# The β Cephei star HD 180642 (V1449 Aql): full integration of CoRoT and ground data for mode identification and interpretation

Maryline Briquet
and many collaborators

KATHOLIEKE UNIVERSITEIT
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CoRoT
LIGHT CURVE

LRc1

GROUND-BASED
MULTICOLOUR
PHOTOMETRY

M. Paparó, J.M. Benkő,
Zs. Bognár, P.J. Amado,
S. Martín-Ruiz, E. Poretti,
C. Aerts, IvS/Leuven observers

GROUND-BASED
HIGH-RESOLUTION
SPECTROSCOPY

E. Poretti, K. Uytterhoeven,
F. Carrier, J. Gutièrrez-Soto,
M. Rainer, P. Mathias, J.-C. Valtier

Poster by Uytterhoeven et al.

BEFORE CoRoT

Hipparcos photometry:
   new candidate β Cephei star
   $f = 5.4871 \ d^{-1}$ Waelkens et al. (1998)

7-colour Geneva photometry:
   large amplitude (39 mmag in V filter)
   radial mode   Aerts (2000)

MODELLING OF CoRoT LIGHT CURVE

* Traditional linear sum-of-sines

* A sum-of-sines where combination frequencies are identified and fixed

* A sum-of-sines with (periodically) modulated amplitudes and phases for the dominant mode

Poster by Degroote et al.

MODELLING OF CoRoT LIGHT CURVE

* Traditional linear sum-of-sines

Preferred
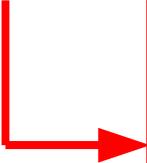
* A sum-of-sines where combination frequencies are identified and fixed

* A sum-of-sines with (periodically) modulated amplitudes and phases for the dominant mode

Poster by Degroote et al.

CoRoT FREQUENCY SPECTRUM

11 independent frequencies
22 combination frequencies
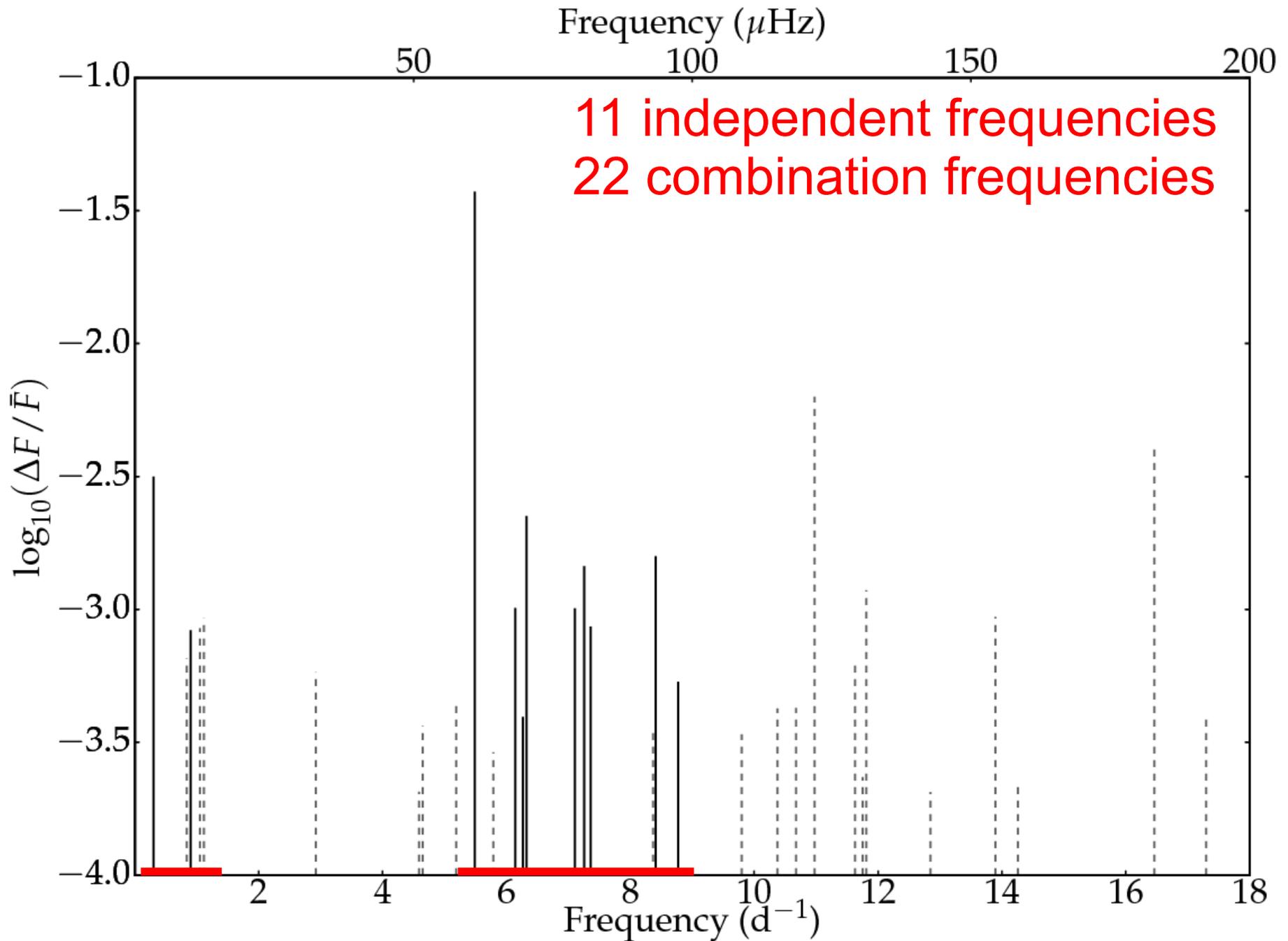
NONLINEAR RESONANT MODE COUPLING

