S3 Services

S3: Simple Self-described Service
A simple access protocol for microphysics simulations

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Requirements

- Simplicity.
  - The simpler the development of the service is, the more people will be willing to implement it $\Rightarrow$ more theoretical models in the VO.
- Flexibility.
  - Self-described data/service.
  - The protocol explains how the service must describe itselt and how that description must be understood and used.

S3 protocol

- Dialog between the application and the model server.
- The server must be able to answer three questions:
  - Which parameters can be used for searching, and what values are allowed for each of them?
  - Which files are available for a given range of those parameters?
  - Give me a particular file.
- Each answer is just a VOTable document (XML)
  - (the final data file/s could be something else: image, fits...)

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S3 protocol

- Dialog
- The se
  - W
    va
    - W
      pa
    - Gi
- Each a
  - (th

The query

http://www.../.../s3p.php?format=metadata

The answer

```
<VOTABLE version="1.1">
  <RESOURCE type="meta">
    <DESCRIPTION>Theoretical Isochrones for the MyModel model.</DESCRIPTION>

    <PARAM name="INPUT:age" ucd="phys.age" unit="Gyr">
      <DESCRIPTION>Age of the star in Gyr.</DESCRIPTION>
      <VALUES TYPE="actual">
        <OPTION VALUE="1">
        <OPTION VALUE="5">
        <OPTION VALUE="15">
      </VALUES>
    </PARAM>

    <PARAM name="INPUT:metallicity" ucd="..." unit=>
      <DESCRIPTION>Metallicity of the star defined as Fe/H </DESCRIPTION>
      <VALUES TYPE="actual">
        <OPTION VALUE="0">
        <OPTION VALUE="0.5">
        <OPTION VALUE="1">
      </VALUES>
    </PARAM>

  </RESOURCE>
</VOTABLE>
```

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S3 protocol

- Dialog
- The se
  - W
    va
  - W
    pa
  - Gi
- Each a
  - (th

The query

http://www.../.../s3p.php?age=0/10&metallicity=0,1

The answer

```
<VOTABLE version="1.1">
  <INFO name="QUERY_STATUS" value="OK"/>
  <RESOURCE type="results">
    ...
    <TABLE>
      <FIELD NAME="age"/>
      <FIELD NAME="metallicity"/>
      <FIELD NAME="link"/>
      <TABLEDATA>
        <TR>
          <TD>1</TD>
          <TD>0</TD>
          <TD><![CDATA[http://myservice.com/s3.php?id=12]]></TD>
        </TR>
        <TR>
          <TD>3</TD>
          <TD>0.5</TD>
          <TD><![CDATA[http://myservice.com/s3.php?id=23]]></TD>
        </TR>
        ...
      </TABLEDATA>
    </TABLE>
  </RESOURCE>
</VOTABLE>
```

S3 protocol

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S3 protocol

- Dialog
- The se
  - W va
  - W pa
  - Gi
- Each a
  - (th ..)

The query

http://www.../.../s3p.php?id=12

The answer

```
<VOTABLE version="1.1">
  <INFO name="QUERY_STATUS" value="OK"/>
  <RESOURCE type="results">
    <DESCRIPTION>
      Theoretical Isochrone for the MyModel model.
    </DESCRIPTION>
    <PARAM name="age" ucd="phys.age" unit="Gyr" value="1" />
    <PARAM name="metallicity" ucd="..." unit="" value="0" />
    <TABLE>
      <FIELD name="t" ucd="time.age" unit="Gyr" datatype="float" />
      <FIELD name="M" ucd="phys.mass" unit="" datatype="float" />
      <FIELD name="teff" ucd="phys.temperature.effective" unit="K" datatype="int" />
      <FIELD name="Logg" ucd="phys.gravity" unit="" datatype="float" />
      <FIELD name="Lum" ucd="phys.luminosity" unit="" datatype="float" />
      <TABLEDATA>
        <TR>
          <TD>0.001</TD>
          <TD>0.0005</TD>
          <TD>628</TD>
          <TD>2.645</TD>
          <TD>4.2658e-06</TD>
        </TR>
        <TR>
          <TD>0.001</TD>
          <TD>0.0010</TD>
          <TD>942</TD>
          <TD>2.996</TD>
          <TD>1.92752e-05</TD>
        </TR>
        ....
```

S3 protocol

- Dialog between the application and the model server.
- The server must be able to answer three questions:
  - Which parameters can be used for searching, and what values are allowed for each of them?
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IVOA Note

International Virtual Observatory Alliance

IVOA Documents

S3: Proposal for a simple protocol to handle theoretical data (microsimulations)
Version 1.00

IVOA Note 15 October 2008

Interest/Working Group:
Theory Interest Group
Author(s):
Carlos Rodrigo, Miguel Cerviño, Enrique Solano, Patrizia Manzato
Editor(s):
Carlos Rodrigo, Enrique Solano

Abstract

The aim of this document is to suggest a new protocol designed to provide access to theoretical data/services in the

A working approach: Services

- Isochrones/evolutionary tracks servers.
  - Spanish VO: NextGen, COND, DUSTY, Siess.
  - Italian VO: BATSI.
- Synthetic photometry service + photometry fit service.
- Asteroseismology models.
  - Big models
  - Complex parametrization

A working approach: Applications

- An application (*VOSA*) using some of these services to infer physical parameters from observed data
  - Photometry fit services for Kurucz, NextGen, Dusty, COND models.
  - NextGen, COND, DUSTY, Siess isochrones/evol. tracks.
  - Used for science (*Bayo et al, A&A 2008, 429,277B*)
- An application (*VOTA*) using asteroseismology models services to:
  - explore the models,
  - find models with certain properties
  - make several kinds of plots
  - etc.

