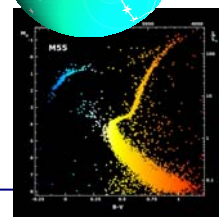
IVOA-Theory
MicroPhysics simulations



BaSTI:
query implementaions
for stellar evolution models via S3P

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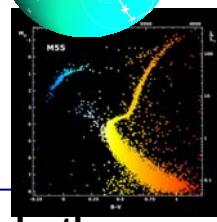
A. Pietrinferni
S. Cassisi

C. Rodrigo
M. Cerviño
E. Solano
R. Gutierrez

BaSTI
a Bag of Stellar Tracks and Isochrones



BaSTI database is a fundamental tools to investigate the properties of stellar populations in both galactic and extragalactic systems.

BaSTI contain a wide range of stellar masses and chemical compositions, as well as of choices about important parameters such as mass loss and core convective overshooting efficiency.

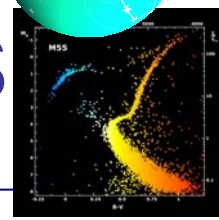
32010 Isochrones
17489 Evolutionary tracks
4438 Evolutionary HB tracks
121 ZAHB (Zero Age Horizontal Branch) tables
121 End He tables
198 Summary tables

BaSTI inside the ITVO (Italian Theoretical Virtual Observatory) and VObs.it:

- Aims:
  - Publishing theoretical data, so to share them with the community;
  - Easy finding and searching the data of interest;
  - Give them a standard format (VOTable and/or FITS binary table);
  - Create a standard access protocol (S3P);
  - Create Web services also using the Grid infrastructure and access them via a standard protocol;
  - Registry the database and services;
  - permit an easy comparison between observational and theoretical data, using the same tools for both kind of data.

ITVO project is develop under EuroVOTECH, EuroVO-DCA and Euro VOAIDA.

