The large-scale magnetic field of the M dwarf double-line spectroscopic binary FK Aqr

M dwarfs

- ~ 75% of all stars in the solar neighbourhood
- Mass - 0.08 - 0.60 Msun
- Teff - 2500 - 4000 K
- Transition of the internal structure at $M \approx 0.35$ Msun (spectral class M3/M4)
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J. Morin+ 2010, 2012
Binarity and Magnetic Interactions in various classes of stars

The goals of the project are to understand the impact of magnetic fields on stellar formation and evolution, of tidal effects on fossil and dynamo magnetic fields, of magnetism on angular momentum and mass transfers between binary components, as well as magnetospheric interactions.

Spectropolarimetric observations with Espadons@CFHT and Narval@TBL
Higher-mass binaries - O, B, A, Ap stars
Binaries with cool components - RS Cvn, W UMa, BY Dra, M-dwarfs
~ 150 systems
The system

- M1-2 Ve
- P = 4.08322 d
- e = 0.01
- Mass ratio q = 0.8
  M1 = 0.54 Msun, M2 = 0.44 Msun

Observations

- 26 spectra
- 3 - 16 September 2014
- Espadons@CFHT - 3.6 m, spectrum coverage from 370 nm to 1050 nm

Analysis

- LSD method
- Radial velocities
- Orbital parameters - PHOEBE
- Bl, Hα, CaII H&K, CaII IRT
- ZDI technique
FK Aqr - LSD

- Least-squares deconvolution method (J.-F. Donati+ 1997)
FK Aqr - RV

- Radial velocities are measured from Stokes I profiles.
- Combined with measurements from G.H. Herbig & J.M. Moorhead 1965

FK Aqr - PHOEBE

- Binary modeling code (Prsa & Zwitter 2005, Prsa+ 2016)
- MCMC sampler
- 30 walkers, 50 000 iterations
$X^2 = 1.3$ (p)
$X^2 = 1.5$ (s)

FK Aqr - PHOEBE

RV residuals
FK Aqr – Bl, H\(\alpha\), CaII H&K, CaII IRT

Primary: (-143) - (-60) G
Secondary: (-368) - (-27) G
FK Aqr – Bl, Hα, CaII H&K, CaII IRT

CaII H (s)

Hε (p)
FK Aqr - B1, Hα, CaII H&K, CaII IRT

$X^2 = 1.7$

The strength, Gauss & Lorentz widths: intervals 0.5 – 5.0 with a step of 0.1

$X^2 = 1.7$
Table 4. The magnetic analysis of the components of FK Aqr.

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Thank you for your attention!