

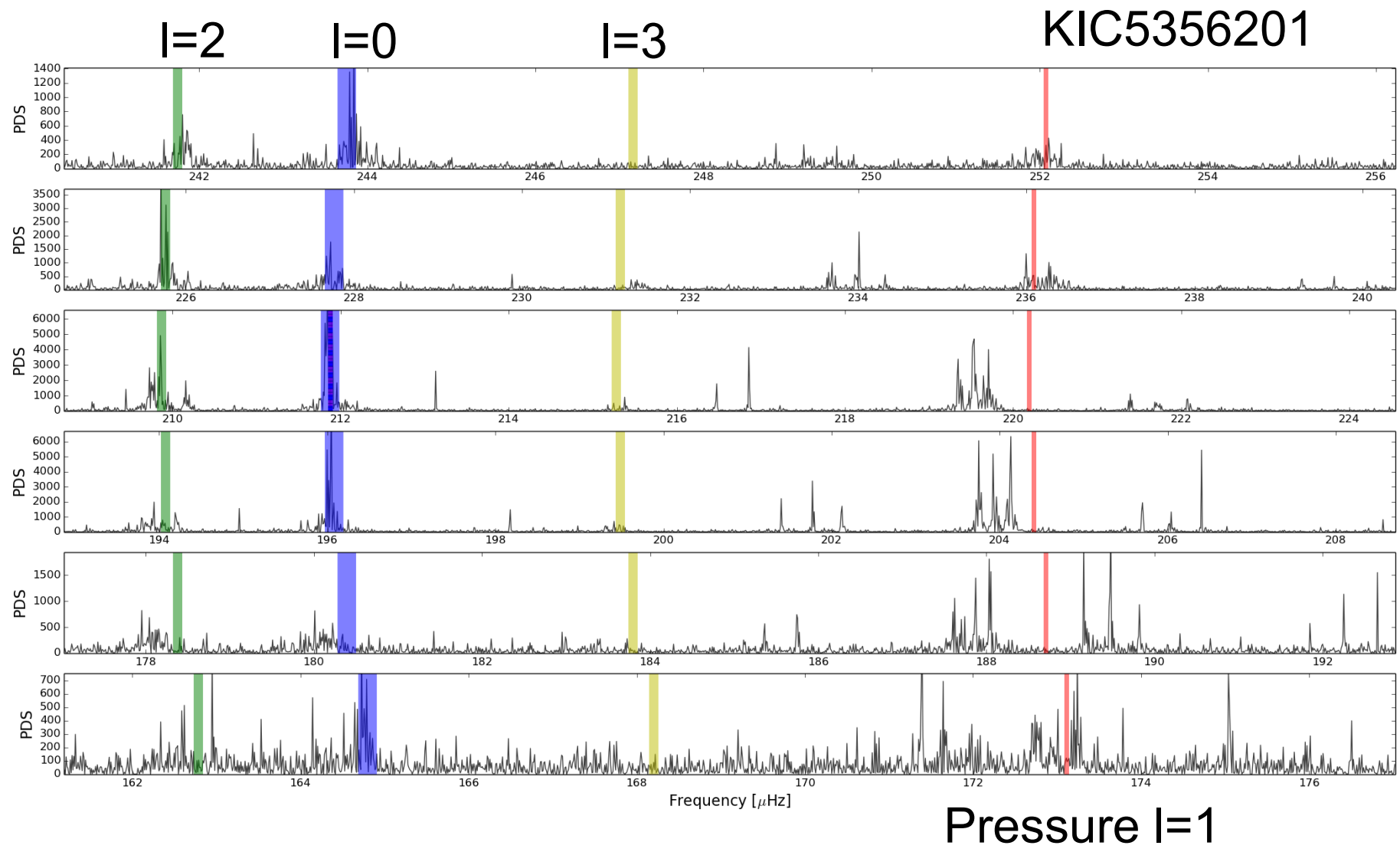


Rotational Splitting

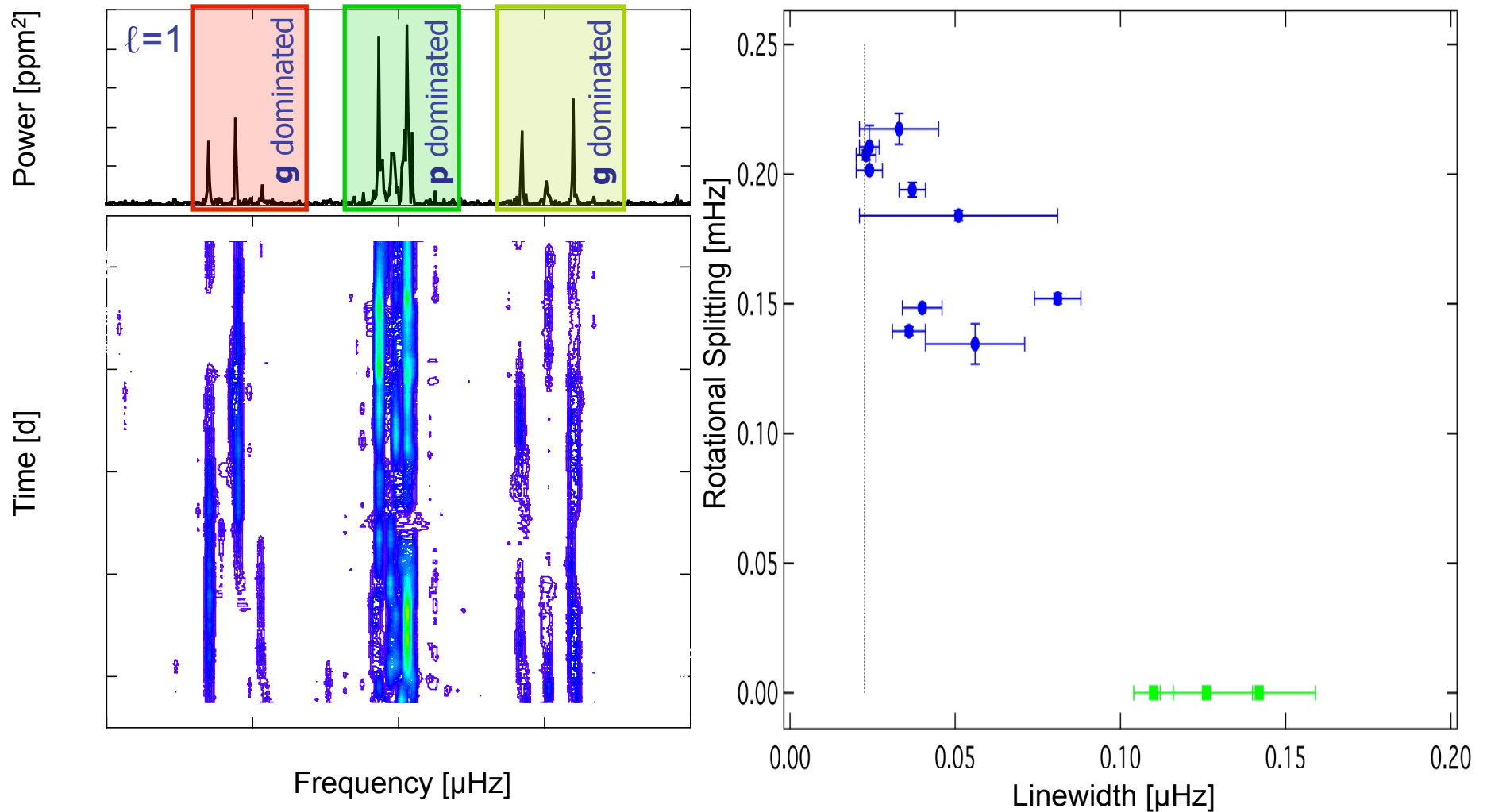
Paul Gerhard Beck

CEA-Saclay

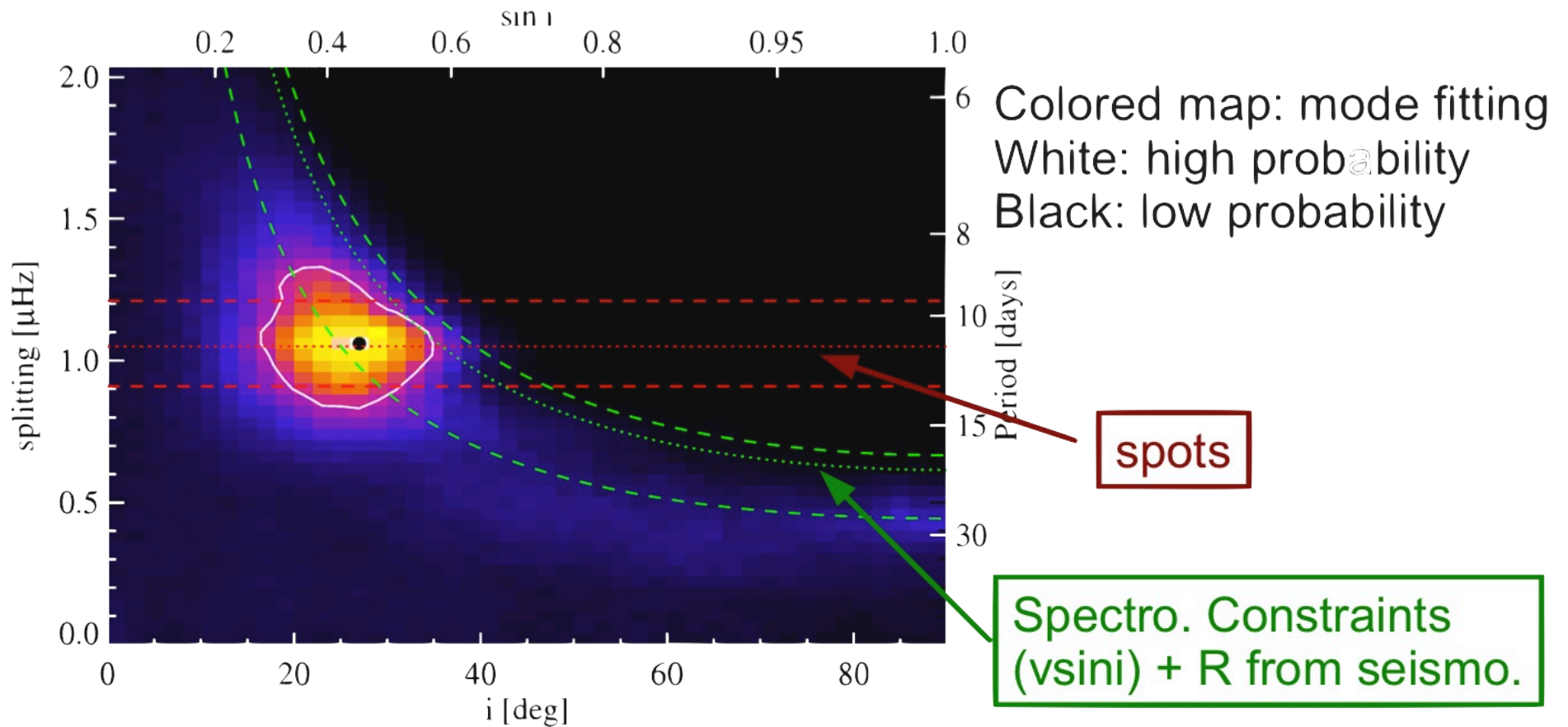
Rotational Splitting



Properties of Splitting

