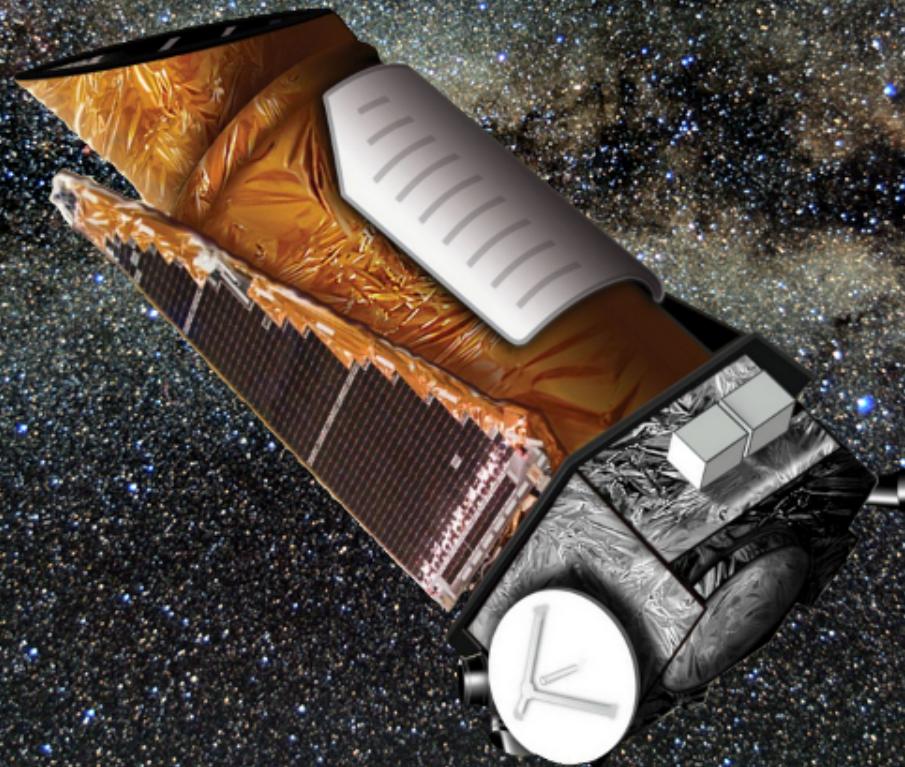


Asteroseismology and the Solar-Stellar Connection

Travis Metcalfe (SSI)



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SMARTNESS

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THINK

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News

42 solar-type stars

April 20, 2014, 4:20 p.m.

Uniform AMP results for a large sample of stars are now available ...

[« Read more »](#)

Welcome to AMP!

Please log in.

Username: travis

Password: ••••••••

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Recent Runs

HD 182633	Optimization
Title: KIC 8026226 (solar-sys well)	<input type="button" value="Run"/>
Submitter: Travis Metcalfe	<input type="button" value="Edit"/>
Completed: Mon 03 Feb 2014	<input type="button" value="View"/>

HIP 95098	Optimization
Title: KIC 8228742 (solar-sys well)	<input type="button" value="Run"/>
Submitter: Travis Metcalfe	<input type="button" value="Edit"/>
Completed: Sat 01 Feb 2014	<input type="button" value="View"/>

Welcome to the XSEDE Asteroseismic Modeling Portal

The Asteroseismic Modeling Portal (AMP) provides a web-based interface for astronomers to use the [Aarhus Stellar Evolution Code](#) (ASTEC) coupled with a [parallel genetic algorithm](#) (MPIKAIA) to derive the properties of Sun-like stars from observations of their pulsation frequencies. For example, check out the data from our favorite star, [the sun](#).

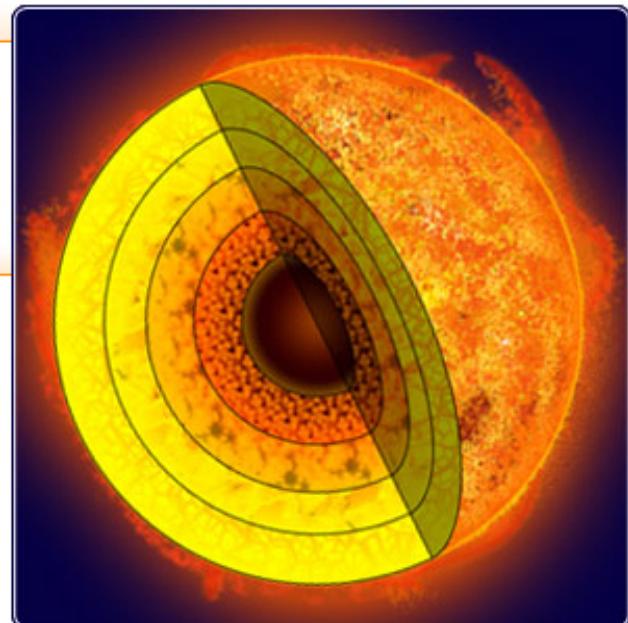
What can I do with AMP?

Everyone can browse the catalog of runs to find data about stars that have been modeled with AMP. You can find basic properties of the stars, such as their radius, mass, and age, and you can download a Hertzsprung-Russell (HR) diagram that shows the star's temperature and luminosity during its lifetime.

Scientists can use AMP to do two things:

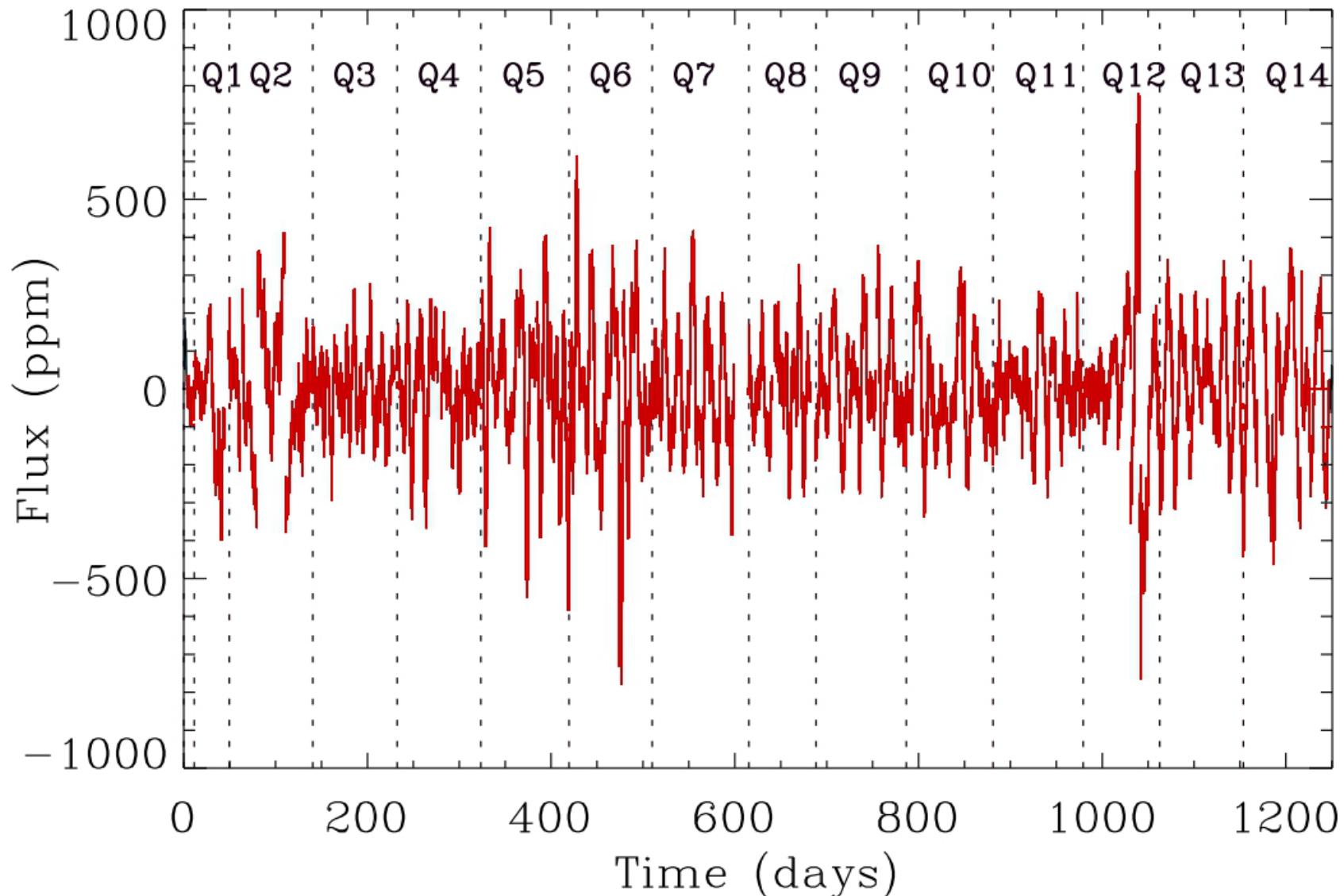
- Observable parameter optimization. In an optimization run, a scientist specifies observable properties, such as pulsation frequencies, and a genetic algorithm is used to identify the stellar model that best fits the observed data. An optimization run makes extensive usage of XSEDE computational resources and consumes about 20,000 CPU hours.
- Direct ASTEC model evaluation. In a direct model run, a scientist specifies a star's parameters, and a model is generated using ASTEC. Data about the hypothetical star, including Echelle and HR diagrams, are produced for inspection. A direct model evaluation takes about 15 minutes to run.

For more information about AMP, please see [About AMP](#) and the [AMP User Guide](#).