* Sum-of-sines where low-order combination frequencies are fixed

* Phase locking for several frequencies

* Modulated behaviour of the amplitudes and phases of some frequencies and combination frequencies

FREQUENCY DECREASE OF THE DOMINANT MODE

0.02 second per year

Total time span of 18 years
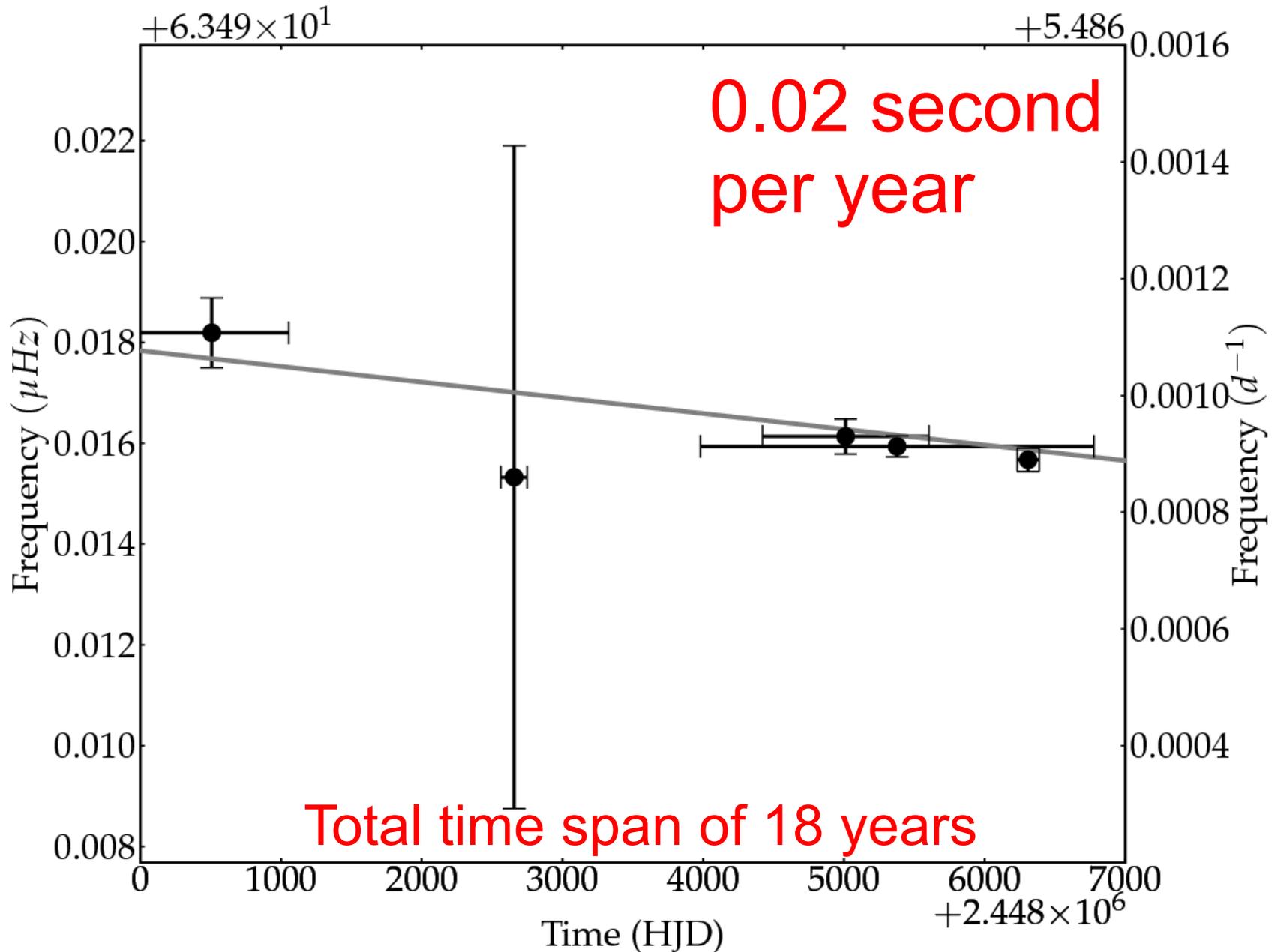
STELLAR PARAMETERS AND CHEMICAL ABUNDANCES

