

S3: Simple Self-described Service

A simple access protocol for microphysics simulations

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Outline

- 1 Protocol requirements.
 - Simplicity.
 - Self-described data.
- 2 S3 protocol
- 3 A working approach
 - VOSA
 - S3 Interface
 - S3Wizard
- 4 Conclusions



Requirements: Simplicity.

- A microphysics model is often developed by
 - **a small team.**
 - **focused on science, not computing.**
- They want to make their model available in the VO, but probably
 - not to study long and complex protocol definitions.
 - not to invest much time (or people) in developing a complex service.



Requirements: Simplicity.

⇒ **Simplicity.**

- The simpler the development of the service is, the more people will be willing to implement it ⇒ more theoretical models in the VO.



Requirements: Self-described data

- **A theoretical model:**
 - Is not related with a real object or with spatial coordinates.
 - Is defined by a set of parameters and the allowed values for each of them.
 - Those parameters and values are not the same for different models.
 - Even models describing similar physics are often characterized using different types of parameters.
- We need **Flexibility**.



Flexibility: Self-described data.

Self-described data.

- The server offering the model must describe itself as clearly as possible.
 - What kind of model is being offered.
 - What parameters characterize the model (what kind of queries can be done).
 - What is the physical meaning of those parameters.
 - What kind of results can be retrieved.
- The protocol must explain how a application/user can:
 - obtain that self-description in a standardized way.
 - build viable queries to the server.



S3 protocol

- **Dialog** between the application and the model server.
- The server must be able to answer three questions:
 - Which parameters define this model, 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)

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S3 protocol

The query

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

- **Dialog** between the application and the model server.

- The server returns 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>
    </PARAM>
    <PARAM name="INPUT:metallicity" ucd="..." unit=">
      <DESCRIPTION>
        Metallicity of the star defined as Fe/H
      </DESCRIPTION>
    </PARAM>
  </RESOURCE>
</VOTABLE>
```



S3 protocol

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S3 protocol

The query

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

- **Dialog** between the application and the model server.

- The server

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

The query

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

- Dialog between the application and the model server.
- The server

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>
      </TABLEDATA>
    </TABLE>
  </RESOURCE>
</VOTABLE>
```

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S3 protocol

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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*](#)

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Editor(s):

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Abstract

A working approach

- Isochrones/evolutionary tracks servers.
 - Spanish VO: NextGen, COND, DUSTY, Siess.
 - Italian VO: BATSI.
 - An application using some services to compare with user data (*iDraw*)
- A service offering synthetic photometry corresponding to 4 collections of models and more than 50 different filters.
 - An application using the service to infer physical parameters from observed data (*VOSA*).
 - Useful for science (*Bayo et al, A&A 2008, in press*).
- TSAP: a similar approach for the case of theoretical spectra.
 - Included as a use case in the SSAP standard.



VOSA

Sessions	Upload files	Coordinates	VO Phot.	Model Fit	HR Diag.	Save Results	Help	Logout
----------	--------------	-------------	----------	-----------	----------	--------------	------	--------

HR Diagram

Choose the parameter ranges that you want to use for the diagram

NextGen Isochrones

Theoretical Evolutionary Tracks from Baraffe, Chabrier, Allard, Hauschildt, 1998, A&A, 337, 403 'Evolutionary models for solar metallicity low-mass stars: mass-magnitude relationships and color-magnitude diagrams' and Baraffe, Chabrier, Allard, Hauschildt, 2001, A&A, accepted 'Evolutionary models for low-mass stars and brown dwarfs: uncertainties and limits at very young ages'

t: - (Min/Max value for the age of the star. Ages are given in Gyr)

NextGen Evolutionary Tracks

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m: - (Min/Max value for the mass of the star. Masses are given in Msun)

DUSTY99 Isochrones

Theoretical Evolutionary Tracks from Chabrier, Baraffe, Allard, Hauschildt, 2000, ApJ, 542, 464 'Evolutionary models for very-low-mass stars and brown dwarfs with dusty atmospheres' and Baraffe, Chabrier, Allard, Hauschildt, 2002, A&A, 382, 563 'Evolutionary models for low-mass stars and brown dwarfs: uncertainties and limits at very young ages'

