



IVOA Interoperability Meeting



Theory: new developments by





Summary



Theory Vobs.it developments:

- Stellar evolution track and isochrones data searchable by TOPCAT;
- VOTable for two services as prototypes of SimDAP:
 - Choosing quantities from different photometric system to add to an isochrone file;
 - Choosing and adding quantities to a track from a file (key point files) that has the abundance element info;
- New IRA-CINECA simulated cluster archive;
- Future plans;



BaSTI on TOPCAT



M. Molinaro implemented a series of Java classes to be inserted in TOPCAT application by M. Taylor, that permit direct queries to BaSTI database, the Teramo Astronomical Observatory database of a Bag of Stellar Tracks and Isochrones.

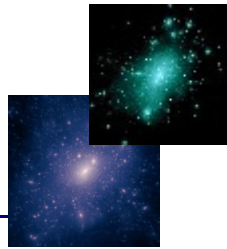
So a user can search inside the DB, choose the interest result and use directly all the potentiality of TOPCAT.

Demo

(Thanks to M. Taylor)



Different photo system inside one isochrone file



VOTable standard format for evolutionary model with four quantities mandatory: M , $\log(L)$, $\log(T_e)$, $\log(t)$ and the possibility of choosing a “colour” from different photometry models:

1. **ACS**: Advanced Camera for Survey - on board of HST - Vega mag (Bedin et al. 2005, MNRAS, 357, 1038);
2. **SLOAN**: Sloan system (Marconi et al. 2005, MNRAS, 371, 1503) ;
3. **JOHNSON CASTELLI**: Johnson-Cousins system (Pietrinferni et al. 2004, ApJ, 612, 168);
4. **STROEMGREN CASTELLI**: Stroemgren system (Pietrinferni et al. 2006, ApJ, 642, 797) ;
5. **WALRAVEN** : Walraven system;
6. **WFC2 HST**: Wide Field Planetary Camera 2 system - on board of HST ;
7. **WFC3 (UVIS) HST**: Wide Field Camera 3 (UVIS) system - on board of HST ;



VOTable

format for
photometric
quantities
service
link



```
C:\Users\Manzato\Documents\ITVO\Presentazioni\2010_Victoria\Colorazioni_iso\Colorazione_wz102y2 - Windows Internet E...
C:\Users\Manzato\Documents\ITVO\Presentazioni\2010_Vi
NL 1998-2001s ottoscritti I 21 febbraio2 002
Preferiti CCNL Comparto Istituzion... CCNLPub 04/2002 C:\Users\Manzato\Doc...
<?xml version="1.0" encoding="UTF-8" ?>
- <VOTABLE version="1.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.ivoa.net/xml/VOTable/v1.2"
  xmlns:stc="http://www.ivoa.net/xml/STC/v1.30">
  <DESCRIPTION>Isochrone photometry system by Pietrinferni - Cassisi - Salaris - Castelli
  2006 ::: Standard Model - Scaled solar model & transformations (Castelli 1999) + BaSel
  Library (2002) + Empirical Transf. for C-Stars</DESCRIPTION>
- <RESOURCE>
  <DESCRIPTION>This file is aimed at let the user get and use one or more photometric system
  for one isochron. The fields log(age), M/Mo, log(L/Lo) and logTe are fixed and than the
  use can choose one or more photometric magnitude</DESCRIPTION>
  <DESCRIPTION>For further information on PARAM(s) and FIELD(s) see:
  "http://www.as.oats.inaf.it/IA2/index.php?
  option=com_wrapper&Itemid=87"</DESCRIPTION>
- <PARAM datatype="char" name="DataType" ucd="meta.note" unit="--" value="Isochrone">
  <DESCRIPTION>Type of data simulation for this service</DESCRIPTION>
  </PARAM>
- <PARAM arraysize="*" datatype="char" name="PhotSystem" ucd="meta.note" unit="--">
  <DESCRIPTION>Photometric system used to translate theoretical
  simulation</DESCRIPTION>
- <VALUES>
  - <OPTION name="ACS-HST" value="ACS-HST">
    ACS-HST
    <OPTION>F435W</OPTION>
    <OPTION>F475W</OPTION>
    <OPTION>F555W</OPTION>
    <OPTION>F606W</OPTION>
    <OPTION>F625W</OPTION>
    <OPTION>F775W</OPTION>
    <OPTION>F814W</OPTION>
  </OPTION>
  - <OPTION>
    Sloan
    <OPTION>Mg</OPTION>
    <OPTION>u-g</OPTION>
    <OPTION>g-r</OPTION>
    <OPTION>r-i</OPTION>
    <OPTION>i-z</OPTION>
  </OPTION>
  - <OPTION>
    Johnson-Cousins
    <OPTION>Mv</OPTION>
    <OPTION>(U-V)</OPTION>
    <OPTION>(B-V)</OPTION>
    <OPTION>(V-I)</OPTION>
    <OPTION>(V-R)</OPTION>
    <OPTION>(V-J)</OPTION>
    <OPTION>(V-K)</OPTION>
    <OPTION>(V-L)</OPTION>
    <OPTION>(H-K)</OPTION>
  </OPTION>
```