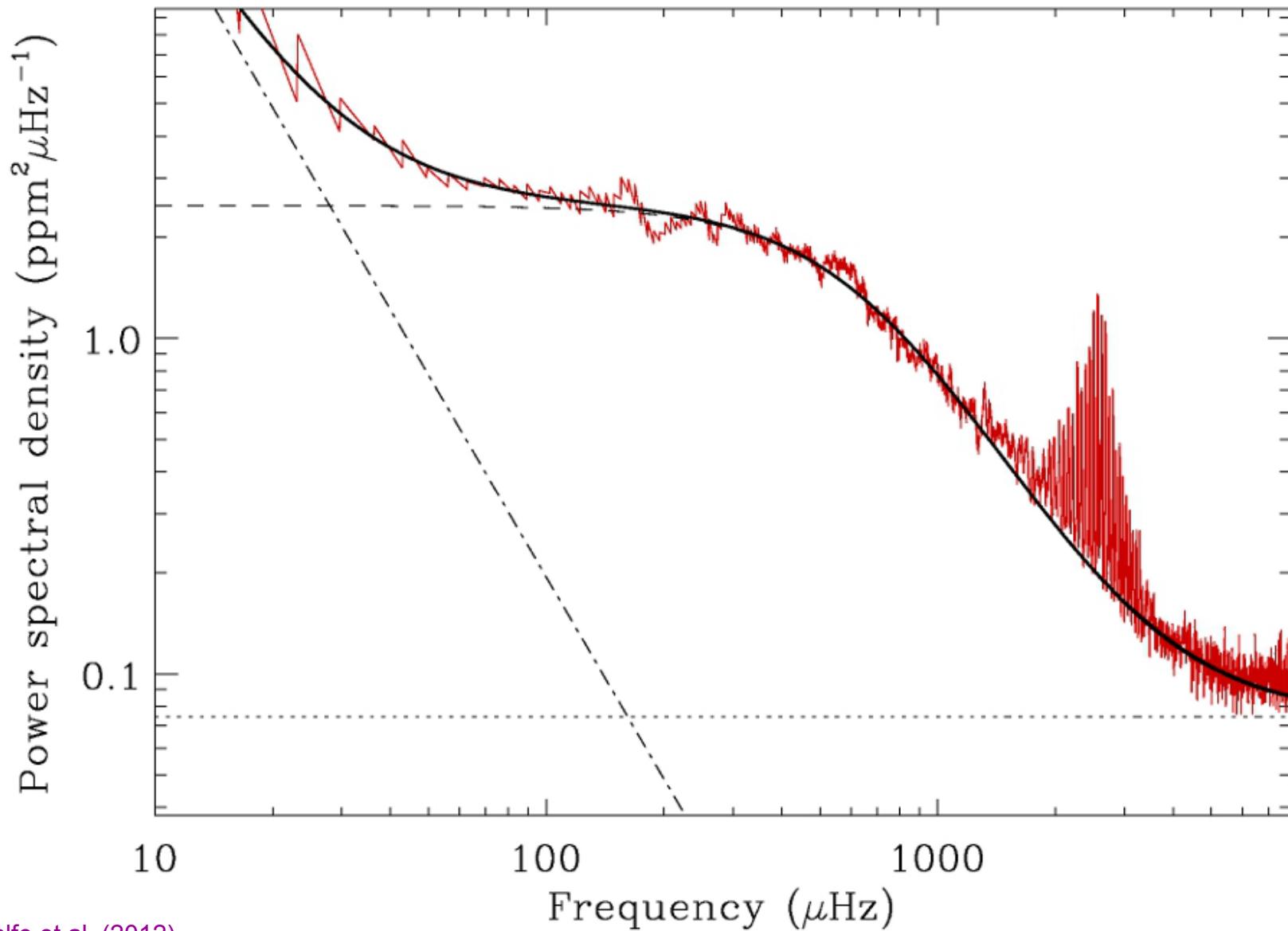


Visit the AMP website at <https://amp.phys.au.dk>

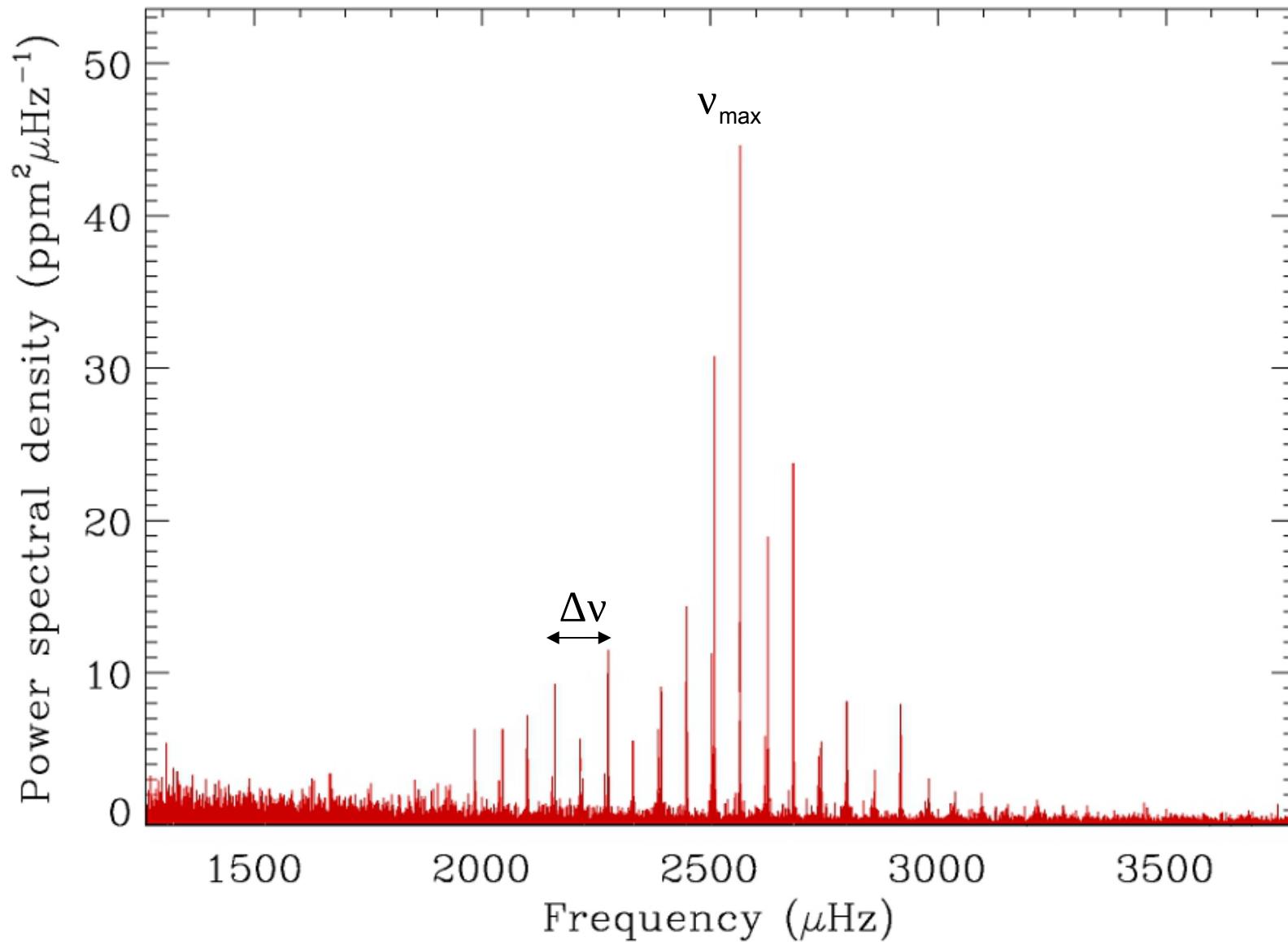
Global oscillation properties



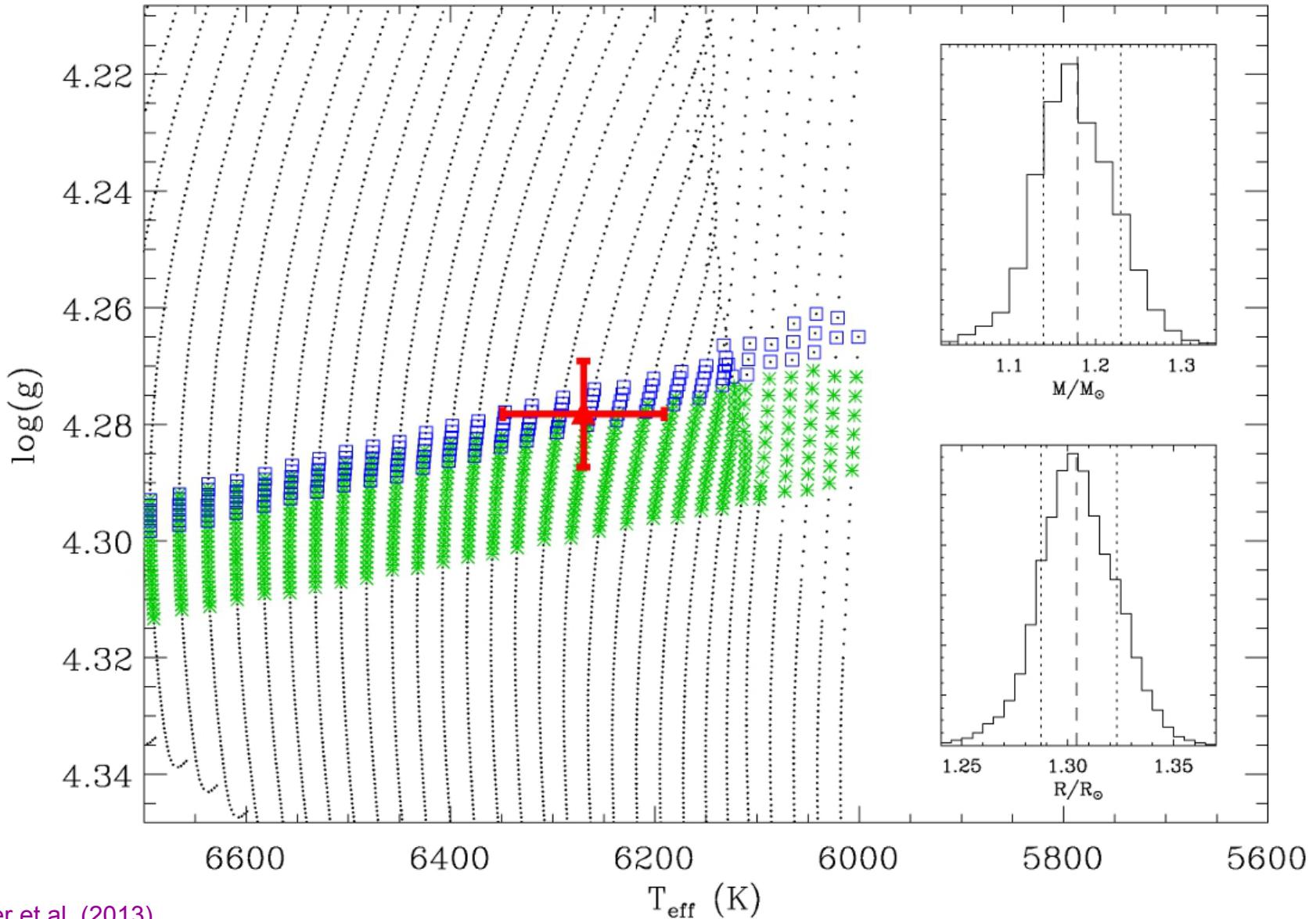
Global oscillation properties



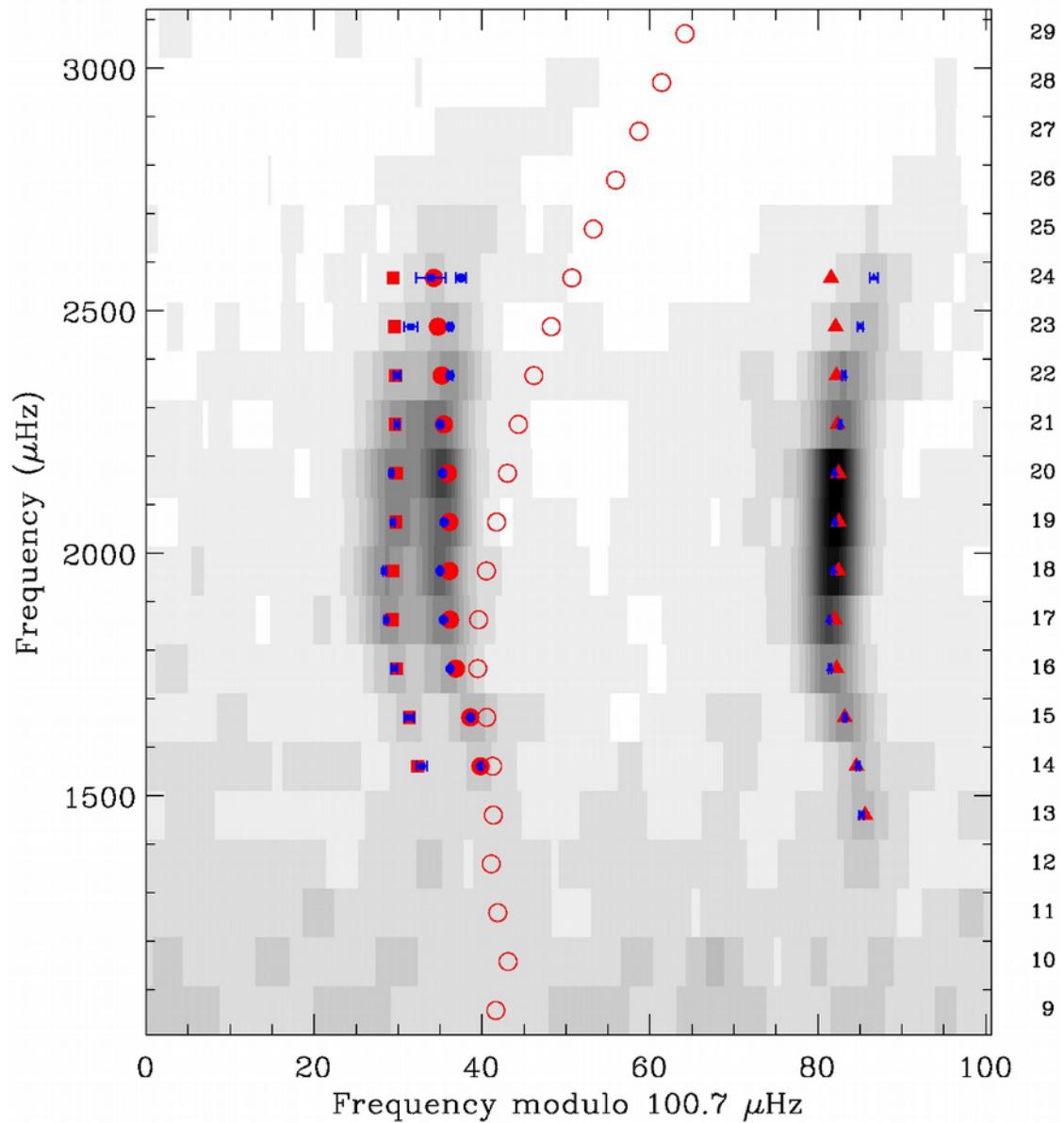