Uses cases of stellar models

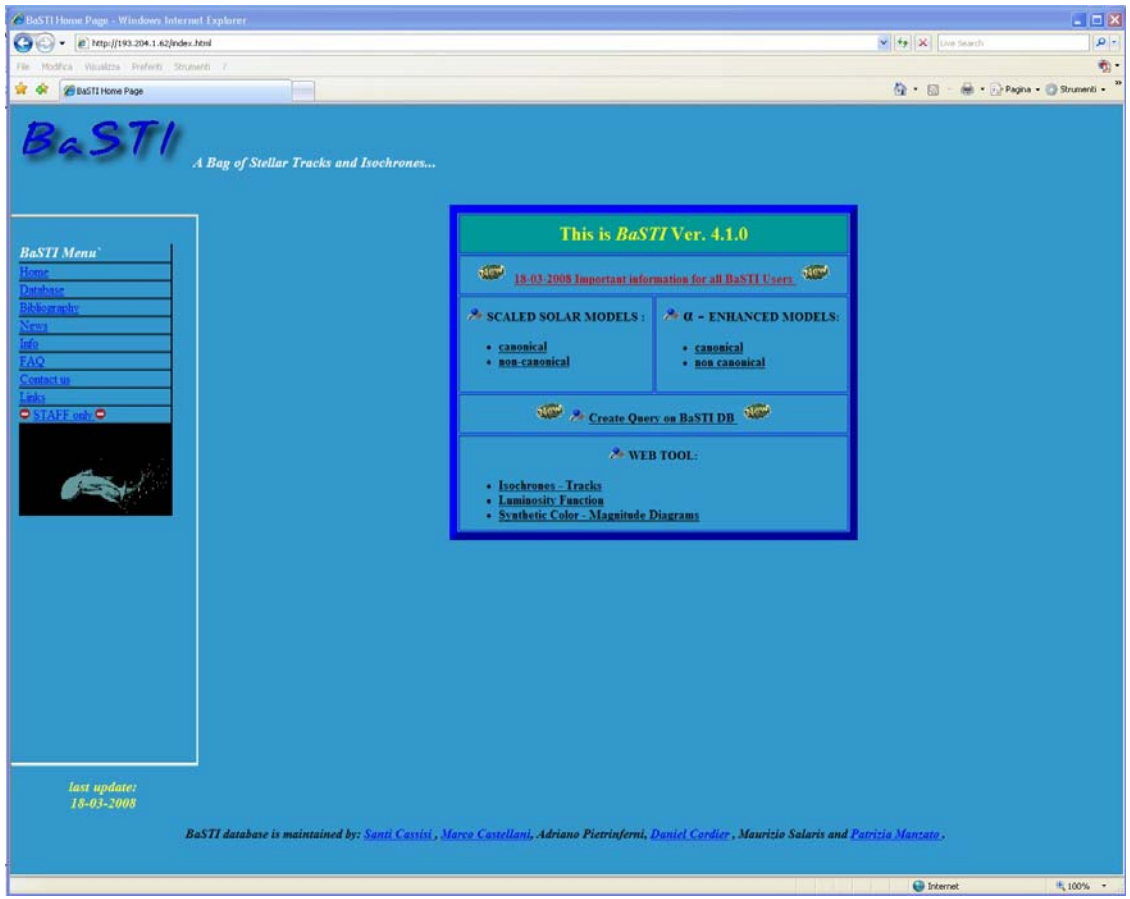


These model are important for:

- testing the “physics” in the regime of high density/low temperature;
- Investigating the IMF in various enviroments;
- Simulated evolutionary tracks and isochrones;
- Simulated the HB for sampling different evolutionary phases and study pulsating stars;
- Study M/L relation and M/R relation and confrontation with observational data;
- Optical photometric bands / near –infrared one;
- Comparison with star clusters, binary systems;
- Study fundamental ingredient for populaion syntesis;
- Analyze the integrated magnitudes, colours and spectra of composite stellar populations;

