Asteroseismology in the VO

Asteroseismology in the VO

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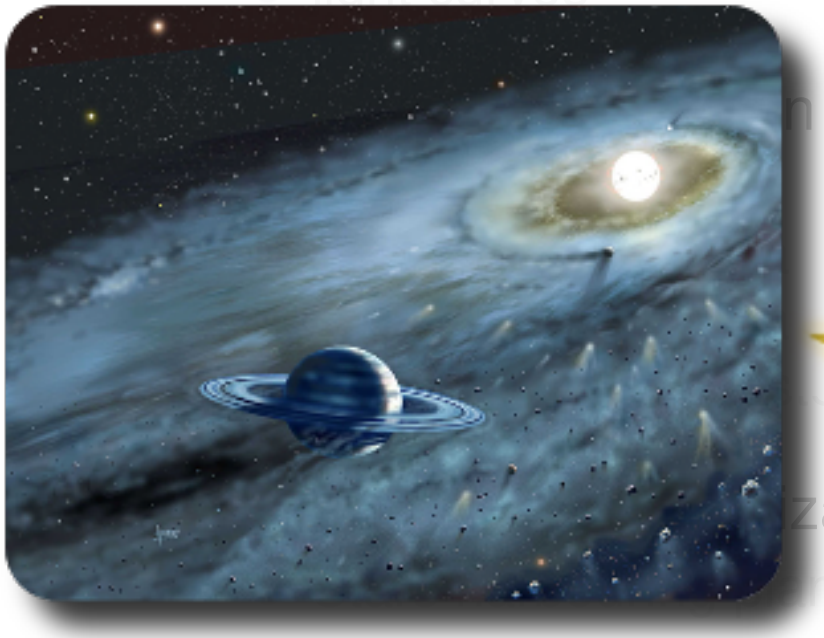
Garching, November 9-12, 2009

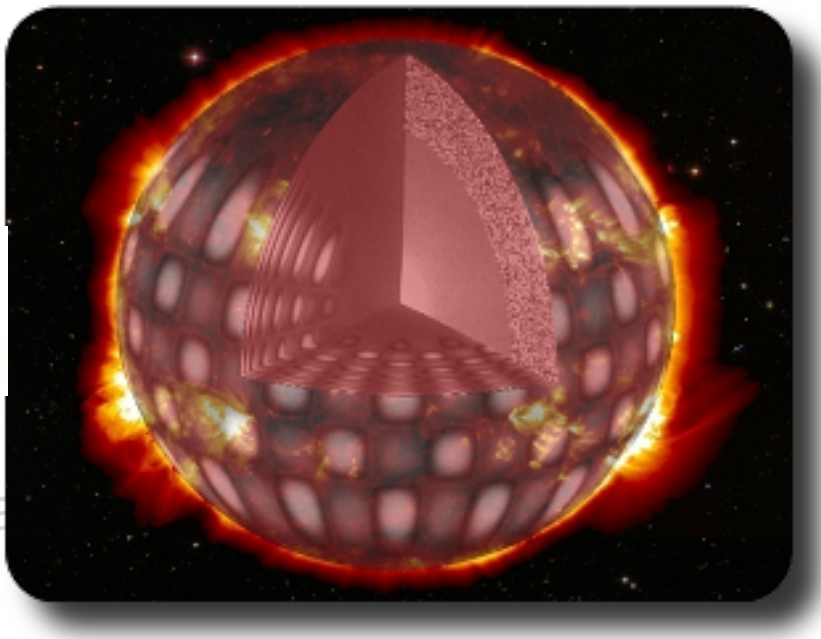
Motivation

- A huge amount of data is going to be available in the near future.
  - light curves
- Seismology information is a great help to restrict stellar properties.
  - Information of stellar structure.
  - Information of stellar evolution.
  - Only way to probe stellar interiors.
- Much better characterization of stars
  - Stars harbouring planets
  - ...

Motivation

- A huge amount of data is going to be available in the near future.
  - light curves
  - ...