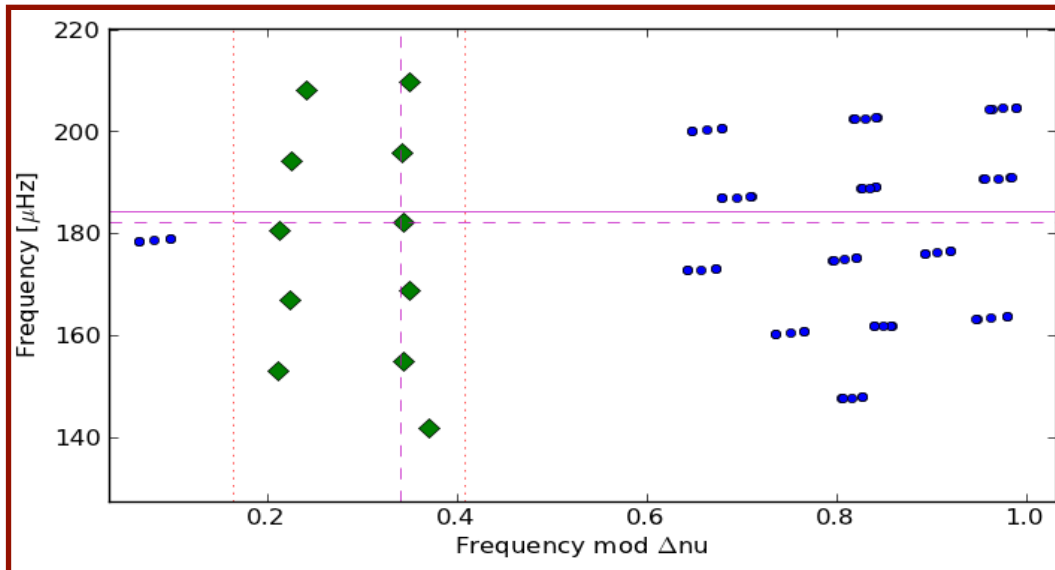


Banana



Ballot et al. 2011, Gizon et al. 2012

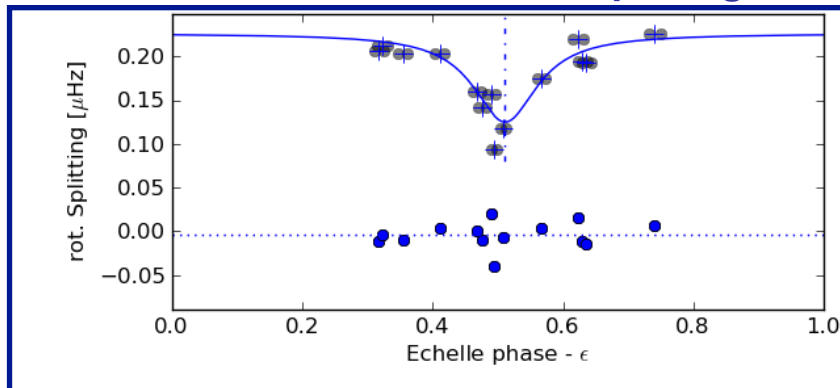
Modulation of splitting



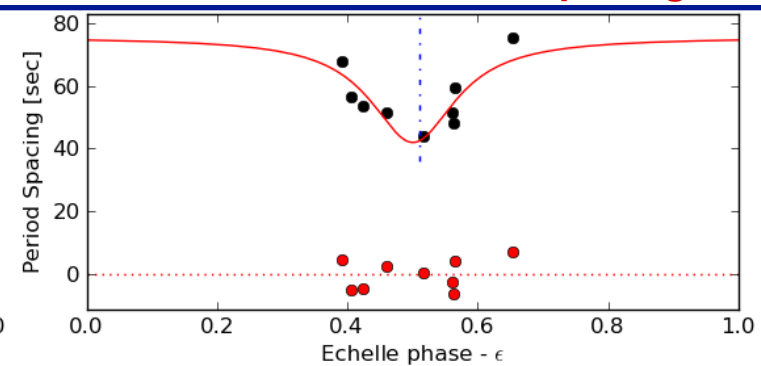
Modulation of splitting by the large separation $\Delta\nu$.