More quantities on a Track file: abundances and others



To a track file
will be possible
to add
one of these
quantities



- Log_t Logarithm of age (yr)
- H_HE H or He central abundance
- Log_L Logarithm of Luminosity (in solar units)
- Log_Te Logarithm of effective Temperature (K)
- Log_Tc Logarithm of central Temperature (K)
- Log_Rc Logarithm of central Density (cgs units)
- Mcc Mass of convective core (solar units)
- M_cHe Mass of He core (solar units)
- M_cCo Mass of C-O core (solar units)
- Mce Mass of convective envelope (solar units)
- Lpp_Ls p-p chain Luminosity (in units of Surface Luminosity)
- Lcno_Ls CNO chain Luminosity (in units of Surface Luminosity)
- L3a_Ls 3-alpha chain Luminosity (in units of Surface Luminosity)
- Lgr_Ls Gravitational Luminosity (in units of Surface Luminosity)
- He_sup Surface He abundance
- Mtot Total star mass (in solar units)
- Log_Tmax Logarithm of maximum Temperature off-center



VOTable format for key point phase quantities service link



```
C:\Users\Manzato\Documents\ITVO\Presentazioni\2010_Victoria\kpt_track\Track_KPTservice.xml - Windows Internet Explorer
C:\Users\Manzato\Documents\ITVO\Presentazioni\2010_Victoria\kpt_track\Track_KP
Preferiti C:\Users\Manzato\Documents\ITVO\Presentazio...
C:\Users\Manzato\Documents\ITVO\Presentazioni\2010_Victoria\kpt_track\Track_KPTservice.xml
<?xml version="1.0" encoding="UTF-8" ?>
- <VOTABLE version="1.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.ivoa.net/xml/VOTable/v1.2" xmlns:stc="http://www.ivoa.net/xml/STC/v1.30">
  <DESCRIPTION>Isochrone photometry system by Pietrinforni - Cassisi - Castelli 2006 ::: Standard Model -
  Scaled solar model & transformations (Castelli 1999) + BaSeL Library (2002) + Empirical Transf. for C-
  Stars</DESCRIPTION>
- <RESOURCE>
  <DESCRIPTION>This file is aimed at let the user get and use one or more quantities contained in the key points
  files for one track. The fields log(age), M/Mo, log(L/Lo) and logTe are fixed and than the use can choose one
  or more photometric magnitude</DESCRIPTION>
  <DESCRIPTION>For further information on PARAM(s) and FIELD(s) see:
  "http://www.as.oats.inaf.it/IA2/index.php?option=com_wrapper&Itemid=87"</DESCRIPTION>
- <PARAM arraysize="*" datatype="char" name="DataType" ucd="meta.note" unit="--" value="Stellar Track">
  <DESCRIPTION>Type of data simulation for this service</DESCRIPTION>
</PARAM>
- <PARAM arraysize="*" datatype="char" name="KPT quantities" ucd="meta.note" unit="--">
  <DESCRIPTION>Quantities available inside the key point file</DESCRIPTION>
- <VALUES>
  <OPTION name="H/HE" value="H/HE">H/HE</OPTION>
  <DESCRIPTION>H or He central abundance</DESCRIPTION>
  <OPTION name="logTc" value="logTc">logTc</OPTION>
  <DESCRIPTION>Logarithm of central Temperature (K)</DESCRIPTION>
  <OPTION name="logRc" value="logRc">logRc</OPTION>
  <DESCRIPTION>Logarithm of central Density (cgs units)</DESCRIPTION>