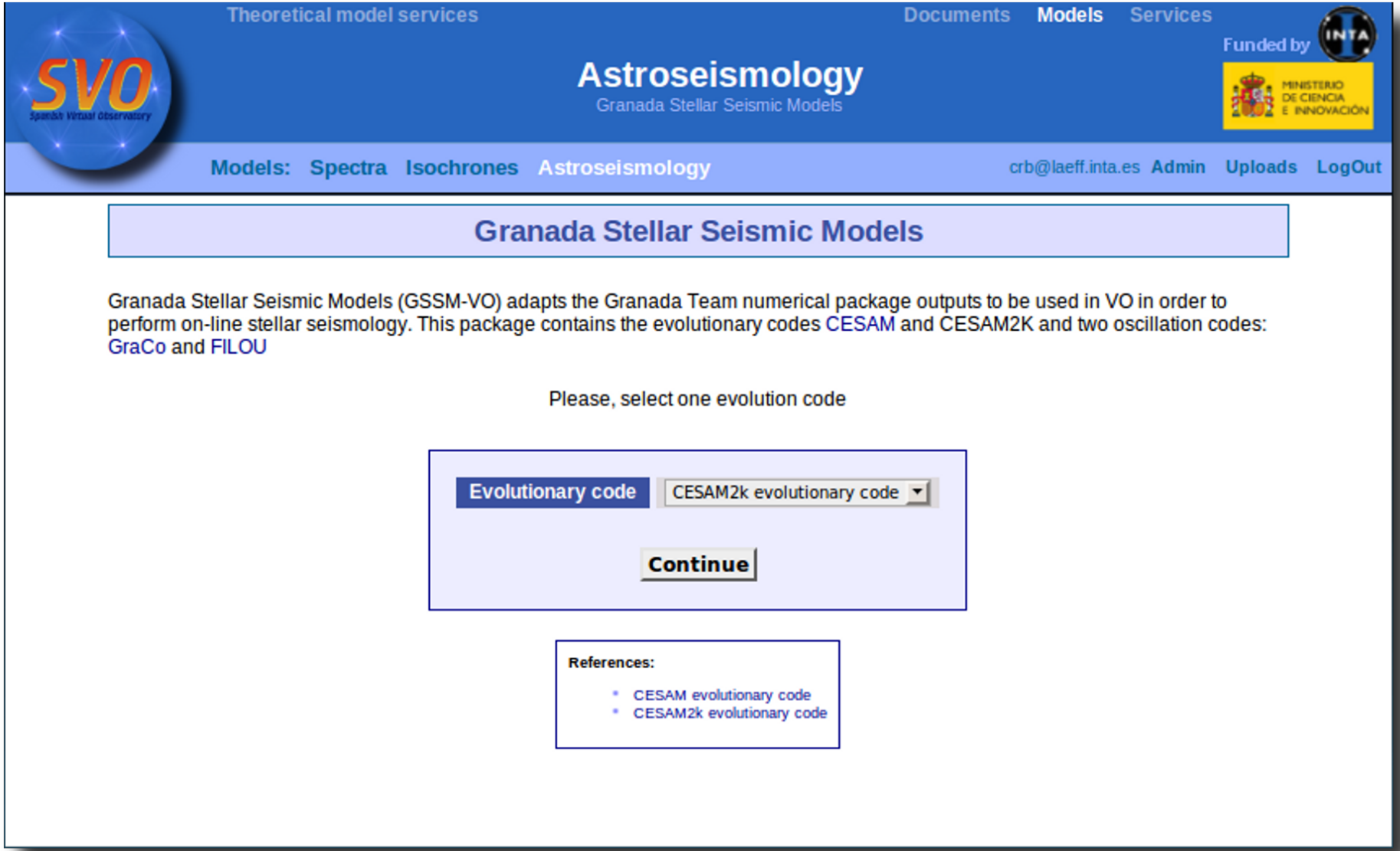
Motivation

- A huge amount of data is going to be available in the near future.
  - light curves from different missions.
- We need an easy and efficient way to compare those many data with theoretical models.
  - To analyze observed objects properties.
- Previous important work: ESTA project for CoRoT mission.
  - http://www.astro.up.pt/corot/models/
  - Difficult task. Problems identified
  - Access to models, different formats, etc.

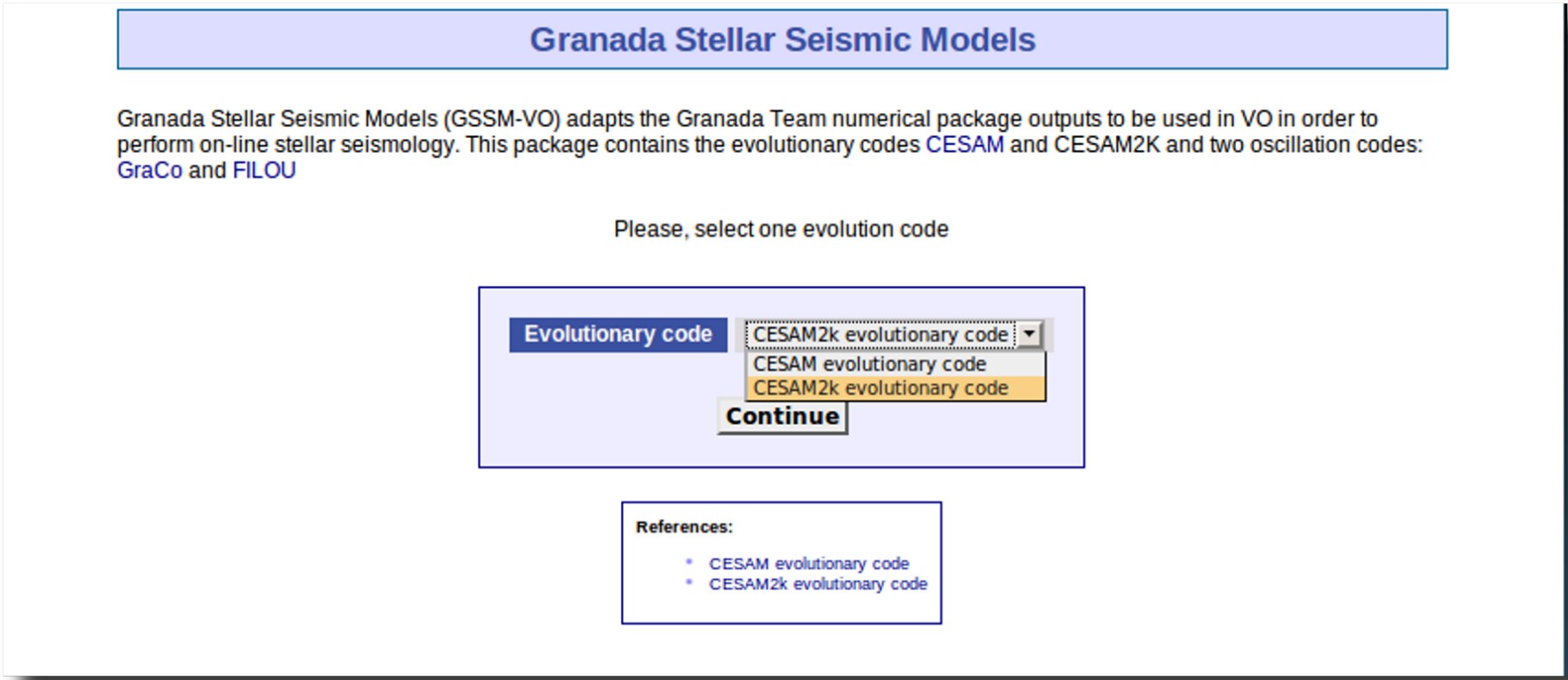
Asteroseismology VO tool

- Currently 4 different codes integrated.
  - CESAM, CESAM2k structure codes.
  - FILOU, GraCo oscillation codes.
  - Different research groups interested in adapting their codes.
  - A S3 server for each code.
  - More that 500.000 models.
  - Almost 1Tb of data.
  - Growing.
- All interactions between tool and data services: S3
- First Data Model for astroseismology data.
  - 17 star global properties.
  - 44 star shell variables.
  - 35 seismic properties.

