VOTA

a VO tool for Asteroseismology.

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Victoria, May 17-21, 2010

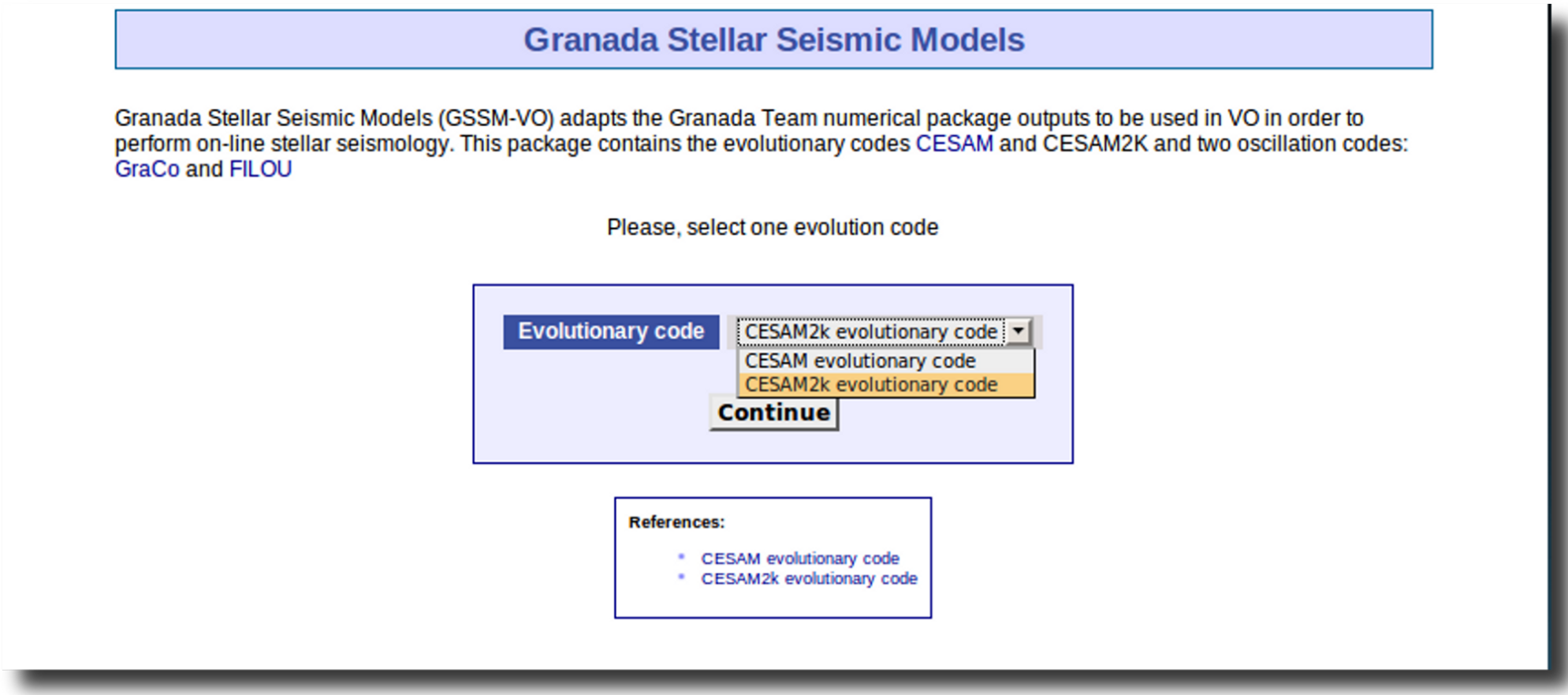
Motivation

- 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.
- Seismology information is a great help to restrict stellar properties.
  - Information of stellar structure.
  - Information of stellar evolution.
  - Only way to probe stellar interiors.
- Previous important work: ESTA project for CoRoT mission.