Global oscillation properties



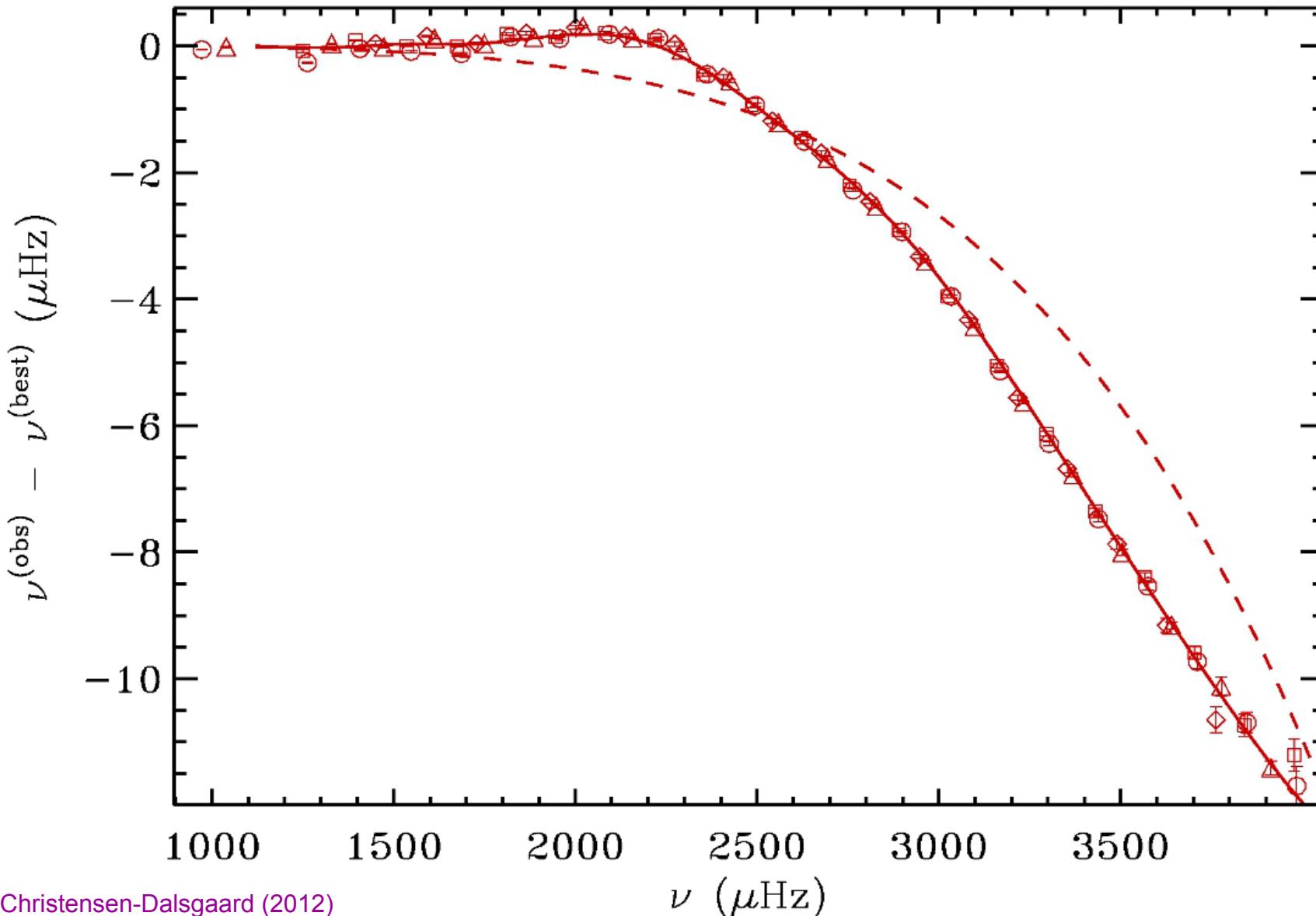
Grid-based modeling



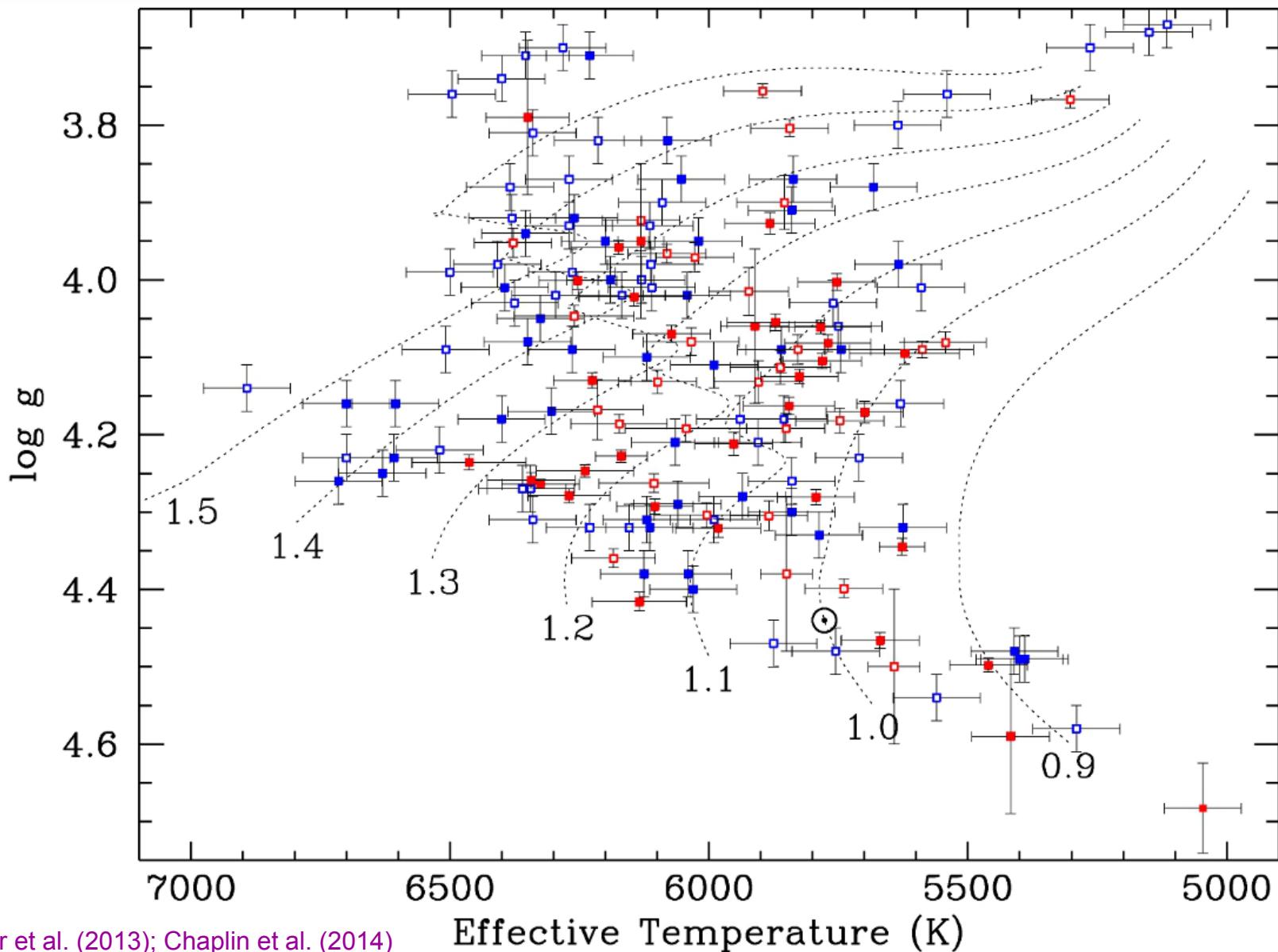
Fitting the frequencies



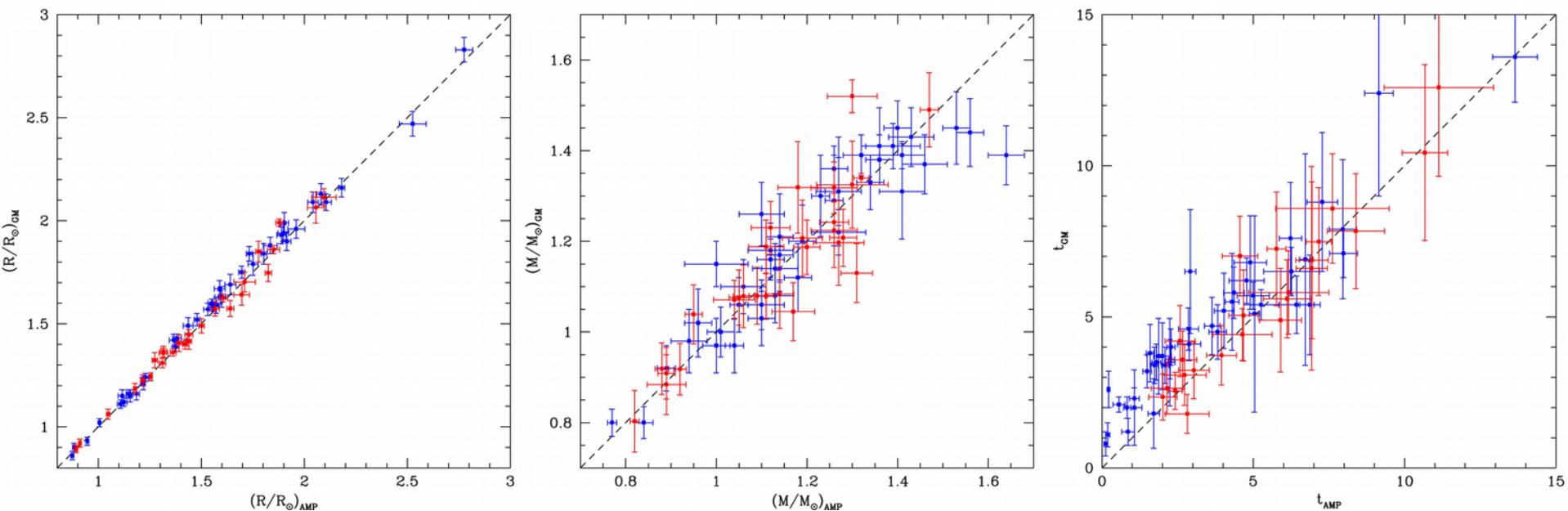
Fitting the frequencies



Asteroseismic samples