  <OPTION name="Mcc" value="Mcc">Mcc</OPTION>
  <DESCRIPTION>Mass of convective core (solar units)</DESCRIPTION>
  <OPTION name="M_cHe" value="M_cHe">M_cHe</OPTION>
  <DESCRIPTION>Mass of He core (solar units)</DESCRIPTION>
  <OPTION name="M_cCO" value="M_cCO">M_cCO</OPTION>
  <DESCRIPTION>Mass of C-O core (solar units)</DESCRIPTION>
  <OPTION name="Mce" value="Mce">Mce</OPTION>
  <DESCRIPTION>Mass of convective envelope (solar units)</DESCRIPTION>
  <OPTION name="Lpp/Ls" value="Lpp/Ls">Lpp/Ls</OPTION>
  <DESCRIPTION>p-p chain Luminosity (in units of Surface Luminosity)</DESCRIPTION>
  <OPTION name="Lcno/Ls" value="Lcno/Ls">Lcno/Ls</OPTION>
  <DESCRIPTION>CNO chain Luminosity (in units of Ssurface Luminosity)</DESCRIPTION>
  <OPTION name="L3a/Ls" value="L3a/Ls">L3a/Ls</OPTION>
  <DESCRIPTION>3-alpha chain Luminosity (in units of Surface Luminosity)</DESCRIPTION>
  <OPTION name="Lgr/Ls" value="Lgr/Ls">Lgr/Ls</OPTION>
  <DESCRIPTION>Gravitational Luminosity (in units of Surface Luminosity)</DESCRIPTION>
  <OPTION name="He_sup" value="He_sup">He_sup</OPTION>
  <DESCRIPTION>Surface He abundance</DESCRIPTION>
  <OPTION name="log(Tmax)" value="log(Tmax)">log(Tmax)</OPTION>
  <DESCRIPTION>Logarithm of maximum Temperature off-center</DESCRIPTION>
</VALUES>
</PARAM>
- <TABLE ID="data1" name="Colour Data" utype="">
  <DESCRIPTION>Output Data fix and asked key points quantities</DESCRIPTION>
- <FIELD arraysize="*" datatype="char" name="Column name" ucd="" unit="--">
  <DESCRIPTION>Column Name of the file</DESCRIPTION>
</FIELD>
<FIELD arraysize="*" datatype="char" name="Description column" ucd="" unit="--">
```



Cineca Data Archive

<http://data.cineca.it/>



The IRA-CINECA Simulated Clusters Archive

The IRA-CINECA Simulated Clusters Archive - Mozilla Firefox

File Modifica Visualizza Cronologia Segnalibri Strumenti Aiuto

http://data.cineca.it/index.php?option=com_content&view=article&id=4&Itemid=14

Più visitati Come iniziare Ultime notizie

The IRA-CINECA Simulated Clusters A...

Cineca Data Archive for numerical simulations

Main Menu

- Home
- IRA-CINECA Simulated Cluster Archive
- The Team
- Movies

Other Data Services

- ITVO@Catania
- ITVO@Trieste

Communities

- Particles in Turbulence Project
- IVOA

Images



Number of accesses

Content View Hits : 632

The IRA-CINECA Simulated Clusters Archive

The archive collects the data of a sample of 20 galaxy clusters with large masses, simulated with high spatial resolution using the ENZO 1.5 Cosmological AMR code. From this service you can download the direct outputs of the simulation (in some cases at very high time resolution), the data specific to the cluster region (gas density, temperature and velocity, dark matter - DM - density) and some processed results (images, statistics...).

The archive is continuously improved and enlarged with new data and information.