- follows Lorentzian profile (Mosser et al. 2012, A&A 548, 10)

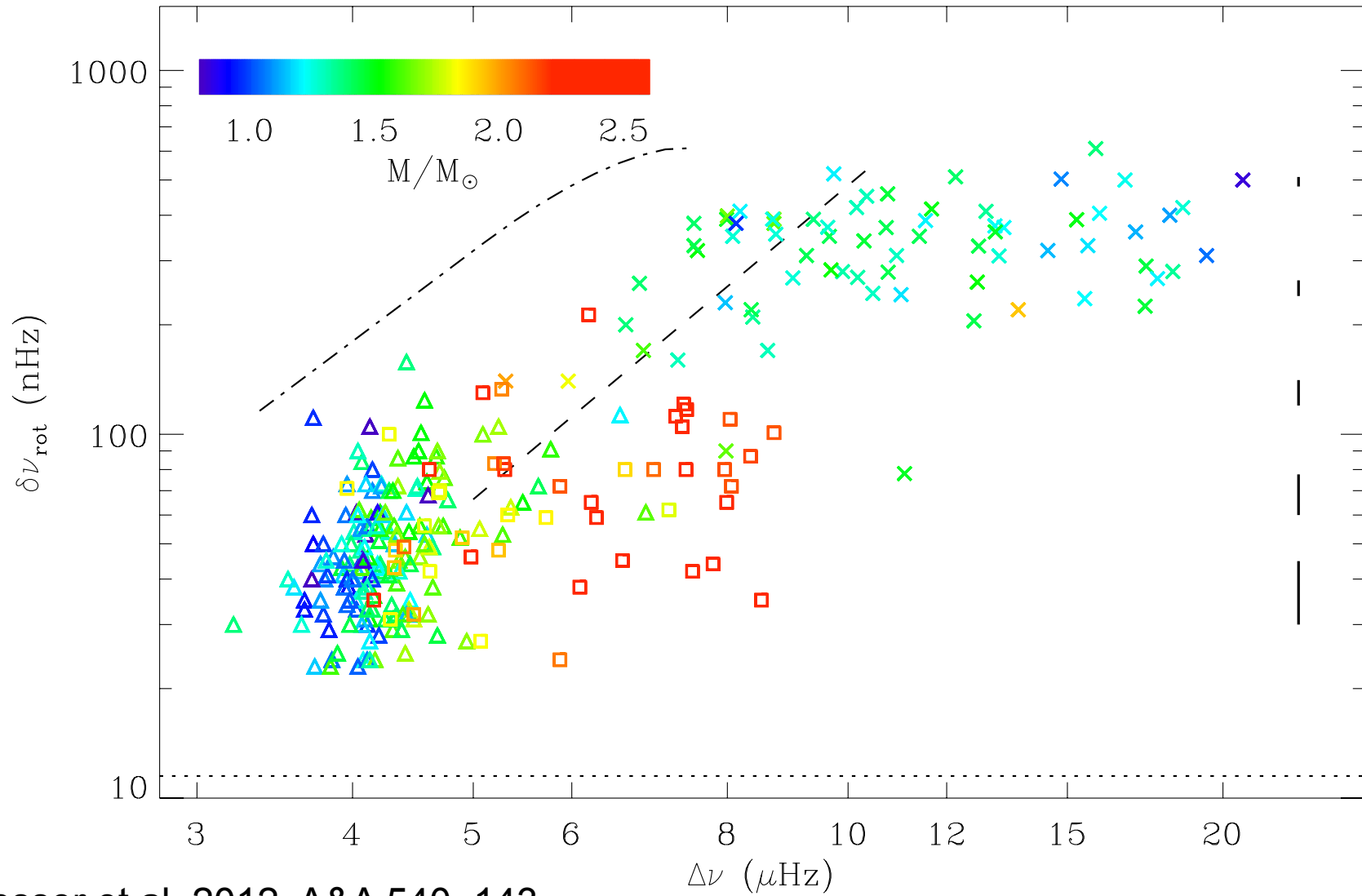
Individual Mode Splitting



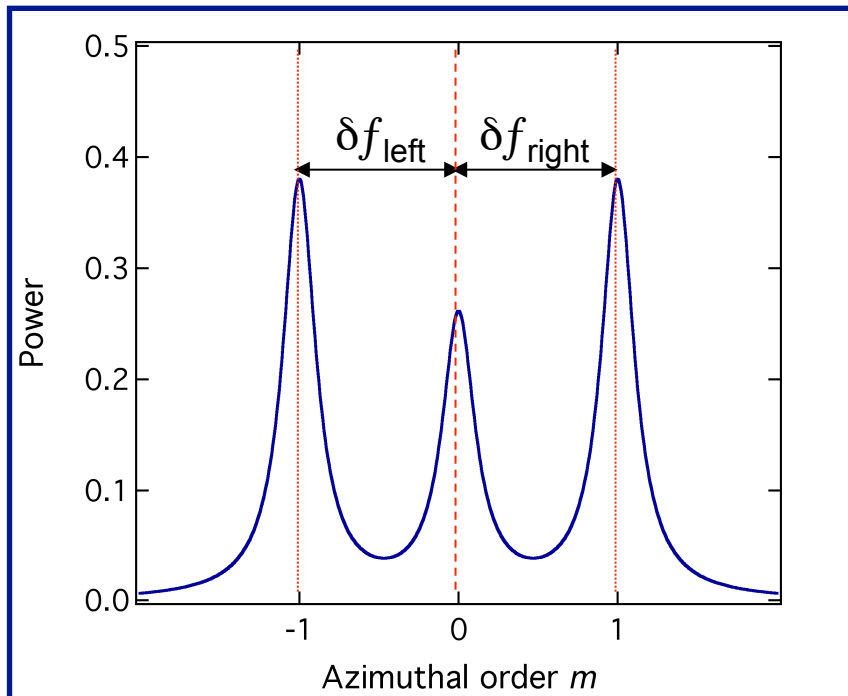
Mixed Mode Period Spacing



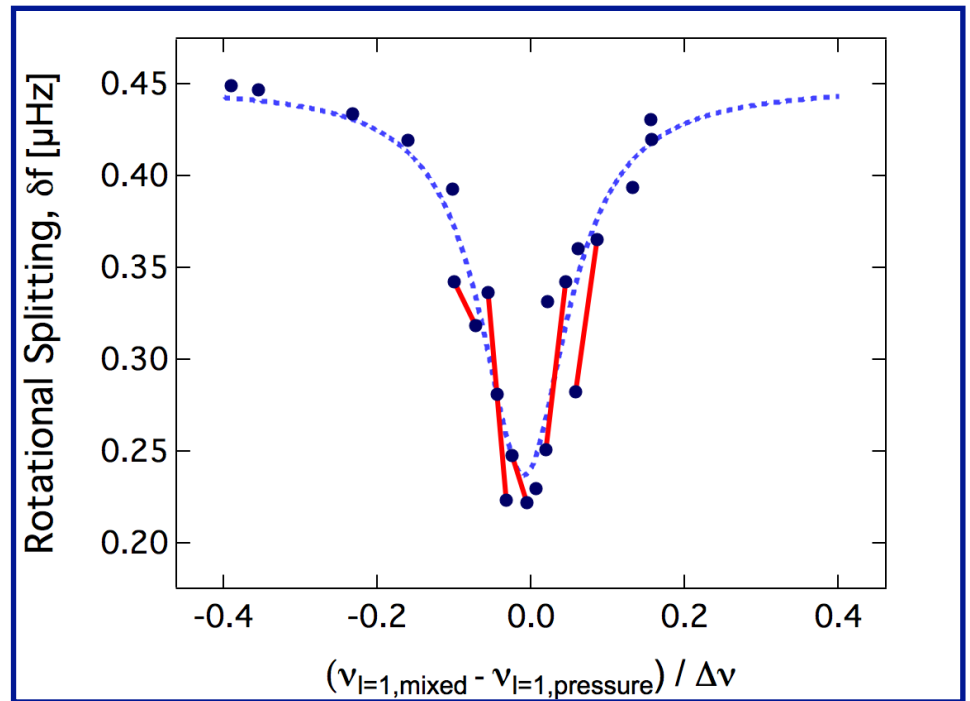
Large Sample



Splitting Asymmetry



Split dipole mode seen at an inclination of $i=60^\circ$

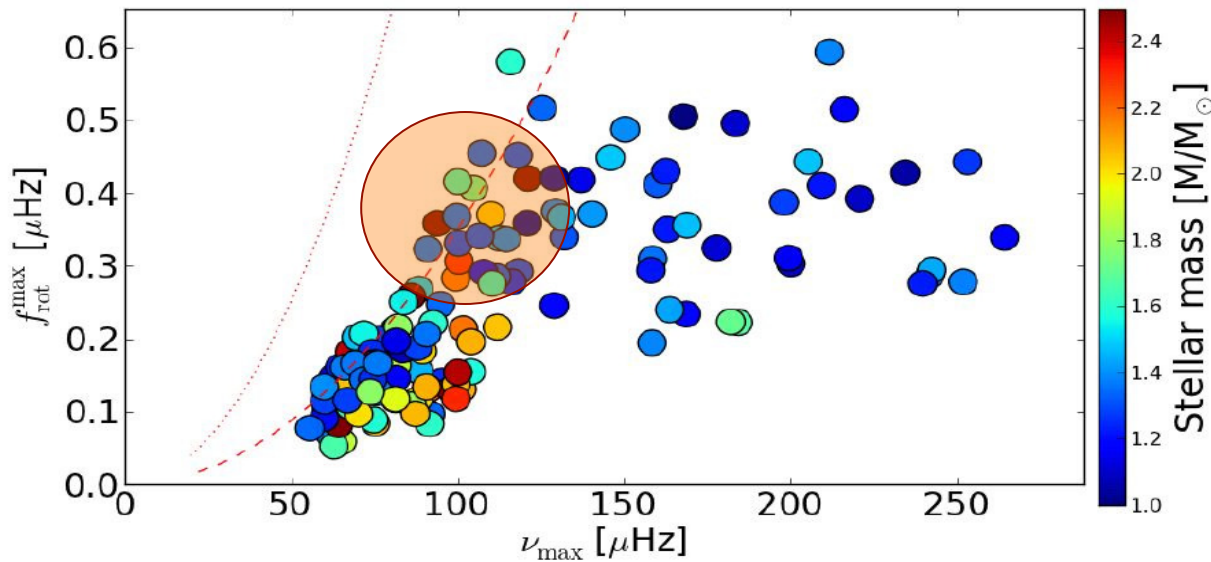