Precise stellar properties



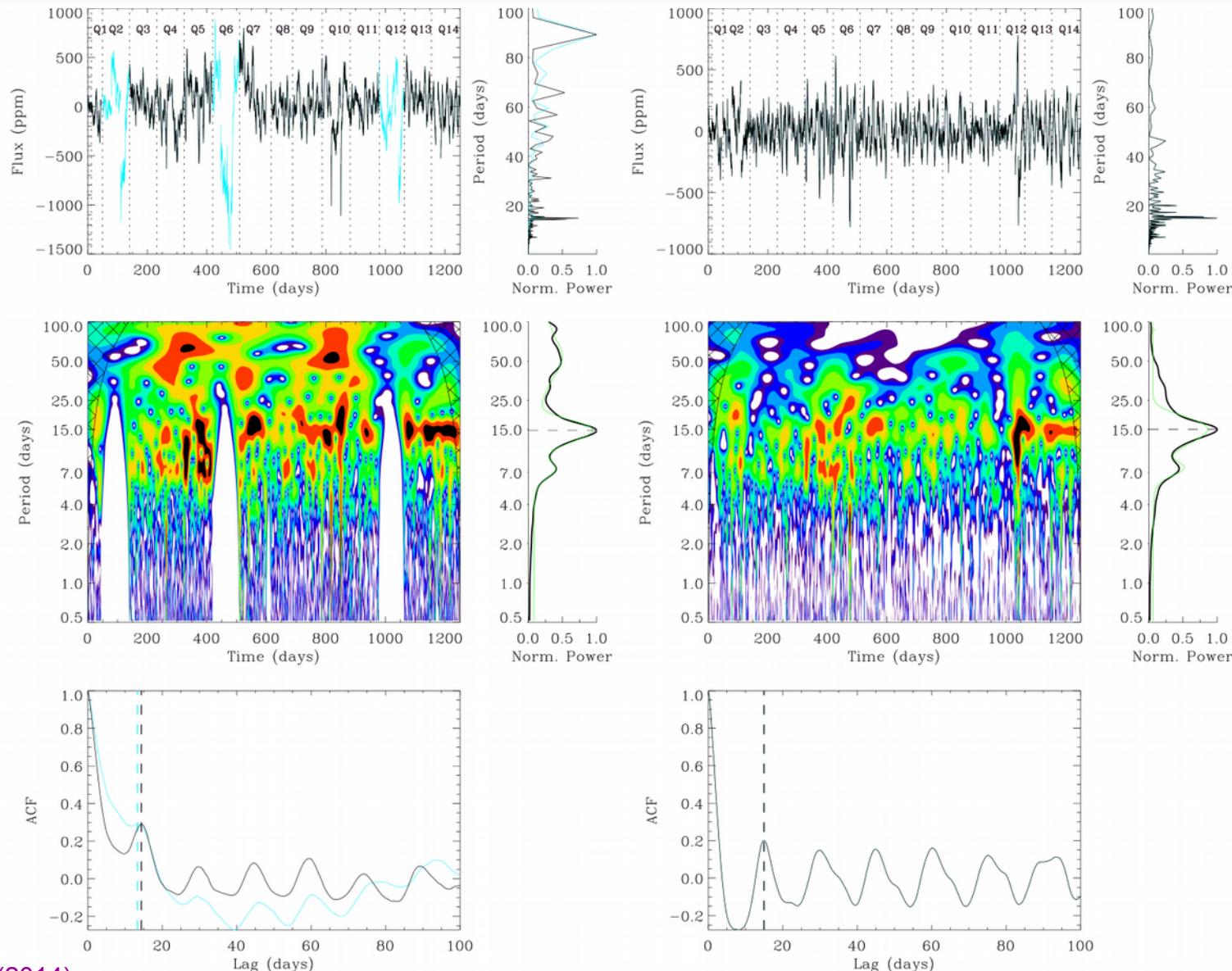
Chaplin et al: **2.1% radius, 5.5% mass, 20% age**

AMP precision: **1.2% radius, 2.8% mass, 8% age**

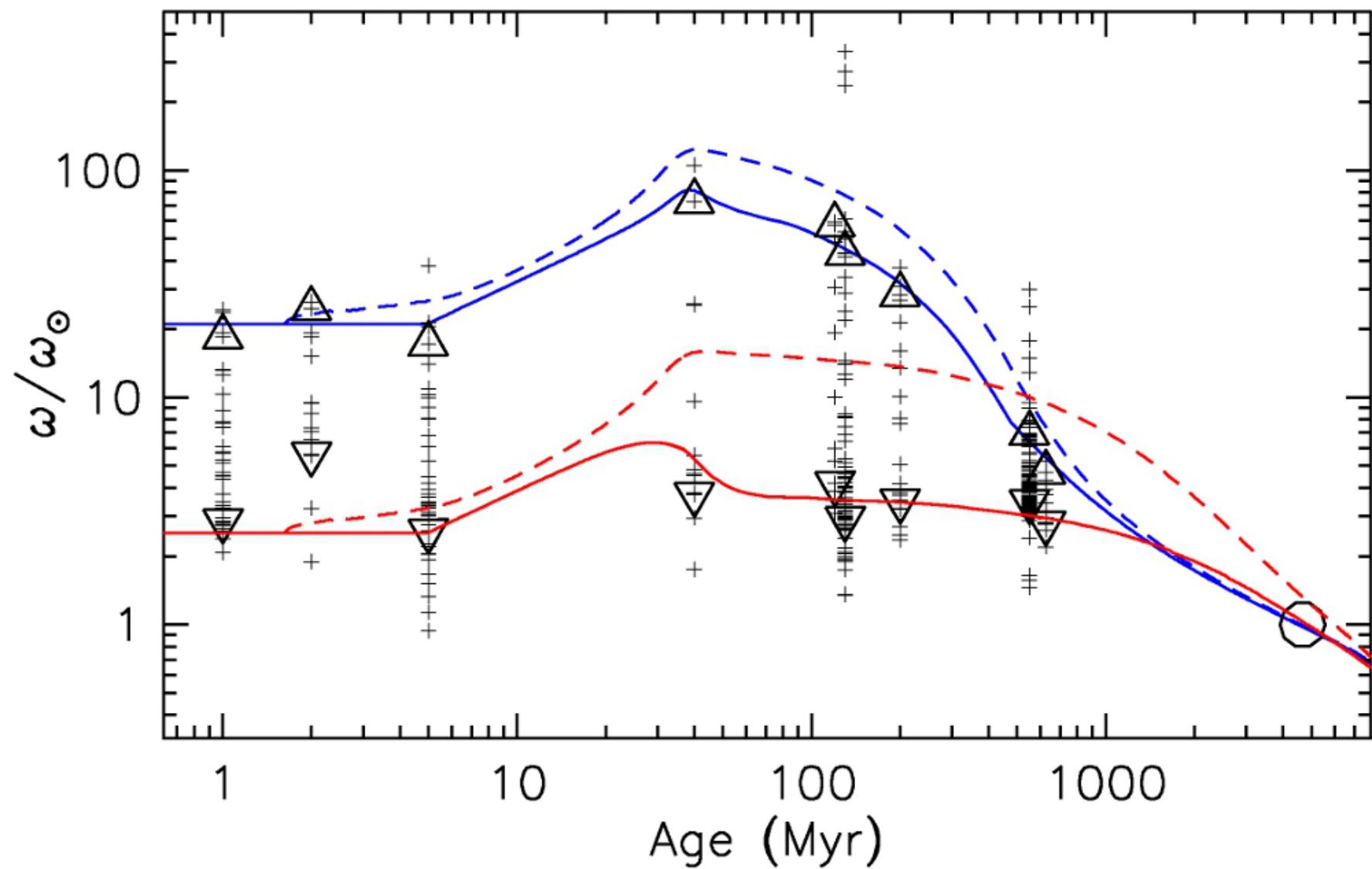
Huber et al: **2.2% radius, 6.0% mass, 28% age**