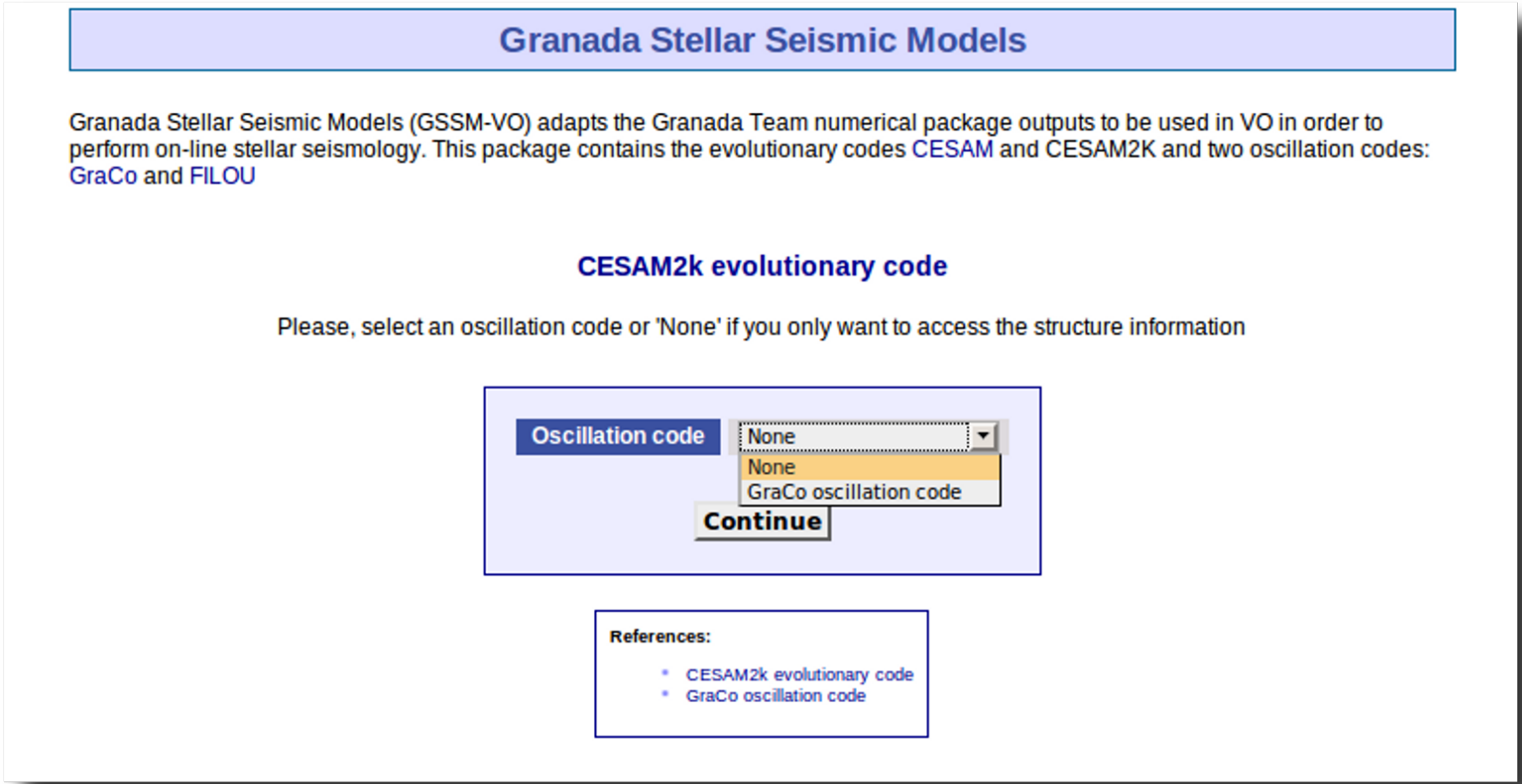
Asteroseismology VO tool



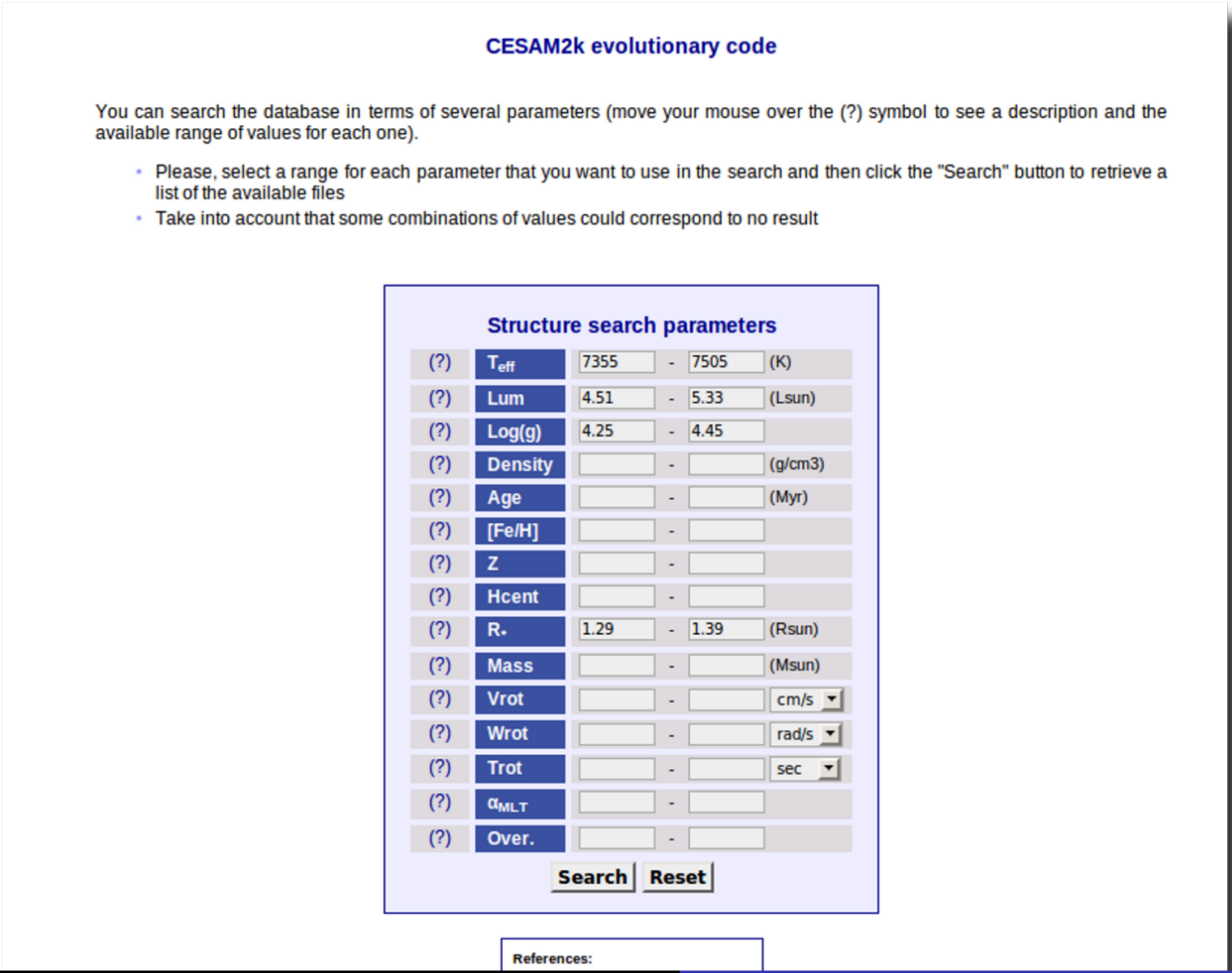
Asteroseismology VO tool



Asteroseismology VO tool



Cesam2k: an interesting case



CESAM2k evolutionary code

You can search the database in terms of several parameters (move your mouse over the (?) symbol to see a description and the available range of values for each one).

