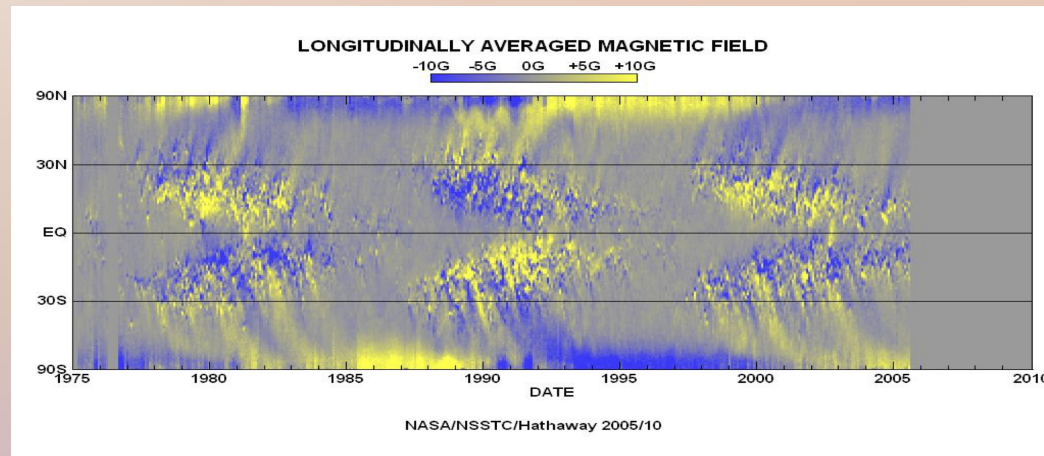


Stellar Magnetic Fields

Elizabeth Cole

Supervisors: Thomas Hackman, Petri Käpylä, Maarit Käpylä

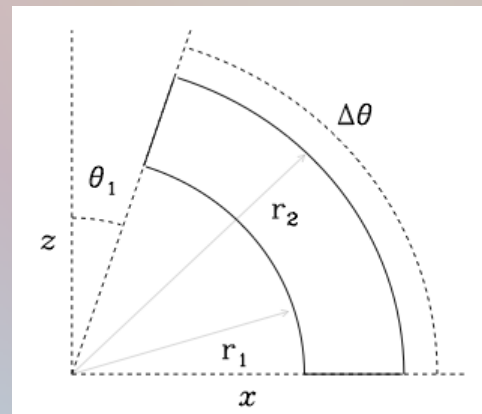
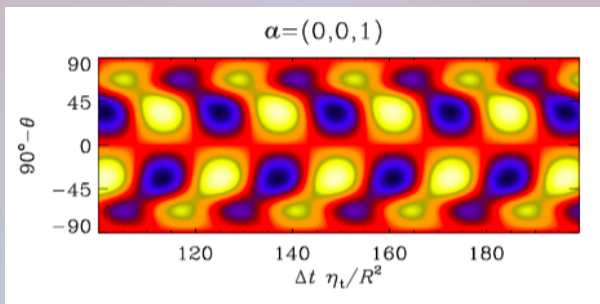
Theory



Solar cycle:

- ≈ 22 year cycle
- Equatorward migration
- Reverses polarity every 11 years.

The Pencil Code is used to model convection in a spherical shell in MHD



Meanfield Dynamo Equations:

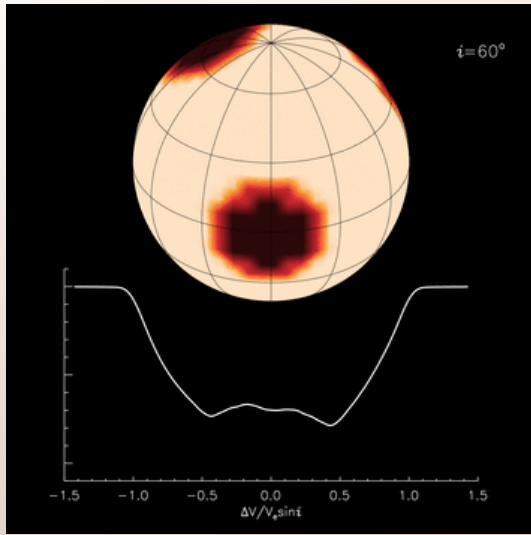
$$\frac{\partial \mathbf{A}}{\partial t} = \mathbf{u} \times \mathbf{B} - \mu_0 \eta \mathbf{J},$$

$$\frac{D \ln \rho}{Dt} = -\nabla \cdot \mathbf{u},$$

$$\frac{D \mathbf{u}}{Dt} = \mathbf{g} - 2\Omega_0 \times \mathbf{u} + \frac{1}{\rho} (\mathbf{J} \times \mathbf{B} - \nabla p + \nabla \cdot 2\nu \rho \mathbf{S}),$$

$$T \frac{Ds}{Dt} = \frac{1}{\rho} [-\nabla \cdot (\mathbf{F}^{\text{rad}} + \mathbf{F}^{\text{SGS}}) + \mu_0 \eta \mathbf{J}^2] + 2\nu \mathbf{S}^2,$$

