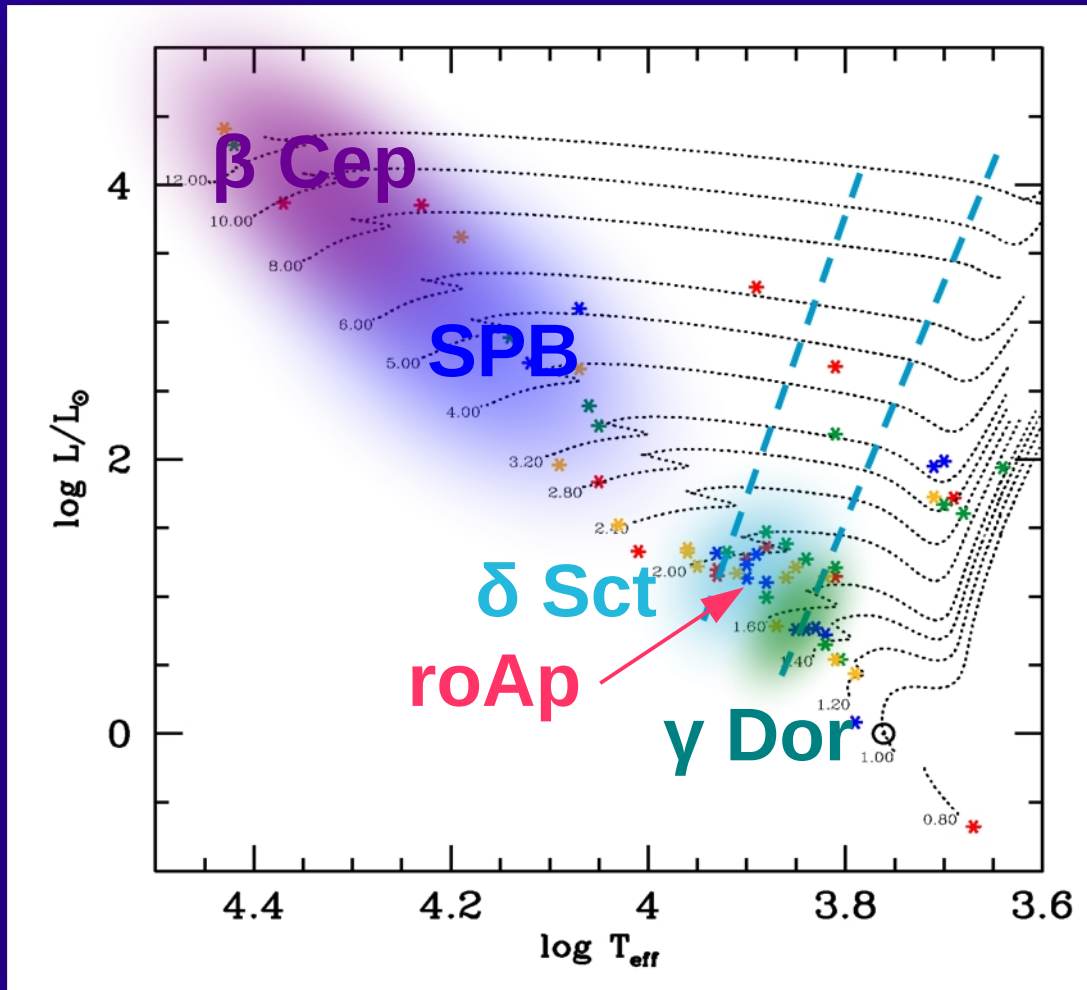


Tests of stellar interiors physics with classical pulsators

Maryline Briquet

ULg, Belgium

Tests of stellar interiors physics with classical pulsators



Part I:
EXCITATION

Part II:
FITTING MODES

Asteroseismic inferences for O-B and A-F stars on the main sequence

Part I: EXCITATION

Observed \leftrightarrow theoretically predicted

- instability domains
- oscillation modes

EXCITATION

O-B stars: OPACITY

Observed lowest frequency mode not theoretically explained in several hybrids

e.g. Pamyatnykh et al. 2008; Desmet et al. 2009; also Briquet et al. 2011 for a O9V star

B pulsators in Magellanic Clouds (SMC: $Z \sim 0.0024$)

Karoff et al. 2008; Diago et al. 2008; Sarro et al. 2009

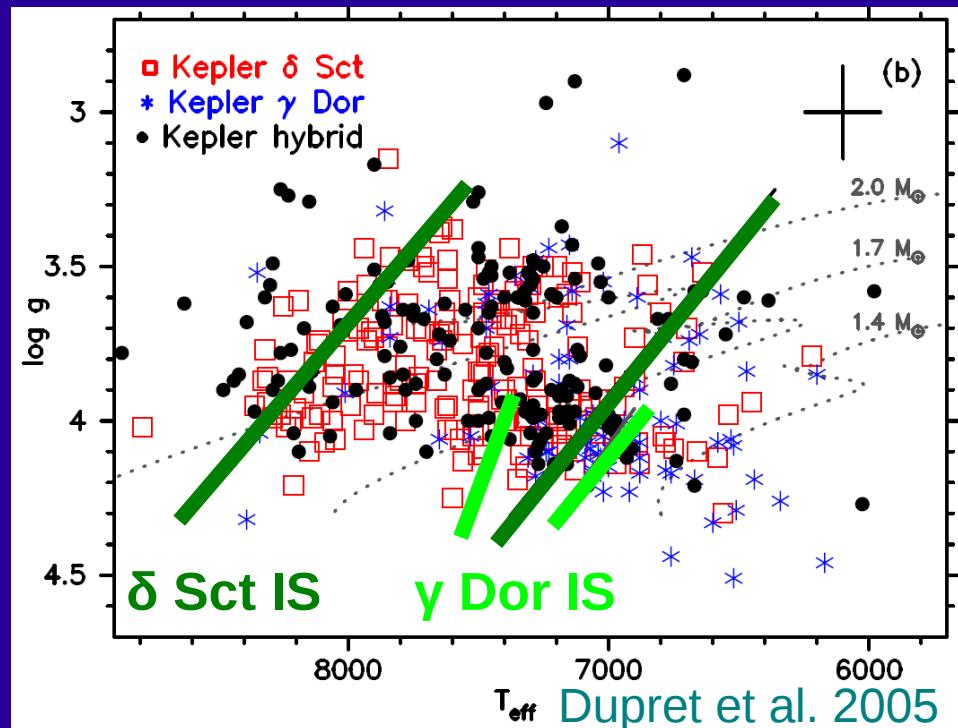
Solution?