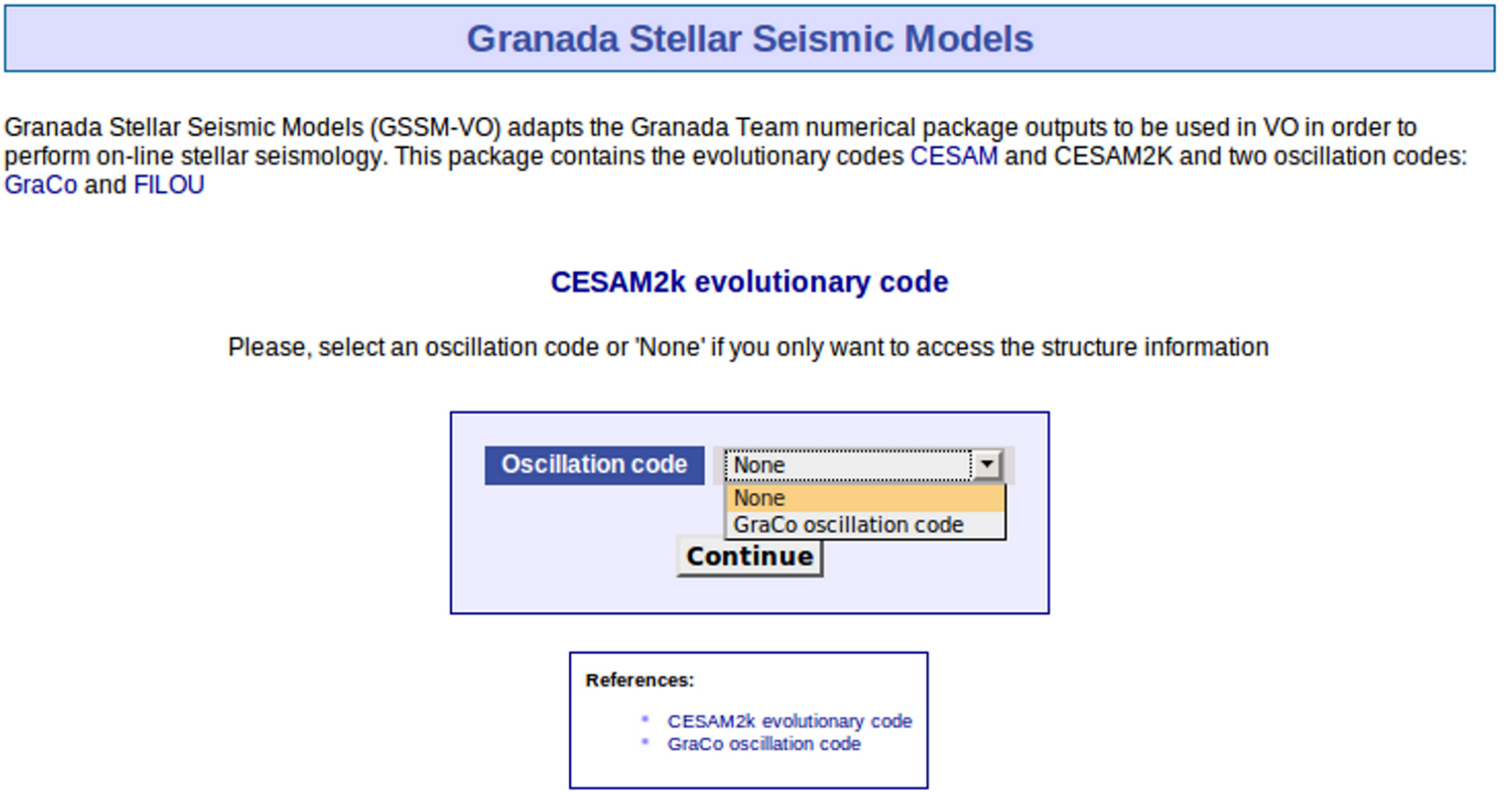
VOTA: VO Tool for Asteroseismology

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

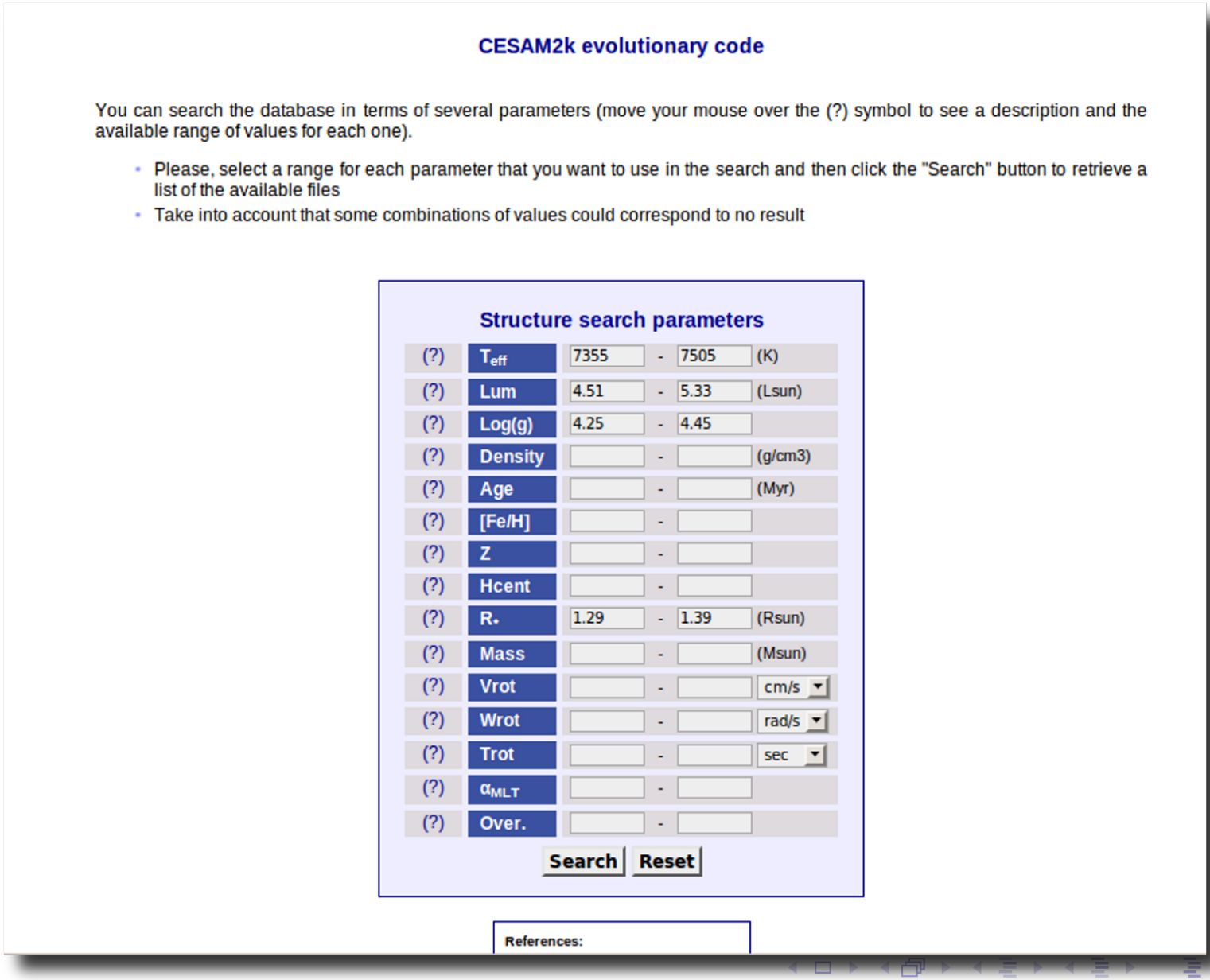
VOTA: model/code selection



VOTA: model/code selection



VOTA: data search



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:

VOTA: data search including seismology

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

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(v)	20	25	(muHz)
(?)	δ(v)			(muHz)
(?)	[v]			(muHz)
(?)	[l]			
(?)	[n]			
(?)	Sta.	all modes		
(?)	v_{Sta}			(muHz)

Search Reset

References:

- CESAM2k evolutionary code
- GraCo oscillation code

VOTA: Summary + HR diagrams

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

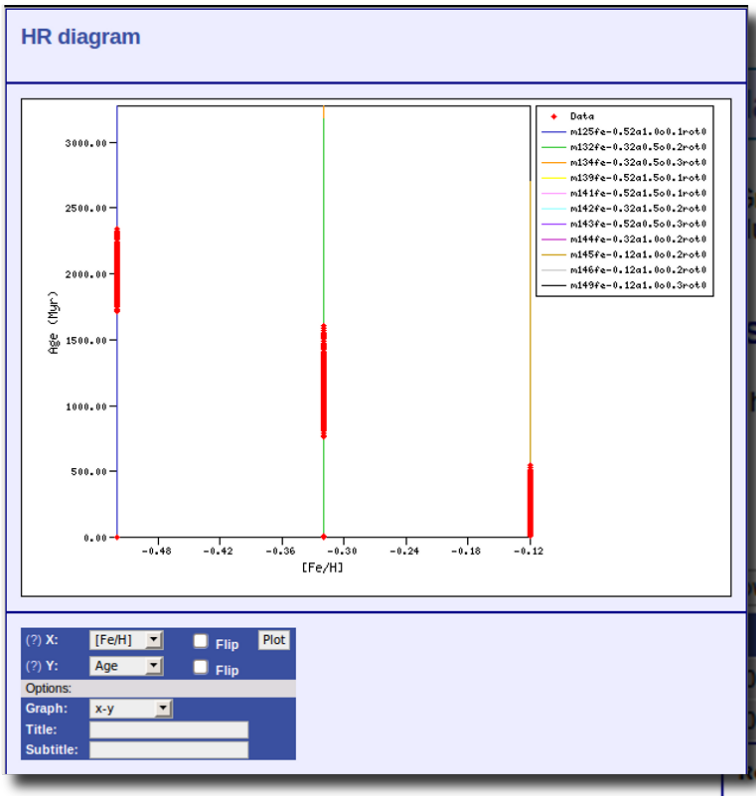
Show Results | HR diag | New Search

	T_{eff}	Lum	Log(g)	Density	Age	[Fe/H]	Z	Hcent	R.	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

VOTA: Summary + HR diagrams



a Stellar Seismic Models

ranada Team numerical package outputs to be used in VO in order to perform
utionary codes CESAM and CESAM2K and two oscillation codes: GraCo and FILOU

SAM2k evolutionary code

have been found for your search criteria.