- Please, select a range for each parameter that you want to use in the search and then click the "Search" button to retrieve a list of the available files
- Take into account that some combinations of values could correspond to no result

Structure search parameters

(?)	T_{eff}	7355	-	7505	(K)
(?)	Lum	4.51	-	5.33	(Lsun)
(?)	Log(g)	4.25	-	4.45	
(?)	Density		-		(g/cm3)
(?)	Age		-		(Myr)
(?)	[Fe/H]		-		
(?)	Z		-		
(?)	Hcent		-		
(?)	R.	1.29	-	1.39	(Rsun)
(?)	Mass		-		(Msun)
(?)	Vrot		-		cm/s
(?)	Wrot		-		rad/s
(?)	Trot		-		sec
(?)	α_{MLT}		-		
(?)	Over.		-		

Search Reset

References:

Cesam2k: an interesting case

Granada Stellar Seismic Models

Granada Stellar Seismic Models (GSSM-VO) adapts the Granada Team numerical package outputs to be used in VO in order to perform on-line stellar seismology. This package contains the evolutionary codes CESAM and CESAM2K and two oscillation codes: GraCo and FILOU

CESAM2k evolutionary code

1939 results have been found for your search criteria.

Summary table

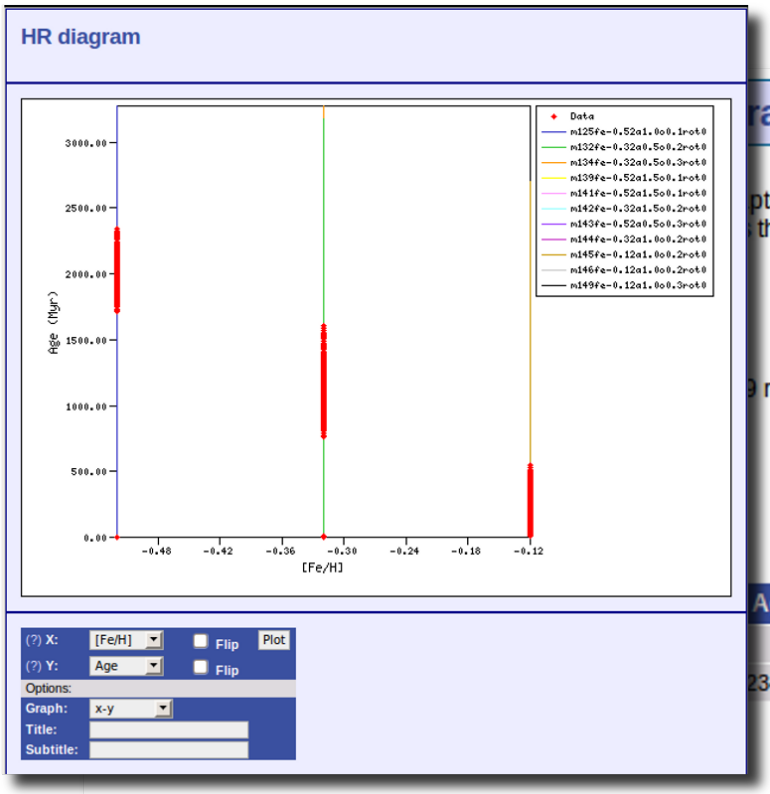
Show Results | HR diag | New Search

	T_{eff}	Lum	Log(g)	Density	Age	[Fe/H]	Z	Hcent	$R_\bullet$	Mass	Vrot	Wrot	Trot	α_{MLT}	Over.
Min	7355.0000	4.5114	4.2506	0.6605	0	-0.5200	0.0055	0.7221	1.2901	1.2502	0	0	0	0.5000	0.1000
Max	7504.9000	5.3293	4.3585	0.9057	2345.9000	-0.1200	0.0134	0.7473	1.3899	1.4902				1.5000	0.3000

References:

- CESAM2k evolutionary code

Cesam2k: an interesting case



ranada Stellar Seismic Models

pts the Granada Team numerical package outputs to be used in VO in order to perform
the evolutionary codes CESAM and CESAM2K and two oscillation codes: GraCo and FILOU

CESAM2k evolutionary code

9 results have been found for your search criteria.