A working approach: Utilities

- S3 wizard
  - A wizard that helps to build a VO service for a theoretical model.
  - Simple inputs
  - The application builds the database, S3 services...
- S3 interface
  - A web interface to test any S3 service.
  - It shows how an application is expected to understand (or not) your service.

Asteroseismology: Service/models parameters

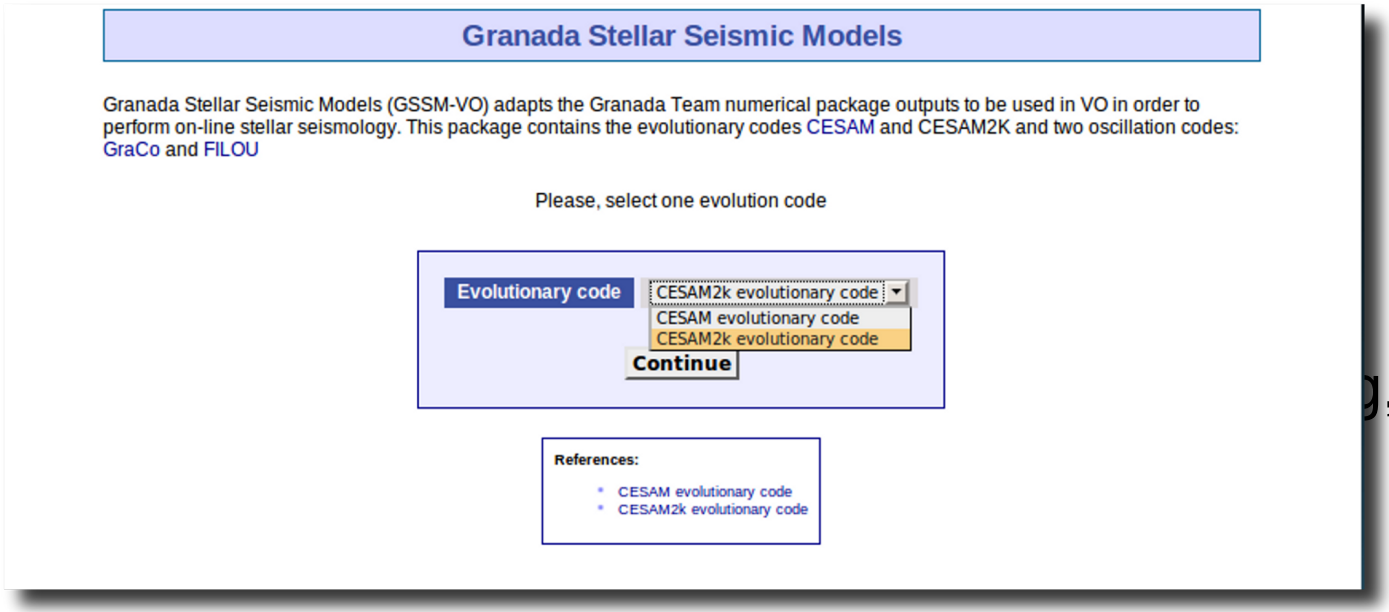
- 1: Which parameters can be used for searching, and what values are allowed for each of them?

Asteroseismology: Service/models parameters

```
<VOTABLE version="1.1" xsi:schemaLocation="http://www.ivoa.net/xml/VOTable/v1.1">  <RESOURCE type="meta">
    <DESCRIPTION>Granada Stellar Seismic Models (GSSM-VO) adapts the Granada Team numerical package outputs to b
    <PARAM name="concepts" value="http://localhost:80/carlos/svo/theory/astrosism/concepts.php"/>
    <PARAM name="bibcode" ucd="meta.bib" value="1997A%26AS..124..597M">
      <DESCRIPTION>CESAM evolutionary code</DESCRIPTION>
    </PARAM>
    <PARAM name="bibcode" ucd="meta.bib" value="2008Ap%26SS.316..129M">
      <DESCRIPTION>GraCo oscillation code</DESCRIPTION>
    </PARAM>
    <PARAM name="bibcode" ucd="meta.bib" value="2008Ap%26SS.316..155S">
      <DESCRIPTION>FILOU oscillation code</DESCRIPTION>
    </PARAM>
    <PARAM name="INPUT:teff:range" ucd="phys.temperature" unit="K" utype="Star.Teff" datatype="float">
      <DESCRIPTION>Effective temperature</DESCRIPTION>
      <values>
        <min value="6330.54259462"/>
        <max value="8624.90808613"/>
      </values>
    </PARAM>
    <PARAM name="INPUT:Lum:range" ucd="phys.luminosity" unit="Lsun" utype="Star.Luminosity" datatype="float">
      <DESCRIPTION>Luminosity (L/Lsun), Lsun=3.839 e33 erg/s</DESCRIPTION>
      <values>
        <min value="2.40289786048"/>
        <max value="17.3890505483"/>
      </values>
    </PARAM>
    <PARAM name="INPUT:logg:range" ucd="phys.gravity" unit="" utype="Star.logg" datatype="float">
      <DESCRIPTION>Log(g) (g in cm/s2)</DESCRIPTION>
      <values>
        <min value="3.8486433931"/>
        <max value="4.41867992287"/>
      </values>
    </PARAM>
    <PARAM name="INPUT:density:range" ucd="phys.density" unit="g/cm3" utype="Star.Density" datatype="float">
      <DESCRIPTION>Average density</DESCRIPTION>
      <values>
        <min value="0.137125362491"/>
        <max value="1.18750725442"/>
      </values>
    </PARAM>
    <PARAM name="INPUT:age:range" ucd="time.age" unit="Myr" utype="Star.Age" datatype="float">
      <DESCRIPTION>Age</DESCRIPTION>
      <values>
        <min value="49.95"/>
        <max value="3803.8"/>
```