Summary table

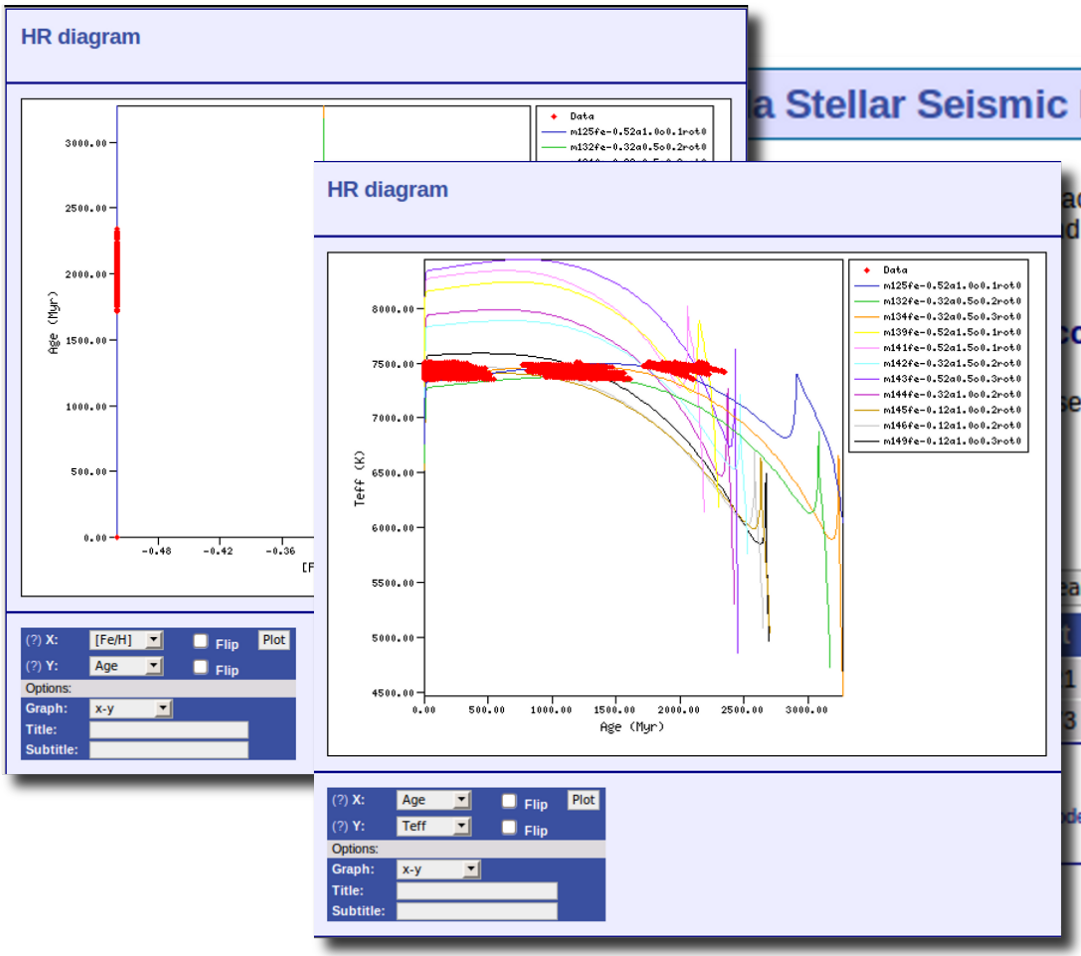
w Results | HR diag | New Search

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

eferences:

- CESAM2k evolutionary code

VOTA: Summary + HR diagrams



a Stellar Seismic Models

ackage outputs to be used in VO in order to perform
d CESAM2K and two oscillation codes: GraCo and FILOU