The Adaptive Mesh Refinement triggered in two ways:

- refining on gas/DM overdensity ($\delta_{\rho}/\rho > 3$);
- refining on velocity jumps associated to shocks/turbulence ($\delta v/v > 3$)

This allows to get high resolution both in the inner parts of the clusters and on the outskirts, where relevant shocks develop.

Simulations are run on the IBM-SP6/5376 cluster at CINECA (Casalecchio di Reno, Bologna, Italy). Every run took about 30-40 000 cpu hours run using 512 processors, for a total time of about 800 000 cpu hours to complete the whole sample. The CPU resources were obtained thanks to the "2008-2010 INAF-CINECA agreement".

All the produced data (and that which will be produced in the future - work is still in progress) is available for free. Soon effective download services will be available. At the moment, if you are interested in one or more datasets, please contact directly the authors (see "The team" section). If you are going to use the Archive's data for your work, please acknowledge the "IRA-CINECA Simulated Cluster Archive" in the related publications.

The **first article** reporting the exploratory results on the sample and the first scientific application can be found [here](#).

Methodology

- A set of low resolution simulations were produced, sampling a total cosmological volume of $(480\text{Mpc/h})^3$
- The most massive clusters ($M > 10e15M_{\text{sol}}$) were resimulated with initial nested grids of increasing spatial/DM mass resolution. The DM mass resolution in the cluster region is $\text{mdm} = 6.7e8M_{\text{sol/h}}$
- Adaptive Mesh Refinement is turned on inside cubes of side $4R_{\text{vir}}$ (R_{vir} is the virial radius of each galaxy cluster at $z=0$), with the techniques tested in [Vazza et al.\(2009\)](#) allowing for a peak spatial resolution of 25kpc/h , and the fairly large dynamical range of $N=(500-600)^3$ for each object.

For the simulations presented here, we assume a "concordance" Lambda-CDM cosmology with:

- $\Omega_0 = 1.0$



Completato [nessun dizionario impostato]