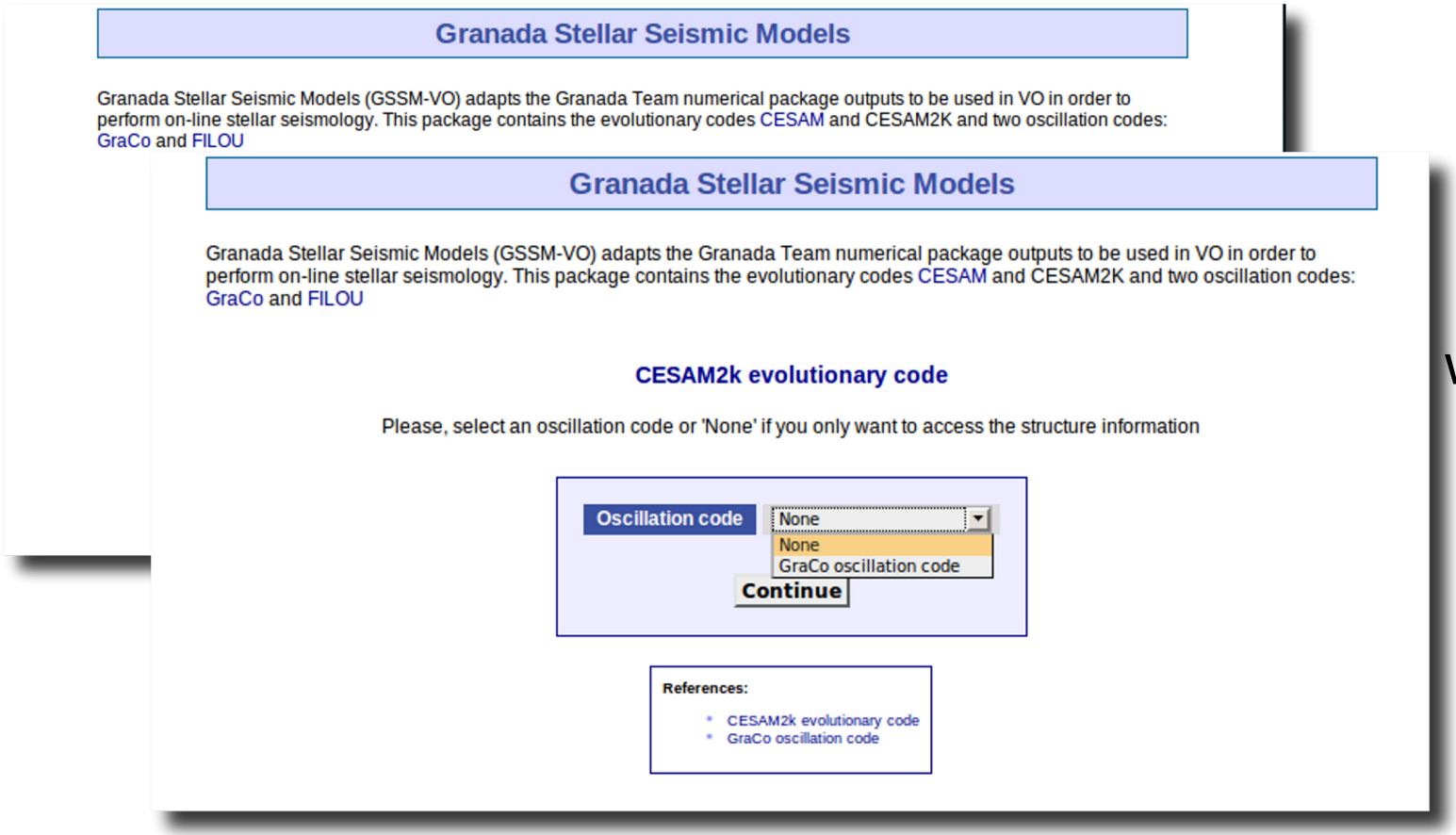
g, and what

Asteroseismology: Service/models parameters



g, and what

Asteroseismology: Service/models parameters



what

Asteroseismology: Service/models parameters

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

Granada Stellar Seismic Models

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- 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(ν)	20	25	(muHz)	
(?)	δ(ν)			(muHz)	
(?)	[ν]			(muHz)	
(?)	[l]				
(?)	[n]				
(?)	Sta.	all modes			
(?)	ν_{Sta}			(muHz)	

Search Reset

References:

Asteroseismology: Search, available results

- 1: Which parameters can be used for searching, and what values are allowed for each of them?
- 2: Which files are available for a given range of those parameters?

