What do CoRoT data reveal about delta Scuti stars?

HD181555

E. Michel, E. Poretti, R. Garrido, L. Lefevre, L. Mantegazza, E. Rodriguez, CoRoT Builders, …
> What is below $10^{-4}$ amplitudes?: How many peaks? Which distribution in amplitude? → mecanism ruling amplitudes?

> Do we see very high l in photometry?

> Do we see specific features in the frequency distribution? → perturbative vs nonperturbative approaches?

> Do amplitudes and/or phase vary on time scales of 150 days?

> Are there constant A-stars at the ppm level?
HD181555- The CoRoT data:

- 156 days of data
- 91% effective duty cycle

Analysis/nonlinear sinewave fitting

Fitting ~100 peaks

Fitting ~2000 peaks
Analysis/nonlinear sinewave fitting

- Fitting ~100 peaks
- Fitting ~2000 peaks

- mV = 9.1
- $V_{sini} \approx 50$
Spectroscopic data Analysis:

688 spectrograms (FEROS, FOCES, SOPHIE) -> mean profile (LSD code (Donati et al. 97)) -> analyse variations across mean profile (FAMIAS code (Zima 2008))

74 peaks detected (68 compatibles)

\[ \text{i} \sim 75\text{deg} \]
Peaks density in frequency:

- $L \geq 7$
- $L \geq 6$
- $L \geq 4$
Distribution of the amplitudes:

\[ n \propto a^\beta \]

\[ \beta \sim -1 \]
Search for specific features in frequency:

- **1272 peaks**
  - $\nu > 80\mu\text{Hz}, \text{all}$

- **855 peaks**
  - $\nu > 80\mu\text{Hz}, a > 10^{-5}$

- **377 peaks**
  - $\nu > 80\mu\text{Hz}, a > 2 \times 10^{-5}$

Search for Pairs
(resolution 0.5$\mu$Hz)
Search for Pairs
(resolution 0.5μHz)

1272 peaks $\nu>80\mu$Hz, all

855 peaks $\nu>80\mu$Hz, $a>10^{-5}$

377 peaks $\nu>80\mu$Hz, $a>2\times10^{-5}$
Search for specific features in frequency:

1272 peaks
\( \nu > 80 \mu \text{Hz}, \text{all} \)

855 peaks
\( \nu > 80 \mu \text{Hz}, a > 10^{-5} \)

377 peaks
\( \nu > 80 \mu \text{Hz}, a > 2 \times 10^{-5} \)
Search for specific features in frequency:

- 136 peaks
  \[ \nu > 80 \mu \text{Hz}, a > 10^{-5} \]

- 377 peaks
  \[ \nu > 80 \mu \text{Hz}, a > 2 \times 10^{-5} \]

- 1272 peaks
  \[ \nu > 80 \mu \text{Hz}, \text{all} \]

Search for signature of 'chaotic modes'
In the distribution of consecutive separations

Lignières & Georgeot 08
PhysRevE78,
Stability of frequencies and amplitudes:

3 consecutive subsets of 50 days:

Comparison of the analysis output differences (200 peaks)
Subset1-Subset3: in frequency; in amplitudes

Amplitudes:
At high amp: some higher than 3-σ level
But NB: $\Delta a/a \sim 10^{-5}-10^{-4}$ !!!!

Frequencies:
At high amp.: $\Delta \nu/\nu \ (< 1-\sigma$ level $)$ and $\sim 10^{-5}-10^{-4}$ i.e. $\Delta \nu \sim 10^{-9}-10^{-8}$ Hz !!!!
At low amp.: $\Delta \nu/\nu \sim 10^{-2}-10^{-1}$ ($>> 1-\sigma$ level)
i.e. $\Delta \nu \sim 10^{-6}-10^{-5}$ Hz $\Rightarrow$ misidentification
Delta Scuti stars observed with CoRoT

- What is below 10^-4 amplitudes?: How many peaks? Which distribution in amplitude? → mechanism ruling amplitudes?
- Do we see very high I in photometry?
- Do we see specific features in the frequency distribution? → perturbative vs nonperturbative approaches?
- Do amplitudes and/or phase vary on time scales of 150 days?
- Are there constant A-stars at the ppm level?

<table>
<thead>
<tr>
<th>Run</th>
<th>mV</th>
<th>Vsini</th>
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<tr>
<td>IR01</td>
<td>9.1</td>
<td>64</td>
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<td>LRa01</td>
<td>7.0</td>
<td>111</td>
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<tr>
<td>SRc01</td>
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<tr>
<td>SRc01</td>
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<td>125</td>
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<tr>
<td>LRc01</td>
<td>7.5</td>
<td>180</td>
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</tbody>
</table>

Amplitude Stability over 150d
Peaks density in frequency:

=> L >= 7
=> L >= 6
=> L >= 4