.0	68	4482	4.9
77 Tau	28307	K0IIIb	1.5	140	1996	2.6
del Crb	141714	G3.5III	5.6	59	1456	3.7
bet Cet	4127	K0III	3.5		1138	8.0
EK Eri	27536	G8III-IV	1.5	307	1000	101.6
24 UMa	82210	G4III-IV	5.5		901	10.5
14 Cet	3229	F5IV	5.0		336	35.0
bet Boo	133208	G8IIIa	2.5		153	ND
eta Her	150997	G7.5IIIb	1.7		63	8.4
Pollux	62509	K0III	1.7		5	0.9

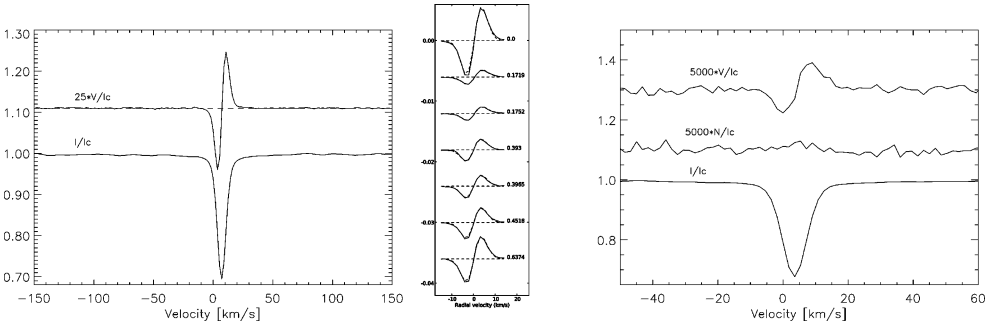

Figure 1. Left: LSD profiles of EK Eri as observed on 20 Sept. 2007 with NARVAL. From bottom to top, Stokes I and Stokes V are presented. For display purposes, the Stokes V profile is enlarged by a factor of 25. Center: Variation of Stokes V profile for EK Eri with rotational phase, as observed with NARVAL during the 2007/2008 season. Right: Mean LSD profiles of Pollux from 51 spectra taken with ESPaDOnS or NARVAL in the September 2007- September 2008 period. From bottom to top are the Stokes I, Null polarization and Stokes V profiles. For display purposes, the Stokes V and Null polarization profiles are enlarged by a factor of 5000.

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