$T_{eff} = 24\ 500 \pm 1000$ K, log g = 3.45 ± 0.15 dex

	HD 180642	Sun 1-D	Sun 3-D
He/H	0.088±0.018 (4)	0.085±0.001	0.085±0.002
log ϵ(C)	8.21±0.10 (9)	8.52±0.06	8.39±0.05
log ϵ(N)	8.00±0.19 (21)	7.92±0.06	7.78±0.06
log ϵ(O)	8.53±0.14 (25)	8.83±0.06	8.66±0.05
log ϵ(Ne)	7.87±0.15 (6)	8.08±0.06	7.84±0.06
log ϵ(Mg)	7.34±0.20 (1)	7.58±0.05	7.53±0.09
log ϵ(Al)	6.22±0.15 (3)	6.47±0.07	6.37±0.06
log ϵ(Si)	7.19±0.19 (7)	7.55±0.05	7.51±0.04
log ϵ(S)	7.10±0.34 (4)	7.33±0.11	7.14±0.05
log ϵ(Fe)	7.34±0.21 (21)	7.50±0.05	7.45±0.05
[N/C]	−0.21±0.22	−0.60±0.09	−0.61±0.08
[N/O]	−0.53±0.24	−0.91±0.09	−0.88±0.08
Z	0.0099±0.0016	0.0172±0.0012	0.0124±0.0007