Beck et al. 2013, A&A accepted

Asymmetries in

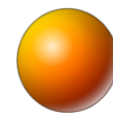
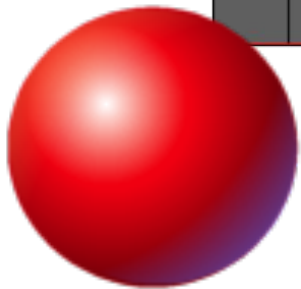
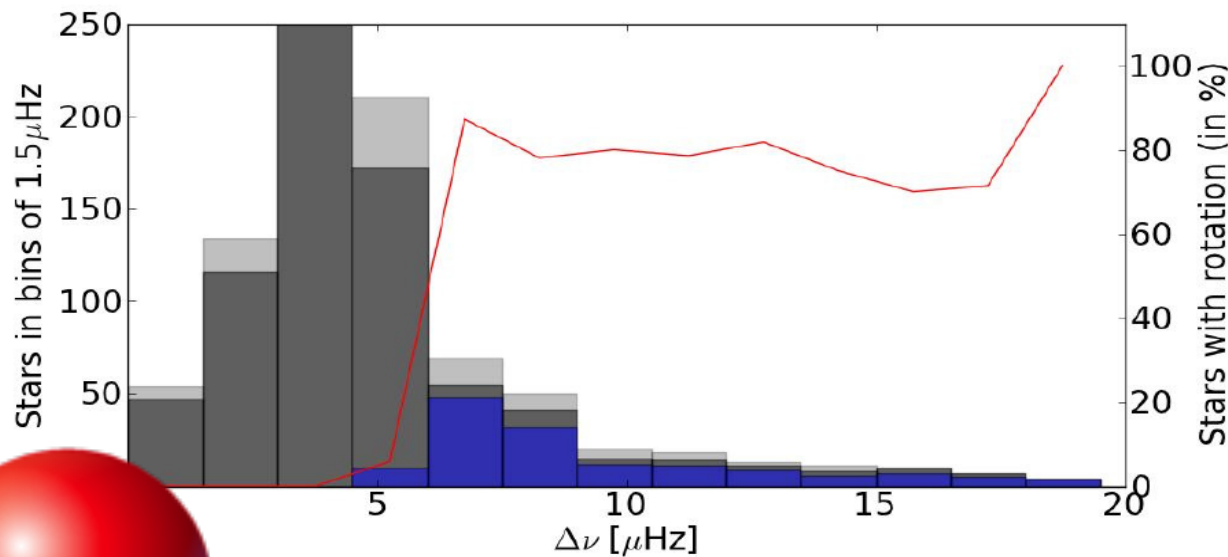
- Mode height (lifetime effects)
- Rotational splitting

Large Sample

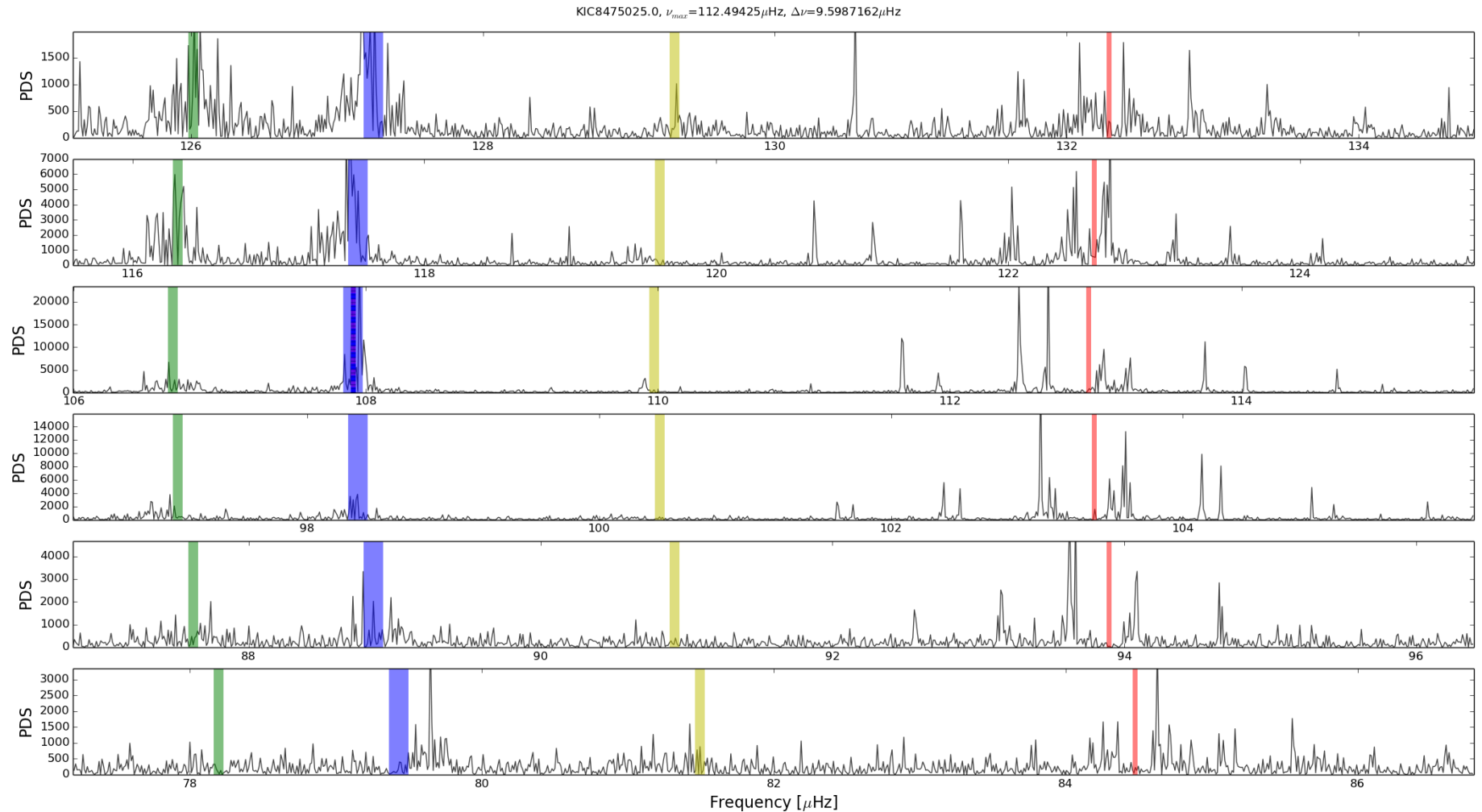


- Max. Splitting = core dominated

- What you see = what you get
 $\ell=1$ ($\ell=2$)



