Diffusion de grilles de modèles stellaires

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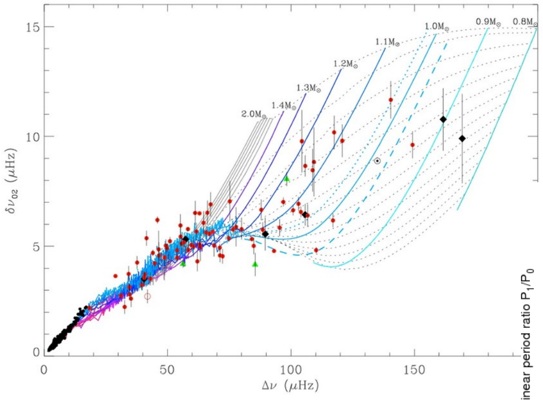
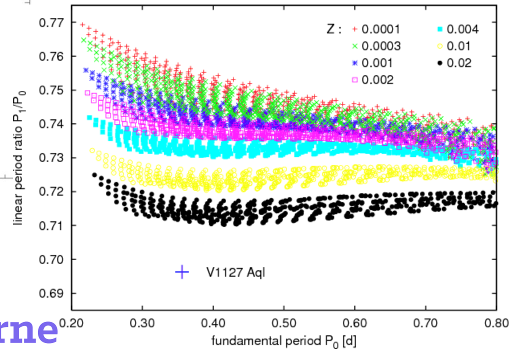
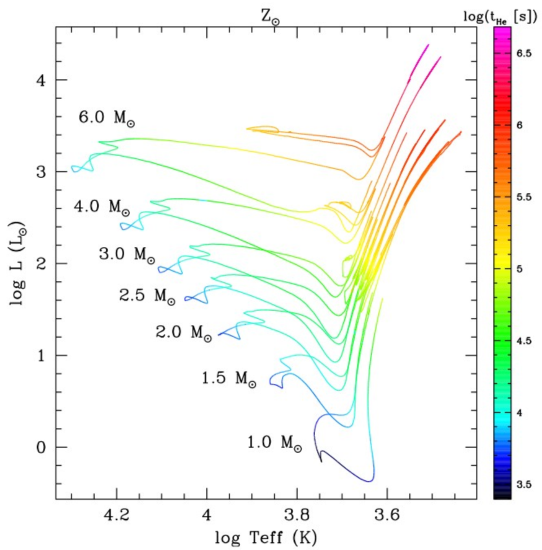
ASOV-ASN Diffusion de modèles et de simulations en astrophysique

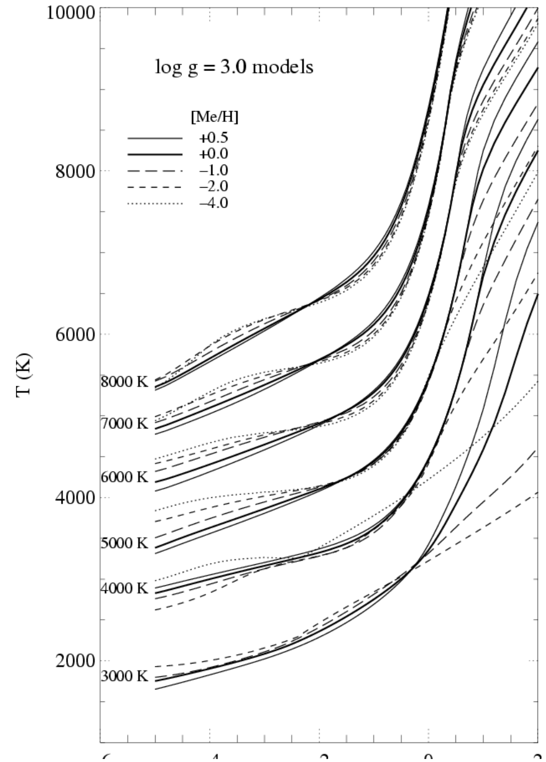
6-7 octobre 2022 – CINES - Montpellier

Grilles de modèles stellaires : quel type ? Pour quoi faire ?