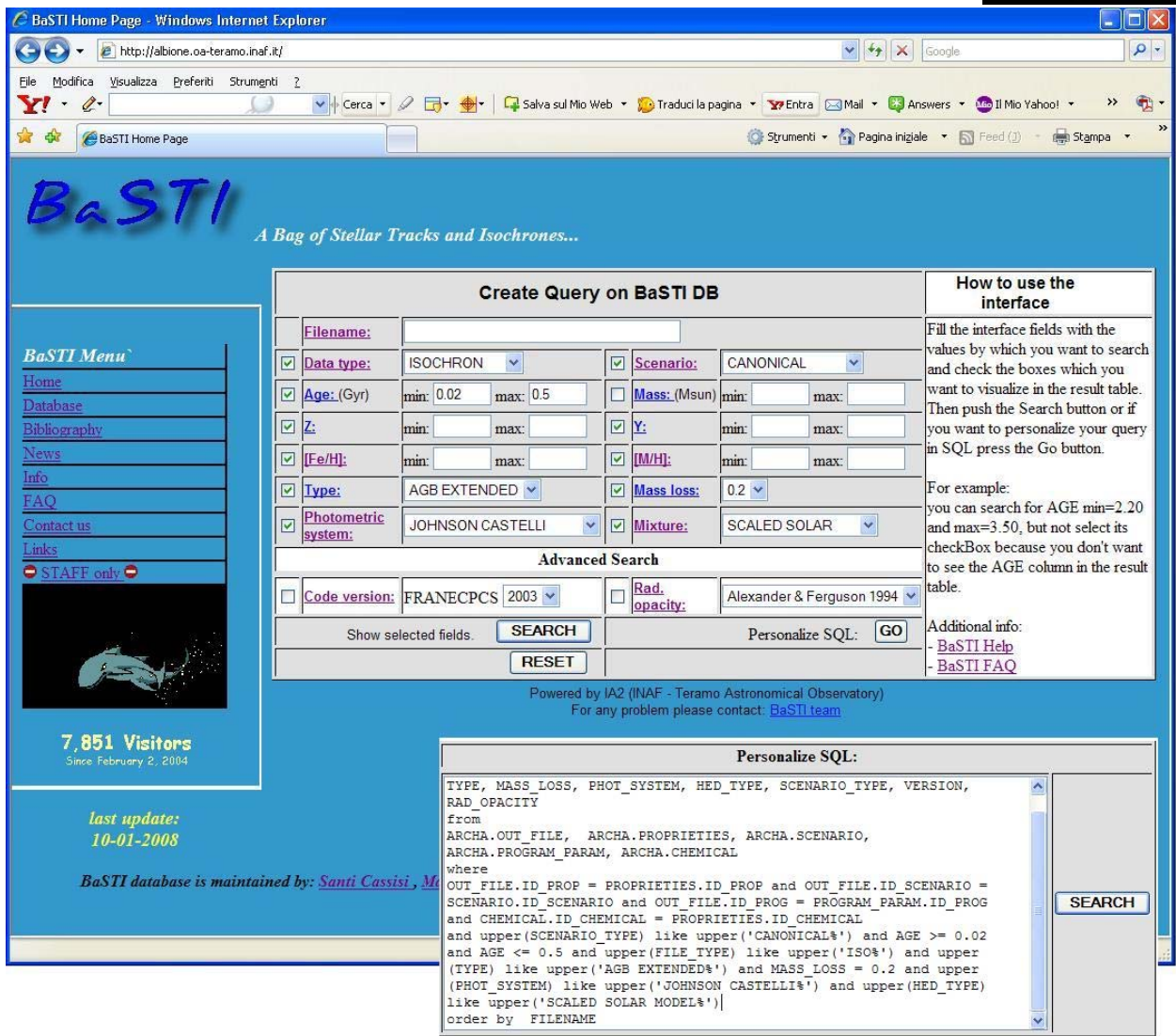
BaSTI

Web portal: http://albione.oa-teramo.inaf.it/



BaSTI web portal

Query the stellar evolutionary DB having the possibility of personalized the SQL query and choosing all the parameters.



Results table

- This is the response after a query. The files are downlodable as ASCII table, or trasform on-the-fly in VOTable.

Search Results : 1232 rows

File	Download	VO format	Data type	Scenario	Age	Z	Y	FE/H	M/H	Type
wz102y259ae2.t600030_c04ae	ASCII.tar.gz	VOTable	ISO	CANONICAL	.03	.01	.259	-.6	-.25	NORMAL
wz102y259ae2.t600030_sloan	ASCII.tar.gz	VOTable	ISO	CANONICAL	.03	.01	.259	-.6	-.25	NORMAL
wz102y259ae2.t600030_strm	ASCII.tar.gz	VOTable	ISO	CANONICAL	.03	.01	.259	-.6	-.25	NORMAL
wz102y259ae2.t600030_walr	ASCII.tar.gz	VOTable	ISO	CANONICAL	.03	.01	.259	-.6	-.25	NORMAL
wz102y259ae2.t600040_c04ae	ASCII.tar.gz	VOTable	ISO	CANONICAL	.04	.01	.259	-.6	-.25	NORMAL
wz102y259ae2.t600040_sloan	ASCII.tar.gz	VOTable	ISO	CANONICAL	.04	.01	.259	-.6	-.25	NORMAL
wz102y259ae2.t600040_strm	ASCII.tar.gz	VOTable	ISO	CANONICAL	.04	.01	.259	-.6	-.25	NORMAL
wz102y259ae2.t600040_walr	ASCII.tar.gz	VOTable	ISO	CANONICAL	.04	.01	.259	-.6	-.25	NORMAL
wz102y259ae2_af94.t600030_c04ae	ASCII.tar.gz	VOTable	ISO	CANONICAL	.03	.01	.259	-.6	-.25	NORMAL
wz102y259ae2_af94.t600030_strm	ASCII.tar.gz	VOTable	ISO	CANONICAL	.03	.01	.259	-.6	-.25	NORMAL
wz102y259ae2_af94.t600040_c04ae	ASCII.tar.gz	VOTable	ISO	CANONICAL	.04	.01	.259	-.6	-.25	NORMAL
wz102y259ae2_af94.t600040_strm	ASCII.tar.gz	VOTable	ISO	CANONICAL	.04	.01	.259	-.6	-.25	NORMAL

VOTable

Isochrone by Pietrinferni - Cassisi - Salaris - Castelli 2006 ::: Standard Model - Alpha-enhanced model & transf. Stroemgren (Castelli 2006)
For further information on PARAM(s) and FIELD(s) see: "http://wwwas.oats.inaf.it/IA2/index.php?option=com_wrapper&Itemid=87"

Use this link (wz102y259ae2_af94.t600040_strm.xml) to retrieve the **plain** XML VOTable
(N.B.: clicking on this link will, likely, result in opening the XML tree on your browser. Use **right-click** + **"Save link as ..."**, or similar, to download it).
Visualized data is subdivided in 3 main blocks: Simulation Metadata, Output Fields and Data Table.

Simulation Metadata (back to top)

Param	Value	UCD	Description
Filename	**wz102y259ae2_af94.t600040_strm**	*meta.id;meta.file*	Name of the converted ASCII file
DataType	**Isochrone**	*meta.note*	Type of data simulation
Mixture	**alfa-enhanced**	*meta.note*	Heavy elements distribution
Overshooting	**F**	*meta.code*	Overshooting parameter
MassLoss	**0.2**	*phys.mass.loss*	mass loss according to the Reimers (1975) law
PhotSystem	**Stroemgren**	*meta.note*	Adopted photometric system used to translate theoretical simulation
Type	**Normal**	*meta.note*	Extent of the evolution's simulation
CodeVersion	**2003**	*meta.note*	FRANEC code version used
RadOpacity	**Alexander & Ferguson 1994**	*meta.note*	Prescription followed to include the low temperature radiative opacity
Np	**2000**	*meta.number*	Number of points in the simulation, i.e. rows in the VOTable
[M/H]	**-.253**	*phys.abund.Z*	The metal abundance in the spectroscopic formalism
Z	**.0100**	*phys.abund.Z*	The mass fraction of the initial heavy elements abundance
Y	**.259**	*phys.abund.Y*	The mass fraction of the initial helium abundance. Actually calculated as Y = 1.44*(Z-0.
Age	**.0400**	*time.age*	Age (in Gyr) of the isochron
CheckDate	**04-02-2006**	*time.processing*	Expresses data computation for further controls or revisions