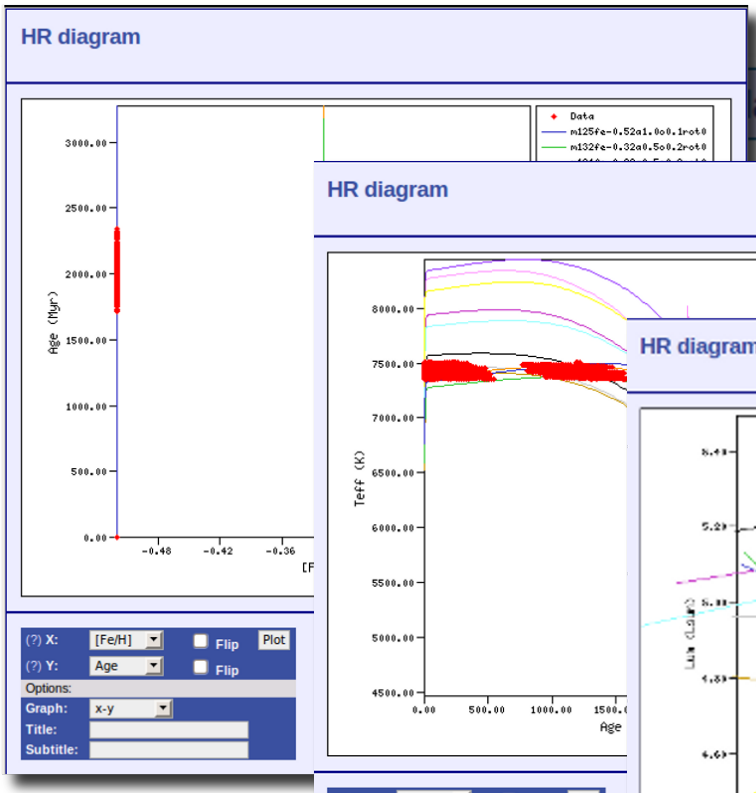
ode

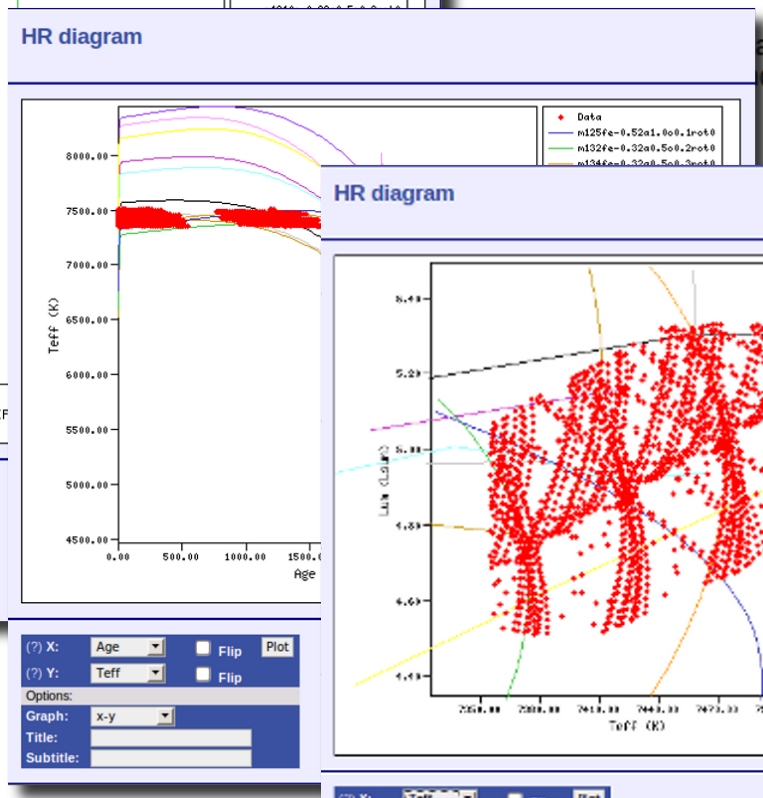
earch criteria.

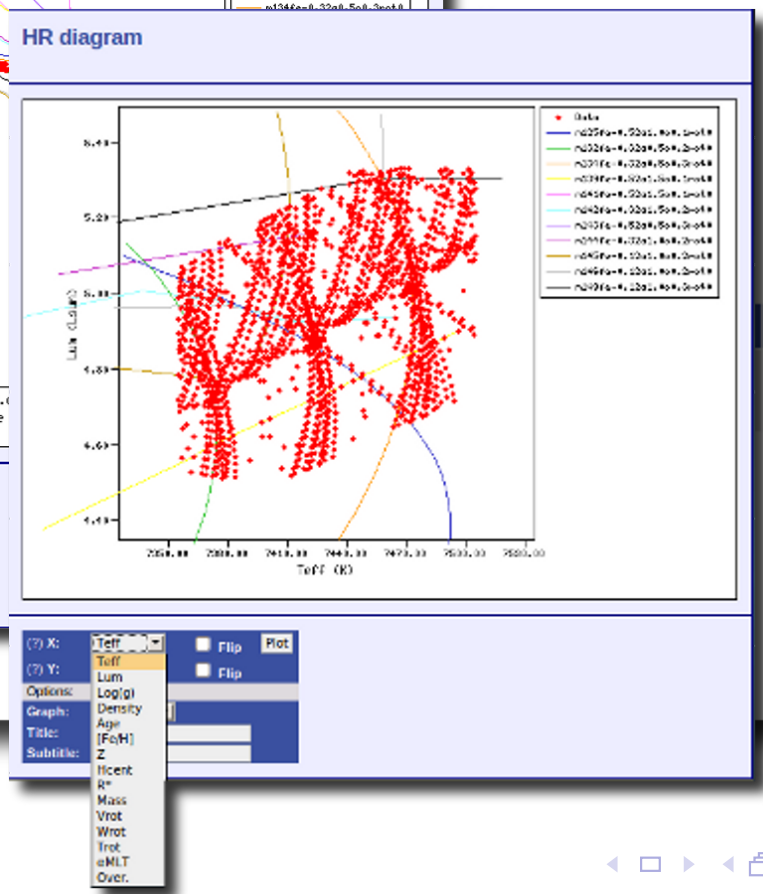
earch

	R.	Mass	Vrot	Wrot	Trot	α_{MLT}	Over.
1	1.2901	1.2502	0	0	0	0.5000	0.1000
3	1.3899	1.4902				1.5000	0.3000

VOTA: Summary + HR diagrams







a Stellar Seismic Models

ackage outputs to be used in VO in order to perform
d CESAM2K and two oscillation codes: GraCo and FILOU