Complicated Splittings

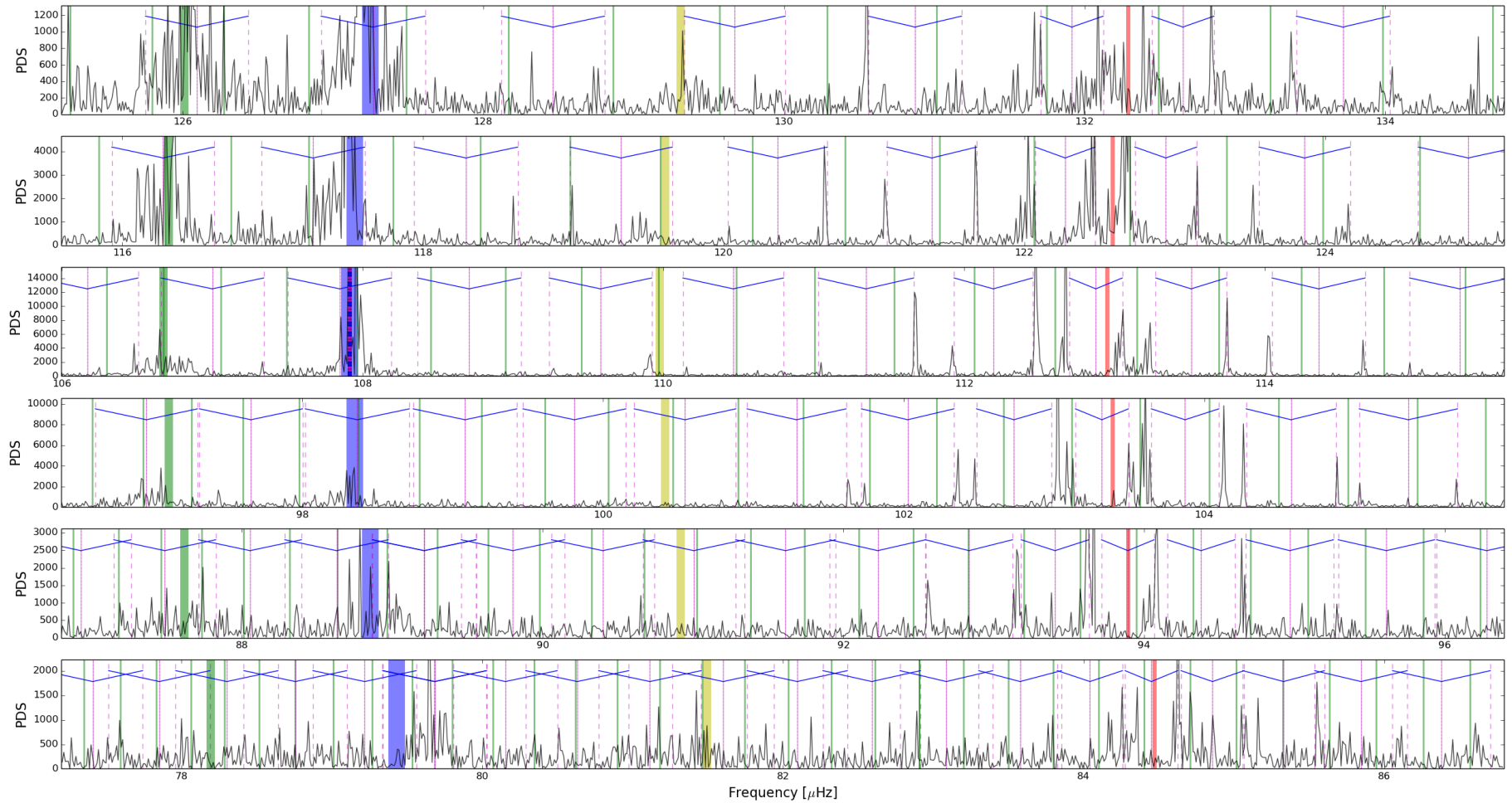


Mode identification, following: Mosser et al. 2012, A&A 548, 10

Beck et al. 2013, PhD thesis

Complicated Splittings

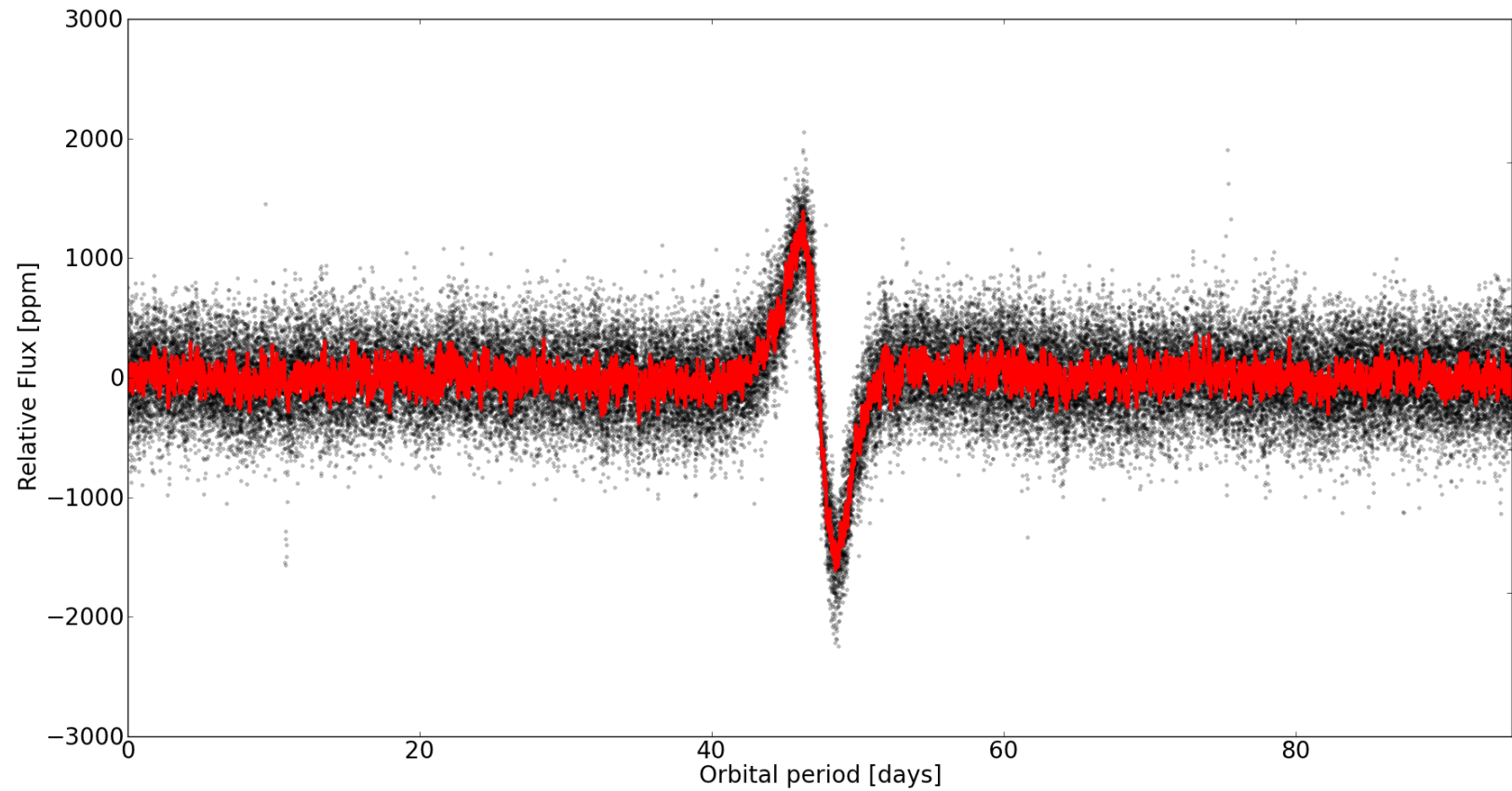
KIC8475025: $\nu_{max} = 107.914 \mu\text{Hz}$, $\Delta\nu = 9.599 \mu\text{Hz}$, $\delta\nu = 1.237 \mu\text{Hz}$, $\Pi_1 = 74.480 \text{sec}$, $q = 0.150$, $\delta f_{max} = 0.35 \mu\text{Hz}$