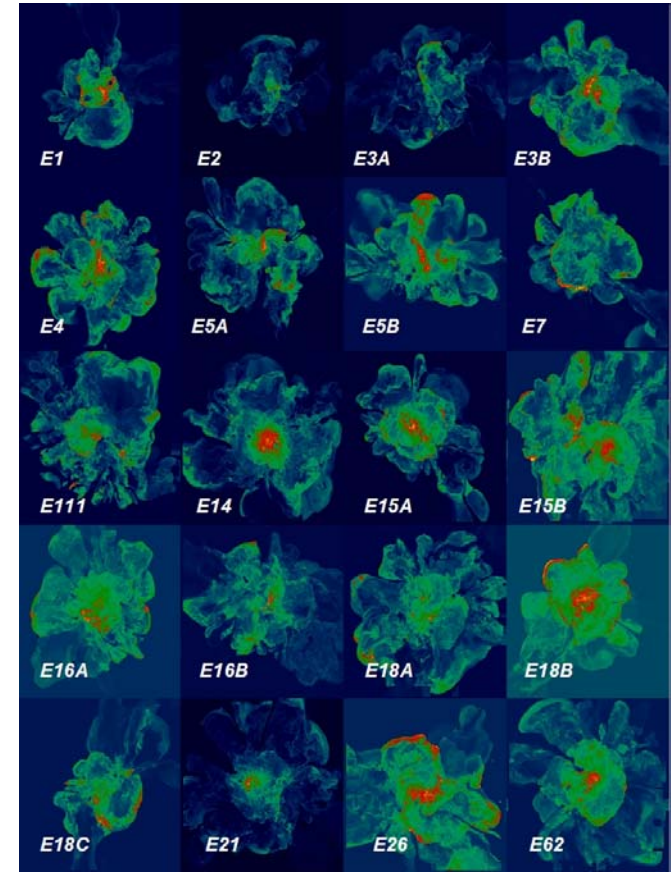
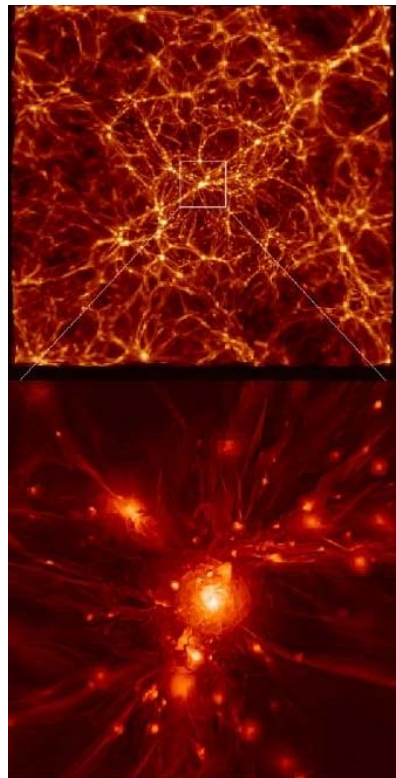
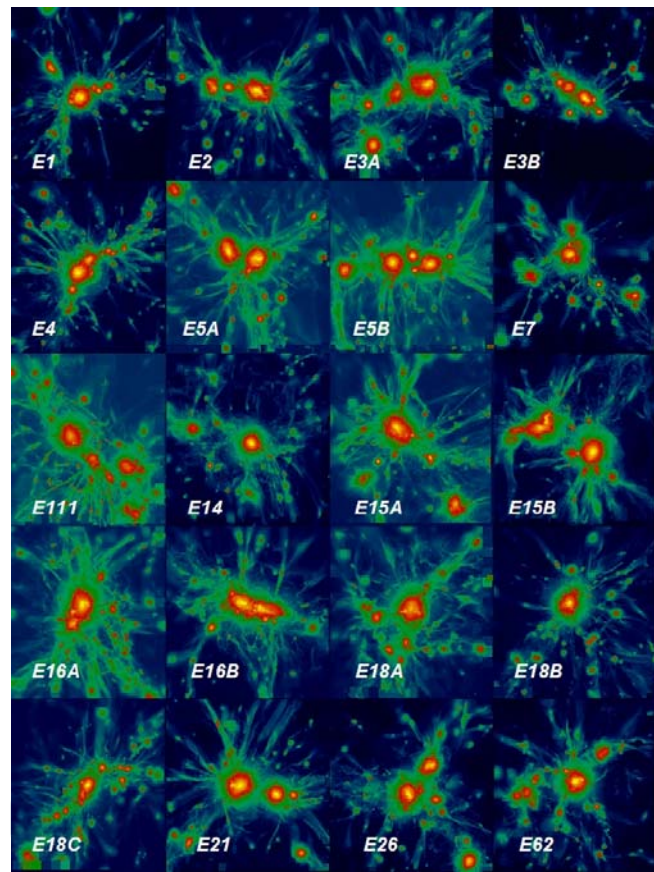
The IRA-CINECA Simulated Clusters Archive