Output Fields (back to top)

Field	UCD	Description
(M/Mo)in	*phys.mass;arith.ratio*	Initial mass, in solar units, of the structure
M/Mo	*phys.mass;arith.ratio*	Mass of the structure
log(L/Lo)	*phys.luminosity;arith.ratio*	Logarithmic luminosity, in solar units, of the structure
logTe	*phys.temperature.effective*	Logarithmic value of the effective temperature
My	*phot.mag*	Photometric magnitude
u-b	*phot.color*	Color index
u_0-b	*phot.color*	Color index
b-y	*phot.color*	Color index
m1	*phot.color*	Color index
c1	*phot.color*	Color index
c1_0	*phot.color*	Color index
H_beta	*phot.color*	Color index
hk	*phot.color*	Color index

Output Data Table. Number of rows: 2000 (back to top)

(M/Mo)in	M/Mo	log(L/Lo)	logTe	My	u-b	u_0-b	b-y	m1	c1	c1_0	H_beta
.5000000000	.4999958383	-1.31174	3.60944	8.902	2.734	2.728	.788	.332	.491	.485	2.502

Mozilla Firefox

File Modifica Visualizza Cronologia Segnalibri Strumenti ?

File:///C:/molinaro/BaSTIASCII2VO/wz102y259o.t600030_acs_hst.xml

Bookmarks Varie Virtual Observatories TUTOS -- Login WebMail Tomcat - Palantir1

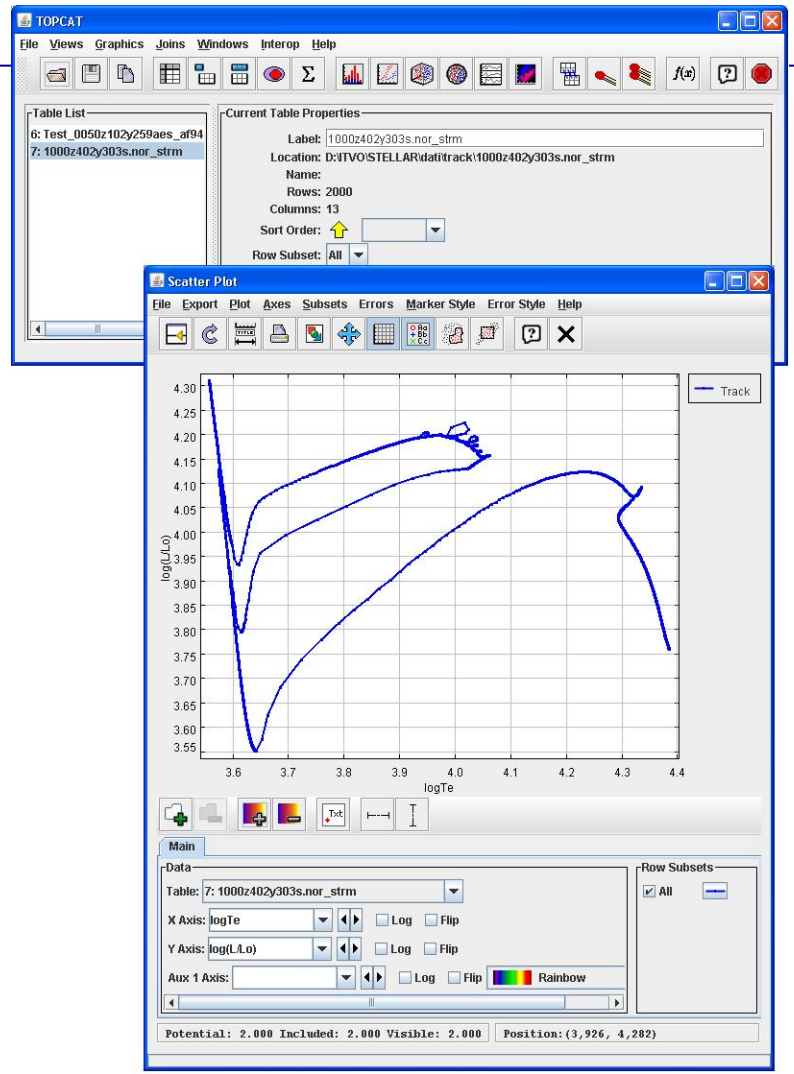

```
- <VOTABLE version="1.1" xsi:noNamespaceSchemaLocation="http://www.ivoa.net/xml/VOTable/v1.1">
  - <DESCRIPTION>
      Isochrone by Pietrinferni - Cassisi - Salaris - Castelli 2006 ::: Non Standard Model - Scaled solar model & transformations for ACS (Castelli 2004)
    </DESCRIPTION>
  - <RESOURCE>
    - <DESCRIPTION>
        For further information on PARAM(s) and FIELD(s) see: "http://wwwas.oats.inaf.it/IA2/index.php?option=com_wrapper&Itemid=87"
      </DESCRIPTION>
    + <PARAM arraysize="*" datatype="char" name="Filename" ucd="meta.id;meta.file" unit="--" value="wz102y259o.t600030_acs_hst"></PARAM>
    + <PARAM arraysize="*" datatype="char" name="DataType" ucd="meta.note" unit="--" value="Isochrone"></PARAM>
    - <PARAM arraysize="*" datatype="char" name="Mixture" ucd="meta.note" unit="--" value="Scaled Solar">
        <DESCRIPTION>Heavy elements distribution</DESCRIPTION>
      - <VALUES>
          <OPTION>Scaled Solar</OPTION>
          <OPTION>alfa-enhanced</OPTION>
        </VALUES>
      </PARAM>
    + <PARAM datatype="boolean" name="Overshooting" ucd="meta.code" unit="--" value="T"></PARAM>
    + <PARAM datatype="float" name="MassLoss" ucd="phys.mass.loss" unit="--" value="0.4"></PARAM>
    + <PARAM arraysize="*" datatype="char" name="PhotSystem" ucd="meta.note" unit="--" value="ACS-HST"></PARAM>
    + <PARAM arraysize="*" datatype="char" name="Type" ucd="meta.note" unit="--" value="Normal"></PARAM>