Stellar opacity due to Ni underestimated by a factor 2

Salmon et al. 2012; Turck-Chièze & Gilles 2013

EXCITATION

A-F stars: CONVECTION



Uytterhoeven et al. 2011, also Hareter and collaborators for CoRoT data

Revision of heat-engine excitation mechanisms?

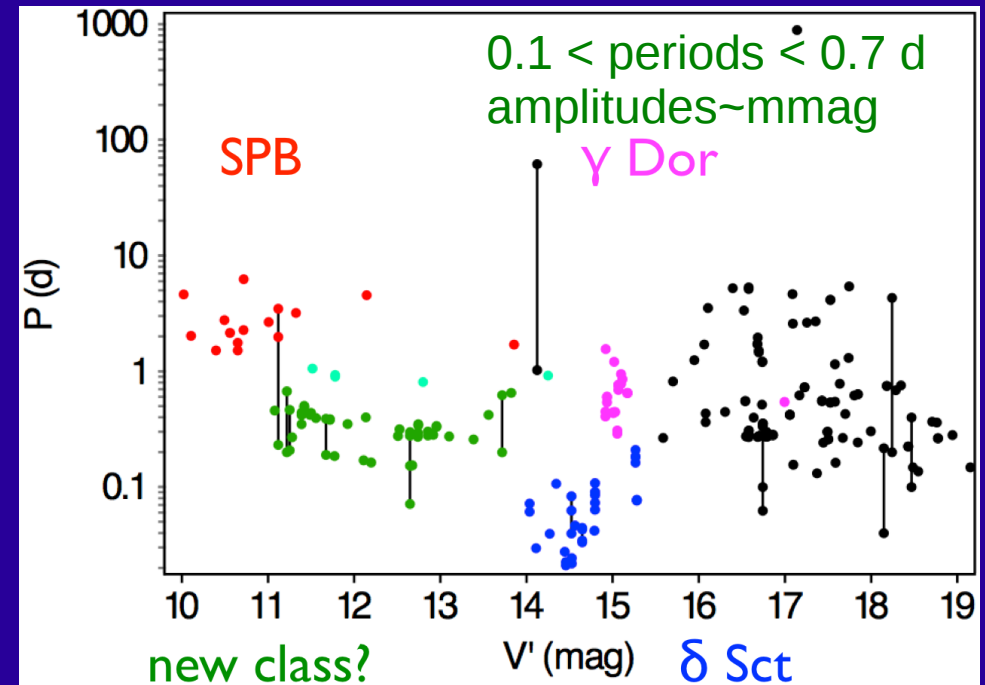
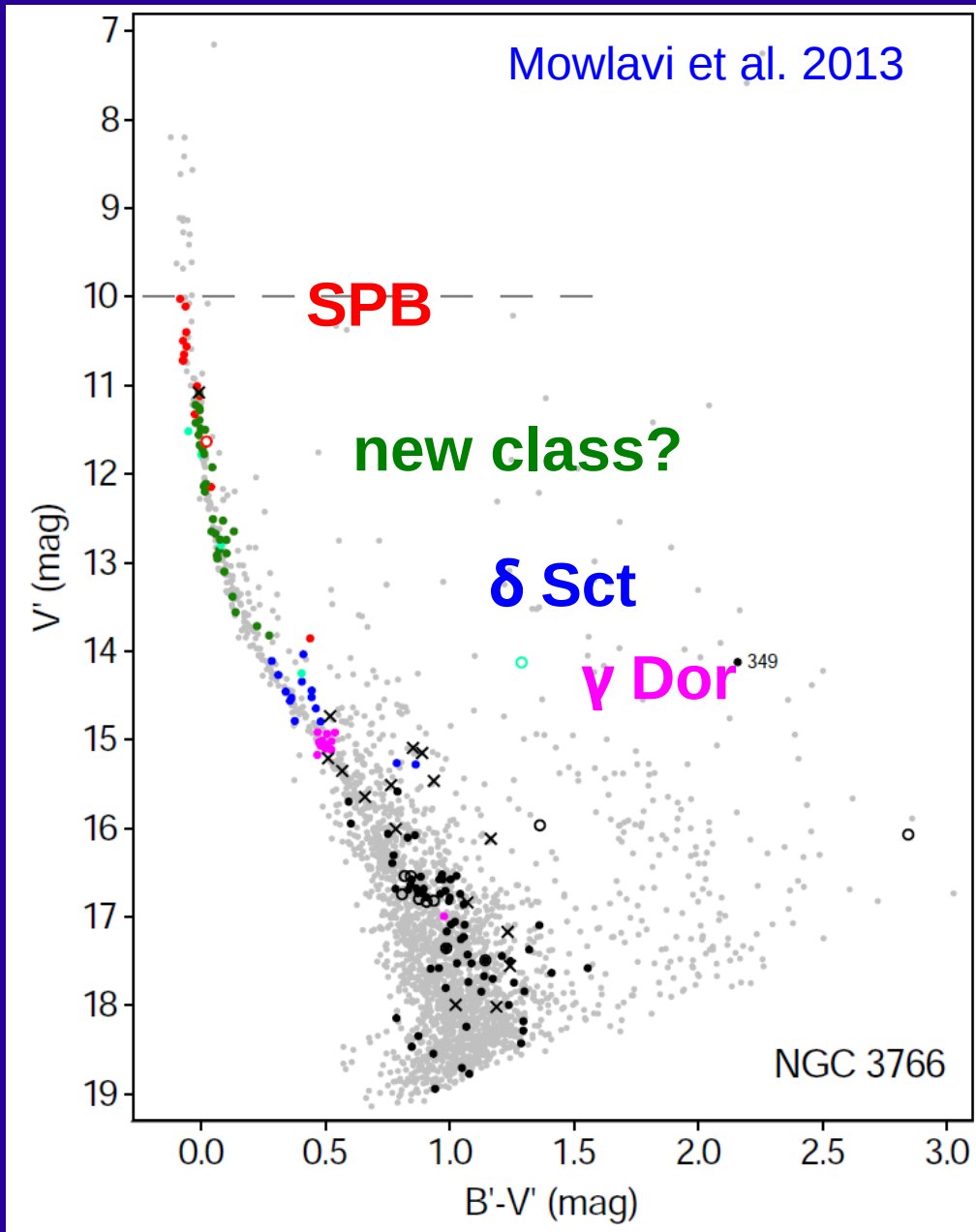
e.g. coupling convection-pulsation