Summary table

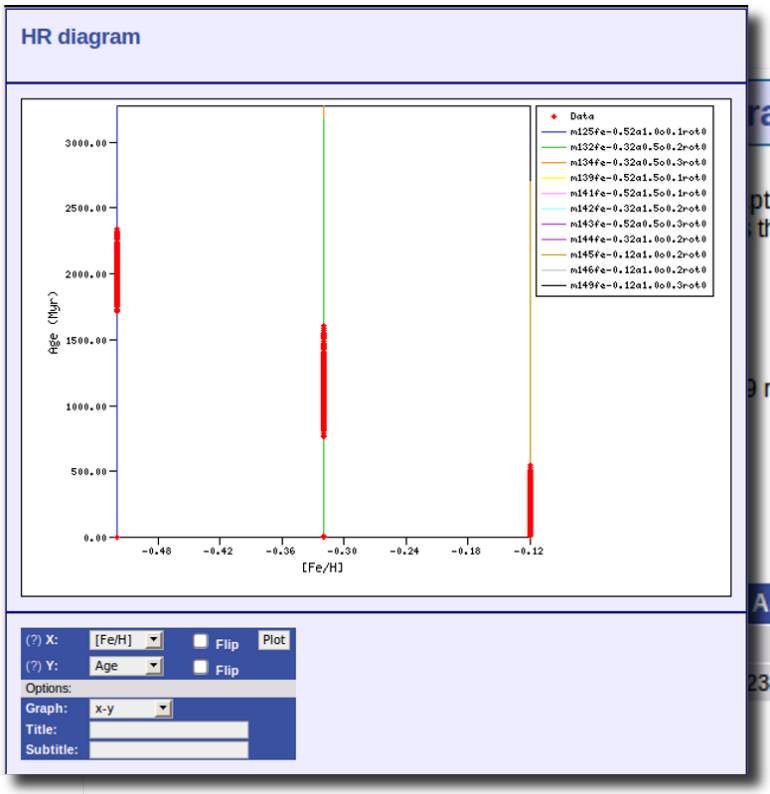
Show Results | HR diag | New Search

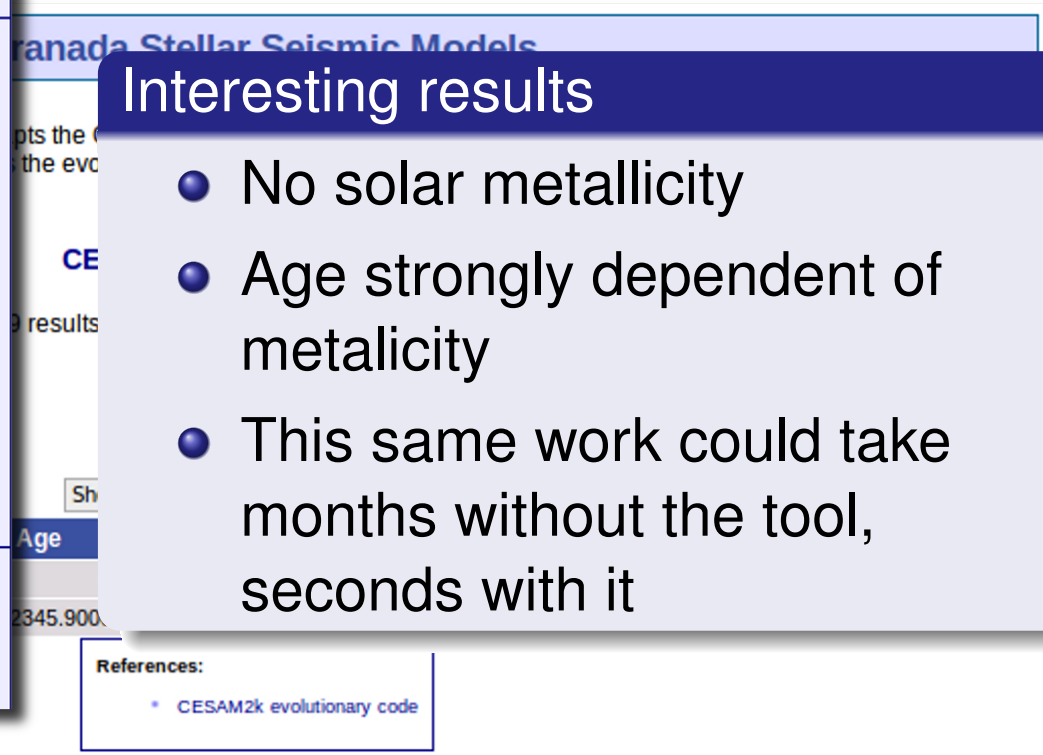
Age	[Fe/H]	Z	Hcent	R•	Mass	Vrot	Wrot	Trot	α_{MLT}	Over.
0	-0.5200	0.0055	0.7221	1.2901	1.2502	0	0	0	0.5000	0.1000
2345.9000	-0.1200	0.0134	0.7473	1.3899	1.4902				1.5000	0.3000

References:

- CESAM2k evolutionary code

Cesam2k: an interesting case

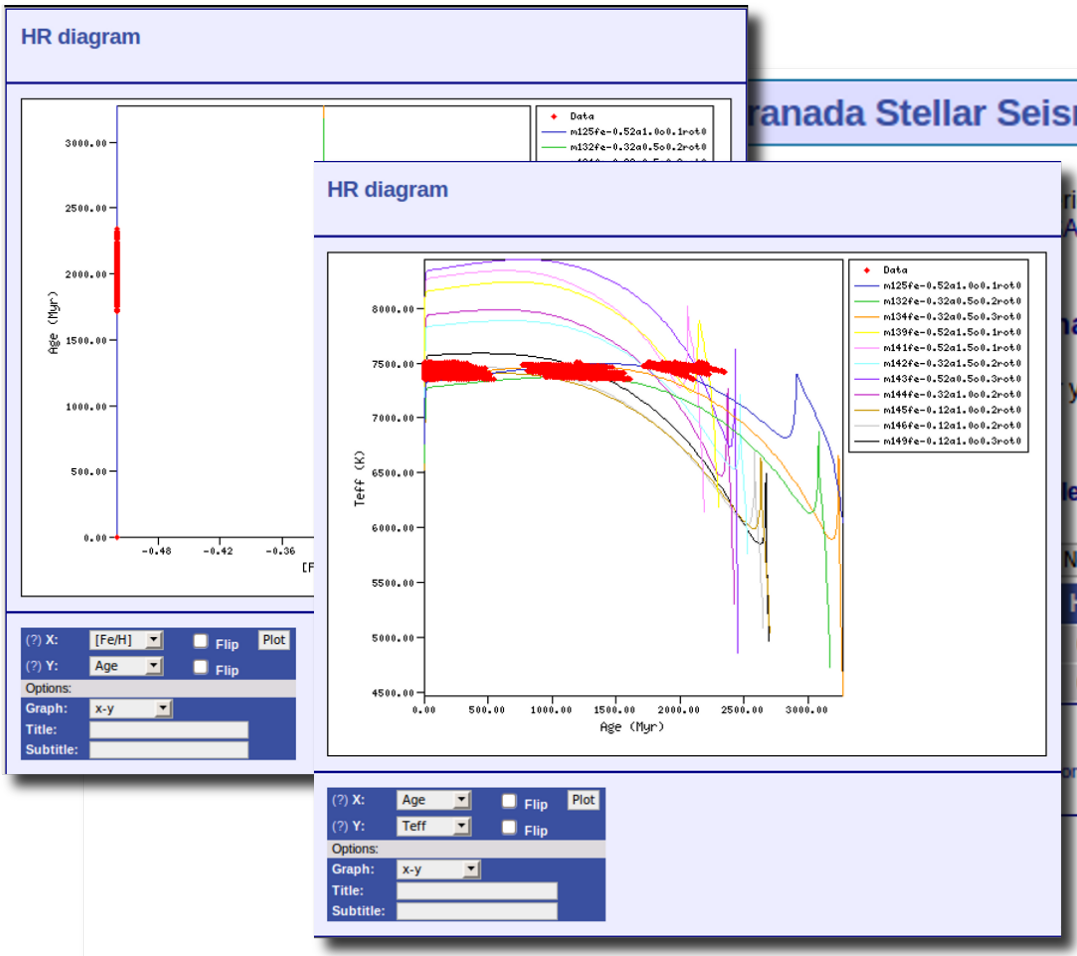




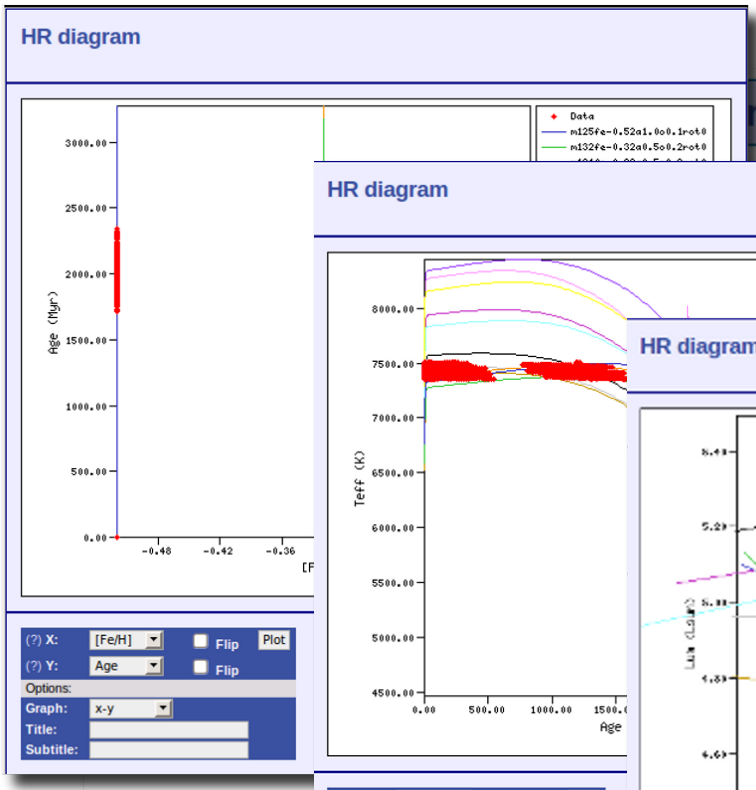
Interesting results

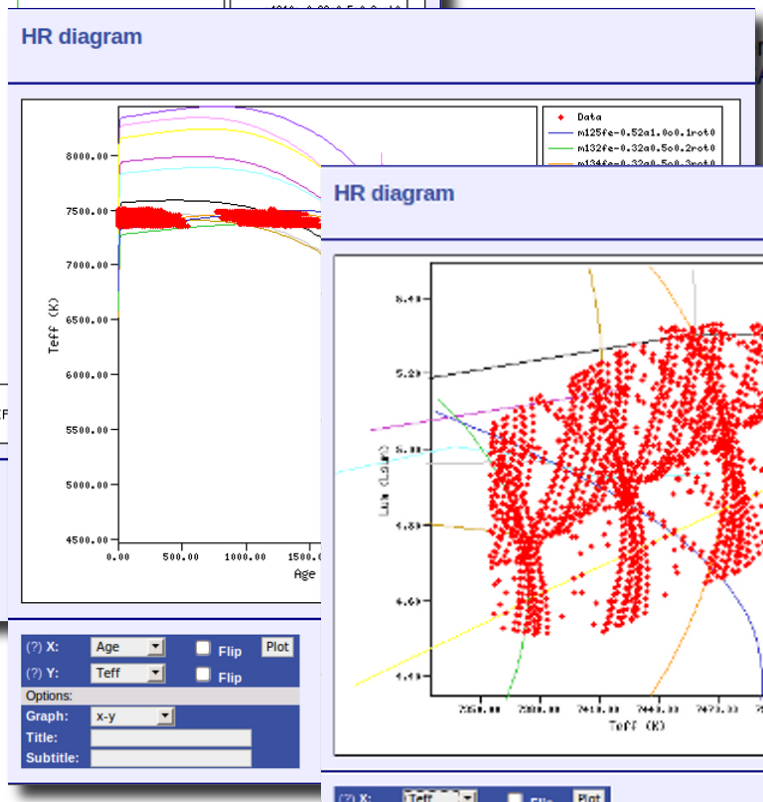
- No solar metallicity
- Age strongly dependent of metalicity
- This same work could take months without the tool, seconds with it

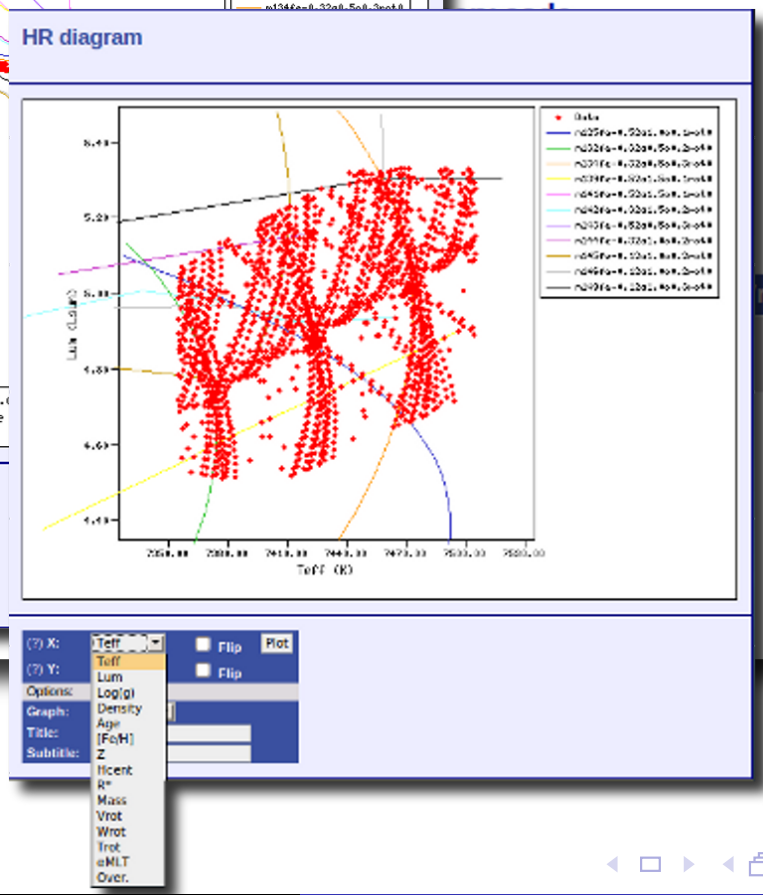
Cesam2k: an interesting case



Cesam2k: an interesting case







ranada Stellar Seismic Models

rical package outputs to be used in VO in order to perform
AM and CESAM2K and two oscillation codes: GraCo and FILOU

rot	Wrot	Trot	α_{MLT}	Over.
0	0	0	0.5000	0.1000
			1.5000	0.3000

Including seismology

- Take into account that some combinations of values could correspond to no result

CESAM2k evolutionary code + GraCo oscillation code

Structure search parameters

(?)	T_{eff}	4000 - 5000	(K)	
(?)	Lum	-	(Lsun)	
(?)	Log(g)	-		
(?)	Density	-	(g/cm3)	
(?)	Age	-	(Myr)	
(?)	[Fe/H]	-		
(?)	Z	-		
(?)	Hcent	-		
(?)	R.	-	(Rsun)	
(?)	Mass	-	(Msun)	
(?)	Vrot	-	cm/s	
(?)	Wrot	-	rad/s	
(?)	Trot	-	sec	
(?)	α_{MLT}	-		
(?)	Over.	-		

Sismology search parameters

(?)	F0	-	(muHz)
(?)	F1	-	(muHz)
(?)	F0/F1	-	
(?)	Δ(ν)	36 - 39	(muHz)
(?)	δ(ν)	-	(muHz)
(?)	[ν]	-	(muHz)
(?)	[l]	-	
(?)	Sta.	all modes	
(?)	ν_{Sta}	-	(muHz)

Search Reset

References:

- CESAM2k evolutionary code
- GraCo oscillation code

Granada Stellar Seismic Models

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CESAM2k evolutionary code + GraCo oscillation code

9 results have been found for your search criteria.
You can click on column titles to sort results by that field