Asteroseismology: Search, available results

```
<VOTABLE version="1.1" xsi:schemaLocation="http://www.ivoa.net/xml/VOTable/v1.1">  <INFO name="QUERY_STATUS" val
  <RESOURCE type="results">
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    </PARAM>
    <PARAM name="bibcode" ucd="meta.bib" value="2008Ap%26SS.316..155S">
      <DESCRIPTION>FILOU oscillation code</DESCRIPTION>
    </PARAM>
    <PARAM name="teff" ucd="phys.temperature" unit="K" value="8000/8300" utype="Star.Teff" datatype="float"/>
    <TABLE>
      <FIELD name="teff" ucd="phys.temperature" unit="K" utype="Star.Teff" datatype="float">
        <DESCRIPTION>Effective temperature</DESCRIPTION>
      </FIELD>
      <FIELD name="Lum" ucd="phys.luminosity" unit="Lsun" utype="Star.Luminosity" datatype="float">
        <DESCRIPTION>Luminosity (L/Lsun), Lsun=3.839 e33 erg/s</DESCRIPTION>
      </FIELD>
      <FIELD name="logg" ucd="phys.gravity" unit="" utype="Star.logg" datatype="float">
        <DESCRIPTION>Log(g) (g in cm/s2)</DESCRIPTION>
      </FIELD>
      <FIELD name="density" ucd="phys.density" unit="g/cm3" utype="Star.Density" datatype="float">
        <DESCRIPTION>Average density</DESCRIPTION>
```

g, and what

f those

```
      <FIELD name="link_osc" ucd="DATA_LINK">
        <DESCRIPTION>Link to structure data file</DESCRIPTION>
      </FIELD>
      <FIELD name="link_freq" ucd="DATA_LINK">
        <DESCRIPTION>Link to seismology data file</DESCRIPTION>
      </FIELD>
      <TABLEDATA>
        <TR>
          <TD>8295.2387</TD>          <TD>13.9730</TD>          <TD>4.1886</TD>          <TD>0.4382</TD>
        <TR>
          <TD>8284.8200</TD>          <TD>14.0225</TD>          <TD>4.1848</TD>          <TD>0.4326</TD>
        <TR>
          <TD>8274.2655</TD>          <TD>14.0723</TD>          <TD>4.1811</TD>          <TD>0.4270</TD>
        <TR>
          <TD>8263.5735</TD>          <TD>14.1225</TD>          <TD>4.1773</TD>          <TD>0.4214</TD>
        <TR>
          <TD>8252.7423</TD>          <TD>14.1729</TD>          <TD>4.1735</TD>          <TD>0.4159</TD>
```

Asteroseismology: Search, available results

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

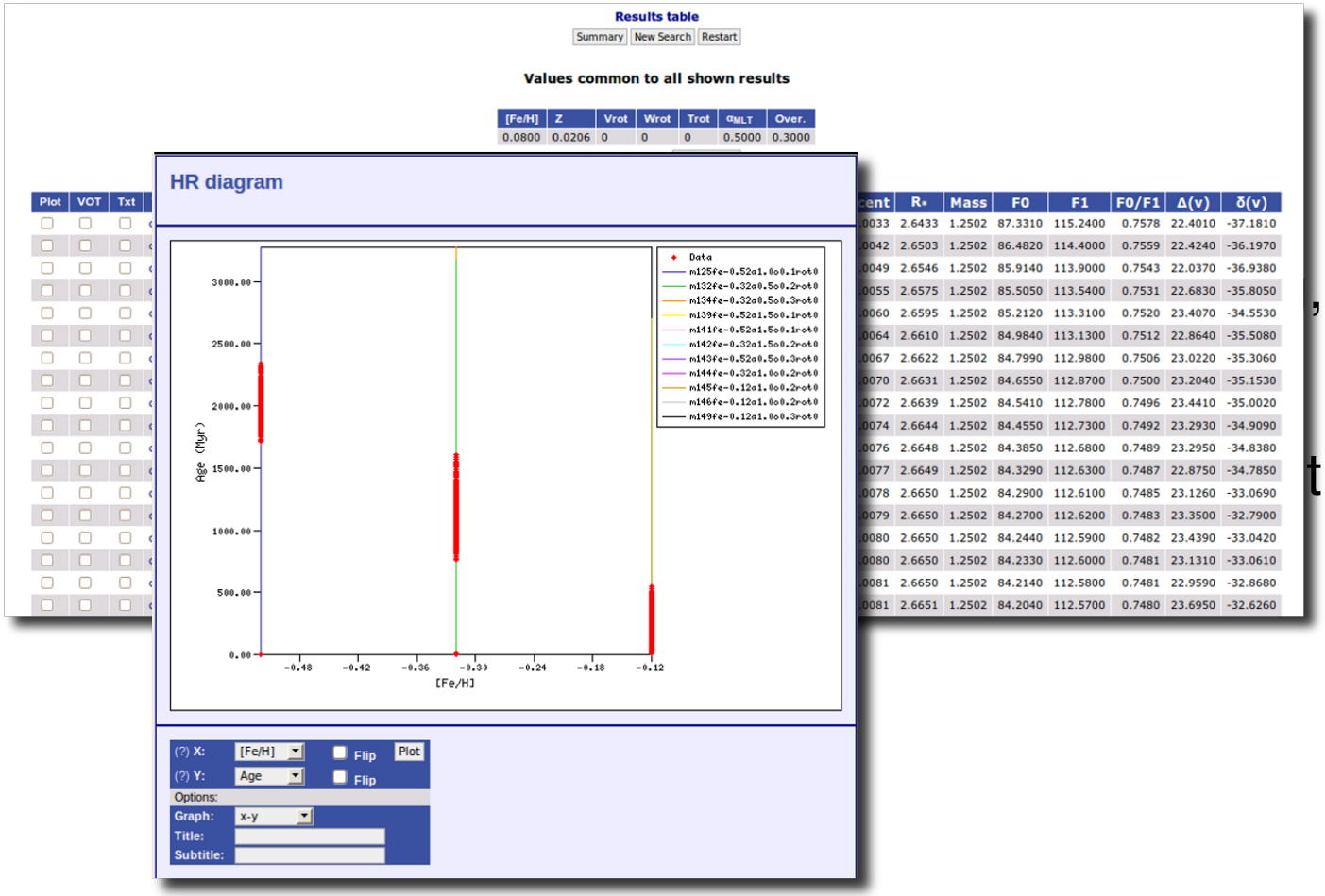
Mark All | Unmark All | Retrieve | Plot

Plot	VOT	Txt	VOT		Txt		Track	Fileid	T_{eff}	Lum	Log(g)	Density	Age	Hcent	R_*	Mass	F0	F1	F0/F1	Δ(ν)	δ(ν)
☐	☐	☐	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