AMP precision: **1.0% radius, 2.6% mass, 13% age**

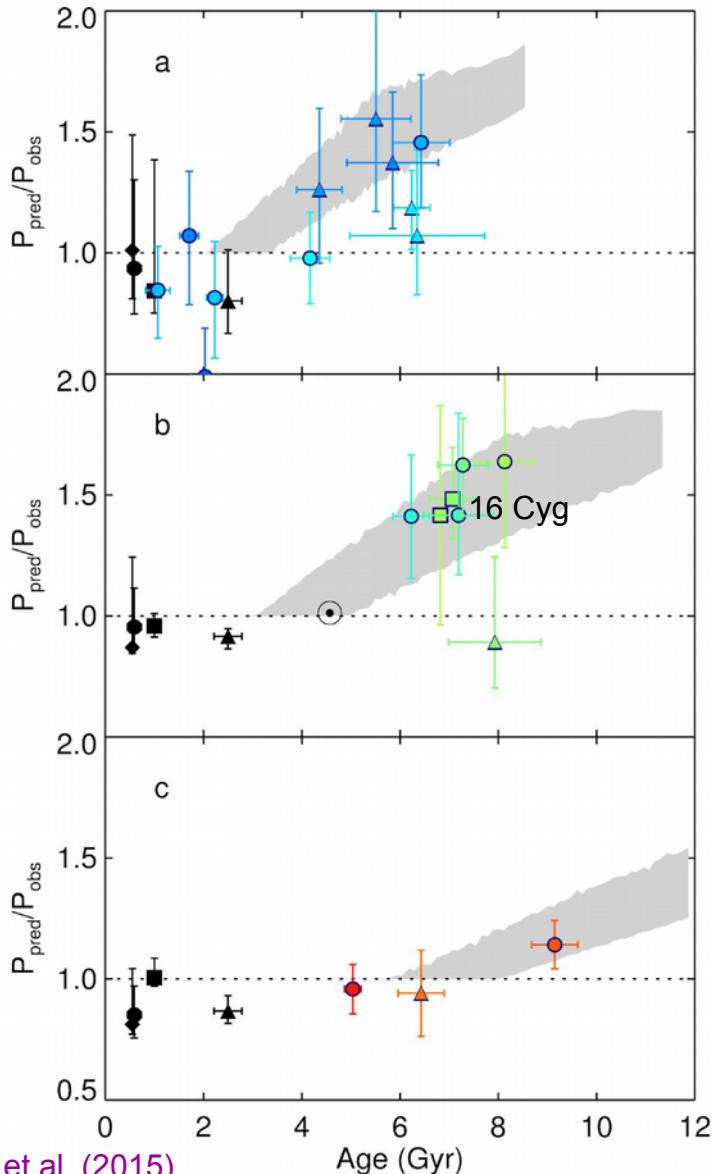
Rotation of Kepler field stars



Rotational evolution

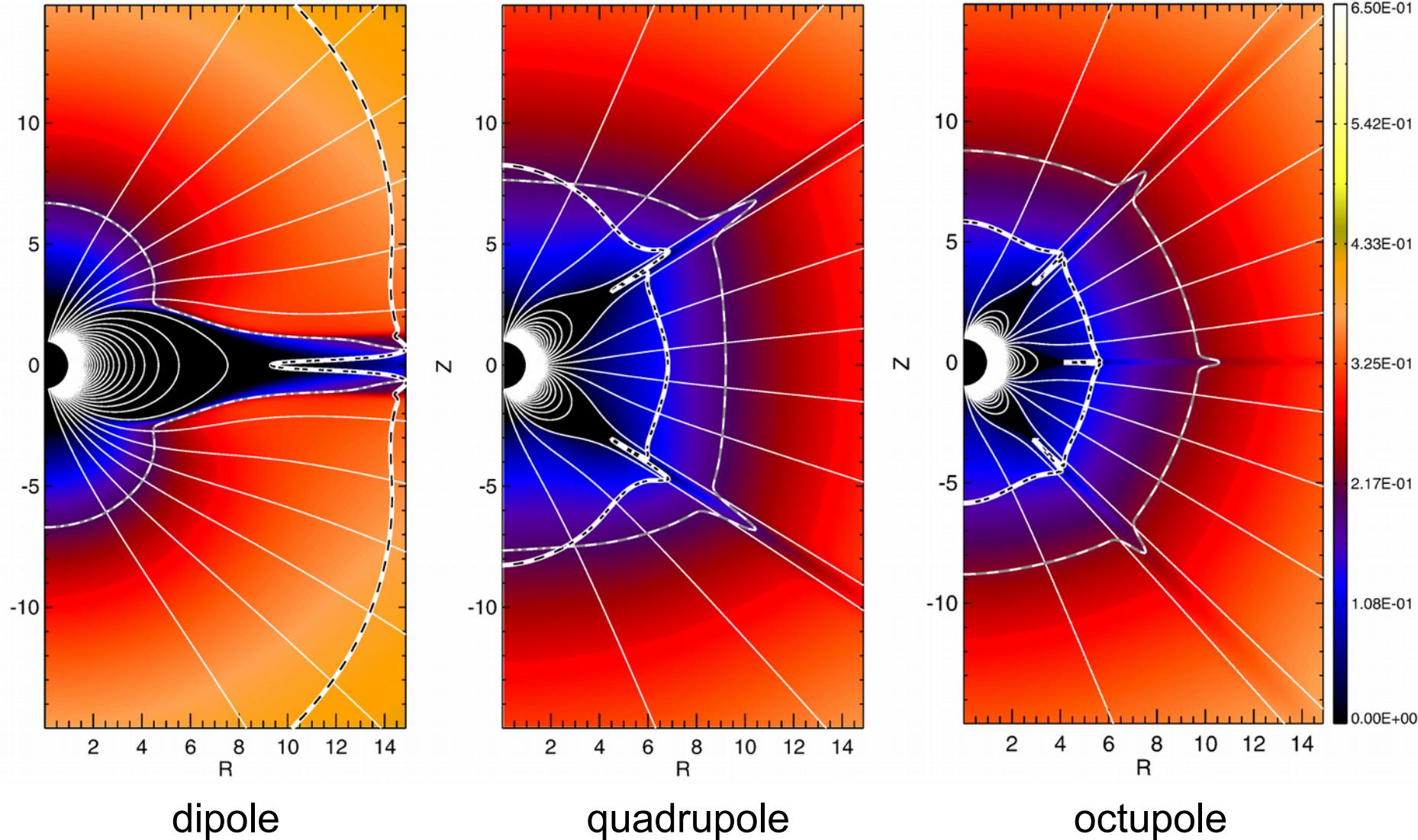


New view of gyrochronology

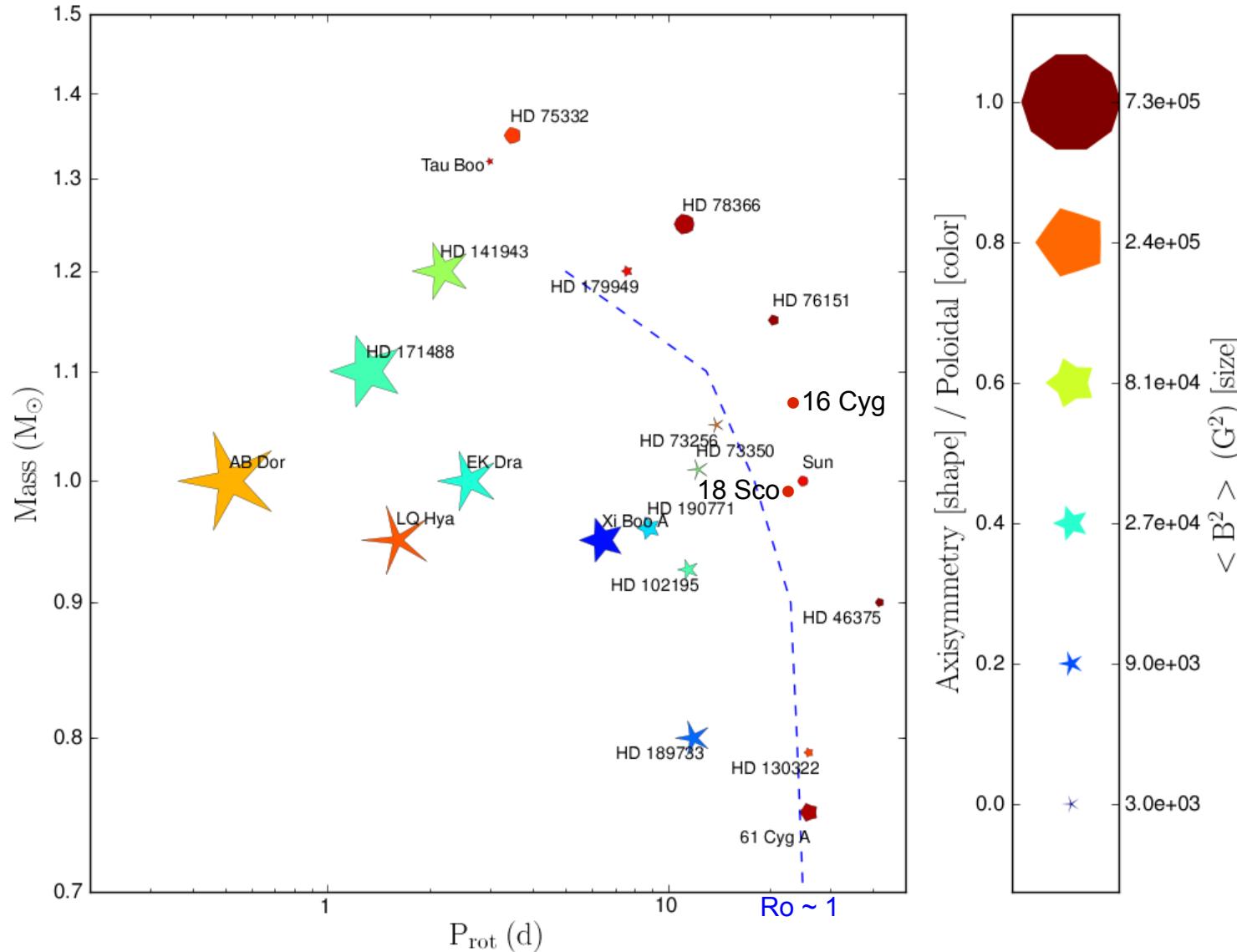


- Stars beyond middle-age rotate more quickly than gyrochronology predicts
- Effect seems to appear beyond a critical Rossby number ($\text{Ro} \sim 2$)
- Onset is earlier in F-type, near solar age in G-type, later in K-type stars