    + <PARAM arraysize="*" datatype="char" name="CodeVersion" ucd="meta.note" unit="--" value="2007"></PARAM>
    + <PARAM arraysize="*" datatype="char" name="RadOpacity" ucd="meta.note" unit="--" value="Ferguson 2005"></PARAM>
    + <PARAM datatype="int" name="Np" ucd="meta.number" unit="--" value="2000"></PARAM>
    + <PARAM datatype="float" name="[M/H]" ucd="phys.abund.Z" unit="[%]" value="-.253"></PARAM>
    - <PARAM datatype="float" name="Z" ucd="phys.abund.Z" unit="%" value=".0100">
      - <DESCRIPTION>
          The mass fraction of the initial heavy elements abundance
        </DESCRIPTION>
      - <VALUES>
          <MIN>0.0001</MIN>
          <MAX>0.04</MAX>
        </VALUES>
      </PARAM>
    + <PARAM datatype="float" name="Y" ucd="phys.abund.Y" unit="%" value=".259"></PARAM>
    + <PARAM datatype="float" name="Age" ucd="time.age" unit="Gyr" value=".0300"></PARAM>
    + <PARAM arraysize="*" datatype="char" name="CheckDate" ucd="time.processing" unit="DD-MM-YYYY" value="16-05-2005"></PARAM>
    - <TABLE>
        <DESCRIPTION>Output Data Table. Number of rows: 2000</DESCRIPTION>
      + <FIELD datatype="float" name="(M/Mo)in" ucd="phys.mass;arith.ratio" unit="%"></FIELD>
      + <FIELD datatype="float" name="M/Mo" ucd="phys.mass;arith.ratio" unit="%"></FIELD>
      + <FIELD datatype="float" name="log(L/Lo)" ucd="phys.luminosity;arith.ratio" unit="[%]"></FIELD>
      - <FIELD datatype="float" name="logTe" ucd="phys.temperature.effective" unit="[K]">
          <DESCRIPTION>Logarithmic value of the effective temperature</DESCRIPTION>
        </FIELD>
      + <FIELD datatype="float" name="F435W" ucd="phot.mag" unit="mag"></FIELD>
      + <FIELD datatype="float" name="F475W" ucd="phot.mag" unit="mag"></FIELD>
      + <FIELD datatype="float" name="F555W" ucd="phot.mag" unit="mag"></FIELD>
      + <FIELD datatype="float" name="F606W" ucd="phot.mag" unit="mag"></FIELD>
      + <FIELD datatype="float" name="F625W" ucd="phot.mag" unit="mag"></FIELD>
      + <FIELD datatype="float" name="F775W" ucd="phot.mag" unit="mag"></FIELD>
      + <FIELD datatype="float" name="F814W" ucd="phot.mag" unit="mag"></FIELD>
      - <DATA>
        - <TABLEDATA>
          - <TR>
              <TD>.5000000000</TD>
              <TD>.4999876494</TD>
              <TD>-1.32717</TD>
              <TD>3.60453</TD>
              <TD>10.272</TD>
              <TD>9.769</TD>
              <TD>9.059</TD>
              <TD>8.597</TD>
              <TD>8.229</TD>
              <TD>7.499</TD>
              <TD>7.392</TD>
            </TR>
          - <TR>
```