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VOSA

m: | 0.020 | - | 1.400 | Msun

DUSTY99 Isochrones

Theoretical Evolutionary Tracks from Chabrier, Baraffe, Allard, Hauschildt, 2000, ApJ, 542, 464 'Evolutionary models for very-low-mass stars and brown dwarfs with dusty atmospheres' and Baraffe, Chabrier, Allard, Hauschildt, 2002, A&A, 382, 563 'Evolutionary models for low-mass stars and brown dwarfs: uncertainties and limits at very young ages'

t: | 0.001 | - | 10.000 | (Min/Max value for the age of the star. Ages are given in Gyr)

DUSTY99 Evolutionary Tracks

Theoretical Evolutionary Tracks from Chabrier, Baraffe, Allard, Hauschildt, 2000, ApJ, 542, 464 'Evolutionary models for very-low-mass stars and brown dwarfs with dusty atmospheres' and Baraffe, Chabrier, Allard, Hauschildt, 2002, A&A, 382, 563 'Evolutionary models for low-mass stars and brown dwarfs: uncertainties and limits at very young ages'

m: | 0.0010 | - | 0.1000 | (Min/Max value for the mass of the star. Masses are given in Msun)

COND99 Isochrones

Theoretical Isochrones from Baraffe, Chabrier, Barman, Allard, Hauschildt, 2003A&A...402..701B in 'Evolutionary models for cool brown dwarfs and extrasolar giant planets. The case of HD 209458'

t: | 0.001 | - | 10.000 | (Min/Max value for the age of the star. Ages are given in Gyr)

COND99 Evolutionary Tracks

Theoretical Evolutionary tracks from Baraffe, Chabrier, Barman, Allard, Hauschildt, 2003A&A...402..701B in 'Evolutionary models for cool brown dwarfs and extrasolar giant planets. The case of HD 209458'

m: | 0.0005 | - | 0.1000 | (Min/Max value for the mass of the star. Masses are given in Msun)

Siess Isochrones

Grid of isochrones for pre-main sequence (PMS) in the mass range 0.1 to 7 Msun

t: | 0.00007 | - | 0.2 | (Min. Age of the star in Gyr)

Siess evolutionary tracks

Grid of evolutionary tracks for pre-main sequence (PMS) in the mass range 0.1 to 7 Msun

m: | 0.1 | - | 7.0 | (Min. Mass of the star in solar masses)



S3 interface



S3 interface

Although there are many fields in Astrophysics with a strong need of direct and rigorous comparisons between theoretical and observational data in most of the occasions, however, the different architectures, programming codes, formats,..., make it extremely difficult the comparison between them.

In the context of the IVOA Theory Interest Group, in particular for Microsimulations, in the Spanish Virtual Observatory we are working in the definition of the required framework to provide applications and services of theoretical astrophysics to the general community. One of the lines of work consists in the development of S3 (*Simple Self-described Service*), a protocol to access theoretical spectral data in a simple way.

This interface allows you to access to the data offered by any S3 server if you know its main URL, and can be used by service providers to check that they are offering their data as VO-S3 compliant.

Enter the full base URL of a S3 service, starting with `http://` (not including the `format=metadata` parameter)

S3 URL:

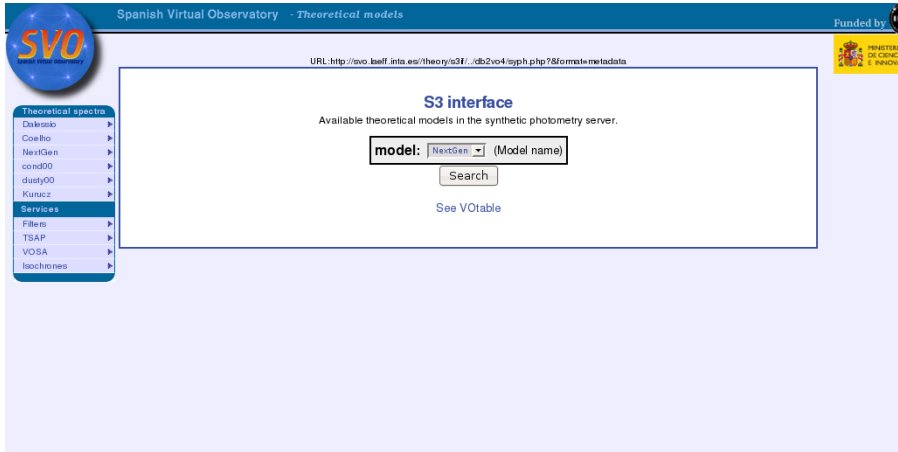
Go

Or try a know S3 service

S3 Service:

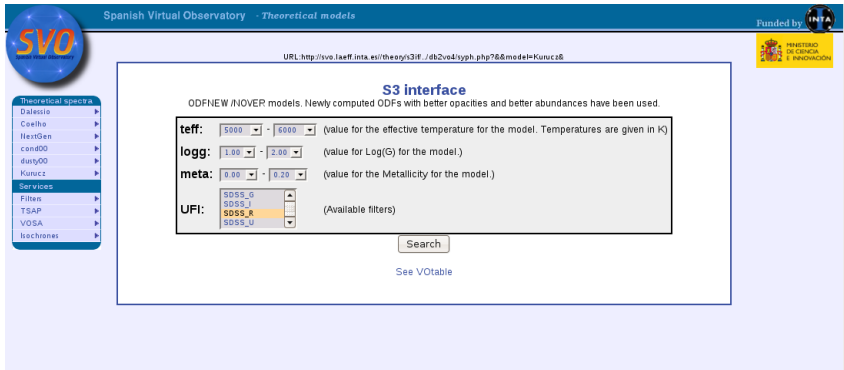
Go

S3 interface





The screenshot shows the S3 interface web page. At the top, there is a header with the SVO logo and the text "Spanish Virtual Observatory · Theoretical models". On the right, it says "Funded by" followed by the Spanish government logo and "MINISTERIO DE CIENCIA E INNOVACION". Below the header, there is a URL: `http://svo.laef.inta.es/theory/s3f/...db2vo4/isyph.php?&format=metadata`. The main content area is titled "S3 interface" and contains the text "Available theoretical models in the synthetic photometry server." Below this, there is a search form with a label "model:" followed by a dropdown menu showing "NextGen" and "(Model name)". A "Search" button is positioned below the dropdown. Underneath the search form, there is a link "See VOTable". On the left side of the page, there is a navigation menu with two sections: "Theoretical spectra" and "Services". The "Theoretical spectra" section includes links for "Dalexiso", "Coelho", "NextGen", "cond00", "dusty00", and "Kurucz". The "Services" section includes links for "Filters", "TSAP", "VOSA", and "Isochrones". At the bottom of the page, there is a navigation bar with various icons for navigation and search.

S3 interface



The screenshot shows the S3 interface web application. At the top, it says "Spanish Virtual Observatory - Theoretical models" and "Funded by INTA". The URL is `http://svo.jaefr.inta.es/theory/s3if/db2ve4/syph.php?&&model=Kurucz&`. The main content area is titled "S3 interface" and contains the text "ODFNEW /NOVER models. Newly computed ODFs with better opacities and better abundances have been used." Below this, there are four input fields: "teff:" with a range of 5000 to 5000 K, "logg:" with a range of 1.00 to 2.00, "meta:" with a range of 0.00 to 0.20, and "UFI:" with a list of filters including SDSS_G, SDSS_J, SDSS_R (selected), and SDSS_U. A "Search" button is located below the input fields, and a link "See VOTable" is at the bottom. On the left side, there is a navigation menu with "Theoretical spectra" and "Services" sections. The "Services" section includes "Filters", "TSAP", "VOSA", and "Isocrones".

