

DEVELOPMENT OF THE TASK 3: FREQUENCY COMPARISON

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- Why a Task 3?
- Codes available
- Some results
- Working plan

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Why a task 3?

Definition

In this task particular types of stellar pulsators are under study in order to quantify the uncertainty on the predicted seismic parameters for these stars. Asteroseismologic test of Task 1.



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Why a task 3?

One result in the literature: Nu Eridanis

Pamyatnikh, A. et al., 2004, MNRAS, 350, 1022

Ausseloos, M. et al., 2004, MNRAS, 355, 352

Suárez, J.C. et al., in preparation

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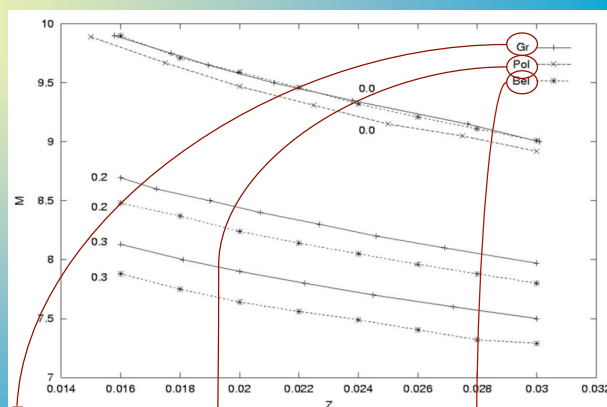
Why a task 3?

One result in the literature: Nu Eridanis

Models fitting:

$f_1 = 5.76327$
cycle/day

$f_2 = 5.6376$
cycle/day



GR=CESAM+GraCo

Bel= CLES+ Liège

Pol = Warsaw+NewJersey

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Why a task 3?

Where do these differences come from?

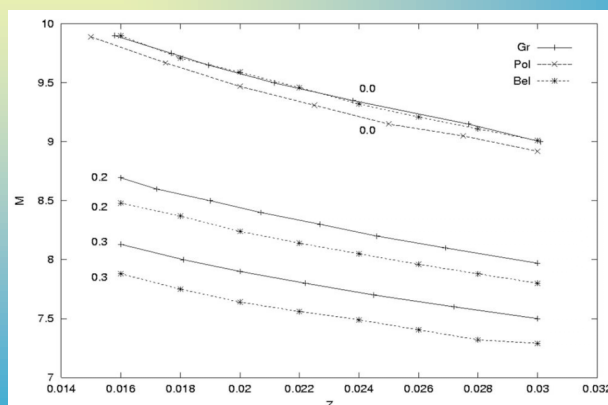
- Differences due to evolutionary codes
 - Intermediate interpolation
- Differences due to oscillation codes

???

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Why a task 3?

Differences Bel – Gr mainly due to overshooting treatment.



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Why a task 3?

Differences Bel – Gr mainly due to overshooting treatment.

With these type of comparisons we can test the physics included in each evolutionary code.

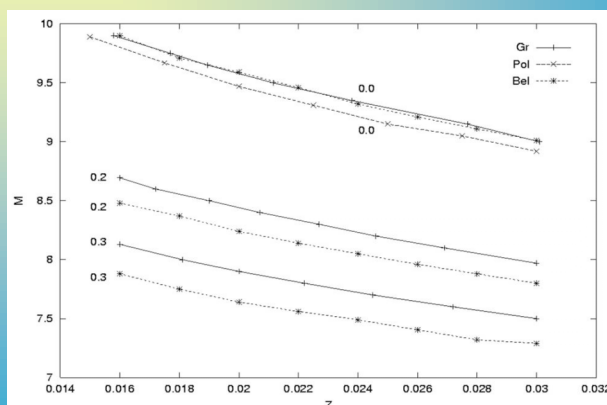
Different stellar types give information about different treatments

δ Scuti, γ Doradus $\Rightarrow$ Convection
 β Cephei and SPB $\Rightarrow$ overshooting
etc...