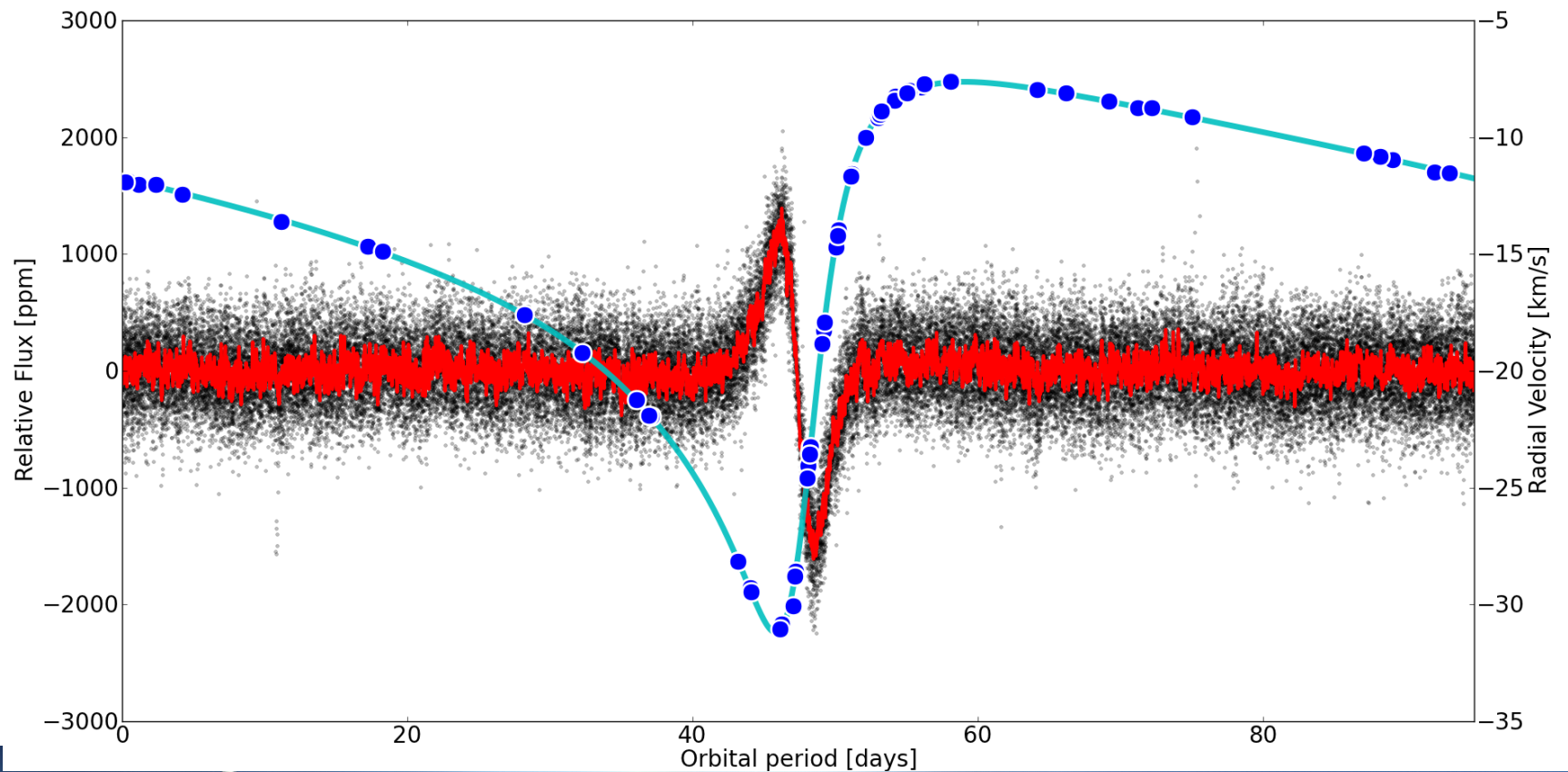
Mode identification, following: Mosser et al. 2012, A&A 548, 10