, and what

those

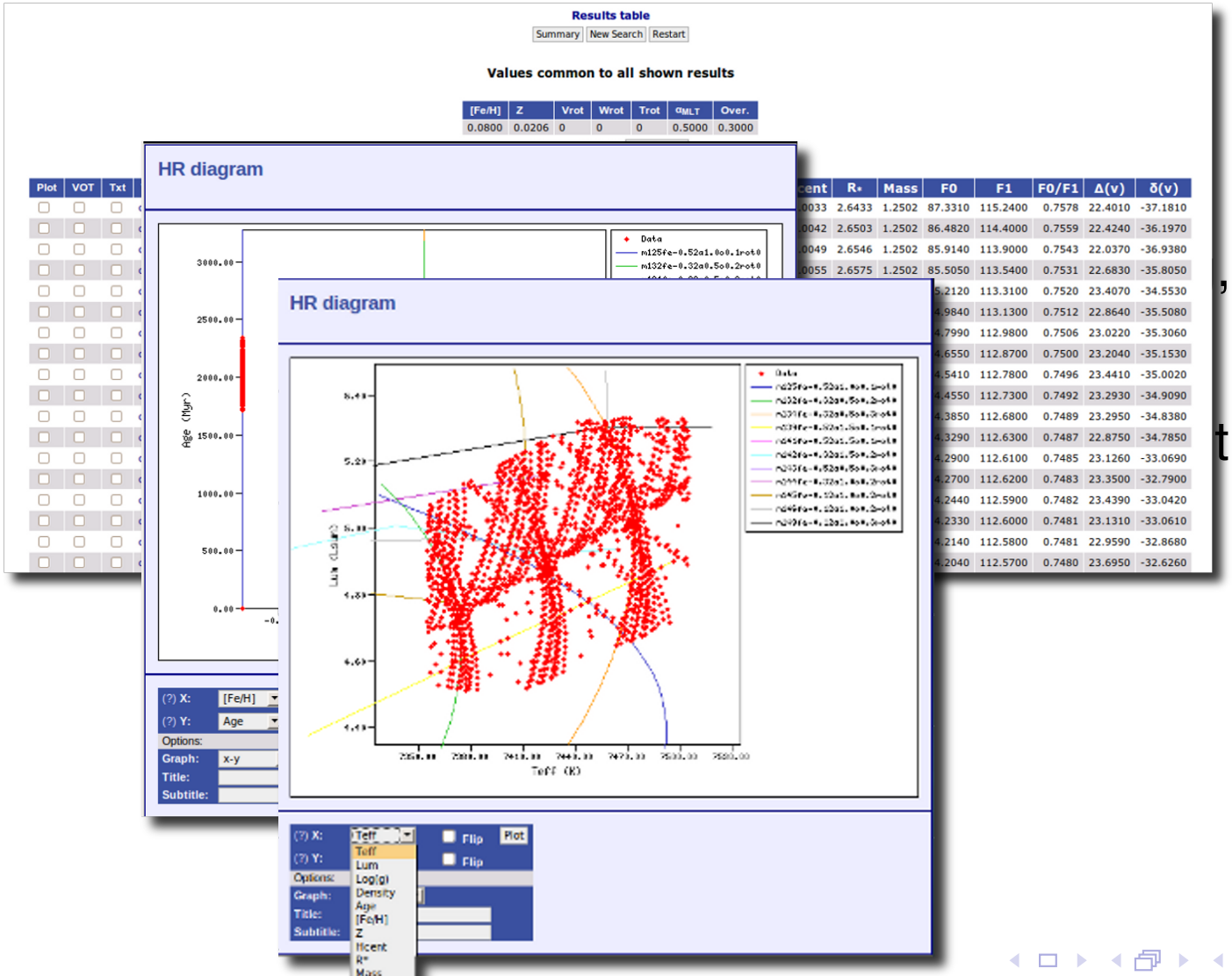
Asteroseismology: Search, available results



, and what

those

Asteroseismology: Search, available results



, and what

those

Asteroseismology: Data files

- 1: Which parameters can be used for searching, and what values are allowed for each of them?
- 2: Which files are available for a given range of those parameters?
- 3: Give me a particular file.