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Why a task 3?

Differences between Pol – (Bel, Gr) due to ???



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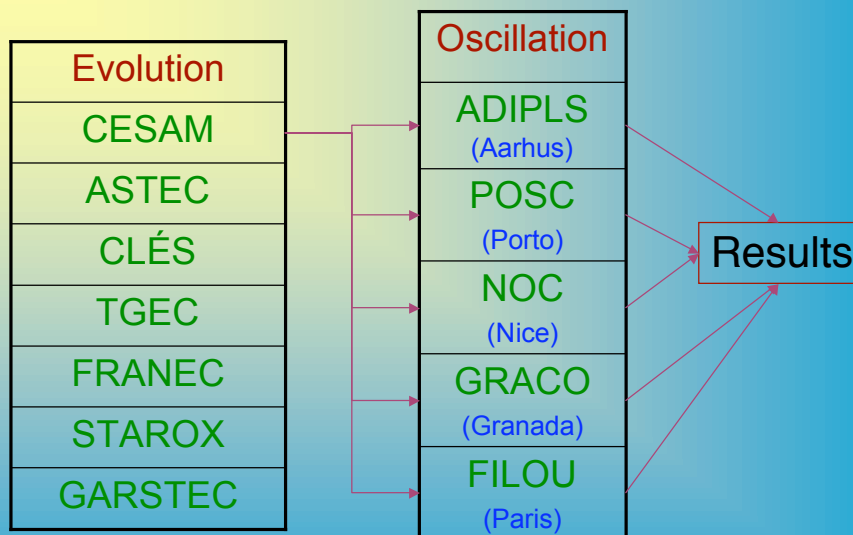
Why a task 3?

Differences between Pol – (Bel, Gr) due to ???

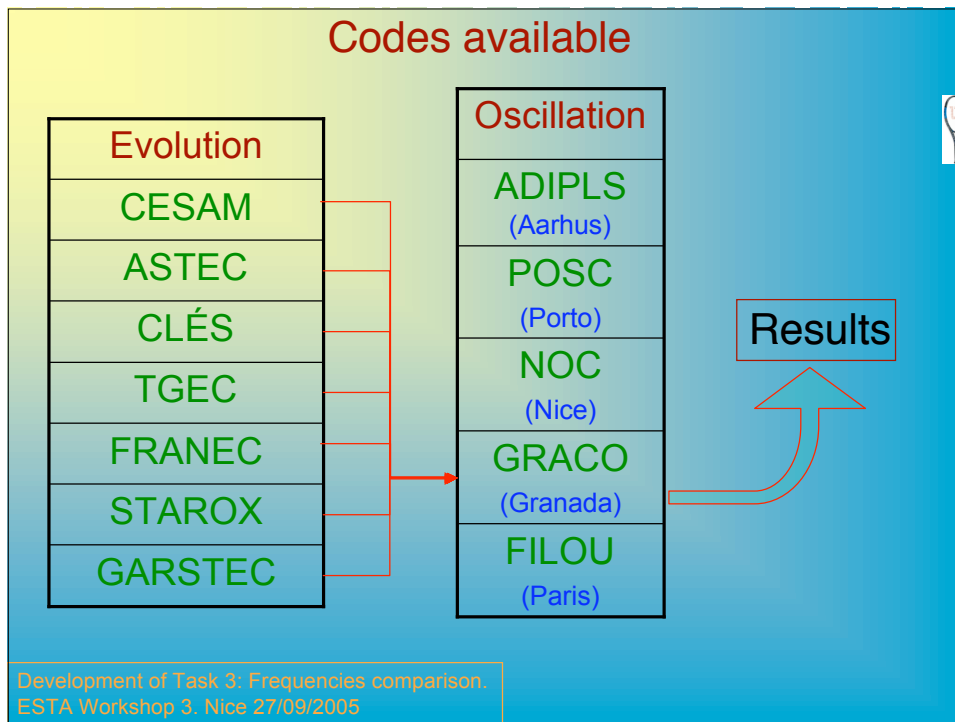
Therefore, to test differences in the physics we must study previously differences in the oscillation codes