Beck et al. 2013, PhD thesis

Eccentric RG Binaries



Eccentric RG Binaries

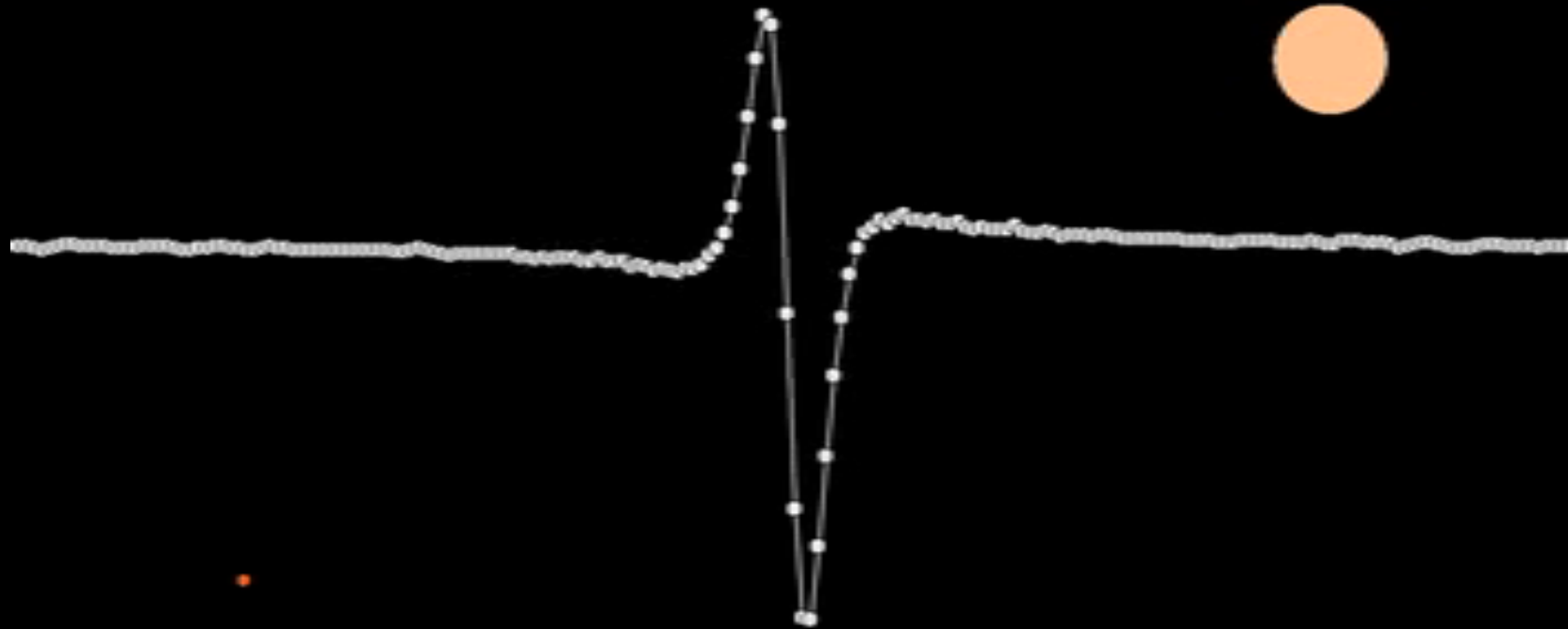


Asteroseismic analysis

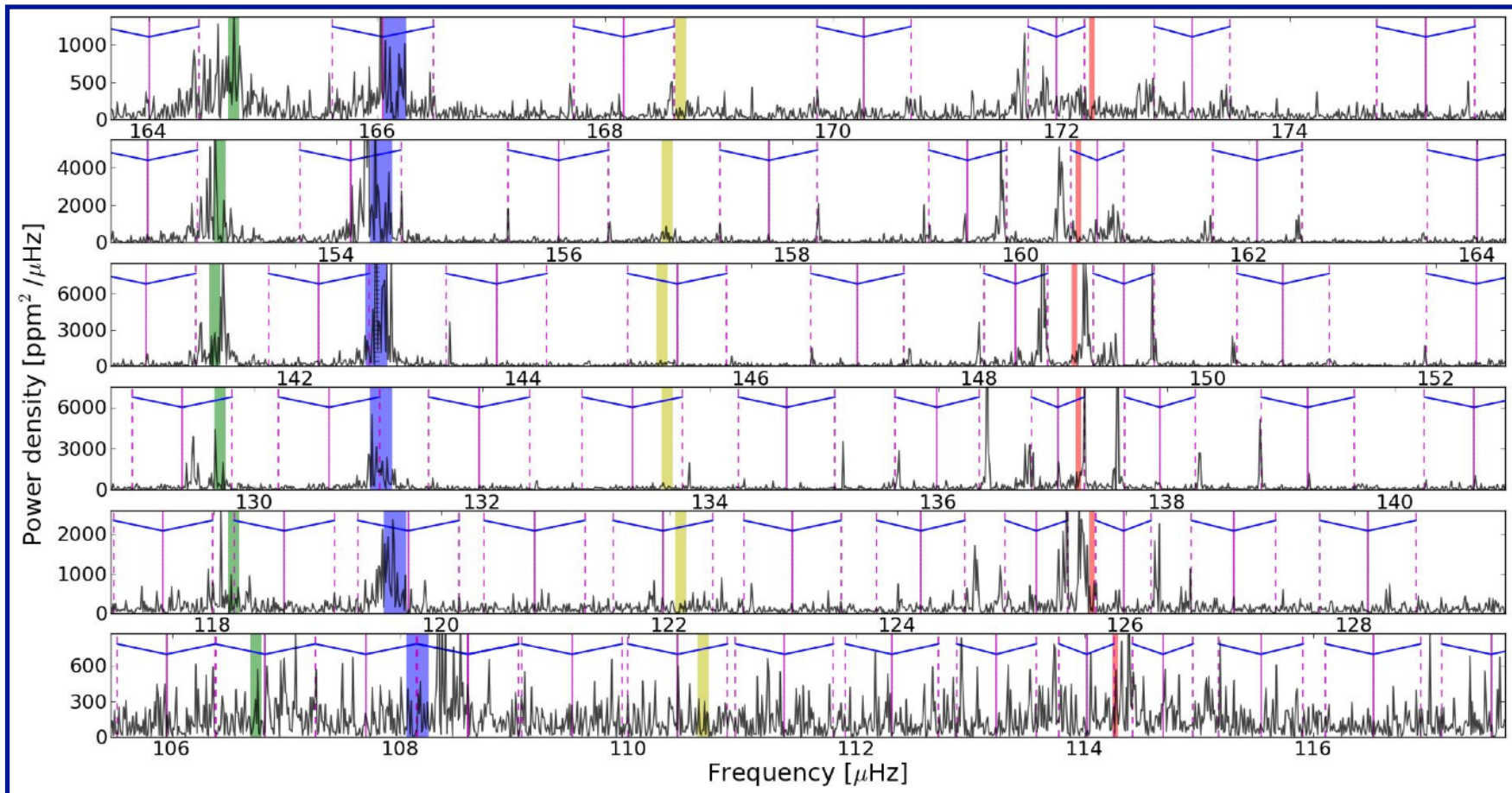
Light curve modelling

Binary evol. (sdb?, CV?)

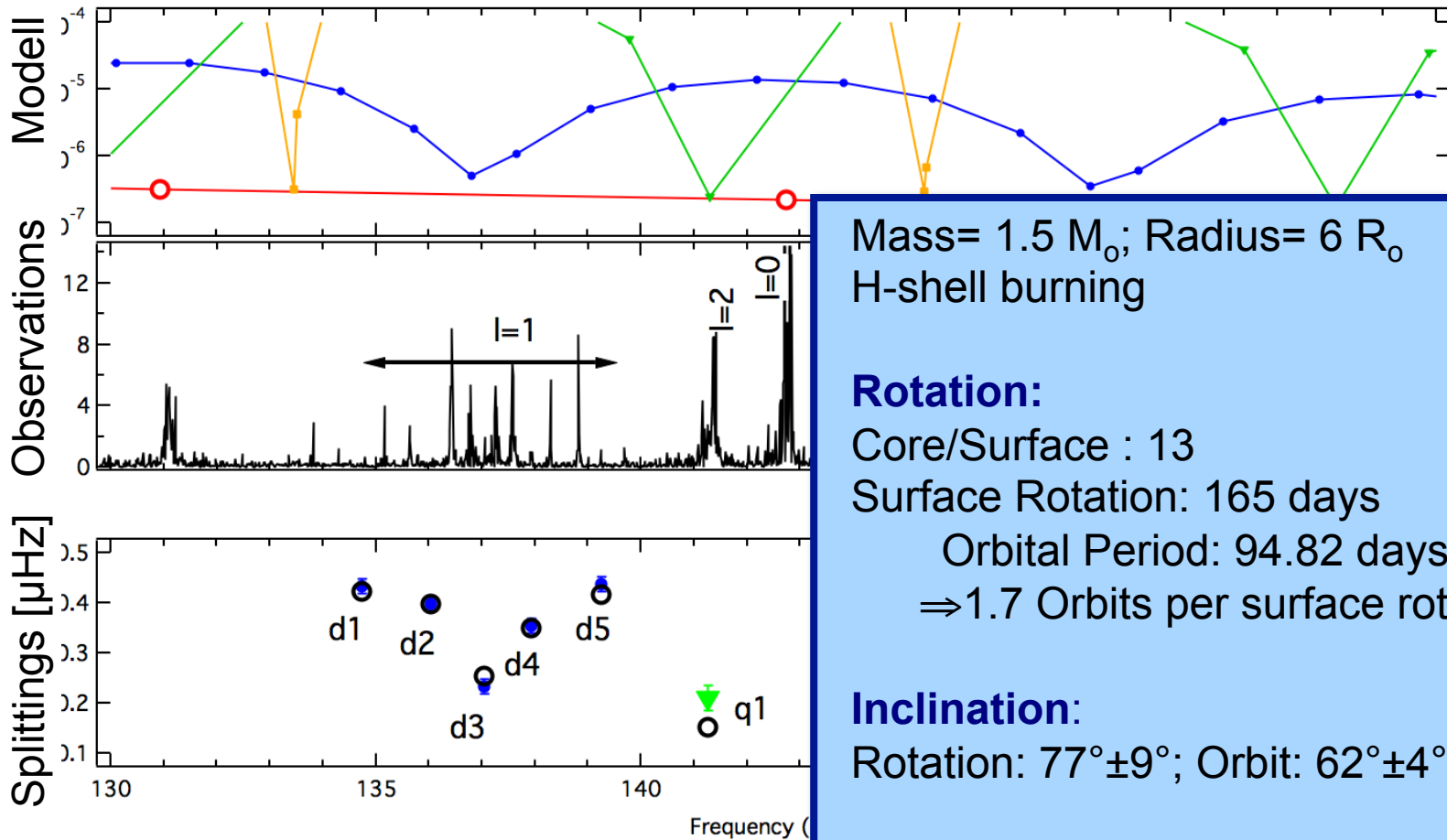
Eccentric Binary Systems



Oscillation power excess



Rotational Profile



Mass= $1.5 M_{\odot}$; Radius= $6 R_{\odot}$
H-shell burning

Rotation:

Core/Surface : 13

Surface Rotation: 165 days

Orbital Period: 94.82 days

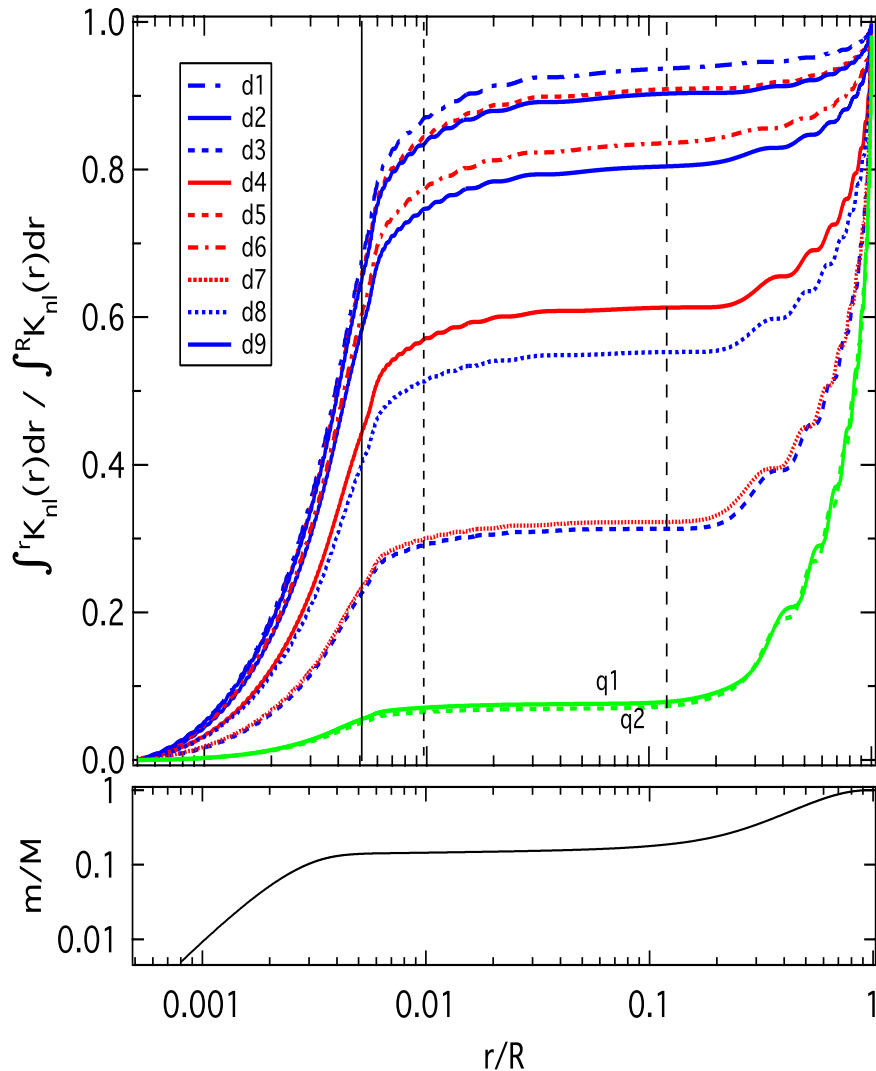
$\Rightarrow 1.7$ Orbits per surface rotation

Inclination:

Rotation: $77^{\circ} \pm 9^{\circ}$; Orbit: $62^{\circ} \pm 4^{\circ}$

The puzzle of Doppler beaming

Future (&) Challenges



Core well constrained.

Form of **rotational gradient**?

? *Splittings* \leftrightarrow *Rotation*? 1st order?

? $\ell=2$, Lifetime, Mixed mod. ($\ell=1,2$)

? **Asymmetries** of splittings

? Mode interaction

Inclination:

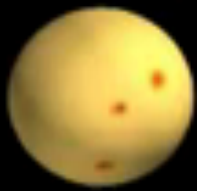
? **Degeneracy**: i vs δf in fit

? **Equipartition** of mode energy

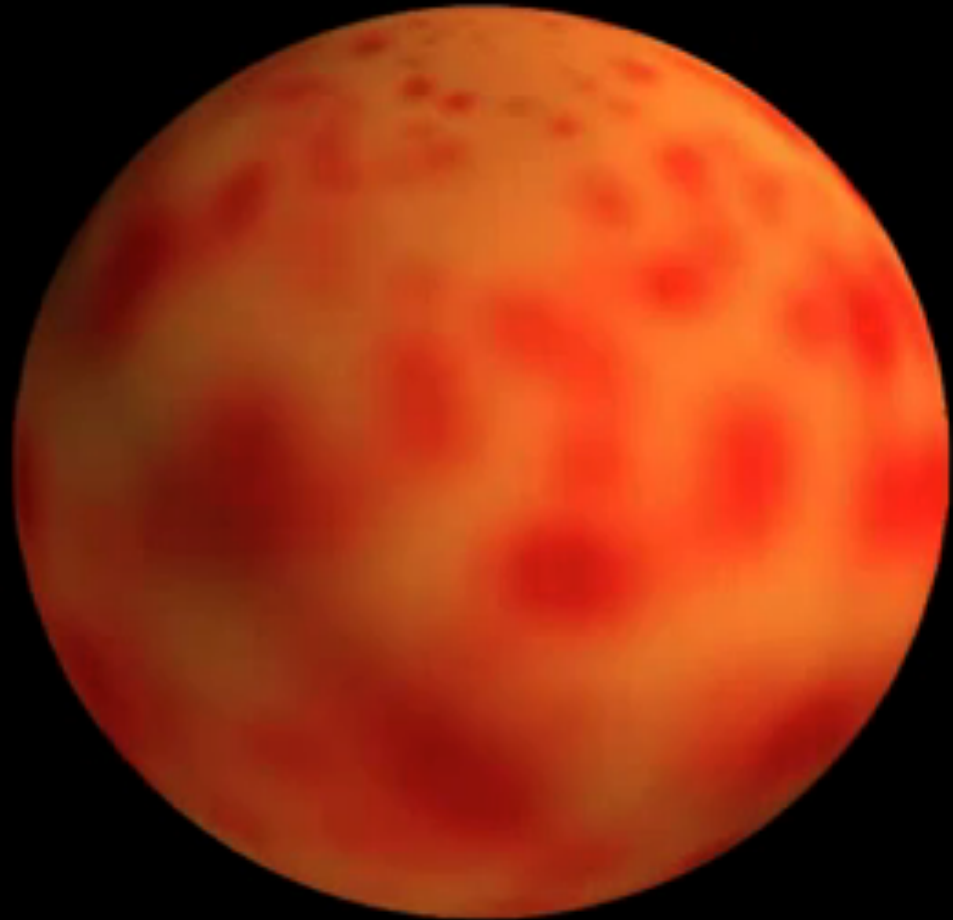
Rewards:

? Rotation on **higher RGB**

? Additional constraints: **Surface**



The Sun



Red Giant

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KU.Leuven, Belgium