S3 interface


Spanish Virtual Observatory - Theoretical models
Funded by 

URL: http://svo.iaeff.inta.es/theory/s3if/db2v4d/cyph.php?6&mode=Kurucz&teff=5000/6000&logg=1.00/2.00&meta=0.00/0.20&UFI=SDSS_R6

S3 interface

Synthetic photometry for Kurucz ODFNEW /NOVER models. Newly computed ODFs with better opacities and better abundances have been used.

teff	logg	meta	UFI	phot
5000	1.00	0.00	SDSS_F	1.39734087217e-13
5000	1.50	0.00	SDSS_F	1.38714034883e-13
5000	2.00	0.00	SDSS_F	1.37719326443e-13
5250	1.00	0.00	SDSS_F	1.7696765093e-13
5250	1.50	0.00	SDSS_F	1.75586497773e-13
5250	2.00	0.00	SDSS_F	1.74290347396e-13
5500	1.00	0.00	SDSS_F	2.19029620013e-13
5500	1.50	0.00	SDSS_F	2.17163839636e-13
5500	2.00	0.00	SDSS_F	2.15413488457e-13
5750	1.00	0.00	SDSS_F	2.66023807988e-13
5750	1.50	0.00	SDSS_F	2.63624783206e-13
5750	2.00	0.00	SDSS_F	2.61345124187e-13
6000	1.00	0.00	SDSS_F	3.17930670692e-13
6000	1.50	0.00	SDSS_F	3.15149711273e-13
6000	2.00	0.00	SDSS_F	3.1237641431e-13


[See VOTable](#)

Theoretical spectra

- Daliesie >
- Coelho >
- NextGen >
- cond00 >
- dusty00 >
- Kurucz >

Services

- Filtres >
- TSAP >
- VOSA >
- Isocrones >





S3wizard

- A wizard that helps to build a VO service for a theoretical model.
- Two inputs are needed
 - A set of ascii files containing the data corresponding to each model.
 - An ascii file with the name of every data file and the values of the parameters that characterize each file.
 - (User inputs about the meaning of parameters, data columns, curation, credits... All by a web interface.)
- The application builds:
 - The database
 - A web page with forms to download files in ascii and votable formats.
 - A VO service able to answer the three types of S3 queries.



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S3wizard



S3 Wizard



Siess et al isochrones

Models

* New Model

* **sless**

* sless_t

Config

* Admin User

* DB config

* About

* Logout

Model

Read File

Params

Data

Curation

Credits

Delete

In order to build a VO service with your model data, some more information is necessary to describe the parameters in a useful way.

Please, try to fill in the following form as much as possible

Name [?]	Type [?]	Unit [?]	UCD [?]	Title [?]	Description [?]
t	float	Gyr	phys.age	Age	Age of the star in Gyr

Save Params

S3wizard



Theoretical Model Server



Available Models

- ▶ **Siess et al isochrones:**
Grid of isochrones for pre-main sequence (PMS) in the mass range 0.1 to 7 Msun
- ▶ **Siess et al evolutionary tracks:**
Grid of evolutionary tracks for pre-main sequence (PMS) in the mass range 0.1 to 7 Msun

S3wizard



Theoretical Model Server



Siess et al isochrones

Grid of isochrones for pre-main sequence (PMS) in the mass range 0.1 to 7 Msun

Age (?) Search Restart

0.00007 - 0.2 10 results

18 results available, 10 shown

Age	Fetch	Fetch
0.0001	VOTable	ASCII
0.0002	VOTable	ASCII
0.0003	VOTable	ASCII
0.0005	VOTable	ASCII
0.0007	VOTable	ASCII
0.1	VOTable	ASCII
0.01	VOTable	ASCII
0.001	VOTable	ASCII
0.2	VOTable	ASCII
0.02	VOTable	ASCII

Conclusions

- **Flexible:** self-described data.
- **Simple:** http queries + dialog + votable.
 - not discarding more complex protocols where they are needed.
- **Useful:**
 - Developers can make their models available in the VO.
 - Applications can access those models.
- *Something like what ConeSearch is for catalogues:*
 - an easy, fast and effective way to develop a theoretical service in the VO.



THANK YOU!