Common values

fileid	[Fe/H]	Z	Hcent	Vrot	Wrot	Trot	α_{MLT}	Over.
	0.0800	0.0206	0.6991	0	0	0	0.5000	0.2000

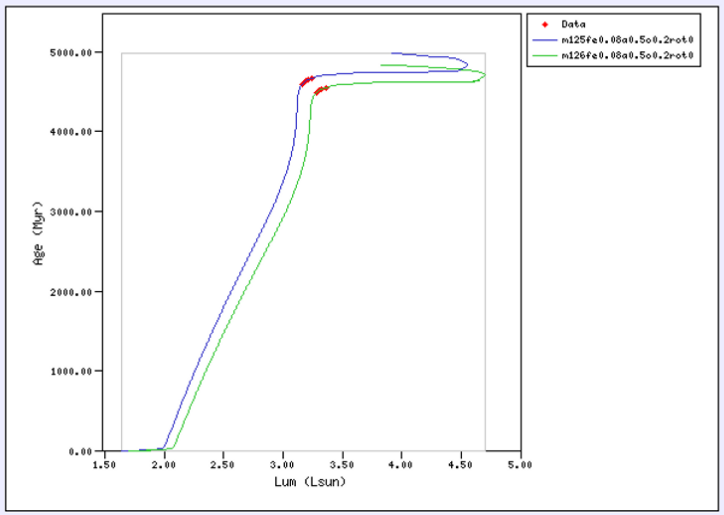
Mark All | Unmark All | Retrieve | Plot | HR diag | New Search

Mark	Files		Track	T_{eff}	Lum	Log(g)	Density	Age	R•	Mass	F0	F1	F0/F1	Δ(ν)	Δ[Δ(ν)]	δ(ν)	Δ[δ(ν)]
☐	cesam2k	graco	m125fe0.08a0.5o0.2rot0	4997.5000	3.1613	3.7834	0.1316	4585.9000	2.3760	1.2502	101.9600	134.6100	0.7574	38.7420	1.5778	-23.7790	5.6465
☐	cesam2k	graco	m125fe0.08a0.5o0.2rot0	4992.4000	3.1737	3.7799	0.1300	4605.9000	2.3855	1.2502	101.2600	133.7600	0.7571	38.5320	1.5687	-24.4040	5.7218
☐	cesam2k	graco	m125fe0.08a0.5o0.2rot0	4989.6000	3.1904	3.7767	0.1285	4625.9000	2.3945	1.2502	100.6600	132.9800	0.7570	38.3310	1.5603	-25.1440	5.8316
☐	cesam2k	graco	m125fe0.08a0.5o0.2rot0	4990.1000	3.2131	3.7738	0.1273	4645.9000	2.4024	1.2502	100.2000	132.3700	0.7570	38.1420	1.5526	-25.9590	5.9016
☐	cesam2k	graco	m125fe0.08a0.5o0.2rot0	4995.8000	3.2452	3.7715	0.1262	4665.9000	2.4090	1.2502	99.9410	131.9200	0.7576	37.9690	1.5463	-26.9180	6.0092
☐	cesam2k	graco	m126fe0.08a0.5o0.2rot0	4994.3000	3.2839	3.7693	0.1248	4485.9000	2.4247	1.2602	99.3810	131.1500	0.7578	37.7520	1.5379	-24.6460	5.8142
☐	cesam2k	graco	m126fe0.08a0.5o0.2rot0	4990.7000	3.3011	3.7657	0.1233	4505.9000	2.4345	1.2602	98.7370	130.3400	0.7575	37.5380	1.5288	-25.4170	5.8868
☐	cesam2k	graco	m126fe0.08a0.5o0.2rot0	4990.8000	3.3248	3.7627	0.1220	4525.9000	2.4432	1.2602	98.2340	129.6600	0.7576	37.3420	1.5209	-26.3200	5.9988
☐	cesam2k	graco	m126fe0.08a0.5o0.2rot0	4996.2000	3.3589	3.7601	0.1209	4545.9000	2.4504	1.2602	97.9500	129.2200	0.7580	37.1630	1.5142	-27.3330	6.1152

Granada Stellar Seismic Models

Granada Stellar Seismic Models (GSSM-VO) adapts the Granada Team numerical package outputs to be used in VO in order to perform on-line stellar seismology. This package contains the evolutionary codes CESAM and CESAM2K and two oscillation codes: GraCo and FILOU

HR diagram



(?) X: Lum Flip Plot
(?) Y: Age Flip
Options:
Graph: x-y
Title:
Subtitle:

ary code + GraCo oscillation code

en found for your search criteria.
mn titles to sort results by that field

Common values

cent	Vrot	Wrot	Trot	α_{MLT}	Over.
6991	0	0	0	0.5000	0.2000

Retrieve | Plot | HR diag | New Search

Mar	sity	Age	R•	Mass	F0	F1	F0/F1	Δ(ν)	Δ[Δ(ν)]	δ(ν)	Δ[δ(ν)]
	1316	4585.9000	2.3760	1.2502	101.9600	134.6100	0.7574	38.7420	1.5778	-23.7790	5.6465
	1300	4605.9000	2.3855	1.2502	101.2600	133.7600	0.7571	38.5320	1.5687	-24.4040	5.7218
	1285	4625.9000	2.3945	1.2502	100.6600	132.9800	0.7570	38.3310	1.5603	-25.1440	5.8316
	1273	4645.9000	2.4024	1.2502	100.2000	132.3700	0.7570	38.1420	1.5526	-25.9590	5.9016
	1262	4665.9000	2.4090	1.2502	99.9410	131.9200	0.7576	37.9690	1.5463	-26.9180	6.0092
	1248	4485.9000	2.4247	1.2602	99.3810	131.1500	0.7578	37.7520	1.5379	-24.6460	5.8142
	1233	4505.9000	2.4345	1.2602	98.7370	130.3400	0.7575	37.5380	1.5288	-25.4170	5.8868
	1220	4525.9000	2.4432	1.2602	98.2340	129.6600	0.7576	37.3420	1.5209	-26.3200	5.9988
	1209	4545.9000	2.4504	1.2602	97.9500	129.2200	0.7580	37.1630	1.5142	-27.3330	6.1152

