VO compliant visualization of theoretical data

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ABSTRACT In the evolving scenario for the inclusion of theoretical and simulated data in the VO, some improvements within the Italian Theoretical Virtual Observatory (ITVO) project are presented. They include cosmological simulated data archives and services (at Trieste and Catania Astronomical Observatories and at the CINECA supercomputing centre in Bologna) and stellar simulations data archives and services (BaSTI, a Bag of Stellar Tracks and Isochrones, maintained at the Teramo Astronomical Observatory). Following an upgrade in BaSTI database and a new Web service endpoint for VisIVOweb in Trieste some improvements in data visualization are presented: from new plots for BaSTI tracks emphasizing star evolution's key points to their comparison with observational data, from direct 3D visualization of galaxy clusters to their direct online data manipulation server side using the VO-compliant VisIVOWeb service. Finally we present a new unique Web portal for the ITVO project under VObs.it, the Italian effort in the VO world, that collects all information regarding the various tokens of this theoretical virtual observatory project that are spread all over Italy.

VisIVOWeb (see figures on the left, with, on top the user home page, accessed after log on) is a collection of web based tools oriented to high quality 3D rendering of astronomical data

VisIVOWeb is available, at present, at 3 sites (INAF-OACt & INAF-OATs Italy, University of Portsmout UK) and will be soon installed at CINECA (Bologna, Italy).

It relies on VisIVOServer as a visualization engine. This tool can be used as well as a standalone application, e.g. through shell or other kinds of scripting, thus allowing re-usable task implementation.

This is done, for example, at the ITVO site hosted at IA2 (INAF-OATs, see figures on the right) to generate, at user request, 3D server side previews of the galaxy clusters simulations hosted at the archive.

This is only one of the various capabilities of VisIVOServer, which deals with data in various formats (VOTable, FITS, binary, ascii, csv, GADGET2 ...), it can filter them in many ways and it can display results in fully customizable ways.

Both VisIVOWeb and VisIVOServer are open source projects (GPL V2) hosted by SourceForge.

BaSTI database as been upgraded (on the left you can see a sketch of the DB schema extension added to the original DB) including more detailed physical information.

The new data ingested into the DB, contained in so called Key Point files, are the full simulation raw data before their normalization to BaSTI tracks. This means finer track resolution and full physical data content available.

Following this DB extension a new preview interface will be added to the BaSTI DB interface. Here we present how it will look like (see the image on the right and its description).

The present visualization service for BaSTI allows single simulation plots (similar to the blue line on this plot) from all data contained in the normalized simulation files. The new preview will highlight the key physical points used during normalization from raw to final track (and isochrones) data and let the user be prompted for physical quantities and values at those points (as detailed in the table up here).

Physical Key Point 9 - Start quiescent central He-burning phase

Log_t	10,34050438	Logarithm of age (yr)
H_HE	9,52E-01	H or He central abundance
Log_L	1,553176	Logarithm of Luminosity (in solar units)
Log_Te	4,070373	Logarithm of effective Temperature (K)
Log_Tc	8,075	Logarithm of central Temperature (K)
Log_Rc	4,263	Logarithm of central Density (cgs units)
Mcc	0,1274	Mass of convective core (solar units)
M_cHe	0,4928	Mass of He core (solar units)
M_cCo	0	Mass of C-O core (solar units)
Mce	0	Mass of convective envelope (solar units)
Lpp_Ls	6,65E-02	p-p chain Luminosity (in units of Surface Luminosity)
Lcno_Ls	2,68E-01	CNO chain Luminosity (in units of Surface Luminosity)
L3a_Ls	6,75E-01	3-alpha chain Luminosity (in units of Surface Luminosity)
Lgr_Ls	-8,38E-03	Gravitational Luminosity (in units of Surface Luminosity)
He_sup	0,00E+00	Surface He abundance
Mtot	0,593391	Total star mass (in solar units)
Log_Tmax	0	Logarithm of maximum Temperature off-center

Along with key points highlighting we plan to add the preview the capability to overplot data from more simulations files but also from user supplied data, thus allowing on the site direct simulation to observational data comparison. Here below you can see a plot with observational data plotted along with BaSTI track data.

Comparison between the multiple Main Sequence loci of the Globular Cluster Omega Centauri (ACS data from Bedin et al. 2009 (in preparation)) and the theoretical sequences for low- and very low-mass stars from BaSTI.

To collect together the ITVO efforts, due to the various ITVO partners in Italy, and to give them direct access trough only one entry point a web portal has been prepared.

The portal (you can see an image of it here on the right) is hosted on the VObs.it web page (http://vobs.astro.it) collects, after a short introduction, the resources available within the project itself giving direct URL enpoints to the services.

The idea is to slowly rearrange the web portal, as most as possible, to make it the main interface to ITVO services, thus letting it to be transparent for the user wherever the services and data are located.