Stochastically excited g modes?

Talk Stéphane Mathis

EXCITATION

Low amplitude variable A and late B-type stars



High rotation

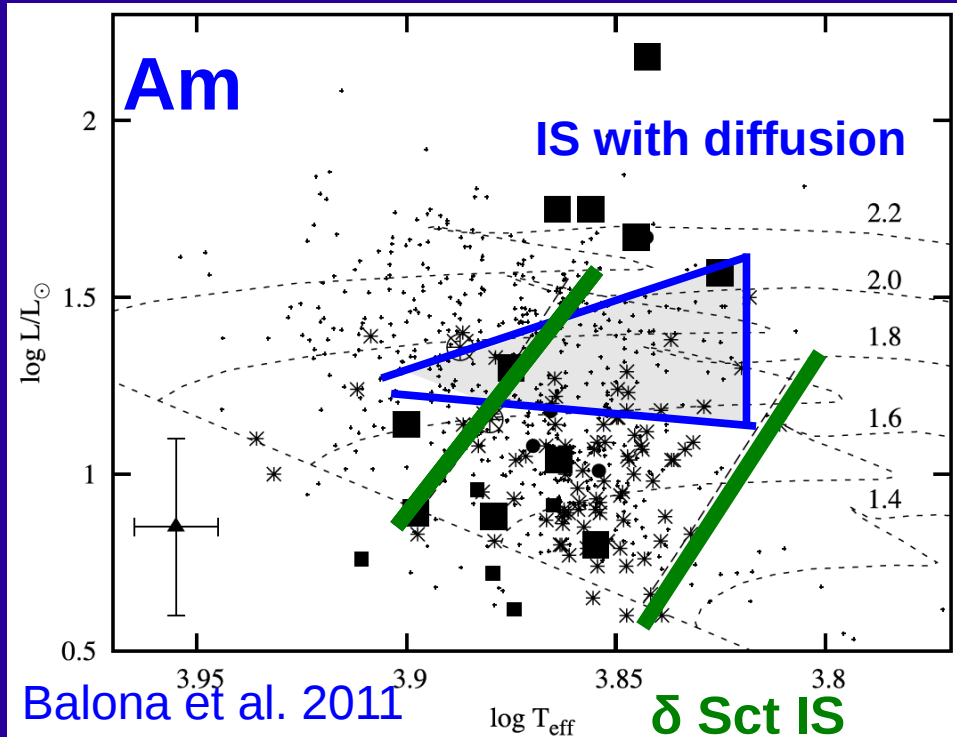
κ mechanism?

Stochastic excitation?