Mild nitrogen excess

Thierry Morel, Karolien Lefever, Ewa Niemczura

GROUND-BASED MULTICOLOUR PHOTOMETRY
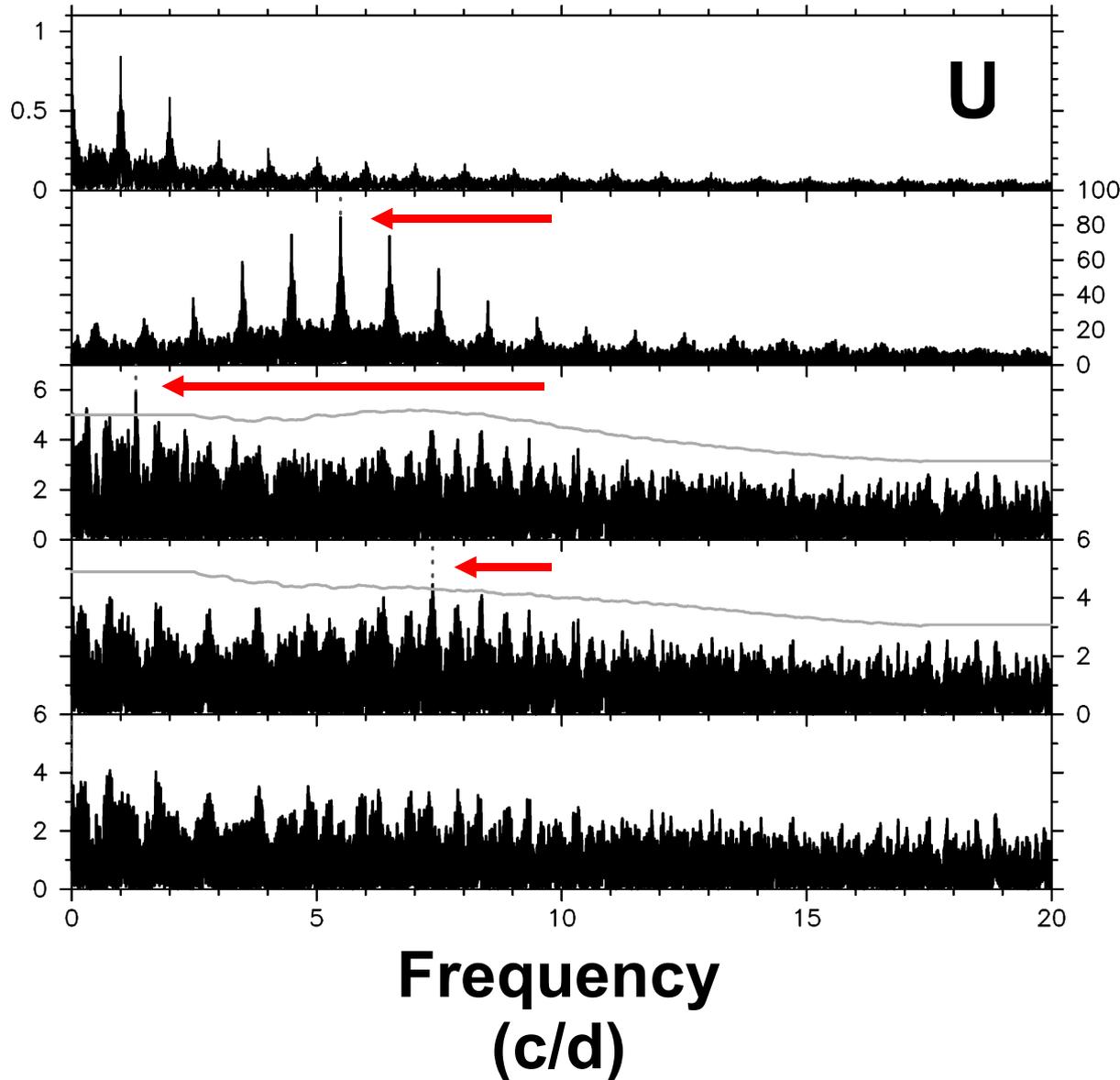
* f_1 = 5.4869 d^{-1}