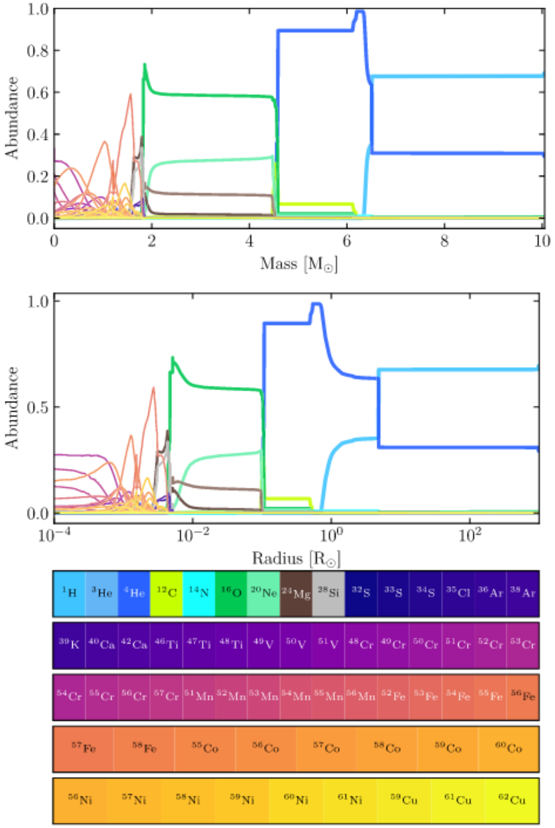




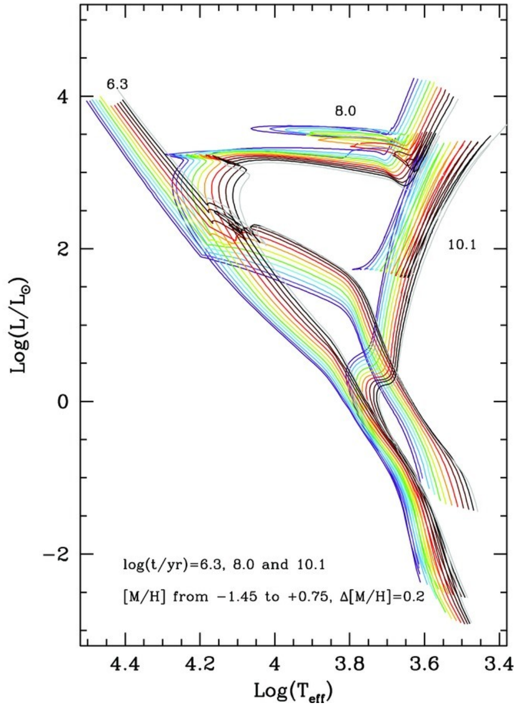




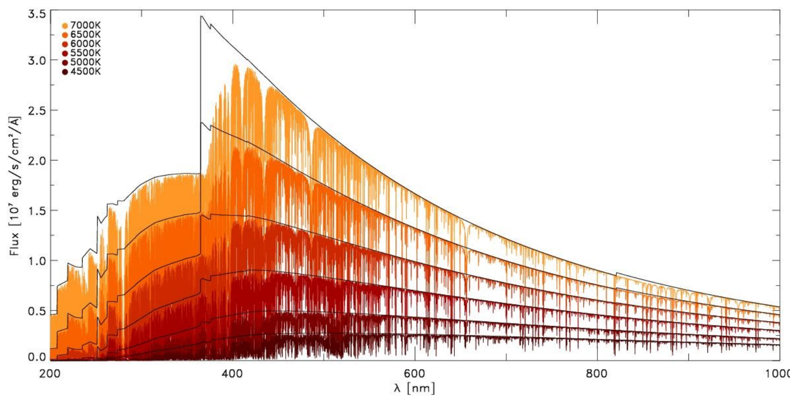
Modèles de structure interne
Et oscillations



Modèles d'évolution stellaire



Modèles d'atmosphères stellaires
Spectres synthétiques



Grilles de modèles stellaires : quel type ? Pour quoi faire ?

Les codes de transfert de rayonnement dans les atmosphères stellaires produisent :

- des structures thermodynamiques utiles pour les modèles d'évolution stellaire
- des spectres synthétiques utiles pour l'analyse des observations spectroscopiques
- des distributions spectrales d'énergie utiles pour l'étude des populations stellaires intégrées (galaxies et amas)

Les codes d'évolution stellaire produisent :

- des tracés évolutifs (évolution temporelle de quelques centaines de paramètres physiques au cœur et à la surface des modèles)
- des isochrones calculés sur la base des tracés évolutifs
- des structures échantillonnant l'évolution (profils de dizaines de quantités physiques à un instant donné)

→ utiles pour l'étude des populations stellaires (comparaison aux observations)
→ utiles pour la datation des systèmes stellaires et exoplanétaires
→ utiles pour la caractérisation des processus physiques dans les intérieurs stellaires

Les codes d'oscillations stellaires produisent des fréquences d'oscillation sur la base de structures stellaires

→ utiles pour l'étude des populations stellaires
→ utiles pour la caractérisation des processus physiques dans les intérieurs stellaires

→ Grilles de modèles évolutifs, d'atmosphères et de spectres synthétiques fondamentales pour l'exploitation des données stellaires observationnelles

→ Production de grille parfois directement attachée aux consortia instrumentaux (Gaia, PLATO)

Un point sur l'existant

Les grilles de modèles stellaires existantes sont produites par des codes 1D essentiellement

Elles résultent parfois de workflows impliquant 2 codes ou plus

Seules grilles de simulations multi-D = grilles de modèles d'atmosphères et de spectres synthétiques

→ information sur les schémas numériques ou la résolution utilisés rarement pertinente par exemple

- Il n'existe pas actuellement de grilles publiques donnant accès à des fréquences d'oscillation stellaires synthétiques.

  Il existe des codes publics permettant de calculer des fréquences d'oscillation sur base de structures stellaires (ADIPLS, GYRE) → interfaçage avec outputs d'évolution stellaire complexes

- Il n'existe pas de grilles publiques de modèles stellaires multi-D .