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

VOTA: detailed results + Plots

Results table

Summary | New Search | Restart

Values common to all shown results

[Fe/H]	Z	Vrot	Wrot	Trot	α_{MLT}	Over.
0.0800	0.0206	0	0	0	0.5000	0.3000

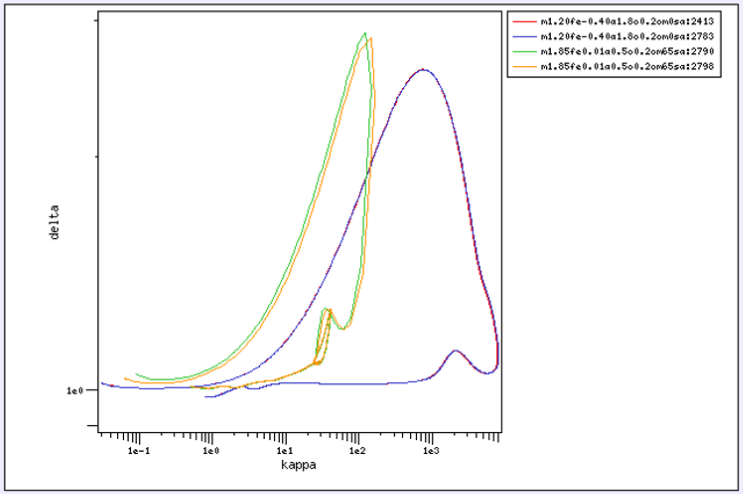
Page: 1 2 3 4 Next Results

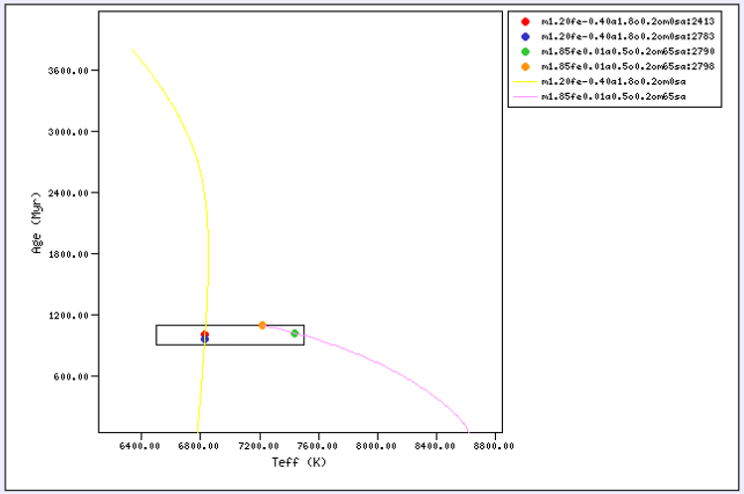
Mark All | Unmark All | Retrieve | Plot

Plot	VOT	Txt	VOT		Txt		Track	Fileid	T_{eff}	Lum	Log(g)	Density	Age	Hcent	R*	Mass	F0	F1	F0/F1	Δ(v)	δ(v)
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0292	4986.7000	3.8788	3.6908	0.0955	5261.3000	0.0033	2.6433	1.2502	87.3310	115.2400	0.7578	22.4010	-37.1810
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0291	4957.1000	3.8078	3.6885	0.0948	5258.6000	0.0042	2.6503	1.2502	86.4820	114.4000	0.7559	22.4240	-36.1970
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0290	4937.7000	3.7608	3.6871	0.0943	5256.4000	0.0049	2.6546	1.2502	85.9140	113.9000	0.7543	22.0370	-36.9380
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0289	4924.1000	3.7276	3.6862	0.0940	5254.6000	0.0055	2.6575	1.2502	85.5050	113.5400	0.7531	22.6830	-35.8050
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0288	4914.2000	3.7033	3.6855	0.0938	5253.0000	0.0060	2.6595	1.2502	85.2120	113.3100	0.7520	23.4070	-34.5530
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0287	4906.7000	3.6849	3.6850	0.0936	5251.8000	0.0064	2.6610	1.2502	84.9840	113.1300	0.7512	22.8640	-35.5080
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0286	4901.0000	3.6708	3.6847	0.0935	5250.7000	0.0067	2.6622	1.2502	84.7990	112.9800	0.7506	23.0220	-35.3060
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0285	4896.4000	3.6597	3.6843	0.0934	5249.8000	0.0070	2.6631	1.2502	84.6550	112.8700	0.7500	23.2040	-35.1530
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0284	4892.7000	3.6509	3.6841	0.0933	5249.0000	0.0072	2.6639	1.2502	84.5410	112.7800	0.7496	23.4410	-35.0020
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0283	4889.7000	3.6435	3.6839	0.0933	5248.4000	0.0074	2.6644	1.2502	84.4550	112.7300	0.7492	23.2930	-34.9090
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0282	4887.3000	3.6372	3.6838	0.0932	5247.9000	0.0076	2.6648	1.2502	84.3850	112.6800	0.7489	23.2950	-34.8380
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0281	4885.4000	3.6319	3.6838	0.0932	5247.5000	0.0077	2.6649	1.2502	84.3290	112.6300	0.7487	22.8750	-34.7850
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0280	4883.9000	3.6275	3.6837	0.0932	5247.1000	0.0078	2.6650	1.2502	84.2900	112.6100	0.7485	23.1260	-33.0690
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0279	4882.7000	3.6240	3.6837	0.0932	5246.8000	0.0079	2.6650	1.2502	84.2700	112.6200	0.7483	23.3500	-32.7900
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0278	4881.8000	3.6213	3.6837	0.0932	5246.6000	0.0080	2.6650	1.2502	84.2440	112.5900	0.7482	23.4390	-33.0420
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0277	4881.1000	3.6193	3.6837	0.0932	5246.4000	0.0080	2.6650	1.2502	84.2330	112.6000	0.7481	23.1310	-33.0610
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0276	4880.6000	3.6179	3.6837	0.0932	5246.2000	0.0081	2.6650	1.2502	84.2140	112.5800	0.7481	22.9590	-32.8680
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0275	4880.3000	3.6171	3.6837	0.0932	5246.1000	0.0081	2.6651	1.2502	84.2040	112.5700	0.7480	23.6950	-32.6260