Observations



Parameter	Value
Temperature	$T_{eff} = 5000\text{K}$
Gravity	$\log g = 4.0$
Inclination	$i = 65^\circ$
Rotation velocity	$v \sin i = 26.5 \text{ km/s}$
Rotation period	$P = 1.^d6001136$
Metallicity	$\log[M/H] = 0$
Macroturbulence	$\zeta_t = 1.5 \text{ km/s}$
Microturbulence	$\xi_t = 0.5 \text{ km/s}$

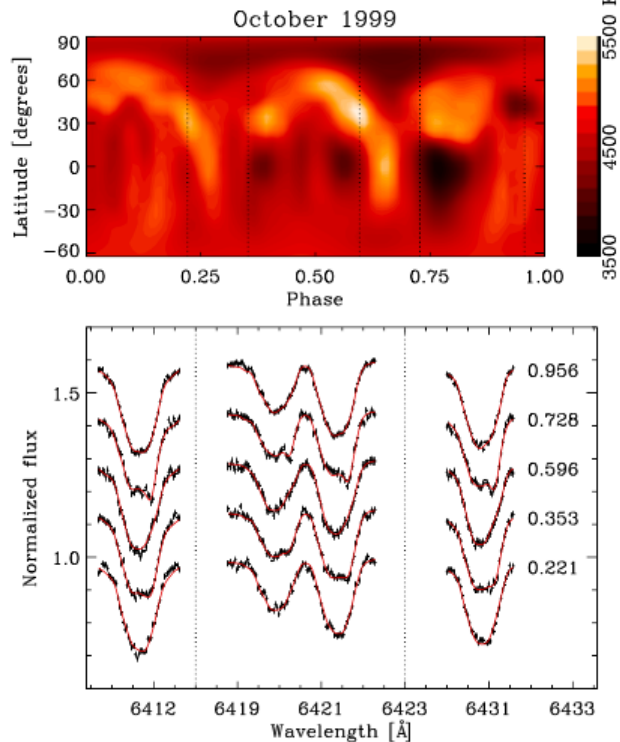
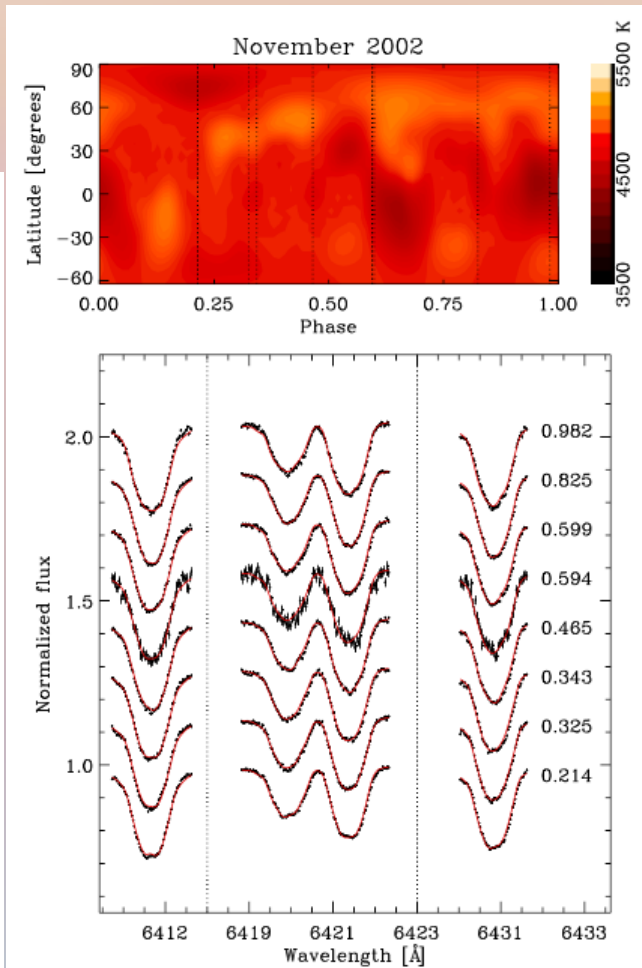
Star selected:
 LQ Hydrae
 -Young solar analogue
 -Very active, large star spots
 -Observed possible cycle