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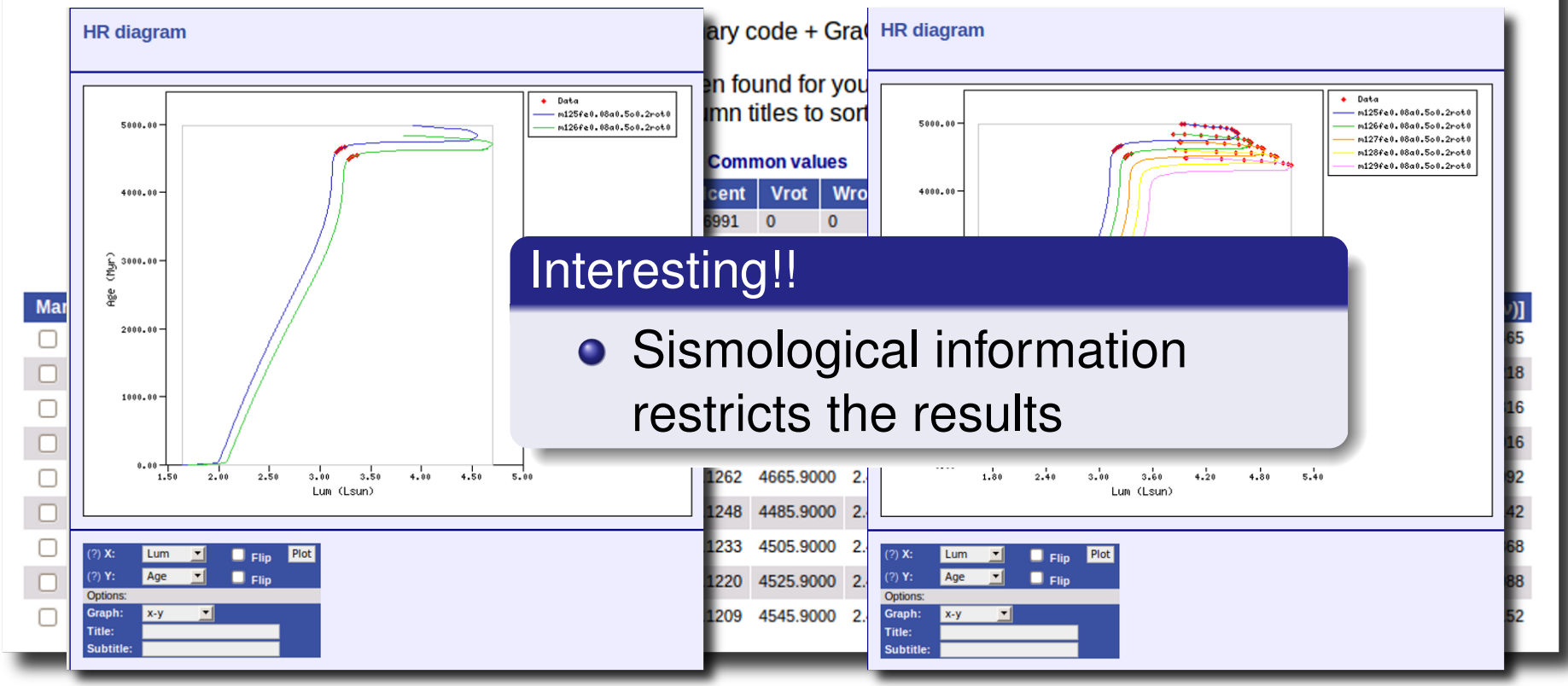
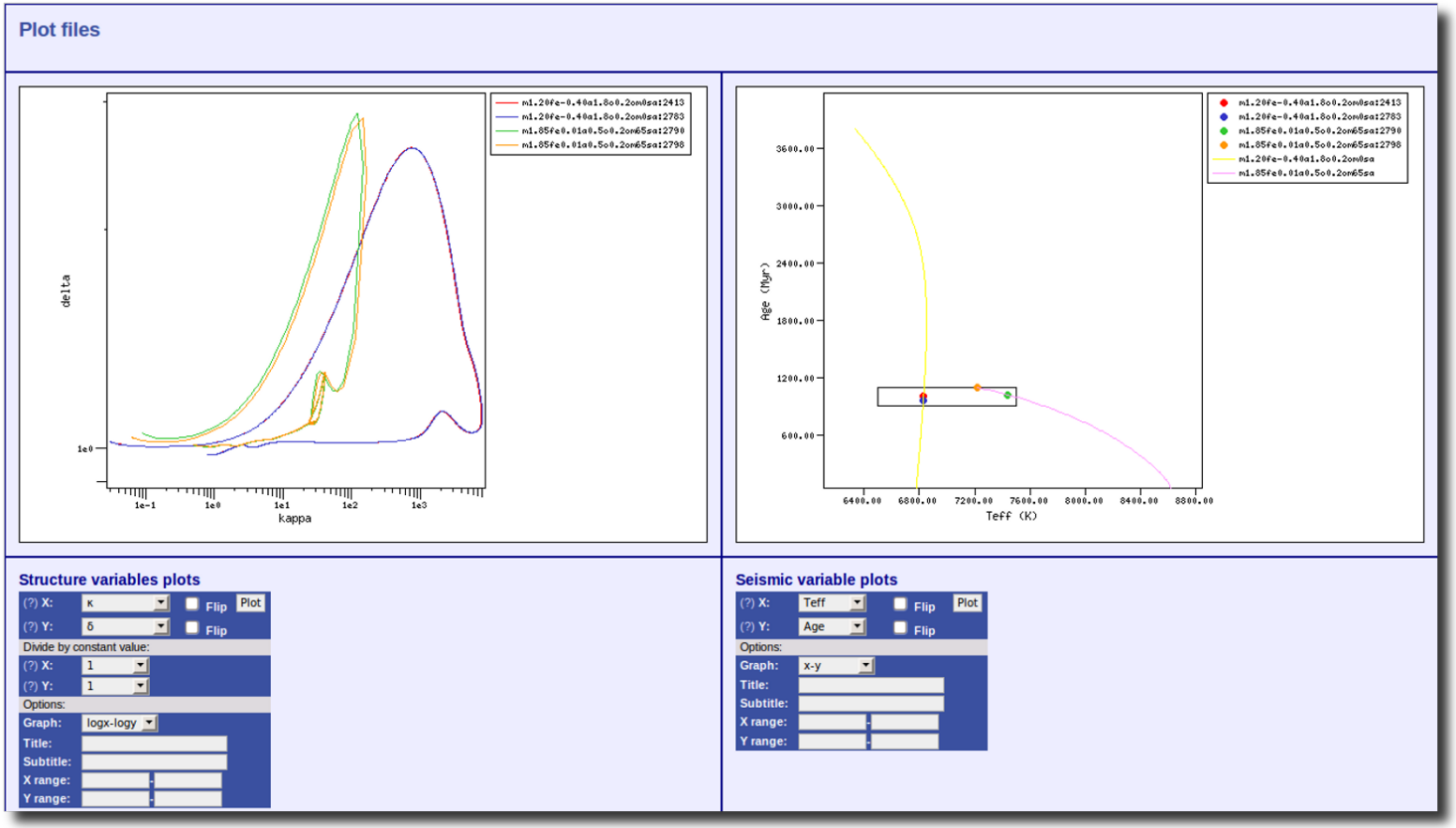


Interesting!!

- Sismological information restricts the results

Shell structure plots



THANK YOU!