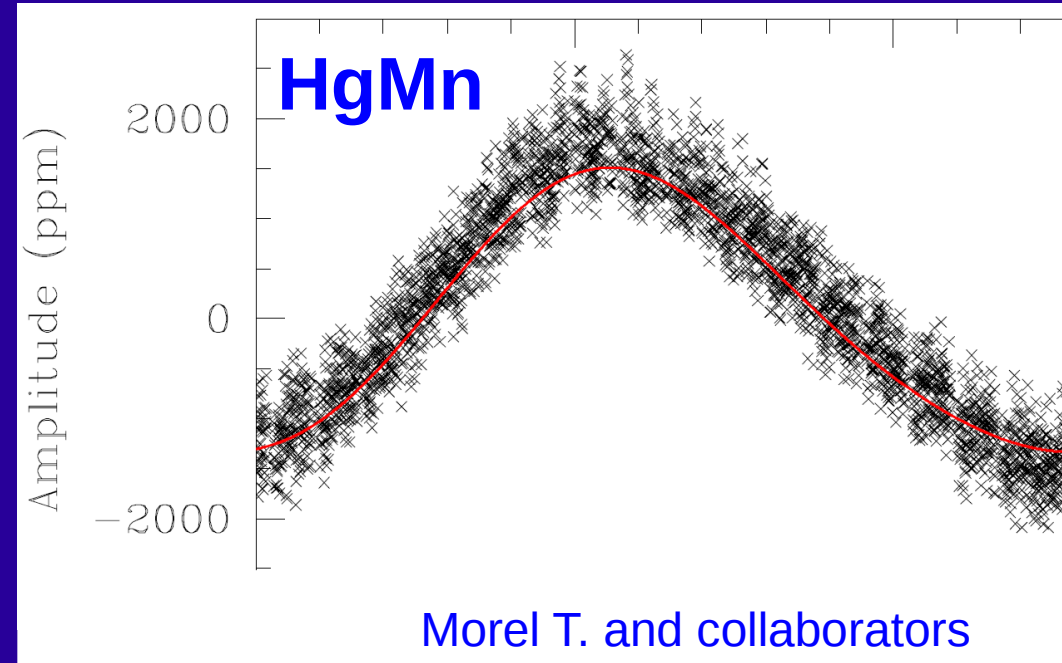
EXCITATION

Chemically peculiar stars: DIFFUSION

A-type δ Sct Kepler



B-type SPB CoRoT



Young Am stars also pulsate HgMn stars do not pulsate

Not reproduced by current models including diffusion

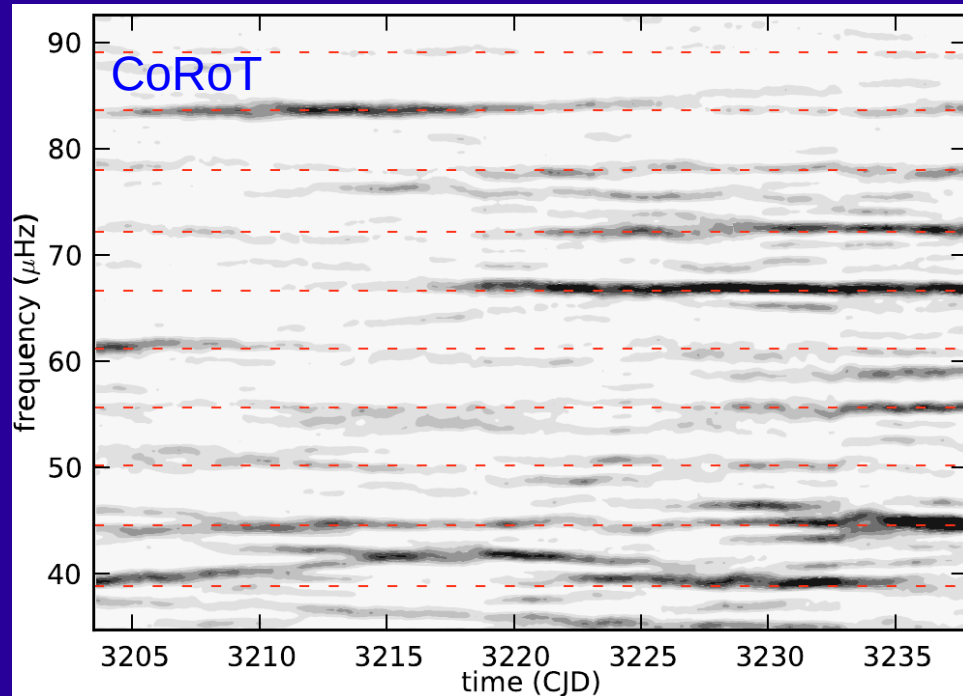
EXCITATION

Solar-like oscillations: (near-) surface CONVECTIVE layers

B-type star β Cep

Belkacem et al. 2009

CoRoT



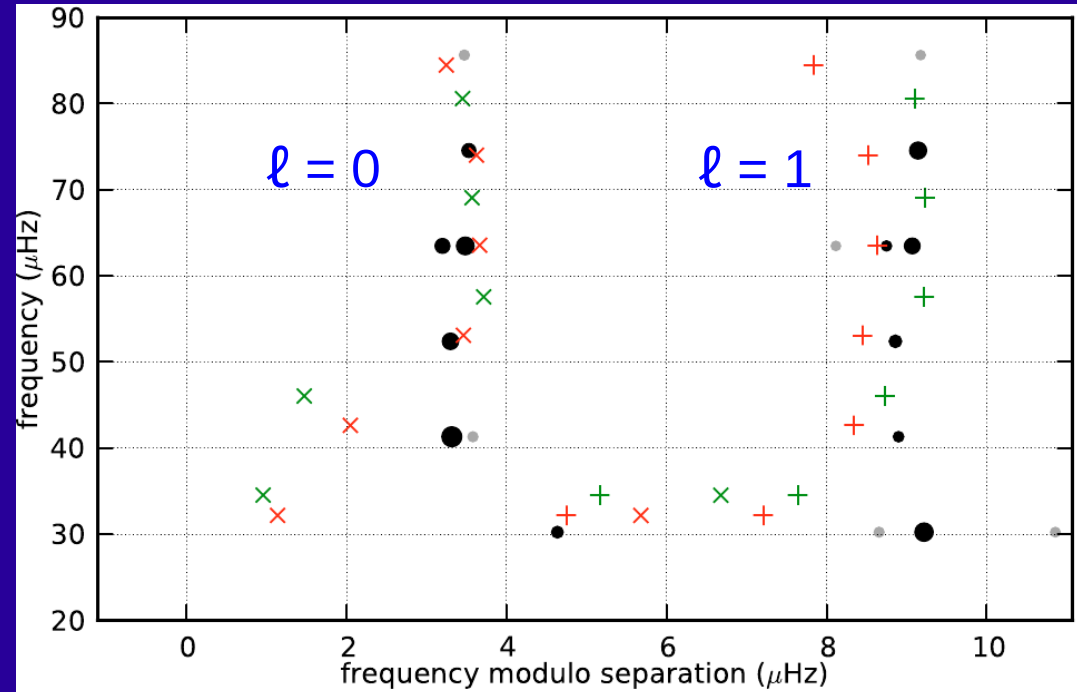
Degroote et al. 2010

O-type star

A-type star δ Sct

Antoci et al. 2011

Kepler



Cantiello et al. 2009; Belkacem et al. 2010

EXCITATION

roAp stars

**Do we really understand
what drives the oscillations in roAp stars?**