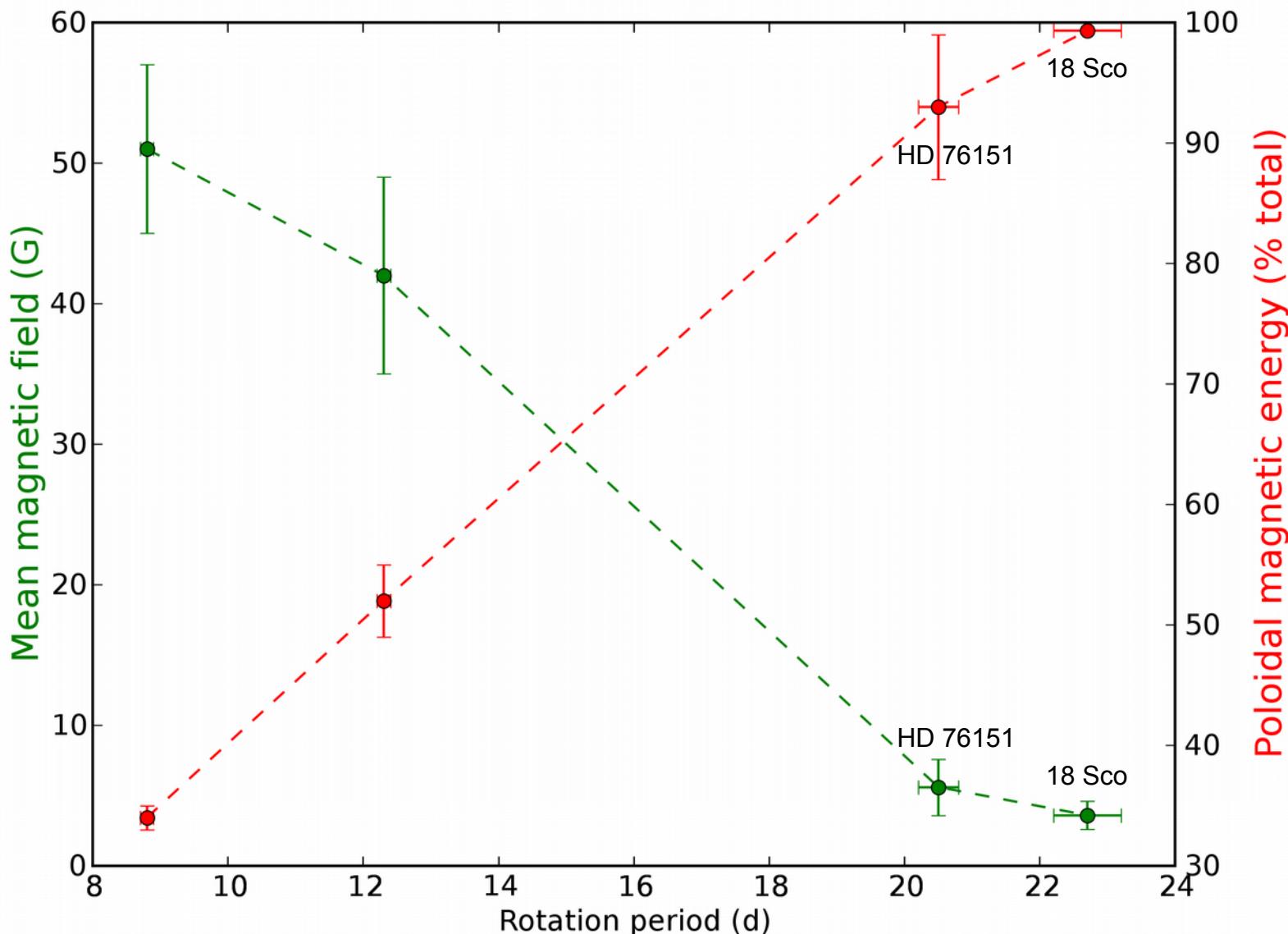
Spindown and magnetic topology



Magnetic fields in sun-like stars

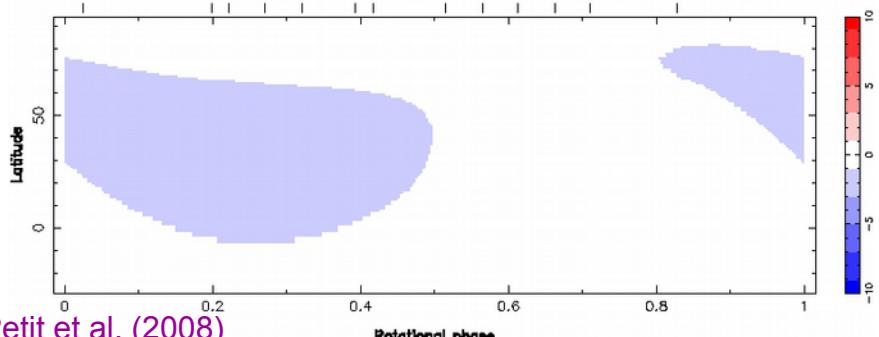
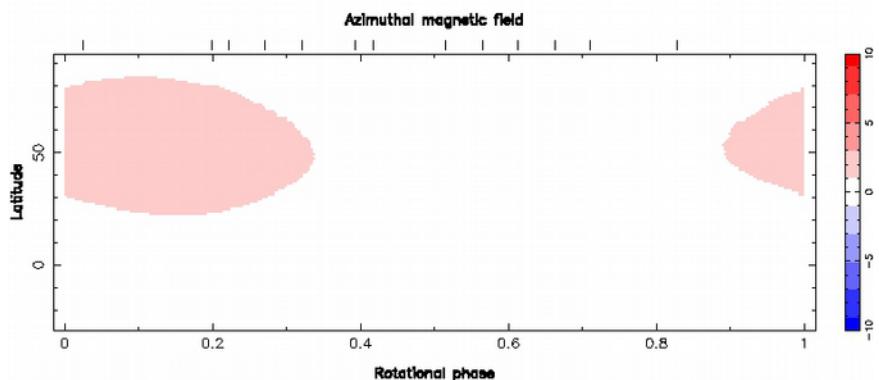
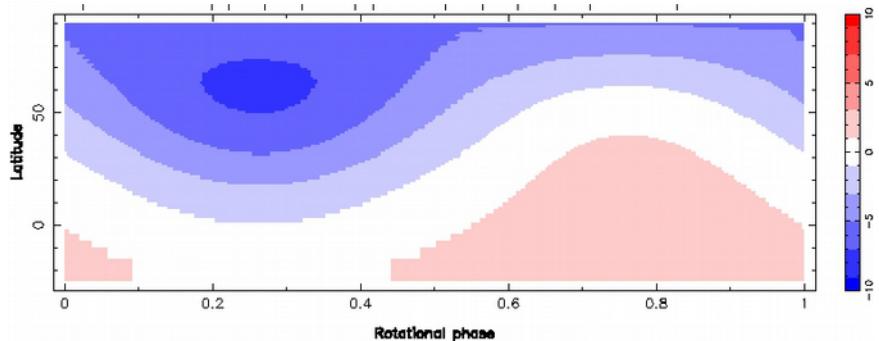


Magnetic fields in sun-like stars

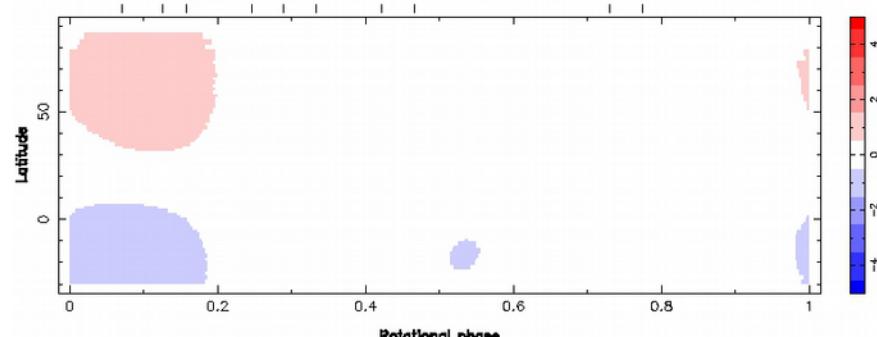
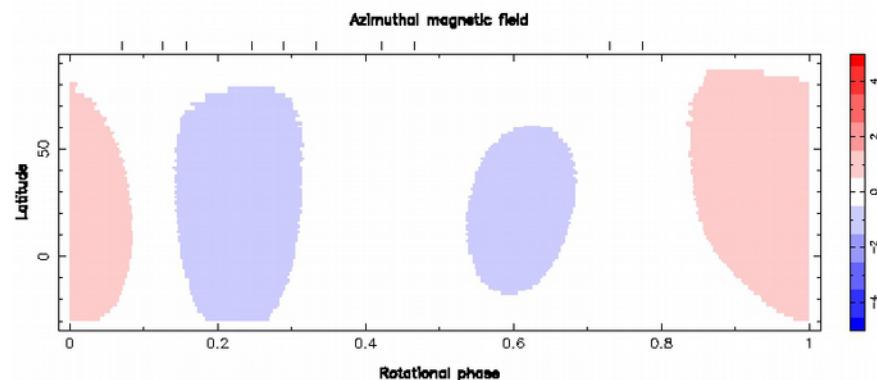
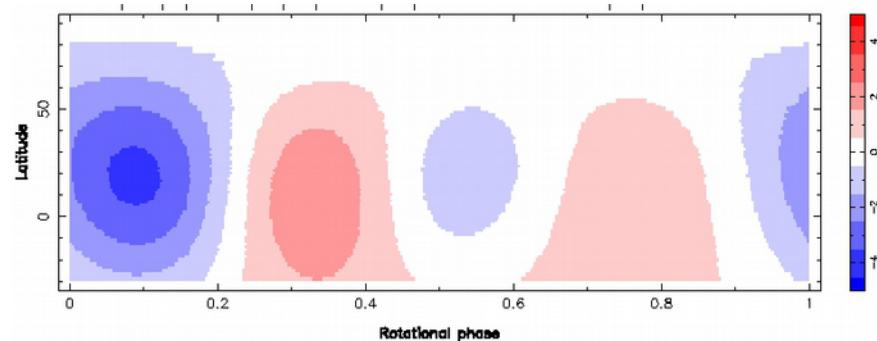


18 Sco spectropolarimetry

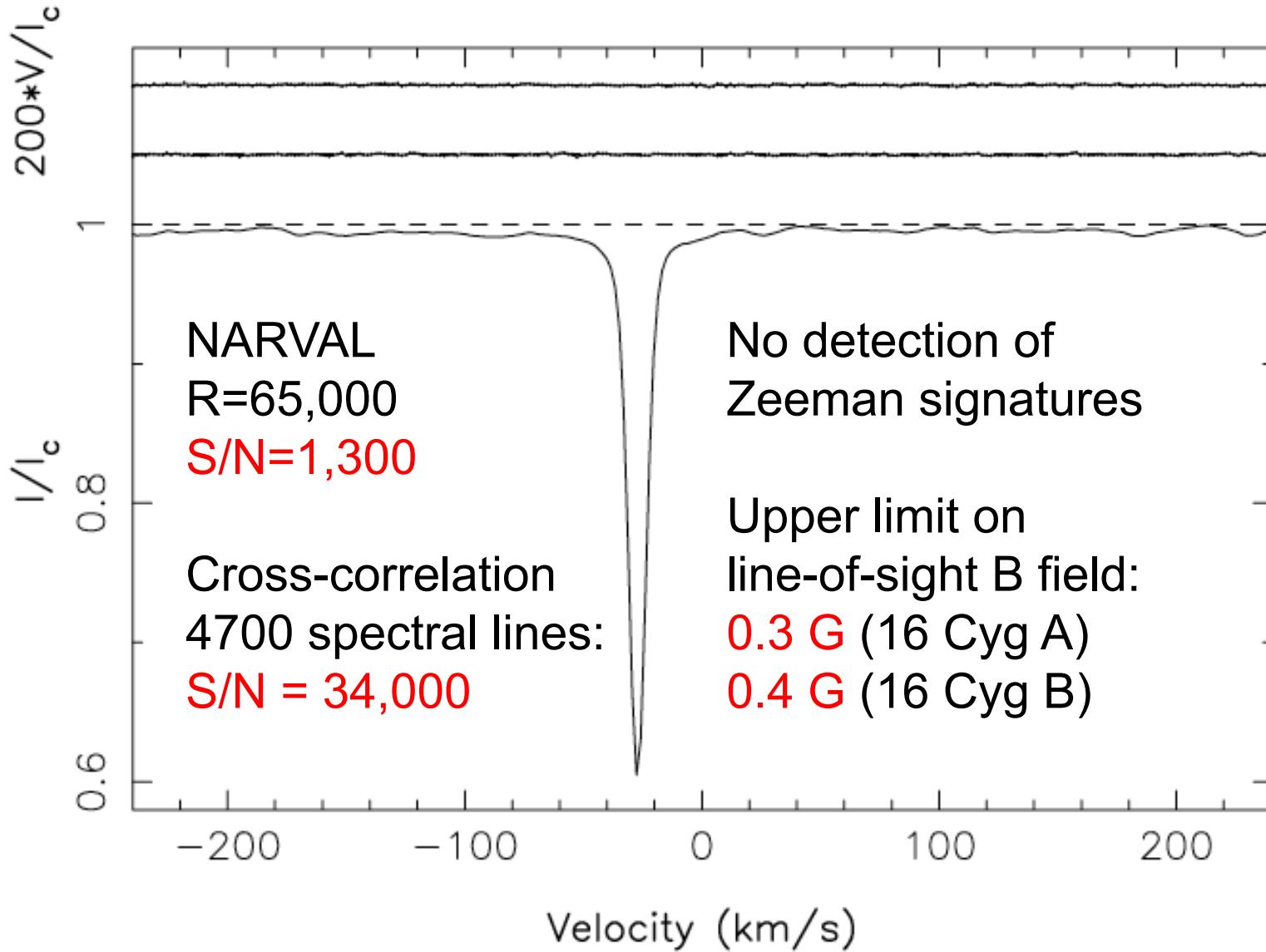
HD 76151 ($P \sim 20d$)