82.8 mmag

+ 2f_1 + 3f_1

* f_2 = 0.3082 d^{-1}

5.2 mmag

* f_3 = 7.3667 d^{-1}

4.6 mmag

Katrien Uytterhoeven, Conny Aerts

PHOTOMETRIC MODE IDENTIFICATION
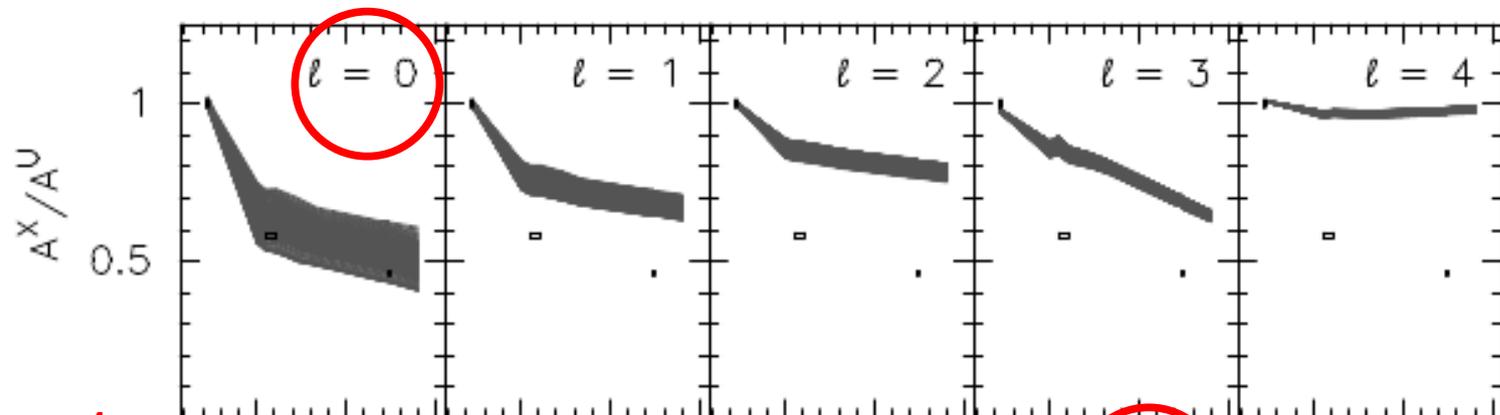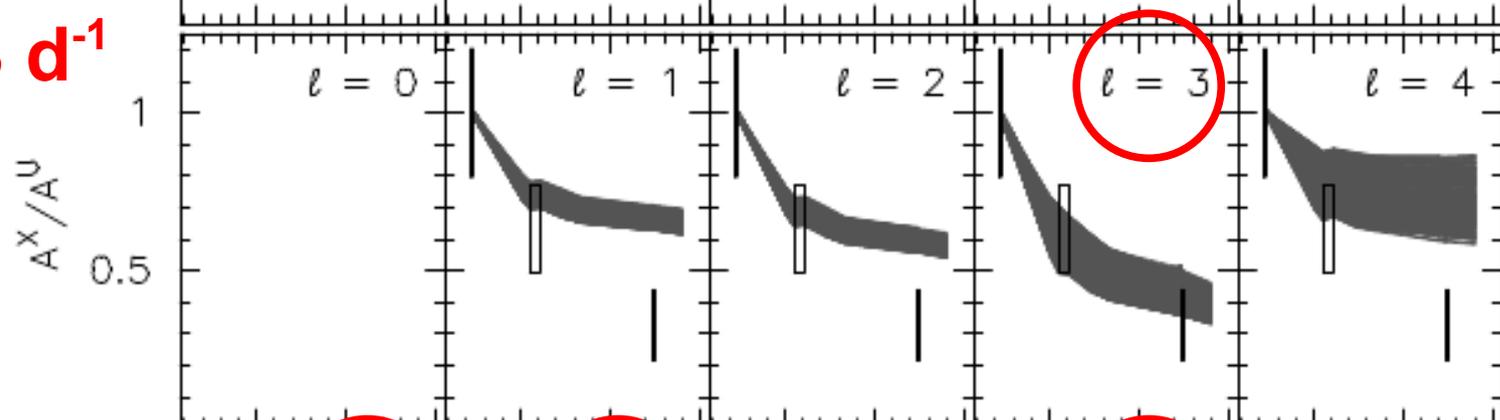
Maryline Briquet, Peter De Cat
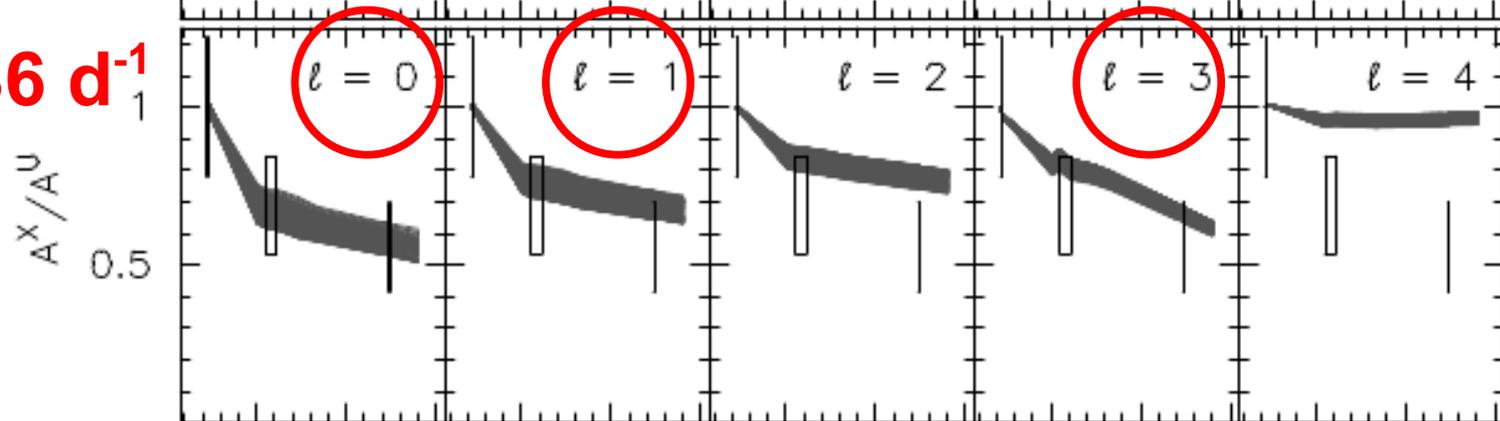
CONSTRAINTS FOR ASTEROSEISMIC MODELLING

* Frequency spectrum:
    11 independent frequencies
    + 22 combination frequencies

* Nonlinear resonant mode coupling

* Frequency decrease of the dominant mode:
    2 seconds per century

* T_{eff} = 24 500 K, log g = 3.45 dex

* Degree ℓ for 3 modes

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