Talk Margarida Cunha

Asteroseismic inferences for B stars on the main sequence

Part II: FITTING MODES

Fitting individual frequencies β Cep

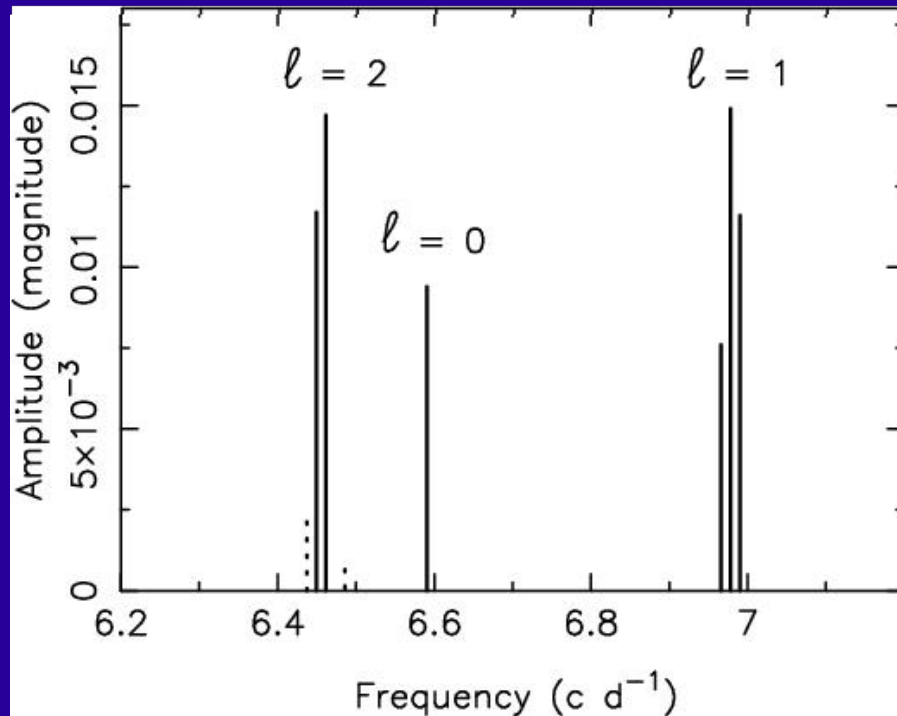
Fitting of group of frequencies Be

Use of period spacings SPB

FITTING INDIVIDUAL MODES

β Cep pulsators: CORE OVERSHOOTING and INTERIOR ROTATION

Aerts et al. 2003



A few observed modes with
mode identification $\rightarrow \alpha_{\text{ov}}$

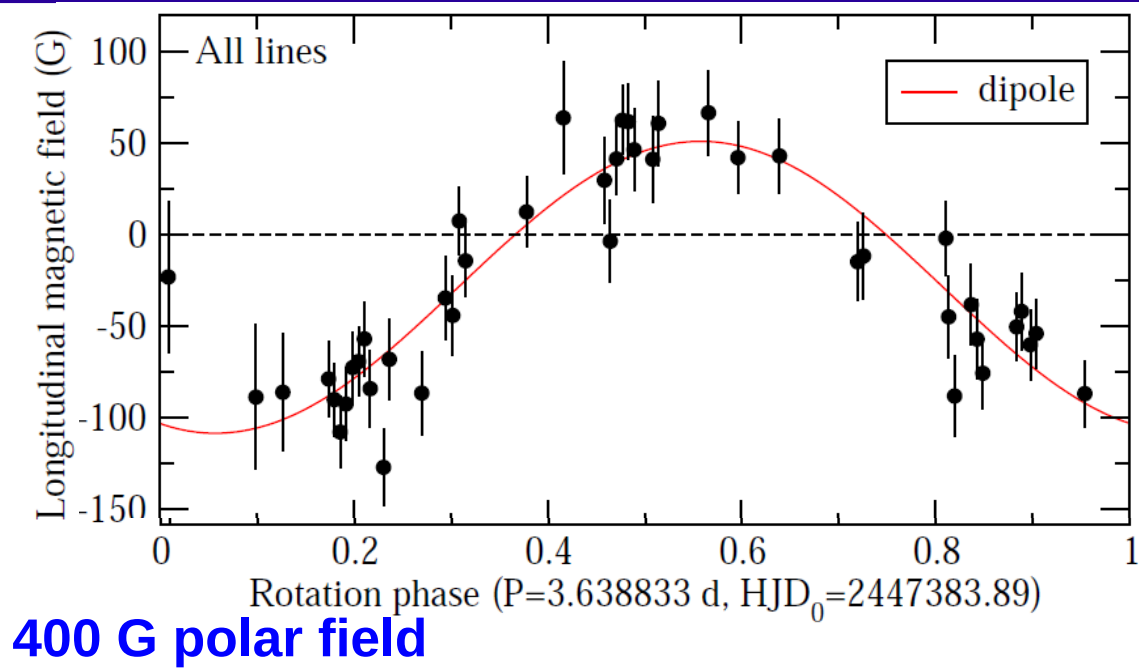
Two rotational multiplets
 \rightarrow rigid rotation ruled out

With intensive ground-based data:
HD 129929, ν Eri, 12 Lac, θ Oph, ...

