

Simple access protocol for microphysics simulations

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Outline

- 1 Introduction
- 2 Protocol requirements.
 - Flexibility.
 - Simplicity.
- 3 A working approach (S3p?)
- 4 Conclusions

Theoretical models in VO?

- **VO protocols for observational data**
 - (ConeSearch, SIAP, SSAP,...)
 - are built around coordinates and/or real objects.
 - <http://.../ssap.jsp?POS=336.5228,-48.43854&SIZE=0.2>
 - **Not valid for theoretical models.**

Theoretical models in VO?

- **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.

Requirements: Flexibility.

- Each scientist develops his/her model focusing on the specific physical problem that he/she wants to address.
- There are reasons why each developer has chosen to characterize his model using a particular set of parameters
 - The metallicity can be expressed in terms of **Z** or **Fe/H**.
 - An IMF can be characterized by a power law (M_{sup} , M_{low} , α), a log-normal ($\langle M \rangle$, σ) or even naming its author.
 - (...)
- 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 a viable query to the server.



Requirements: Simplicity.

- A microphysics model is often developed by a small team.
 - **focused on science, not computing.**
 - few people (one or two senior scientists, one or two PhD students...)
- They want to make their model available in the VO.
 - more visibility.
 - they know it's useful for other people, for instance, to infer physical properties from the observations...

Requirements: Simplicity.

- Authors would prefer to develop their own service
 - Make available new versions as they are developed (offering new functionalities, correcting errors, refining details...)
- But... there is a good chance that they don't have time, money or will to:
 - study long and complex protocol definitions.
 - 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.

A working approach (S3p?)

- **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)
- You don't need to change your code.
 - Just add a layer to understand and answer the queries.

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A working approach (S3p?)

The Query

- **Dialog** between the app

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

- The server must be able

- Which parameters defined for each of the

- Which files are available for each of the parameters?

- Give me a particular file

- Each answer is just a VO

- You don't need to change

- Just add a layer to understand

```
--<VOTABLE version="1.1" xsi:schemaLocation="http://www.ivoa.net/xml/VOTable/v1.1" --<RESOURCE type="meta">
  --<DESCRIPTION>
    Theoretical isochrones from Baraffe, Chabrier, Barman, Allard, Hauschildt, 2003A&A...458...101B...
  --</DESCRIPTION>
  --<INFO name="QUERY_STATUS" value="OK"/>
  --<PARAM name="INPUT.tmin" uid="phys.age">
    --<DESCRIPTION>
      min value for the age of the star. Ages are given in Gyr
    --</DESCRIPTION>
    --<VALUES type="actual">
      --<OPTION value="0.001"/>
      --<OPTION value="0.005"/>
      --<OPTION value="0.010"/>
      --<OPTION value="0.050"/>
      --<OPTION value="0.100"/>
      --<OPTION value="0.120"/>
      --<OPTION value="0.500"/>
      --<OPTION value="1.000"/>
      --<OPTION value="5.000"/>
      --<OPTION value="10.000"/>
    --</VALUES>
  --</PARAM>
  --<PARAM name="INPUT.tmax" uid="phys.age">
    --<DESCRIPTION>
      max value for the age of the star. Ages are given in Gyr
    --</DESCRIPTION>
    --<VALUES type="actual">
      --<OPTION value="0.001"/>
      --<OPTION value="0.005"/>
      --<OPTION value="0.010"/>
      --<OPTION value="0.050"/>
      --<OPTION value="0.100"/>
      --<OPTION value="0.120"/>
      --<OPTION value="0.500"/>
      --<OPTION value="1.000"/>
      --<OPTION value="5.000"/>
      --<OPTION value="10.000"/>
    --</VALUES>
  --</PARAM>
--</TABLE>
```

are

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A working approach (S3p?)