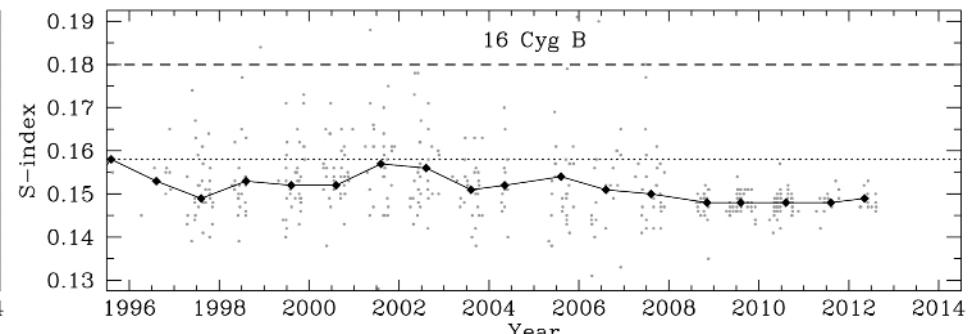
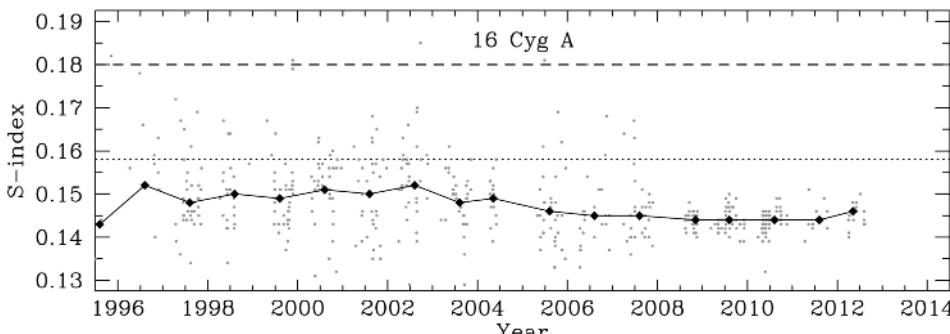
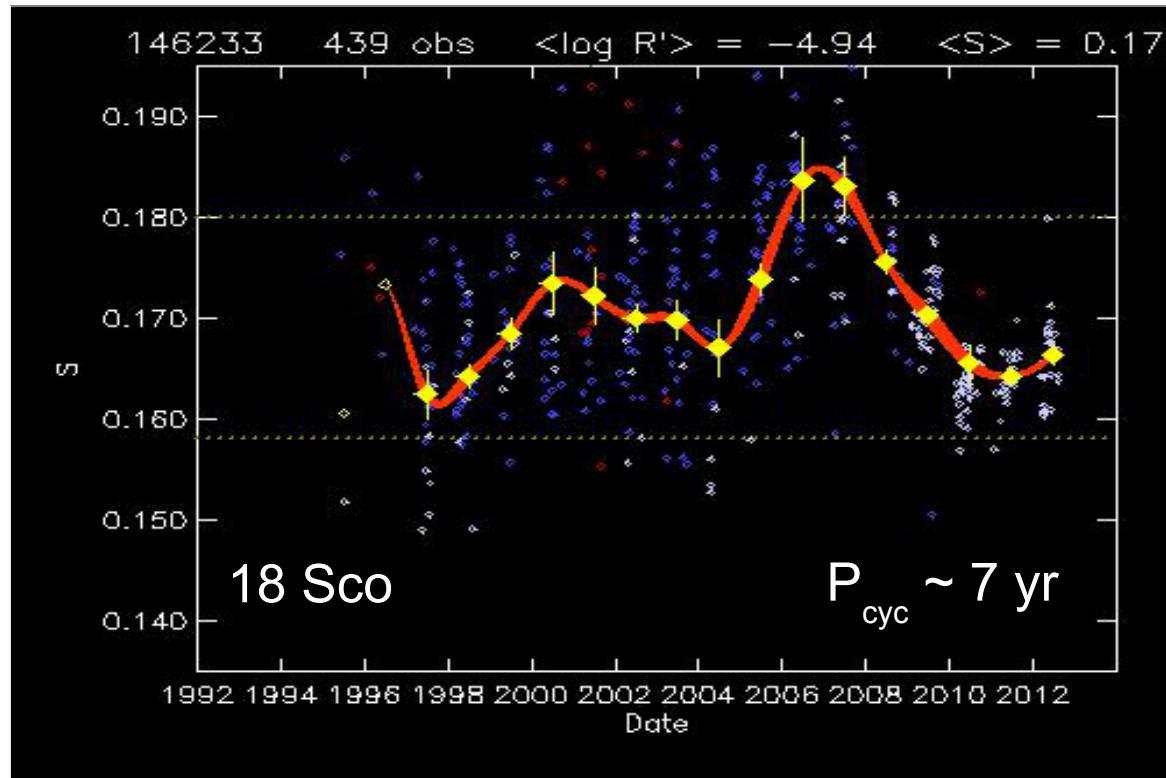
18 Sco ($P \sim 23d$)