VOTA: detailed results + Plots

Plot files





Structure variables plots

(?) X: κ Flip Plot
(?) Y: δ Flip
Divide by constant value:
(?) X: 1
(?) Y: 1
Options:
Graph: logx-logy
Title:
Subtitle:
X range:
Y range:

Seismic variable plots

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

Plot	VOT	Txt	V																Δ(ν)	δ(ν)
☐	☐	☐	c																22.4010	-37.1810
☐	☐	☐	c																22.4240	-36.1970
☐	☐	☐	c																22.0370	-36.9380
☐	☐	☐	c																22.6830	-35.8050
☐	☐	☐	c																23.4070	-34.5530
☐	☐	☐	c																22.8640	-35.5080
☐	☐	☐	c																23.0220	-35.3060
☐	☐	☐	c																23.2040	-35.1530
☐	☐	☐	c																23.4410	-35.0020
☐	☐	☐	c																23.2930	-34.9090
☐	☐	☐	c																23.2950	-34.8380
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0281	4885.4000	3.6319	3.6838	0.0932	5247.5000	0.0077	2.6649	1.2502	84.3290	112.6300	0.7487	22.8750	-34.7850
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0280	4883.9000	3.6275	3.6837	0.0932	5247.1000	0.0078	2.6650	1.2502	84.2900	112.6100	0.7485	23.1260	-33.0690
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0279	4882.7000	3.6240	3.6837	0.0932	5246.8000	0.0079	2.6650	1.2502	84.2700	112.6200	0.7483	23.3500	-32.7900
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0278	4881.8000	3.6213	3.6837	0.0932	5246.6000	0.0080	2.6650	1.2502	84.2440	112.5900	0.7482	23.4390	-33.0420
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0277	4881.1000	3.6193	3.6837	0.0932	5246.4000	0.0080	2.6650	1.2502	84.2330	112.6000	0.7481	23.1310	-33.0610
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0276	4880.6000	3.6179	3.6837	0.0932	5246.2000	0.0081	2.6650	1.2502	84.2140	112.5800	0.7481	22.9590	-32.8680
☐	☐	☐	cesam2k	graco	cesam2k	graco	m125fe0.08a0.5o0.3rot0	0275	4880.3000	3.6171	3.6837	0.0932	5246.1000	0.0081	2.6651	1.2502	84.2040	112.5700	0.7480	23.6950	-32.6260

Future plans

Every step in this application:

S3 query producing a VOTable.

- Get available models,
- Get available values for the parameters,
- Get results for given ranges of some parameters,
- Get star oscillations for one particular case,
- Get star shell structure for one particular case.
- etc.

Future plans

In development:

- Application to a science case.
- New models from other groups.
- Fit observations using the models.
  - Neural network/Bayesian methods.

THANK YOU!