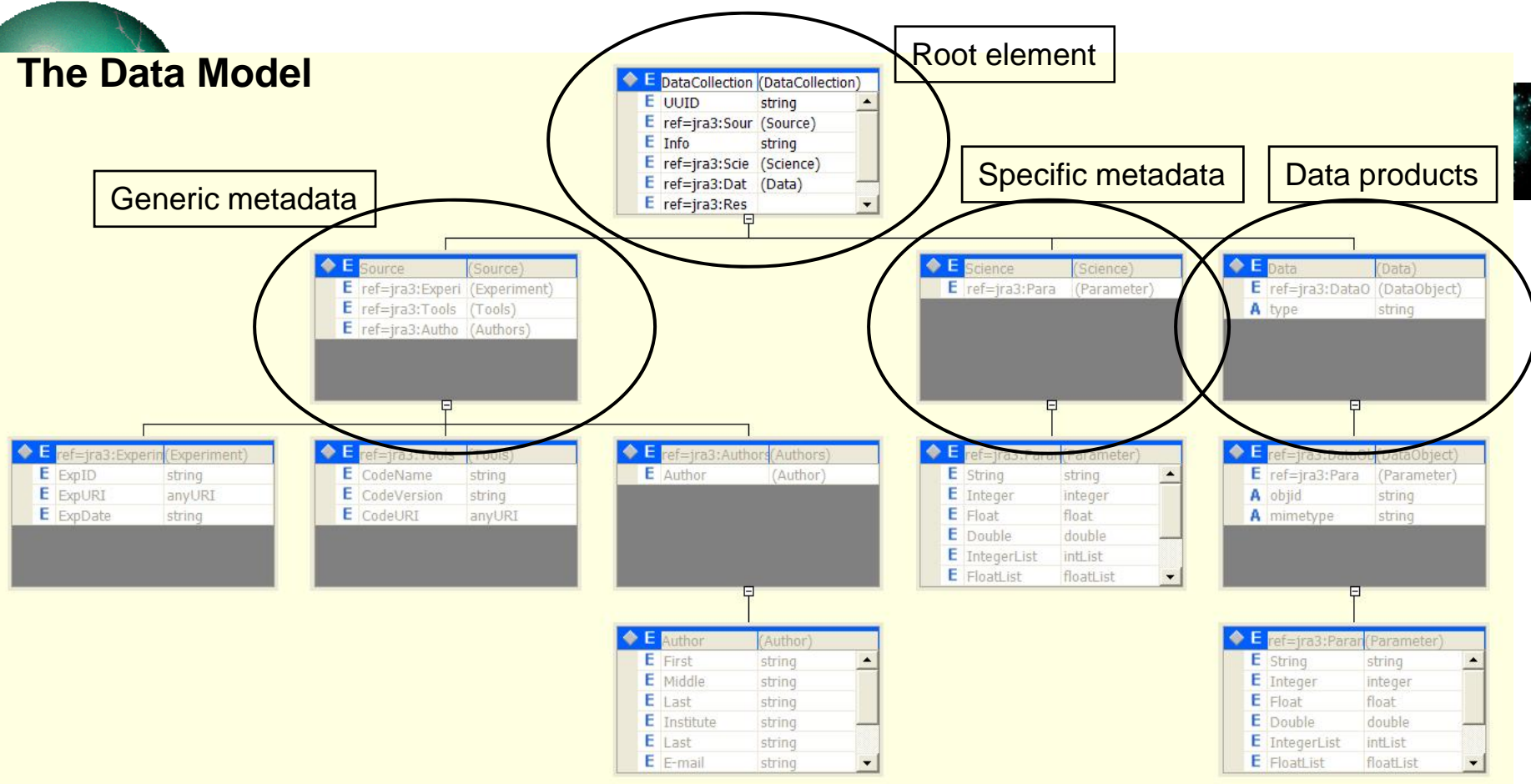
The archive collects the data of a sample of 20 galaxy clusters with large masses, simulated with high spatial resolution using the [ENZO 1.5](#) Cosmological AMR code.

Authors: Franco Vazza (PI) and Gianfranco Brunetti (IRA-INAF), Claudio Gheller and Riccardo Brunino (CINECA)

<http://data.cineca.it>



The Data Model



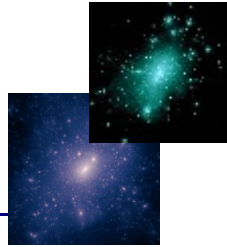
The model is designed to describe each single simulation in terms of:

- Generic searchable metadata (general infos of the whole run – author, code...)
- Specific searchable metadata (specific infos on science – cosmological model...)
- Data products (snapshots, Level 1 post-processed data)

XML schema available at <http://www.hpc-europa.eu/files/schemavs2.5.xsd>



Implementation and services



The data is stored on a dedicated SP6
(CINECA supercomputer, http://www.cineca.it/bdp/r/sezioni/risorse_it/hardware/index)
filesystem (GPFS technology)

The archive is implemented using iRODS (<https://www.irods.org/>)

Services:

At present we have only the web page (with lots of infos)..... But.....

We expect to provide:

- Query capabilities (search for interesting data querying metadata)
- Data preview (using a light visualization service)
- Data download



“Real” data are large binary files in HDF5 (<http://www.hdfgroup.org/HDF5/>)
format. An associated VOTable, describing the data and the content of
the file is delivered to the user... see example...