Completato

BaSTI and VO tool

The output of BaSTI is an **ASCII file** so the natural tool to analyze these data is TOPCAT.

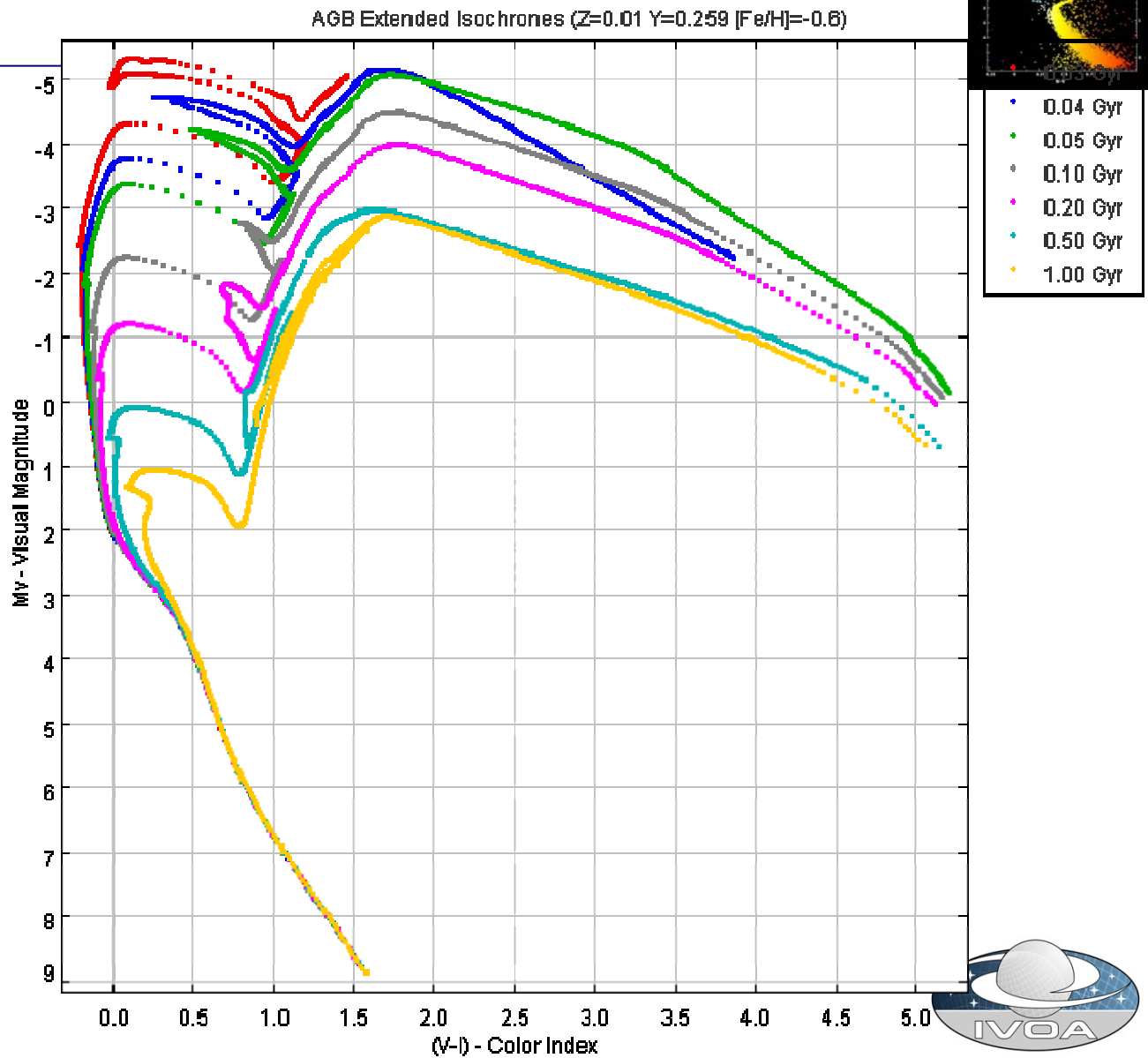
We transform it in a **VOTable** (or **FITS-Table)**.