The Query

http://www.../s3p.php?tmin=0.5&tmax=1

- **Dialog** between the app
- The server must be able
 - Which parameters define the simulation?
 - Which files are available for each of the parameters?
 - Give me a particular file
- Each answer is just a VO
- You don't need to change
- Just add a layer to understand

```
</DESCRIPTION>
</PARAM>
</GROUP>
- <GROUP utype="General">
  <PARAM name="Subject" datatype="char" arraysize="" value="Isocrones"/>
  <PARAM name="Source" datatype="char" arraysize="" value="2003A&A...402">
  <PARAM name="ReferenceURL" datatype="char" arraysize="" value="http://www.laeff.esa.es/projects/svo/theory/isocr/cond99/getiso.php"/>
  <PARAM name="Type" datatype="char" arraysize="" value="Simulation"/>
  <PARAM name="ContentLevel" datatype="char" arraysize="" value="Research">
</GROUP>
- <FIELD name="t" ucd="time.age" unit="Gyr" datatype="float">
  <DESCRIPTION> value for the age of the star in Gyr </DESCRIPTION>
</FIELD>
- <FIELD name="title" ucd="VOX:image_title" datatype="char" arraysize="">
  <DESCRIPTION> Title.</DESCRIPTION>
</FIELD>
- <FIELD name="format" ucd="VOX:spectrum_format" datatype="char" arraysize="">
  <DESCRIPTION> Spectrum format.</DESCRIPTION>
</FIELD>
- <FIELD name="Spectrum" ucd="DATA_LINK" datatype="char" arraysize="">
  <DESCRIPTION> Link to the spectrum file.</DESCRIPTION>
</FIELD>
- <DATA>
  <TABLEDATA>
    <TR>
      <TD>0.500</TD>
      <TD>SOME99 isocrone for t=0.500 Gyr</TD>
      <TD>votable</TD>
    </TR>
    <TR>
      <TD>
        http://www.laeff.esa.es/projects/svo/theory/isocr/cond99/getiso.php?t=1.000
      </TD>
    </TR>
    <TR>
      <TD>1.000</TD>
      <TD>COND99 isocrone for t=1.000 Gyr</TD>
      <TD>votable</TD>
    </TR>
    <TR>
      <TD>
        http://www.laeff.esa.es/projects/svo/theory/isocr/cond99/getiso.php?t=1.000
      </TD>
    </TR>
  </TABLEDATA>
</DATA>
</RESOURCE>
</NOTABLE>
```

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A working approach (S3p?)

The Query

- **Dialog** between the app
- The server must be able to
 - Which parameters define the data?
 - Which files are available for each of the parameters?
 - Give me a particular file
- Each answer is just a VO
- You don't need to change
 - Just add a layer to understand

<http://www.../s3p.php?t=0.5>

```
<FIELD name="Mk" ucd="phot.mag" unit="" datatype="float">  
<DESCRIPTION> Absolute K magnitude. CIT-system </DESCRIPTION>  
</FIELD>  
--<FIELD name="Ml" ucd="phot.mag" unit="" datatype="float">  
<DESCRIPTION> Absolute L' magnitude. Johnson-Glass system </DESCRIPTION>  
</FIELD>  
--<FIELD name="Mm" ucd="phot.mag" unit="" datatype="float">  
<DESCRIPTION> Absolute M magnitude. Johnson system </DESCRIPTION>  
</FIELD>  
</DATA>  
--<TABLEDATA>  
--<TR>  
<TD>0.500</TD>  
<TD>0.0005</TD>  
<TD>1.41</TD>  
<TD>-8.415</TD>  
<TD>3.097</TD>  
<TD>0.105</TD>  
<TD>56.3</TD>  
<TD>51.03</TD>  
<TD>46.6</TD>  
<TD>37.42</TD>  
<TD>33.07</TD>  
<TD>51.62</TD>  
<TD>23.09</TD>  
<TD>20.59</TD>  
</TR>  
--<TR>  
<TD>0.500</TD>  
<TD>0.0010</TD>  
<TD>203</TD>  
<TD>-7.753</TD>  
<TD>3.365</TD>  
<TD>0.109</TD>  
<TD>47.57</TD>  
<TD>42.98</TD>  
<TD>38.99</TD>  
<TD>31.61</TD>  
<TD>29.15</TD>  
<TD>43.23</TD>  
<TD>20.93</TD>  
<TD>18.68</TD>  
</TR>  
--<TR>
```

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A working approach

- An isochrones/evolutionary tracks server.
 - An application using the service to compare with user data.
- A service offering synthetic photometry corresponding to 4 collections of models and 51 different filters.
 - An application using the service to infer physical parameters from observed data.
 - Useful for science: *Bayo et al, 2008*.
- TSAP: a similar approach for the case of theoretical spectra.
 - Included as a use case in the SSAP standard.

Conclusions

- **Flexible:** self-described data.
- **Simple:** http queries + dialog + votable.
 - not discarding more complex protocols where they are needed.
- *Something like what ConeSearch is for catalogues:*
 - an easy, fast and effective way to develop a theoretical service .in the VO.
- Specific needs:
 - **Credits:** considered explicitly.
 - **What else?**
 - input from everybody interested is important.

S3p

Simple
Self-described
Service
Protocol

?

THANK YOU!