CINECA archive VOTable Example

[link](#)



```
C:\Users\Manzato\Documents\ITVO\Presentazioni\2010_Victoria\CINECA\DownloadResult.xml - Windows Internet Explorer
C:\Users\Manzato\Documents\ITVO\Presentazioni\2010_Victoria\CINECA\
Google
Preferiti C:\Users\Manzato\Documents\ITVO\Presentazio...
<?xml version="1.0" ?>
- <VOTABLE version="1.2" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xmlns="http://www.ivoa.net/xml/VOTable/v1.2" xmlns:stc="http://www.ivoa.net/xml/STC/v1.30">
  <DESCRIPTION>This file is aimed at let the user get and use one or more datafiles. The file can contain
  references to one or more data collections: RESOURCE is a collection INFO contains generic metadata
  about the RESOURCE each TABLE represents one time output OR result (possibly multiple files)
  </DESCRIPTION>
- <RESOURCE ID="resource1" name="E1" utype="">
  <DESCRIPTION>Here we give the infos regarding the whole collection/simulation</DESCRIPTION>
  <INFO name="Authors" value="Franco Vazza, Claudio Gheller" />
  <INFO name="Tools" value="Enzo 1.5" />
  <LINK name="ToolsURI" href="http://lca.ucsd.edu/portal/software/enzo" />
  <LINK name="ServiceUri" href="http://data.cineca.it" />
  <PARAM name="UUID" utype="" value="f3662aa8-693e-4816-a00b-a30e625d524c" datatype="char" />
  <PARAM name="Omega" utype="" value="1.0" datatype="float" unit="" />
  <PARAM name="Omega_BM" utype="" value="0.0441" datatype="float" unit="" />
  <PARAM name="Omega_DM" utype="" value="0.2139" datatype="float" unit="" />
  <PARAM name="Omega_LAMBDA" utype="" value="0.742" datatype="float" unit="" />
  <PARAM name="Hubble_param" utype="" value="0.72" datatype="float" unit="" />
  <PARAM name="Box_size" utype="" value="187" datatype="float" unit="Mpc/h" />
- <TABLE ID="data1" name="Data" utype="">
  <DESCRIPTION>Level 1 data - processed output extracted from the final redshift</DESCRIPTION>
  <PARAM name="Redshift" utype="" value="0.000" datatype="float" unit="" />
  <PARAM name="DType" utype="" value="Level1-data" datatype="char" unit="" />
  <LINK href="http://data.cineca.it/scratch/data1.tar" />
  <FIELD name="Phys_field" utype="" datatype="char" />
  <FIELD name="Unit" utype="" datatype="char" />
  <FIELD name="Filename" utype="" datatype="char" />
  <FIELD name="Format" utype="" datatype="char" />
- <DATA>
- <TABLEDATA>
- <TR>
  <TD>BM_density</TD>
  <TD>2.9834e-30</TD>
  <TD>amr_2rv_dt074</TD>
  <TD>HDF5</TD>
</TR>
- <TR>
  <TD>BM_temperature</TD>
  <TD>1.0</TD>
  <TD>amr_2rv_dt074</TD>
  <TD>HDF5</TD>
</TR>
- <TR>
  <TD>BM_velocity</TD>
  <TD>6.47841e+09</TD>
  <TD>amr_2rv_v074</TD>
  <TD>HDF5</TD>
</TR>
- <TR>
```



Future plans



- New data inside BaSTI DB:
white dwarf models;
- New DB for BaSTI synthetic spectra and
make these visible by VOSpec via SSAP;
- Investigate interoperability between single
galaxy simulation and stellar model? (could
the output parameter of stellar model be the
input of a galaxy simulation?)



Acknowledgement



Thanks to all the theory VObs.it group

INAF



ISTITUTO NAZIONALE DI ASTROFISICA
NATIONAL INSTITUTE FOR ASTROPHYSICS



P. Manzato
M. Molinaro
F. Pasian

S. Cassisi
A. Pietrinferni

F. Vazza
G. Brunetti

R. Brunino
C. Gheller