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Codes available



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Codes available

Case	$\log(L/L_{\odot})$	T_{eff}	$\log g$	Frequencies (μHz)
γ Doradus	0.845	7200	4.24	[11, 22]
δ Scuti (FG Vir.)	1.109	7345	4.00	[70, 410]
SPB (HD 215573)	2.453	12960	4.09	[5, 12]
β Ceph. (EN Lac.)	3.877	21756	3.842	[55, 95]

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Some results

A previous work

Mazumdar A., in *CoRoT Week 3*,
Liège - Belgium, 4-7 December
2002.

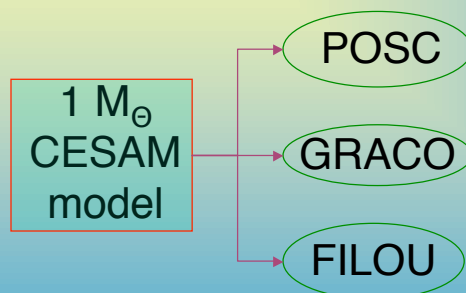
Compare 4 oscillation codes for 3 different
stellar masses (1, 1.2 and 1.5 $M_{\odot}$). In the
line of the first step of Task 3

Poster

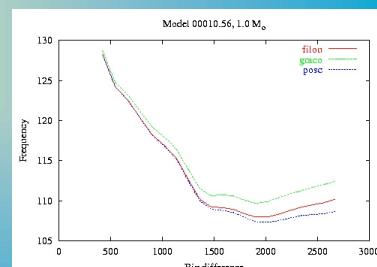
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Some results

In the context of ESTA some preliminary
results have been obtained



10.56 My

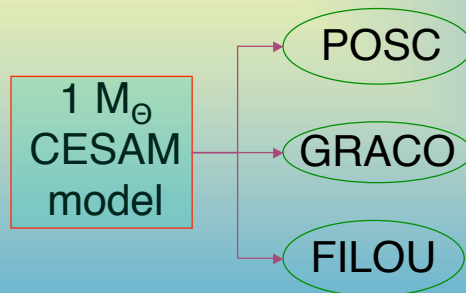


Big differences

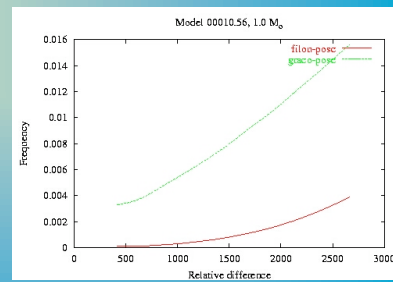
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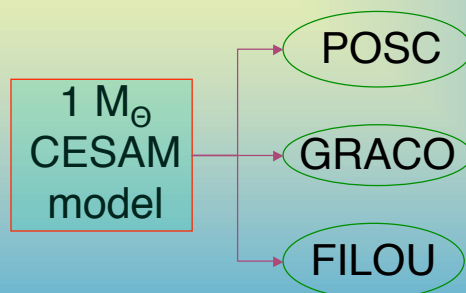


Relative differences

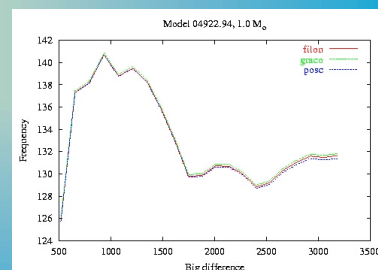
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4922 My