  Il existe des codes publics permettant de simuler des processus HD et MHD dans des intérieurs stellaires à 2D ou 3D (PENCIL code,MagiC, Rayleigh)

- Il existe de nombreuses grilles publiques de modèles d'atmosphères stellaires 1D et quelques grilles 3D

- Il existe de nombreuses grilles publiques de spectres synthétiques 1D (1 grille « 3D » dans POLLUX)

- Il existe de nombreuses grilles publiques de modèles d'évolution stellaires et d'isochrones

SpecModels

http://specmodels.iag.usp.br/

SpecModels Home
News & Updates
Search & Download
Additional Data
P. Coelho website

Spectral models of stars and stellar populations

by Paula R. T. Coelho and collaborators

At this website you can download theoretical spectra of stars and stellar populations computed for a wide range of parameters and applications. You can go directly to the listings of stellar spectra or stellar population models.

Links to the papers describing the different models are listed below, together with the corresponding links to the download section. Files containing whole libraries can be large, so if you want to download only a specific interval of parameters, go to the search & download interface.

Feel free to contact me in case of doubts, pcoelho at usp.br

Theoretical stellar spectra

Pacheco et al. (2021)
A Grid of Synthetic Spectra for Subdwarfs: Non-LTE Line-blanketed Atmosphere Models
In this work a new grid of NLTE atmosphere model spectra for hot and moderately cool subdwarf stars is presented. High-resolution spectra are calculated in the ran… range 4.5 <= log g [… boundaries regardin…

The models can be … abundances: sol_He… lowZ_Herich ([Fe/H]=… Example: t10000_g+4…

The files can also be…

Coelho, Bruzual & …
To use or not to u…

Paper | Atmospheres | Spectra | Spec. Intensities | Limb Darkening | Contact

http://phoenix.astro.physik.uni-goettingen.de/

Publication

A new extensive library of PHOENIX stellar atmospheres and synthetic spectra

Tim-Oliver Husser[1], Sebastian Wende – von Berg[1], Stefan Dreizler[1], Derek Homeier[12], Ansgar Reiners[1], T. Barman[3], and Peter H. Hauschildt[4]

TLUSTY

Version 202

- User's Guide
- Basic References
- Data
- Stellar Atmospheres
  - OSTAR2002
  - BSTAR2006
- Accretion Disks
- Download *Tlusty*
- SEDs for *Cloudy*
- Applications
- *Synspec*
- *Tlusty*'s Home

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Web Authors

Last update: July 2, 2012

Wed, Oct 5, 2022 at 2:56:40 pm

Tlusty

Model Stellar Atmospheres

In addition to the Tlusty source code and the necessary data, we provide some model atmospheres for various stellar parameters and of different sophistication (as far as explicit NLTE model atoms are concerned). We intend to increase the number and variety of available NLTE model atmospheres in the future.

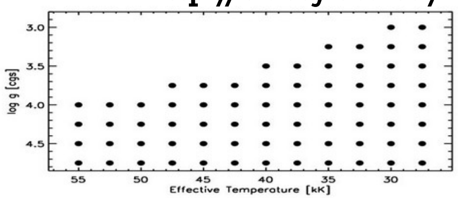
The OSTAR2002 Grid

We have constructed a comprehensive grid of 690 metal line-blanketed, NLTE, plane-parallel, hydrostatic model atmospheres for the basic parameters appropriate to O-type stars. The OSTAR2002 grid considers 12 values of effective temperatures, 27500 K <= Teff <= 55000 K with 2500K steps, 8 surface gravities, 3.0 <= log g <= 4.75 with 0.25 dex steps, and 10 chemical compositions, from metal-rich relative to the Sun to metal-free. The lower limit of log g for a given effective temperature is set by an approximate location of the Eddington limit. The selected chemical compositions have been chosen to cover a number of typical environments of massive stars: the galactic center, the Magellanic Clouds, Blue Compact Dwarf galaxies like I Zw 18, and galaxies at high redshifts. The table lists the stellar parameters and chemical compositions included in the grid. There are 69 model atmospheres per composition. We have assumed a solar helium abundance, He/H=0.1 by number, and a microturbulence velocity, Vt = 10 km/s.

Reference: Lanz, T., & Hubeny, I. 2003, ApJS, 146, 417 (Abstract) (PDF)

Stellar Parameters

http://tlusty.oca.eu/Tlusty2002/tlusty-frames-OS02.html



Chemical Compositions

Key	Z / Zo	Key	Z / Zo
C	2	V	1 / 30
G	1	W	1 / 50
L	1 / 2	X	1 / 100
S	1 / 5	Y	1 / 1000
T	1 / 10	Z	0

Each model is characterized by a unique filename root describing the parameters of the model, for example G35000g400v10. The first letter indicates the composition, followed by the effective temperature, the gravity and the turbulent velocity. A suffix is added to describe the contents of a given file.

The grid is available in the form of several tar archive files containing different products for each chemical composition.