Instrument:
 SOFIN at the Nordic
 Optical Telescope

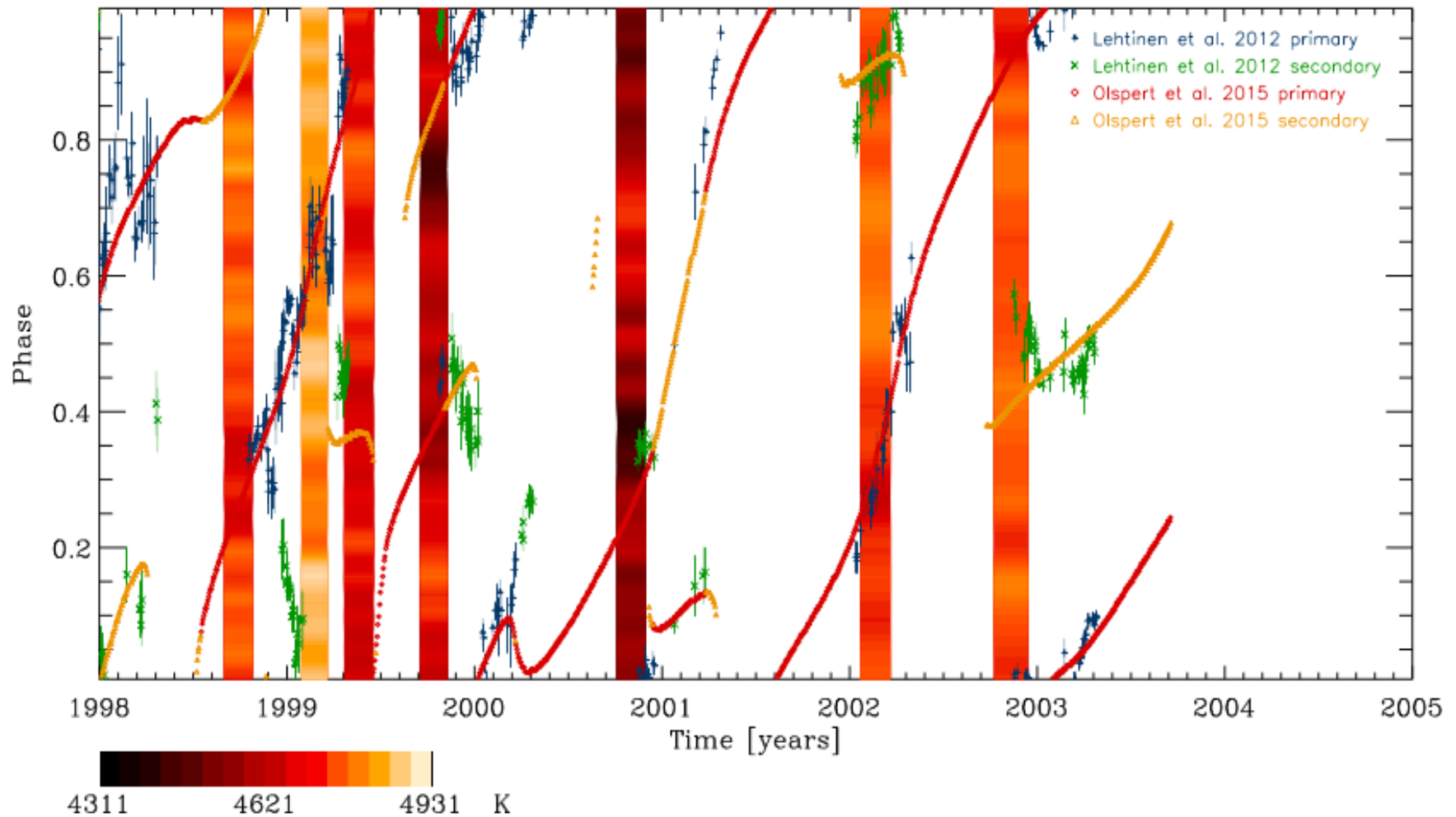
Observations:
 October 1998 –
 November 2002

Technique:
 Doppler Imaging

Results:
 Some trend in activity,
 but more chaotic than
 other cycles, such as
 that observed in the sun



Observations



Minima retrieved via Continuous Period Search method (Lehtinen et al. 2012)
And Carrier Fit method (Olsper et al. 2015) mapped to latitudinal averages of
Spot distribution from Cole et al. 2015