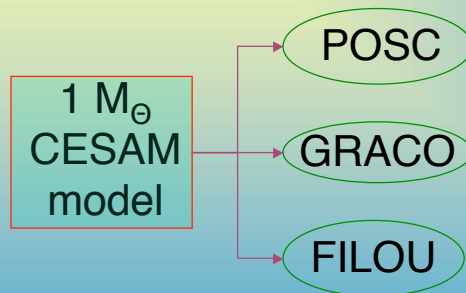


Big differences

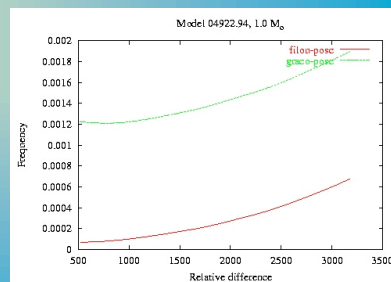
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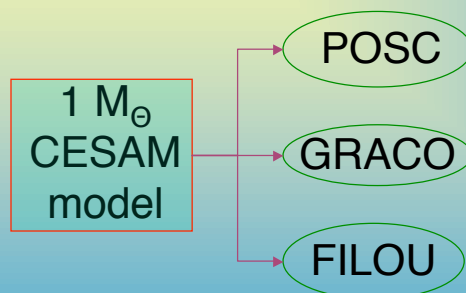


Relative differences

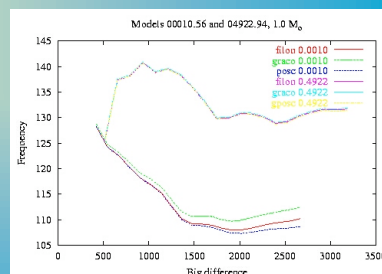
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Some results

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Both models

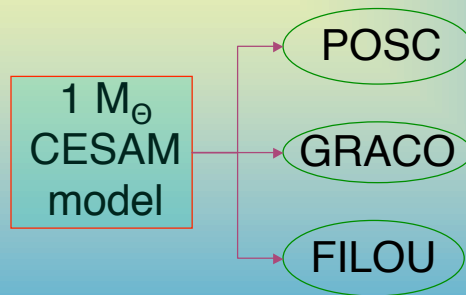


Big differences

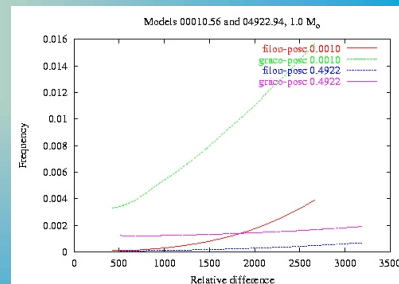
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Some results

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Both models



Relative differences

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Some results

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A possible difference, the number
of mesh points:

10.56 My $\Rightarrow$ 439

4922 My $\Rightarrow$ 1574

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Some results

Differences between codes

- POSC: Shooting method using second order centered differences representation.
- GRACO: Henyey method as explained in Unno et al.
- FILOU: Galerkin method
- Other possible differences as boundary conditions, etc.

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Working plan

Previous requirements

- Development of Task 1 ???
- Development of the conversion tool MODCONV or similar (those used in the work of Mazumdar, for example)

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Working plan



- Obtain some models per stellar type (different evolutionary stages, number of mesh points, etc.).
- Construct with CONVMOD all necessary input models for all oscillation codes.
- Compare eigenfrequencies and eigenfunctions.
- Study the reasons of the differences and fix standards as for the evolutionary codes.
- Repeat this study for the non-adiabatic codes available.

Scheme

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Working plan



Once the first comparisons have been done and standards are fixed:

- Obtain models of different stellar types with the evolutionary codes available and solve them with the same pulsational adiabatic and non-adiabatic code.
- Study the differences obtained and the reason of them in terms of the physics inside the evolutionary codes.

Scheme

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Working plan



Finally, develop an exercise as the example with Nu Eridanis (define a star and solve it with independent set of codes). This will ensure a better understanding of the physics in the star.