M A

Marcs Homepage

MARCS DataB…

Search Form

Standard composition

Effective temperature
Log g
Overall Metallicity [Fe/H]
Mass
Microturbulence

α elements [α/Fe]	0	0.4
Carbon [C/Fe]	0	0
Nitrogen [N/Fe]	0	0
Oxygen [O/Fe]	0	0.4
Helium [He/H]	0	0
r process elements [r/Fe]	0	0
s process elements [s/Fe]	0	0

Default Value | Clear All | Search

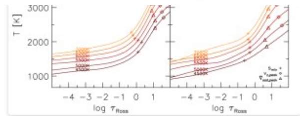
…press.com/mean-3d/

…r HowTo.

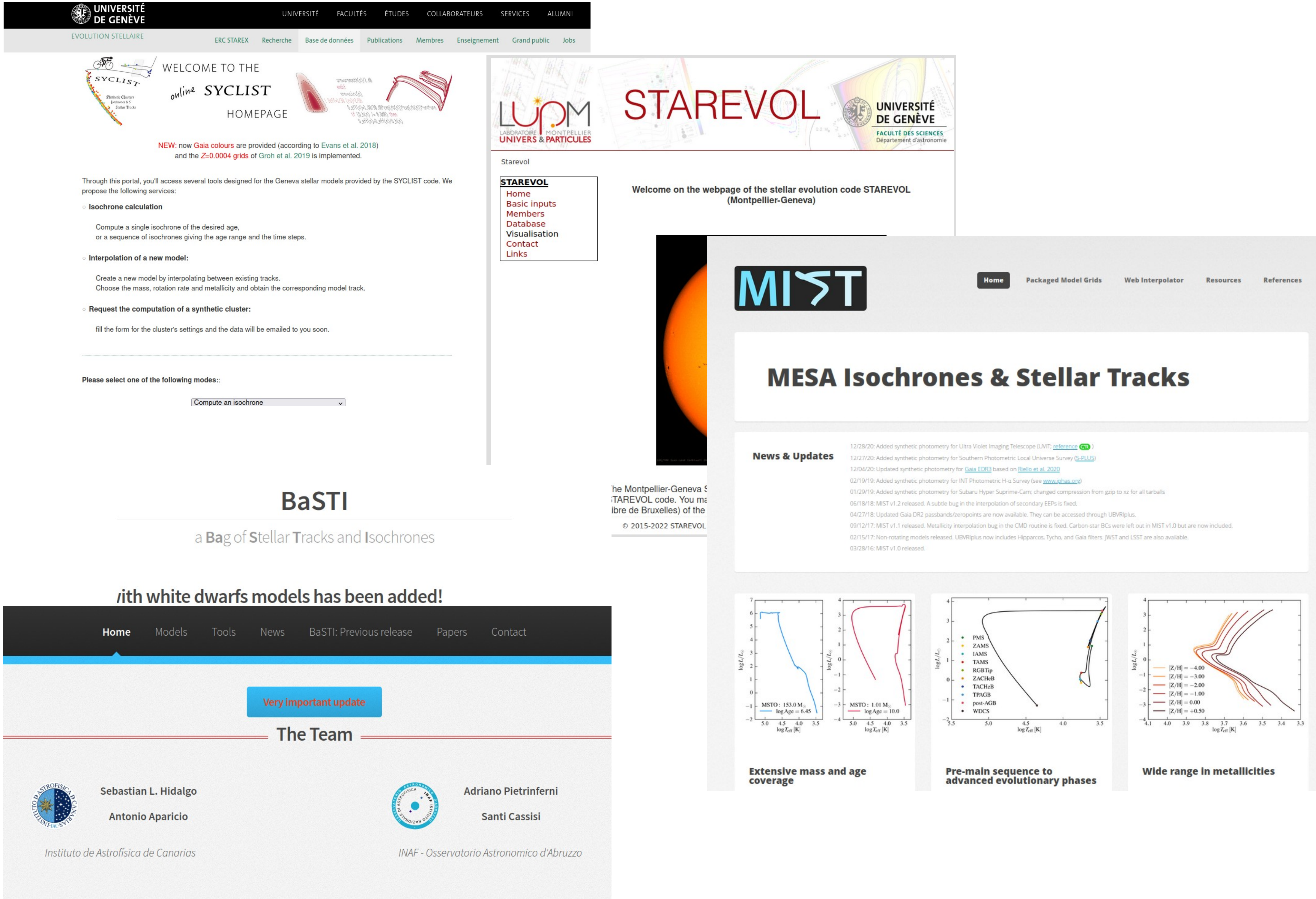
…ns we provide **spatially** and **temporally averaged** stratifica… …dels for **four** different **reference depth scale**. In Paper II, we …ce depth scales and found that the averages taken on constant …e **best** results in comparison with full 3D LTE spectral line calcu…

…ll provide in the near-future the suitable averages.

…f you refer to the <3D> models, please use Magic et al. 2013b as reference.