FITTING INDIVIDUAL MODES

B pulsators: MAGNETIC FIELD and MIXING

Neiner et al. 2012a



Briquet et al. 2012

A few modes
+
Rotation period



Magnetic field



$$\alpha_{\text{ov}} = 0.07 \pm 0.08 H_p$$

Talk Coralie Neiner

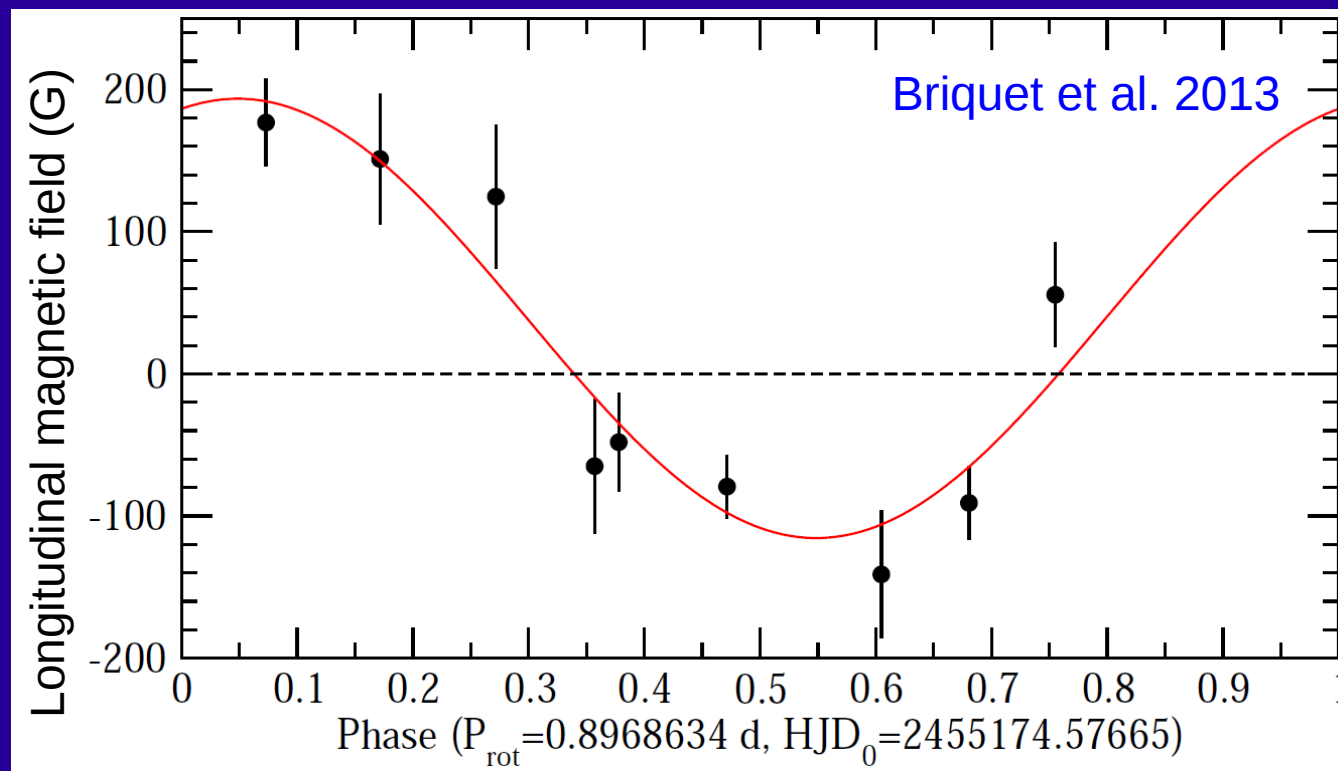