Asteroseismology: Data files

```
<VOTABLE version="1.1" xmlns="http://www.ivoa.net/xml/VOTable/v1.1" xsi:schemaLocation="http://www.ivoa.net/xml/VOTable/v1.1">  <INFO na
  <RESOURCE type="data">
    <PARAM name="concepts" value="http://localhost:80/carlos/svo/theory/astrosism/concepts.php"/>
    <TABLE>
      <FIELD name="r" ucd="phys.size.radius" unit="cm" utype="Shell.Radius" datatype="float">
        <DESCRIPTION>Distance to the center of the star</DESCRIPTION>
      </FIELD>
      <FIELD name="logm" ucd="phys.mass" unit="" utype="Shell.Mass.Log" datatype="float">
        <DESCRIPTION>Logarithm of the mass of the shell at r distance from the center. It is given as a logarithm</DESCRIPTION>
      </FIELD>
      <FIELD name="temp" ucd="phys.temperature" unit="K" utype="Shell.Temp" datatype="float">
        <DESCRIPTION>Temperature at a distance r from the center: T(r))</DESCRIPTION>
      </FIELD>
      <FIELD name="pressure" ucd="phys.pressure" unit="dyn/cm^2" utype="Shell.Pressure" datatype="float">
        <DESCRIPTION>Pressure at distance r from the center: P(r)) </DESCRIPTION>
      </FIELD>
      <FIELD name="density" ucd="phys.density" unit="g/cm^3" utype="Shell.Density" datatype="float">
        <DESCRIPTION>density at distance r from the center: rho(r))</DESCRIPTION>
      </FIELD>
      <FIELD name="dlTdlP" ucd="arith.grad;phys.temperature;phys.pressure" unit="" utype="Shell.RealGradient" datatype="float">