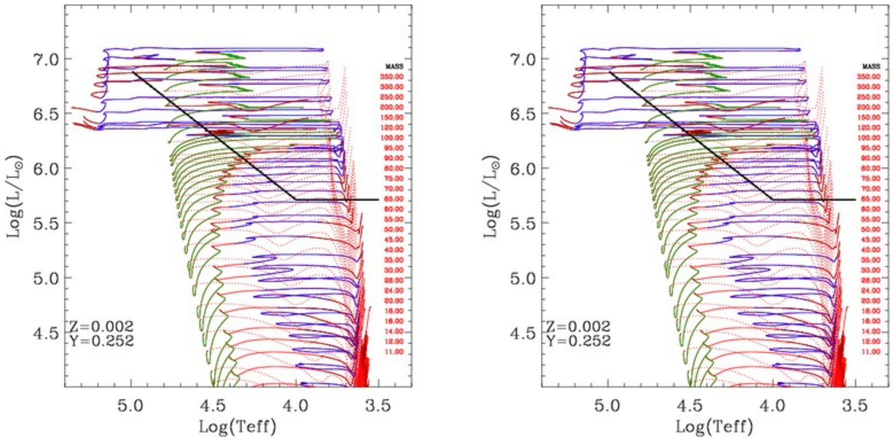
Mean temperature stratification for models with different stellar parameters.


UNIVERSITÉ DE GENÈVE
UNIVERSITÉ FACULTÉS ÉTUDES COLLABORATEURS SERVICES ALUMNI
ÉVOLUTION STELLAIRE
ERC STAREX Recherche Base de données Publications Membres Enseignement Grand public Jobs
WELCOME TO THE online SYCLIST HOMEPAGE
NEW: now Gaia colours are provided (according to Evans et al. 2018)
and the Z=0.0004 grids of Groh et al. 2019 is implemented.
Through this portal, you'll access several tools designed for the Geneva stellar models provided by the SYCLIST code. We propose the following services:
Isochrone calculation
Compute a single isochrone of the desired age,
or a sequence of isochrones giving the age range and the time steps.
Interpolation of a new model:
Create a new model by interpolating between existing tracks.
Choose the mass, rotation rate and metallicity and obtain the corresponding model track.
Request the computation of a synthetic cluster:
fill the form for the cluster's settings and the data will be emailed to you soon.
Please select one of the following modes::
Compute an isochrone
LUPM LABORATOIRE UNIVERS & PARTICULES MONTPELLIER
STAREVOL
UNIVERSITÉ DE GENÈVE FACULTÉ DES SCIENCES Département d'astronomie
Starevol
STAREVOL
Home
Basic inputs
Members
Database
Visualisation
Contact
Links
Welcome on the webpage of the stellar evolution code STAREVOL (Montpellier-Geneva)
© 2015-2022 STAREVOL
MIST
Home Packaged Model Grids Web Interpolator Resources References
MESA Isochrones & Stellar Tracks
News & Updates
12/28/20: Added synthetic photometry for Ultra Violet Imaging Telescope (UVIT; reference)
12/27/20: Added synthetic photometry for Southern Photometric Local Universe Survey (S-PLUS)
12/04/20: Updated synthetic photometry for Gaia EDR3 based on Riello et al. 2020
02/19/19: Added synthetic photometry for INT Photometric H-α Survey (see www.iphas.org)
01/29/19: Added synthetic photometry for Subaru Hyper Suprime-Cam; changed compression from gzip to xz for all tarballs
06/18/18: MIST v1.2 released. A subtle bug in the interpolation of secondary EEPs is fixed.
04/27/18: Updated Gaia DR2 passbands/zeropoints are now available. They can be accessed through UBVRIplus.
09/12/17: MIST v1.1 released. Metallicity interpolation bug in the CMD routine is fixed. Carbon-star BCs were left out in MIST v1.0 but are now included.
02/15/17: Non-rotating models released. UBVRIplus now includes Hipparcos, Tycho, and Gaia filters. JWST and LSST are also available.
03/28/16: MIST v1.0 released.
MSTO: 153.0 M⊙ logAge = 6.45
MSTO: 1.01 M⊙ logAge = 10.0
PMS ZAMS IAMS TAMS RGBTip ZACHeB TACHeB TPAGB post-AGB WDCS
[Z/H] = −4.00 [Z/H] = −3.00 [Z/H] = −2.00 [Z/H] = −1.00 [Z/H] = 0.00 [Z/H] = +0.50
Extensive mass and age coverage
Pre-main sequence to advanced evolutionary phases
Wide range in metallicities
BaSTI
a Bag of Stellar Tracks and Isochrones
ith white dwarfs models has been added!
Home Models Tools News BaSTI: Previous release Papers Contact
Very important update
The Team
Sebastian L. Hidalgo
Antonio Aparicio
Instituto de Astrofísica de Canarias
Adriano Pietrinferni
Santi Cassisi
INAF - Osservatorio Astronomico d'Abruzzo

Diffusion souvent très « low tech »

PARSEC STELLAR EVOLUTION CODE

Bressan et al. 2012 *Bressan et al. 2013*



NEW in version 2.1s ***Evolutionary tracks***

(new 23/12/2014: PHASE added to the files, see readme.txt)

(new 7/1/2015: Z=0.03 and Z=0.04)

!!