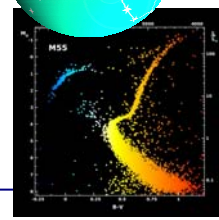
STILTS for creating plots

STILTS (Mark Taylor, Bristol, UK) is a VO tool that forms the command-line counterpart of the GUI table analysis tool TOPCAT .

It will be implemented by M. Molinaro on the BaSTI Web portal, the result will be as show in the figure.



S3P implementations



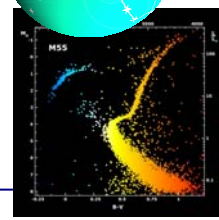
A simple access protocol to search stellar evolution files:

S3P (Simple Self-described Service Protocol)

- For searching Tracks:
  - INPUT: Mass;
  - INPUT: Metallicity;
  - OUTPUT:Mass;
  - OUTPUT:Metallicity;
  - OUTPUT:….
- For searching Isochrones:
  - INPUT: Age;
  - INPUT: Metallicity;
  - OUTPUT:Age;
  - OUTPUT:Metallicity;
  - OUTPUT:….

(see Carlos Rodrigo talk about S3P and IVOA document Note)

S3P example implementations



Isochrones:

- http://albione.oa-teramo.inaf.it/PHPmetadata/BaSTIisochron.php?format=metadata
- http://albione.oa-teramo.inaf.it/PHPmetadata/BaSTIisochron.php?age=0.003/0.03&meta=0.0/0.004
- http://albione.oa-teramo.inaf.it/PHPmetadata/BaSTIisochron.php?id=42749

Tracks:

- http://albione.oa-teramo.inaf.it/PHPmetadata/BaSTItrack.php?format=metadata
- http://albione.oa-teramo.inaf.it/PHPmetadata/BaSTItrack.php?mass=0.4/0.7&meta=0.0/0.002
- http://albione.oa-teramo.inaf.it/PHPmetadata/BaSTItrack.php?id=42611

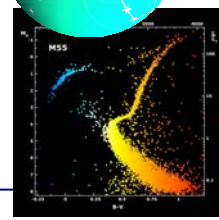
BaSTI Web tools – developed by OATeramo

The tools will be transformed in web-services:

- Isochrones- tracks extractor;
- Luminosity function
- Syntetic color – Magnitude diagrams (stellar population synthesis program)

All is written in PERL.

Tool: isochrone/track extractor



BaSTI *A Bag of Stellar Tracks and Isochrones...*

Isochrone/track Extractor

Output Type
- (•) Isochrone (for a given age)
- ( ) Interpolated track (for a given mass)

Heavy Elements Mixture
- (•) Scaled to solar mixture
- ( ) Alpha enhanced mixture (not yet available)

Color-temperature Transformation
- (•) UBVRIJHKL (Scaled solar or Alpha enhanced)
- ( ) ACS (Scaled solar only)

Model Type
- (•) Standard - η=0.2 - (without overshooting)
- ( ) Non standard - η=0.4 - (with overshooting)