FITTING INDIVIDUAL MODES

B pulsators: MAGNETIC FIELD and MIXING

Gravito-inertial and pressure modes in a B pulsator
observed by CoRoT

Pápics et al. 2012

+ magnetic field



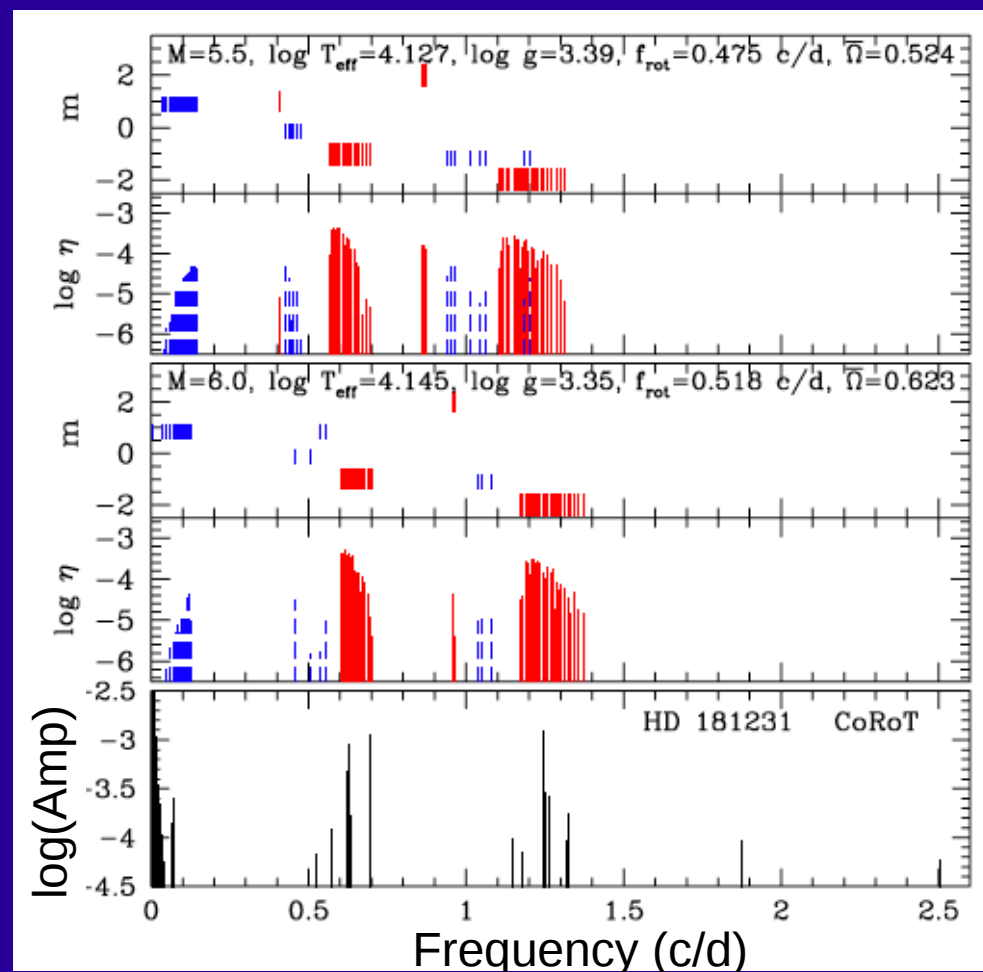
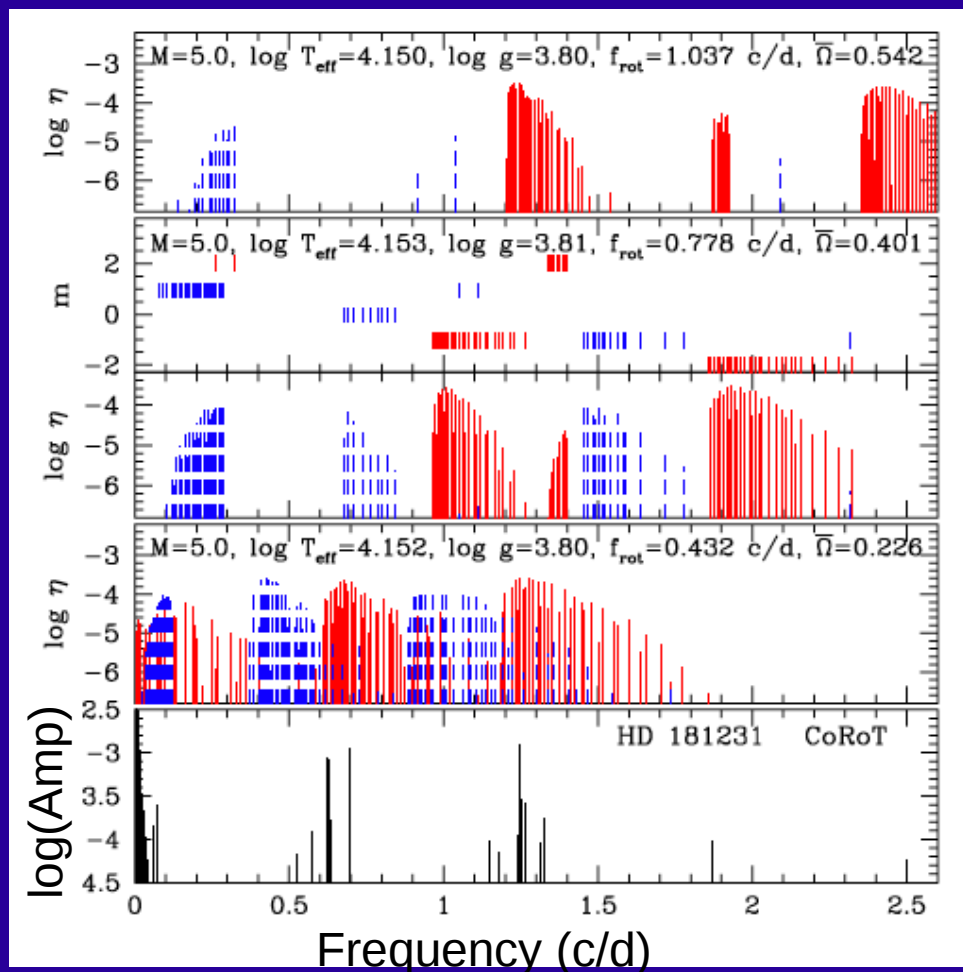
FITTING GROUP OF MODES