I. **NEW MODELS OF VERY LOW MASS STARS** ***Chen et al 2014***

II. **NEW MODELS OF MASSIVE STARS (up to 350 Mo)**

   a. **LOW METALLICITY MODELS & DWARF IRREGULARS** ***Tang et al 2014***

   b. **HIGH METALLICITY MODELS & NEW BOLOMETRIC CORRECTIONS** ***Chen et al 2014b*****, to be submitted**

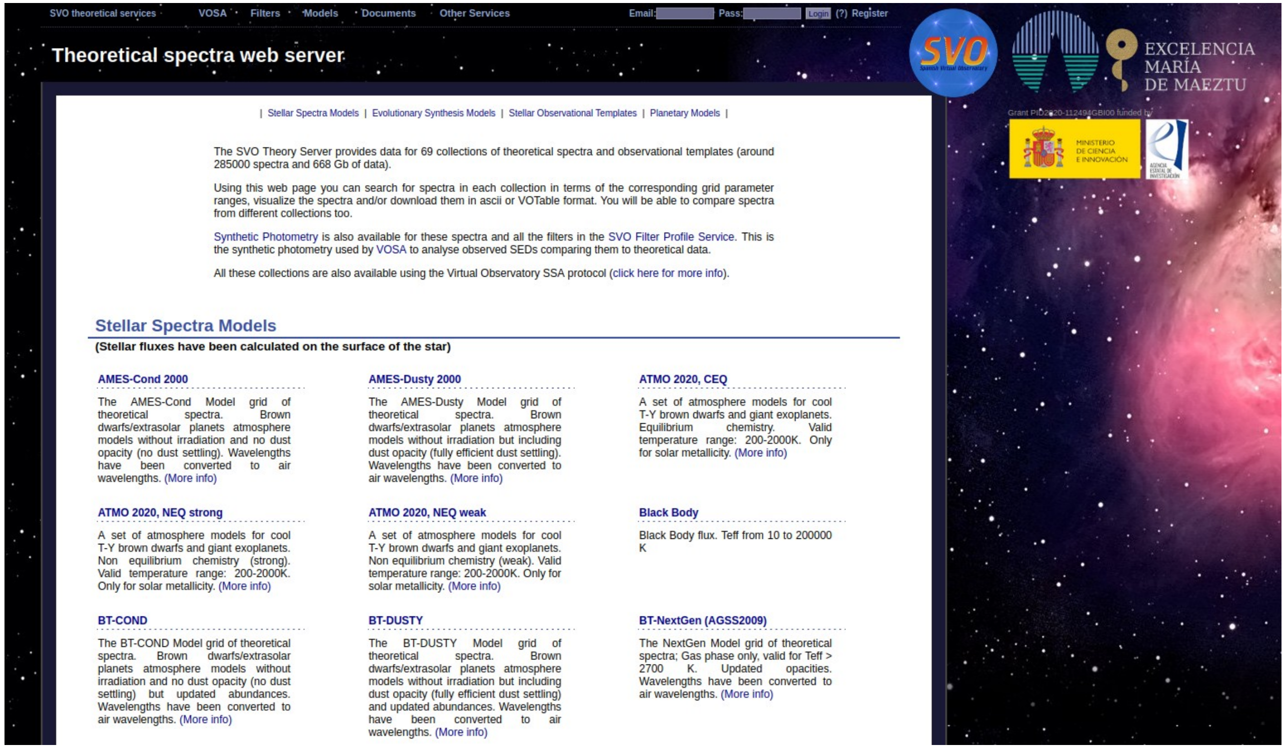
SISSA People Personal Home Pages

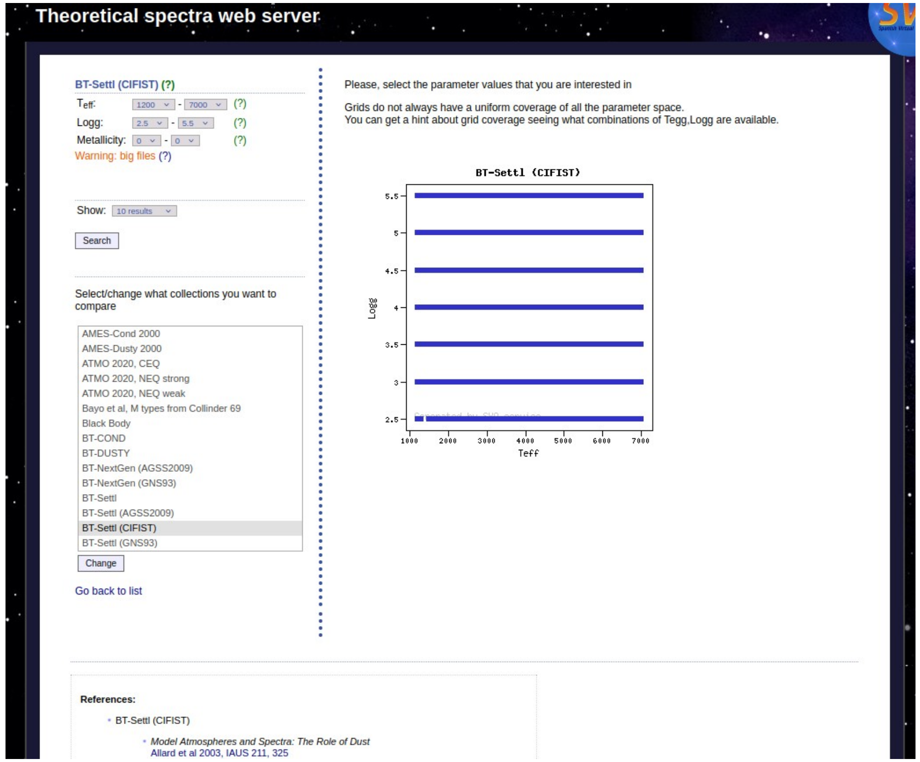
Name	Last modified	Size	Description
Parent Directory		-	
HR diagrams of massive stars/	2015-09-18 14:27	-	
Z0.0001Y0.249.tar.gz	2014-12-18 21:03	14M	
Z0.0002Y0.249.tar.gz	2014-12-18 21:03	14M	
Z0.0005Y0.249.tar.gz	2014-12-18 21:03	14M	
Z0.001Y0.25.tar.gz	2014-12-18 21:03	15M	
Z0.002Y0.252.tar.gz	2016-02-01 12:05	15M	
Z0.004Y0.256.tar.gz	2014-12-18 21:03	16M	
Z0.006Y0.259.tar.gz	2016-02-01 11:58	16M	
Z0.008Y0.263.tar.gz	2014-12-18 21:03	16M	
Z0.01Y0.267.tar.gz	2016-02-01 12:00	17M	
Z0.014Y0.273.tar.gz	2014-12-18 21:03	17M	
Z0.017Y0.279.tar.gz	2014-12-18 21:03	17M	
Z0.02Y0.284.tar.gz	2014-12-18 21:03	19M	
Z0.03Y0.302.tar.gz	2016-02-01 17:58	20M	
Z0.04Y0.321.tar.gz	2016-02-01 17:59	20M	
Z0.06Y0.356.tar.gz	2016-02-02 16:39	22M	
no_phase/	2014-12-23 16:53	-	
pcrit/	2015-09-18 14:30	-	
readme.txt	2015-03-11 10:15	3.4K	
reference_solar_partition.txt	2014-10-31 08:56	6.6K	

Diffusion des modèles stellaires dans l'OV

La diffusion de grilles de modèles stellaires dans l'OV se limite aux grilles de spectres synthétiques :

A minima via le serveur Theory du VOSA :





Diffusion aidée par l'outil Pleinpot via le LyDU et accès OV

CRAL CRAL ENSENS cnrs cnrs Lyon 1 Lyon 1 PhoenixPhoenix FAllardFAllard

Archive of PHOENIX synthetic spectra of stars, brown dwarfs and planets

This interface gives access to numerous collections of spectra computed by France Allard and her collaborators with the Phoenix code. In total more than 1 TB of data can be accessed.