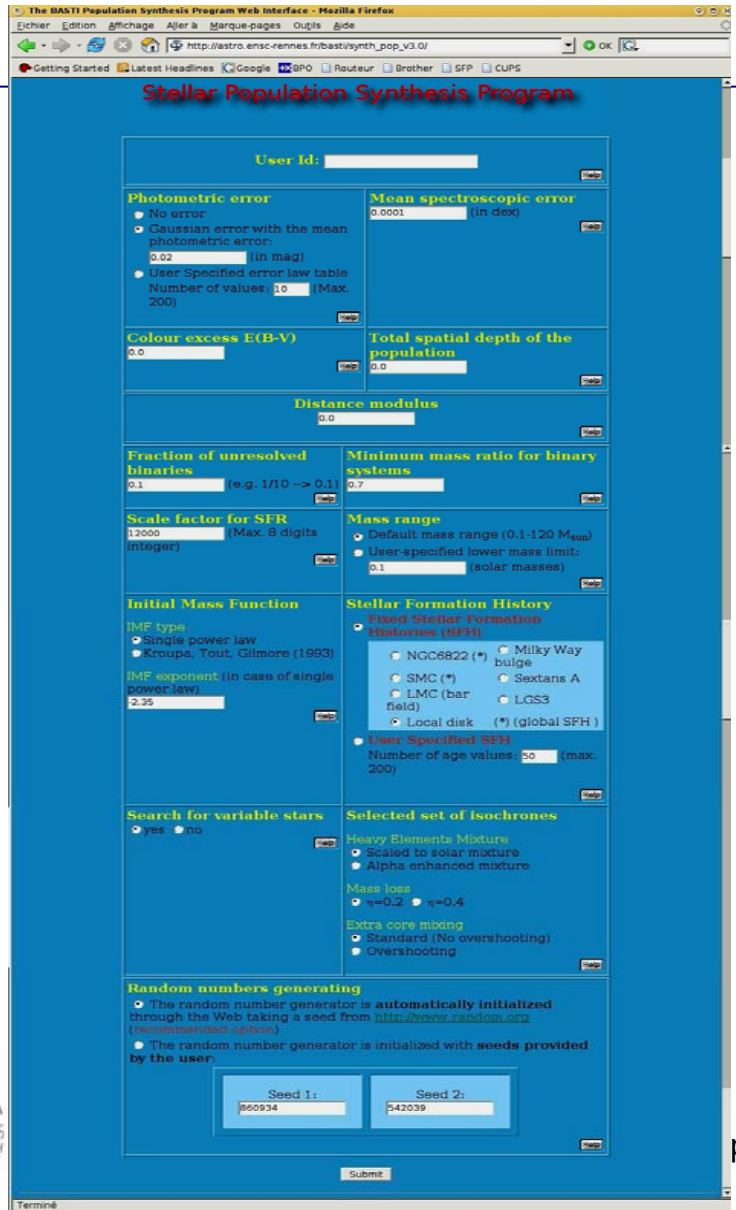
Chemical composition

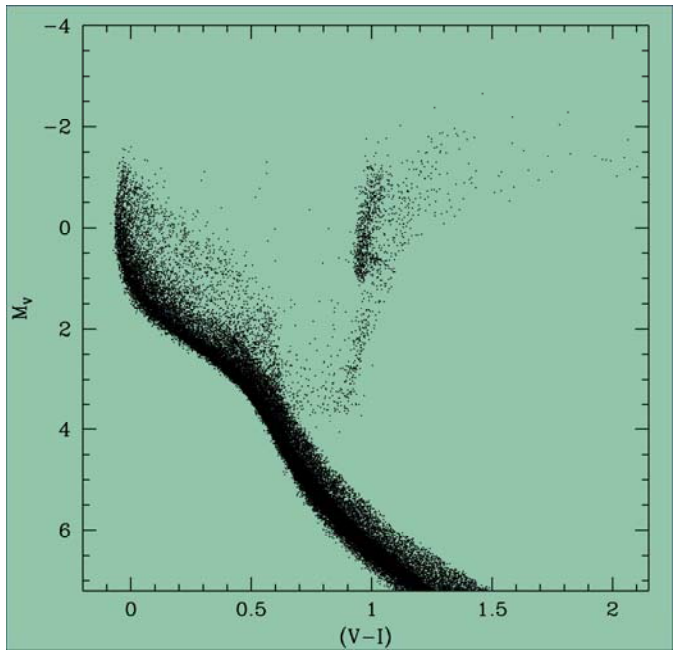
(•) Z= 0.0001 Y= 0.245	( ) Z= 0.008 Y= 0.256
( ) Z= 0.0003 Y= 0.245	( ) Z= 0.01 Y= 0.259
( ) Z= 0.001 Y= 0.246	( ) Z= 0.0198 (Sun) Y= 0.273
( ) Z= 0.002 Y= 0.248	( ) Z= 0.03 Y= 0.288
( ) Z= 0.004 Y= 0.251	( ) Z= 0.04 Y= 0.303

Submit

© 2004 web interface written by

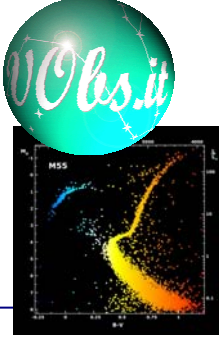
Synthetic Colour-Magnitude diagrams





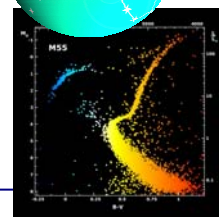
p.- Theory, Baltimore

VOTable description of the archive



As C. Gheller present we will investigate if will be possible describe the micro-archive content (directory and files) in a xml file (VOTable) an adopt this as a standard format to exchange information in an interoperable way.

The end



You can see my poster at ADASS, Quebec.

Thanks for your attention.