        <DESCRIPTION>Called "real gradient". Variation of the temperature as a function of the pressure) (adimensional)</DESCRIPTION>
      </FIELD>
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, and what

those

- 3: Give me a particular file

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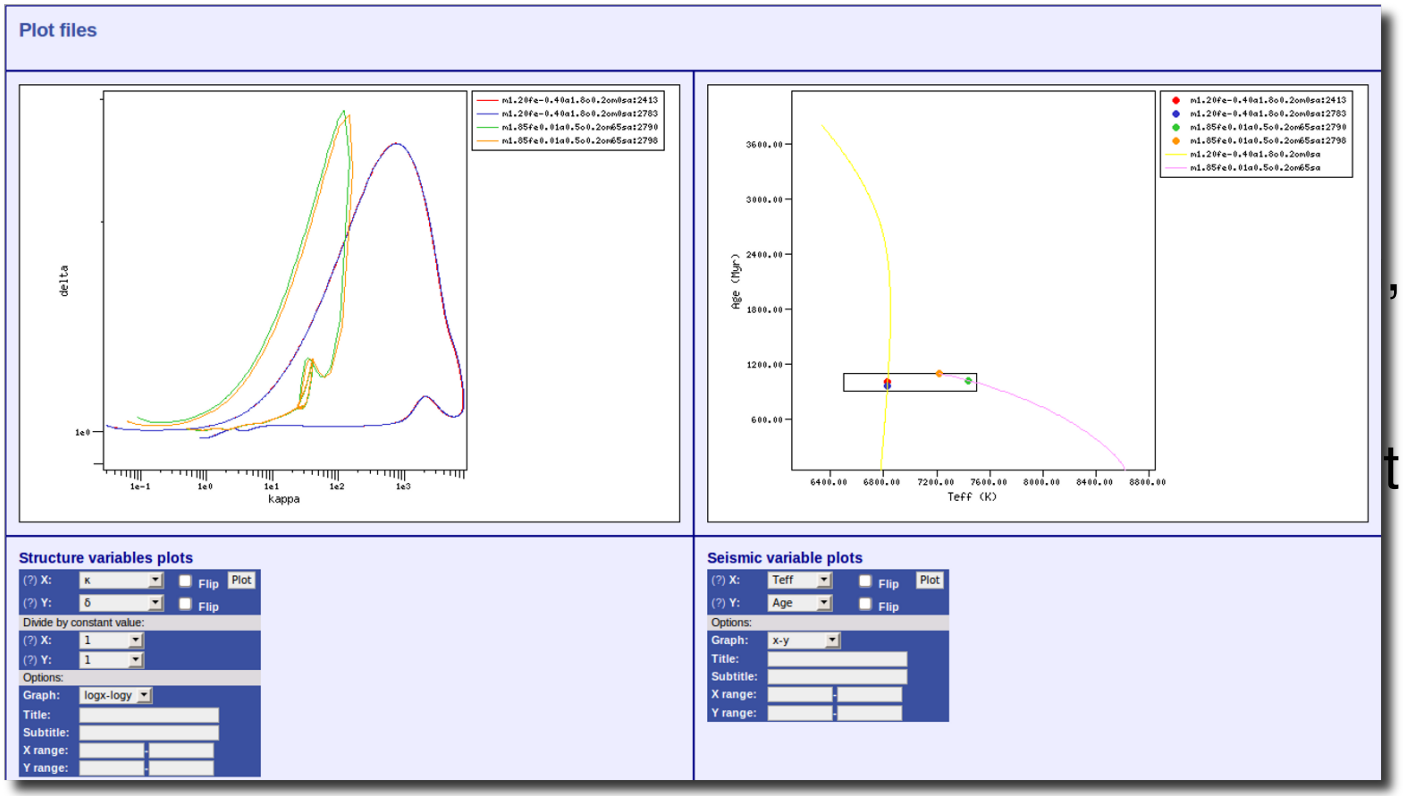
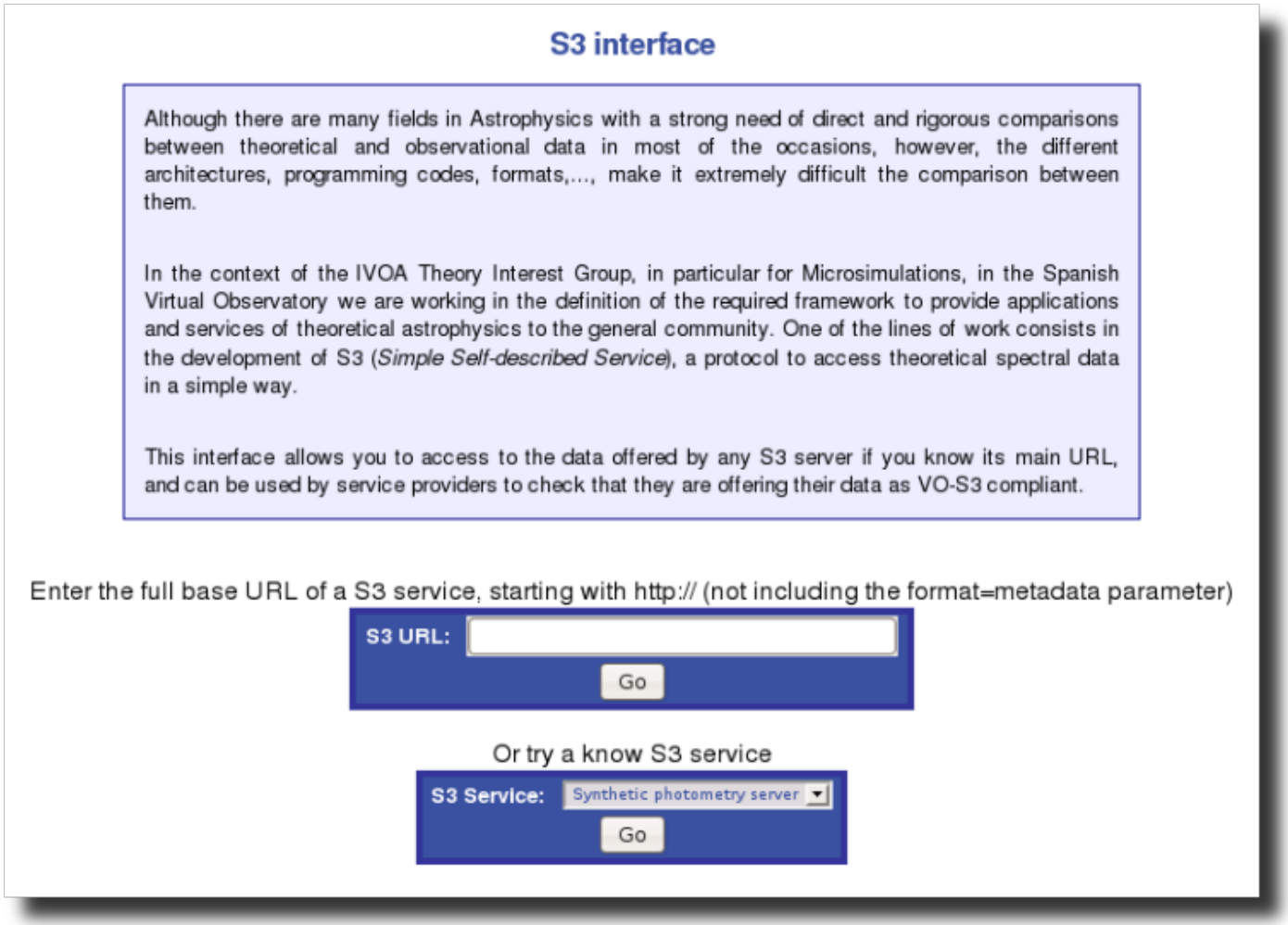
Asteroseismology: Data files



, and what

those

S3 interface



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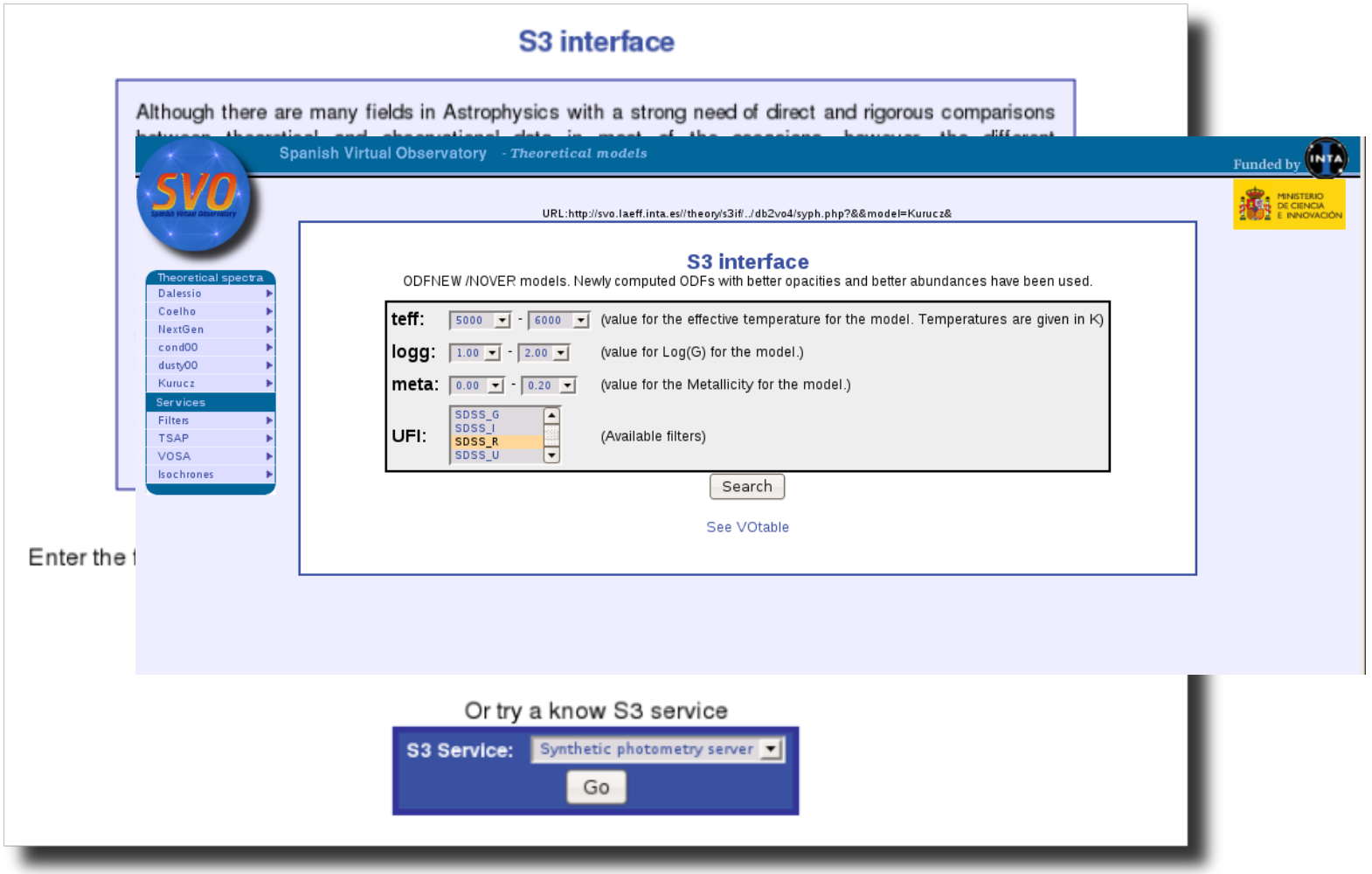

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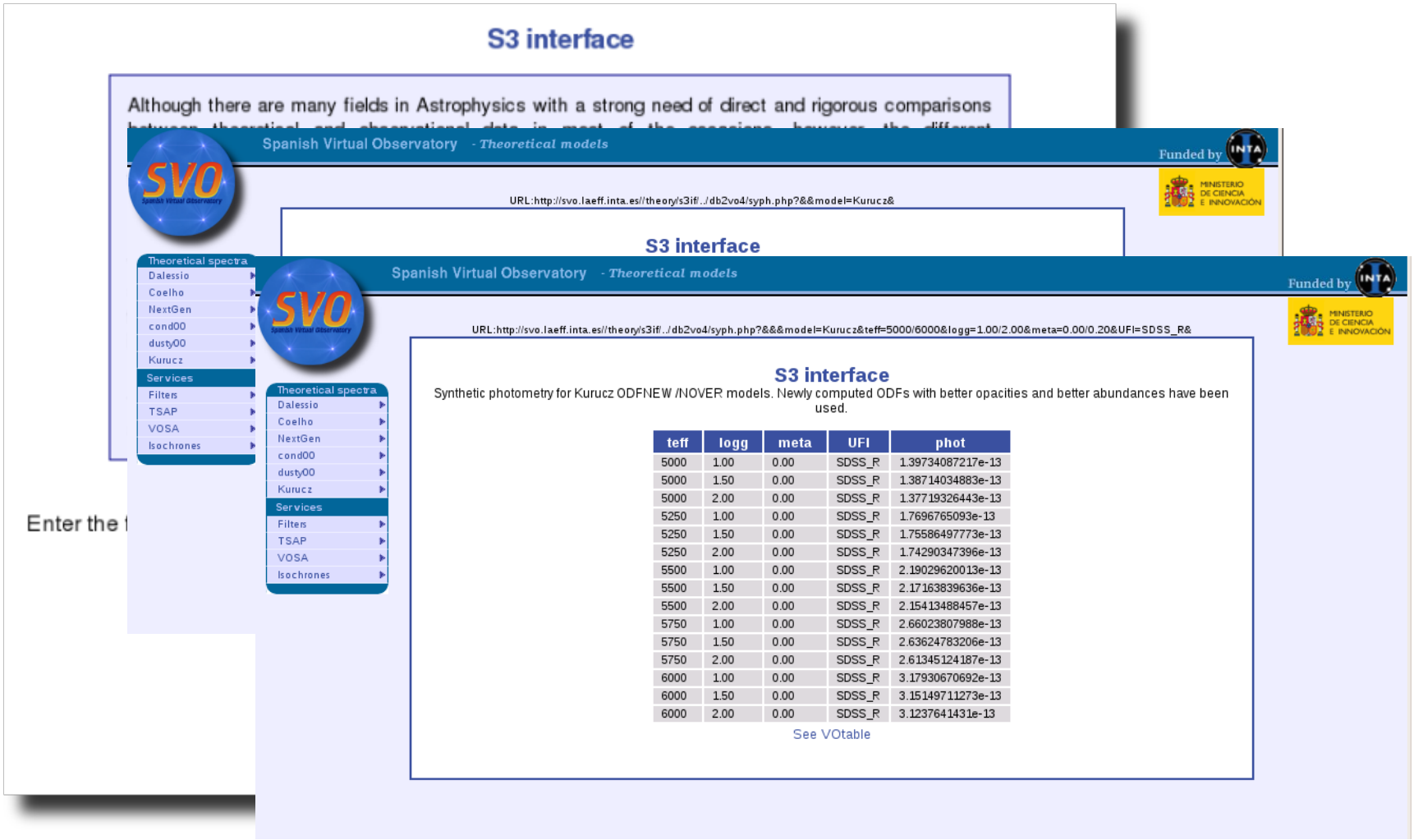

THANK YOU!