Recommended models

The wider coverage of the parameter space, and one of the most recent grid — BT-Settl/CIFIST2011

The most recent grid, lacking the lowest metallicities — BT-Settl/CIFIST2011_201 ?

All the families of models

BT models — Choose a model set...

Older generations of models — Choose a model set... ?

The archive file tree & full database search

Search the whole databa — Explore the file tree ?

Last revision: 10/05/2022 17:08:14

Lyon Data center for the Sciences of the Universe: LyDU

Virtual Observatory Services (astronomical spectroscopy)

The Virtual Observatory is a worldwide effort of the astronomical community to build a network of interoperable services. This is required in order to optimize the usage, and enhance the scientific return of the large surveys and programs carried-on in the various laboratories and observatories. Observatoire de Lyon provides a suite of services that deliver spectra.
This page is at the destination of the VO developers or specialists.

The PHOENIX spectral archive

The PHOENIX SSA gives access to the theoretical spectra contained in the archive.

URL of the classical web interface
  http://osubdd.ens-lyon.fr/phoenix/
Base URL of the SSA
  http://osubdd.ens-lyon.fr/phoenix/phoenix.cgi?n=phoenix_ssa&c=ssa
FORMAT=metadata request
  http://osubdd.ens-lyon.fr/phoenix/phoenix.cgi?n=phoenix_ssa&c=ssa&FORMAT=metadata
Example of data request
  http://osubdd.ens-lyon.fr/phoenix/phoenix.cgi?n=phoenix_ssa&c=ssa&teff=3000/3200&logg=5/&metal=-1
Conformance with the standard
  The service has been last checked to conform to SSA 1.1 using the VOParis validator on 2016/04/27.

CRAL ENS DE LYON cnrs Lyon 1 PHOENIX

IOENIX models BT-Settl / CIFIST2011

Constrain any fields, choose the fields to display, and order the records ?