Be pulsators as laboratory of MIXING processes

Standard

Neiner et al. 2012b

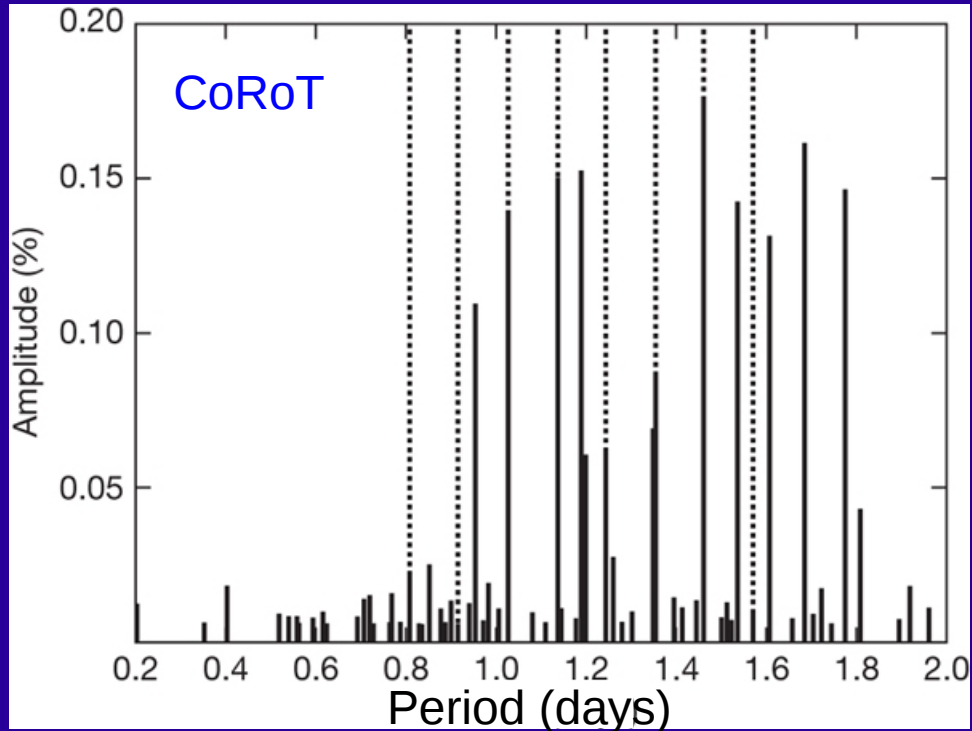
Non-standard



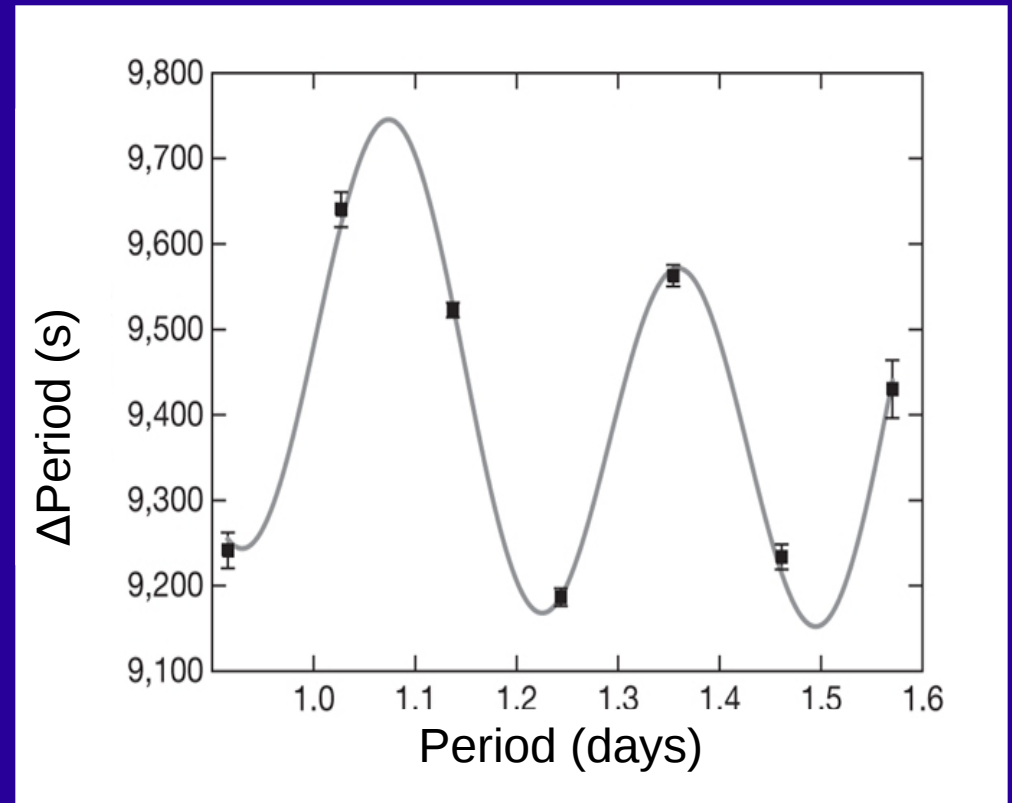
Extra mixing of $\alpha_{\text{ov}} = 0.35 H_p$

PERIOD SPACINGS OF G-MODES

SPB stars: NEAR-CORE REGION



Degroote et al. 2010



Deviations from uniform period spacing
→ **chemically inhomogeneous region around core**

Miglio et al. 2008

Tests of stellar interiors physics with classical pulsators

Maryline Briquet

ULg, Belgium