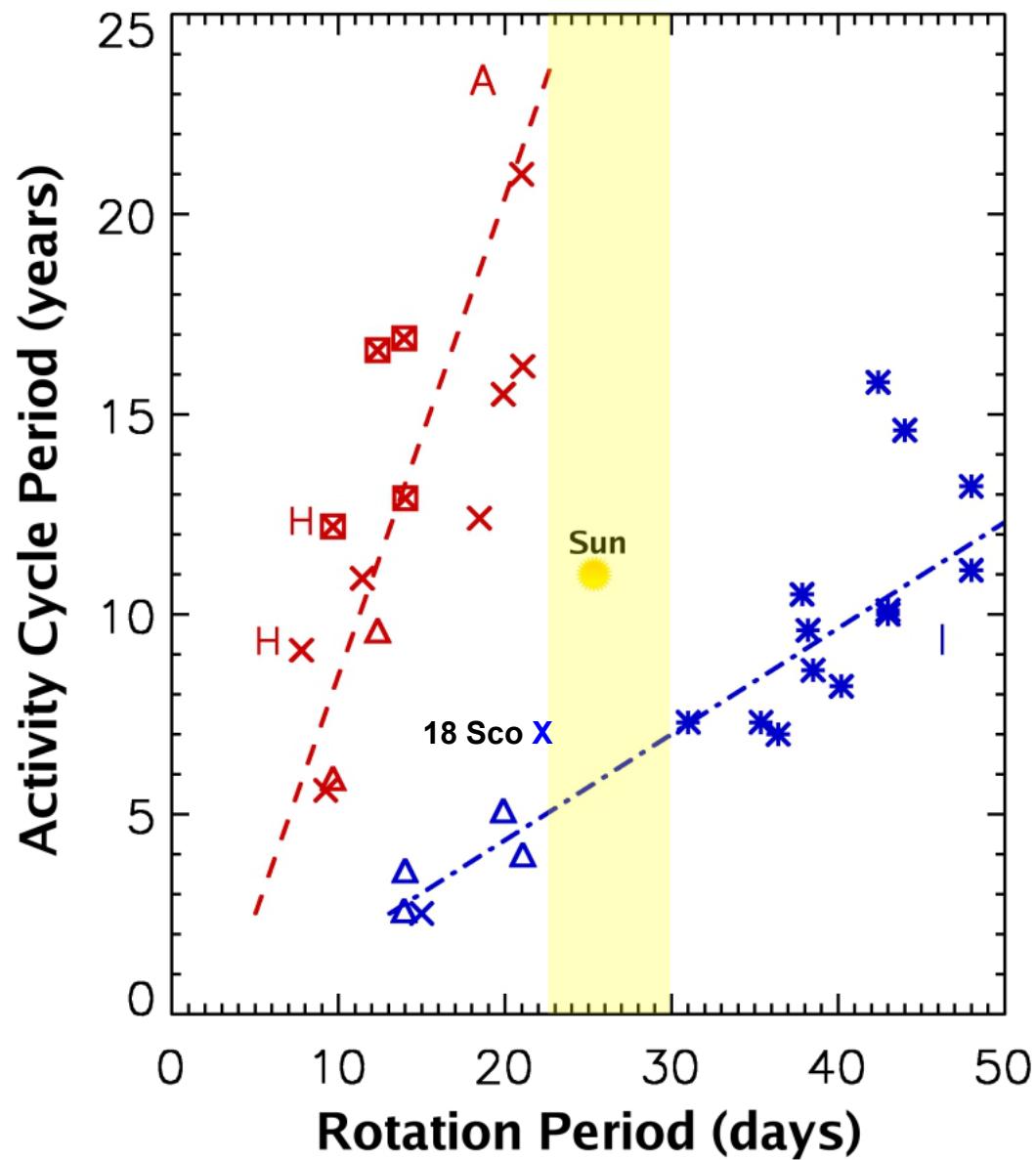
16 Cyg spectropolarimetry



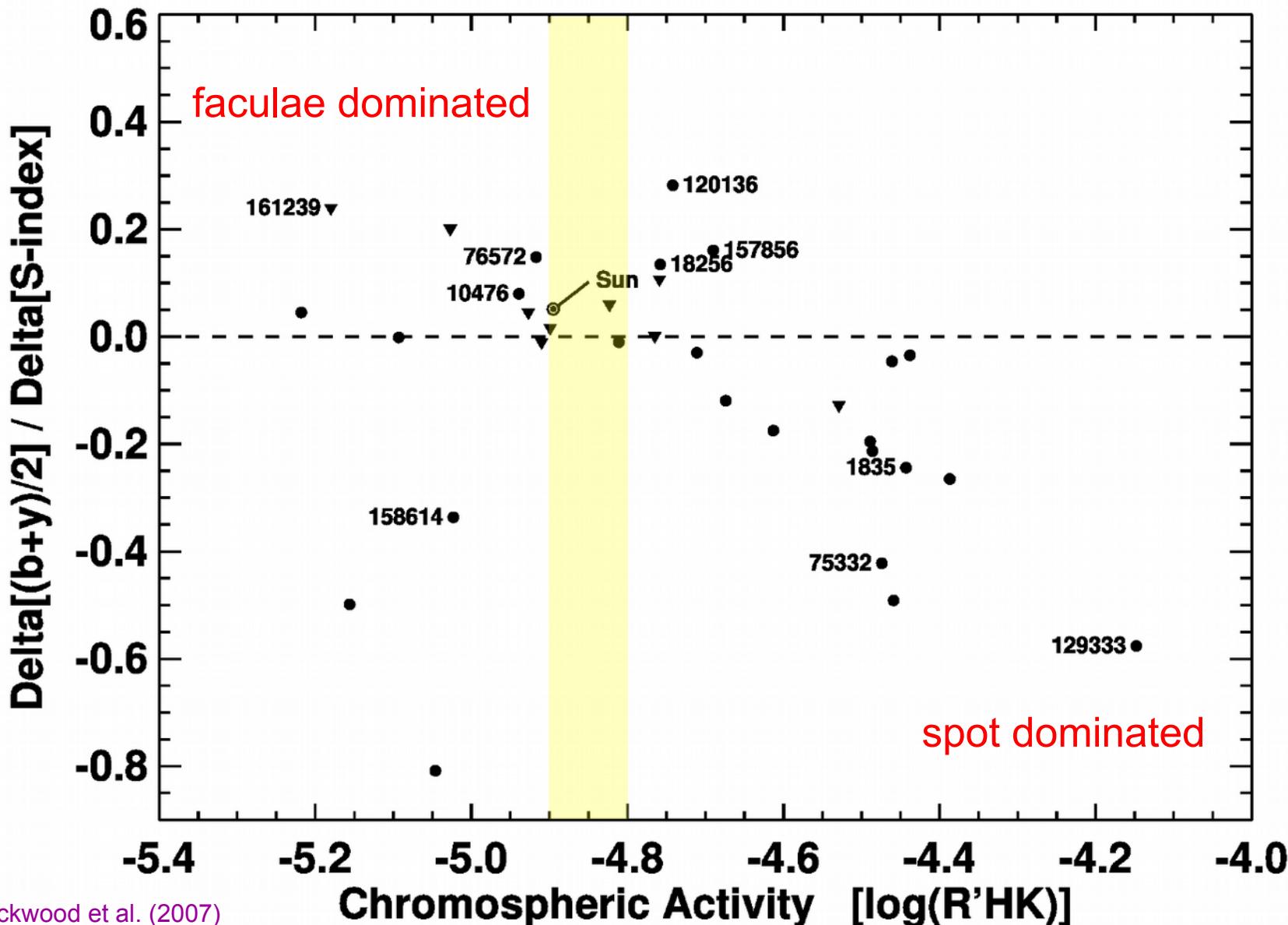
18 Sco & 16 Cyg activity



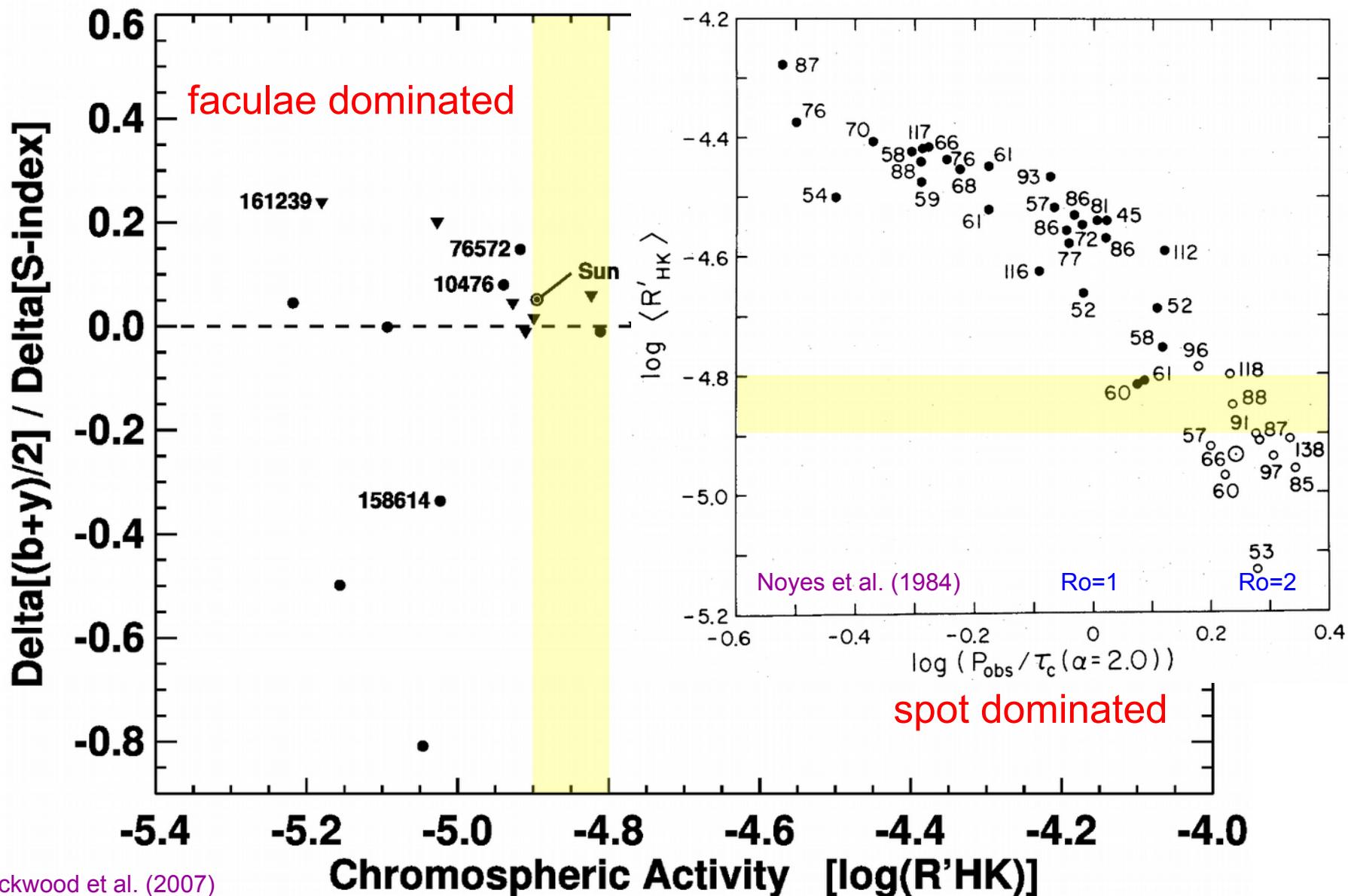
Clue #1: activity cycles



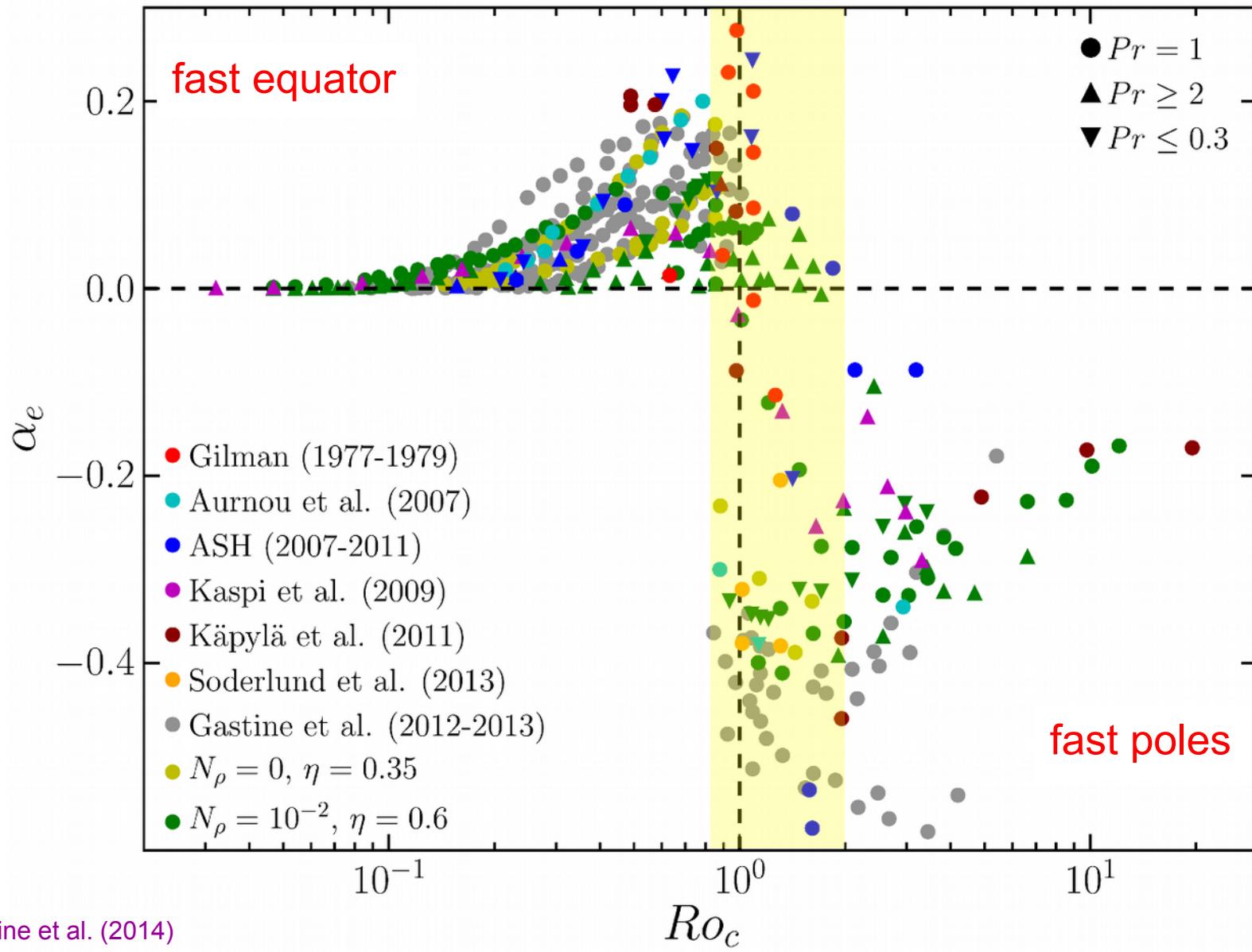
Clue #2: spots and faculae



Clue #2: spots and faculae



Clue #3: differential rotation



I THINK YOU
SHOULD BE MORE
SPECIFIC HERE IN
STEP TWO