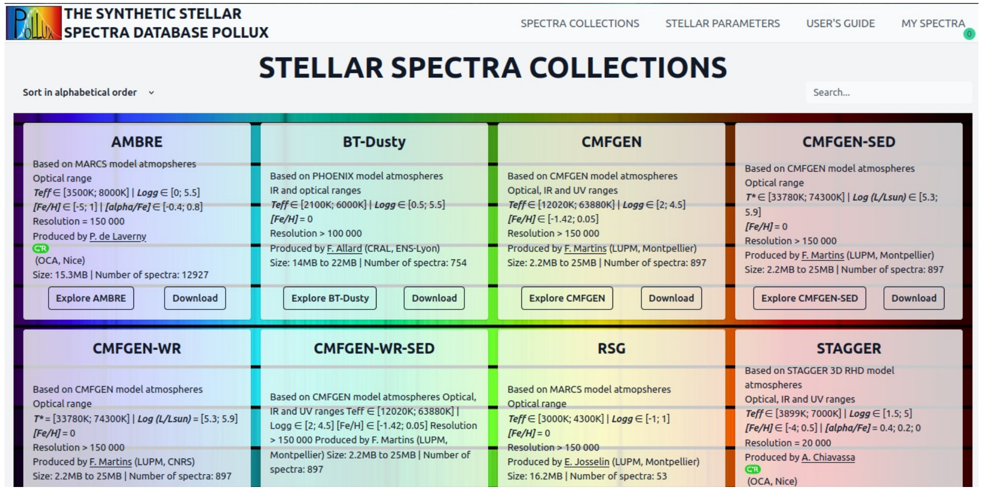
Field	Constraint	Show	Sort
grid		☑	
Solar abundance		☑	
Water vapor lines		☑	☐
LTE		☑	☐
Teff		☑	☐
log(g)		☑	☐
[M/H]		☑	☐
[alpha/Fe]		☑	☐
Spectrum		☑	
FITS header		☑	
Native file		☑	
FITS		☑	
format		☐	☐
file		☐	☐
Solar abundance bibcode		☐	☐
Water vapor lines bibcode		☐	☐
wget command		☐	☐

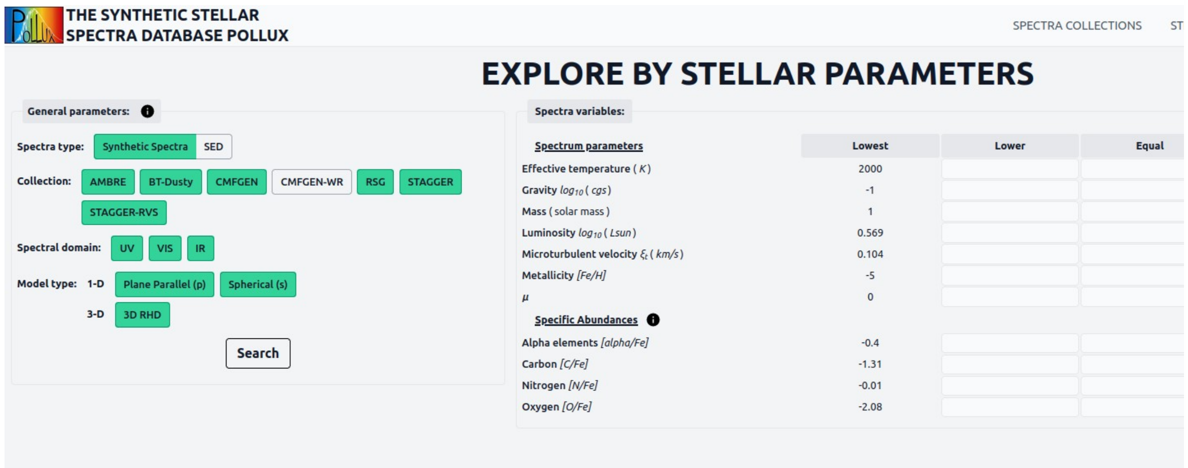
Output as HTML table — Default — Submit

Diffusion des modèles stellaires dans l'OV

La diffusion de grilles de modèles stellaires dans l'OV se limite aux grilles de spectres synthétiques :

De façon détaillée via POLLUX





Data model maison

Visibilité des modèles stellaires dans l'OV

Services BDD visibles dans Registry

Quelques web services permettent de faire de la visualisation et de l'analyse e utilisant le protocole SSA :

CASSIS

VOSpec

TOPCAT

Pas de service d'accès aux spectres stellaires synthétiques via protocoles basés sur SimDM/ SimDAL

Distribution de grilles de modèles d'évolution stellaire ?

Production importante de grilles fortement utilisées par l'ensemble de la communauté

Exemple : grilles produites pour PLATO → internes au consortium mais pourraient devenir publiques

Modèles « simples » : on n'a pas à faire à des simulations MHD ou cosmologiques

Outputs très fortement multi-dimensionnels (entre 20 à 50 paramètres physiques par pas de temps)

Aucune standardisation des outputs.

Intérêt pourtant certain d'une meilleure mise à disposition via de vraies base de données interopérables

Possibilité : utiliser POLLUX comme une « plateforme » pour l'ouvrir à d'autres types de modèles stellaires en utilisant des technos comme celles proposées par ISMDB (cf présentation F. Le Petit)