ASOVF Theory WG Workshop, June 2007

Evolution of the Besançon Model of the Stellar Populations of the Galaxy // emerging Theory VO standards

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Overview

- Besançon model of stellar populations of the Galaxy:
  a theory application, but “on the verge” compared to others
  -> *provides directly a “sky view” of the results of the model*
- Presentation of on-going set-up of a data base to store model results
- How does this database face current status of the *SNAP* protocol ?

Besançon model of the Galaxy

- Theoretical and semi-empirical bases
- Numerical simulations → catalogues of simulated stars
  (intrinsic properties and observational parameters)
- observational parameters (magnitudes, velocities, ...) including observational errors
- Directly comparable to observed catalogues

- On line since 1996 **http://www.obs-besancon.fr/model/**
- New version since late 2003 (*Robin et al., 2003*), *CFHT-Megacam* photometric system added in 2004
- "asynchronous" operation mode: *ftp* when the simulation is completed
- Provides catalogues of simulated stars or count tables

Model of the Galaxy: what for ?

- Test formation scenarios of the Galaxy, stellar models, Galactic dynamics

- Produce realistic simulations to help for the interpretation of observed data

  galactic clusters, resolved galaxies, stellar clusters, molecular clouds, Kuiper objects, ...

- Produce simulations to prepare observations and test their objectives:
  - Limiting magnitude, required precision, choice of filters...

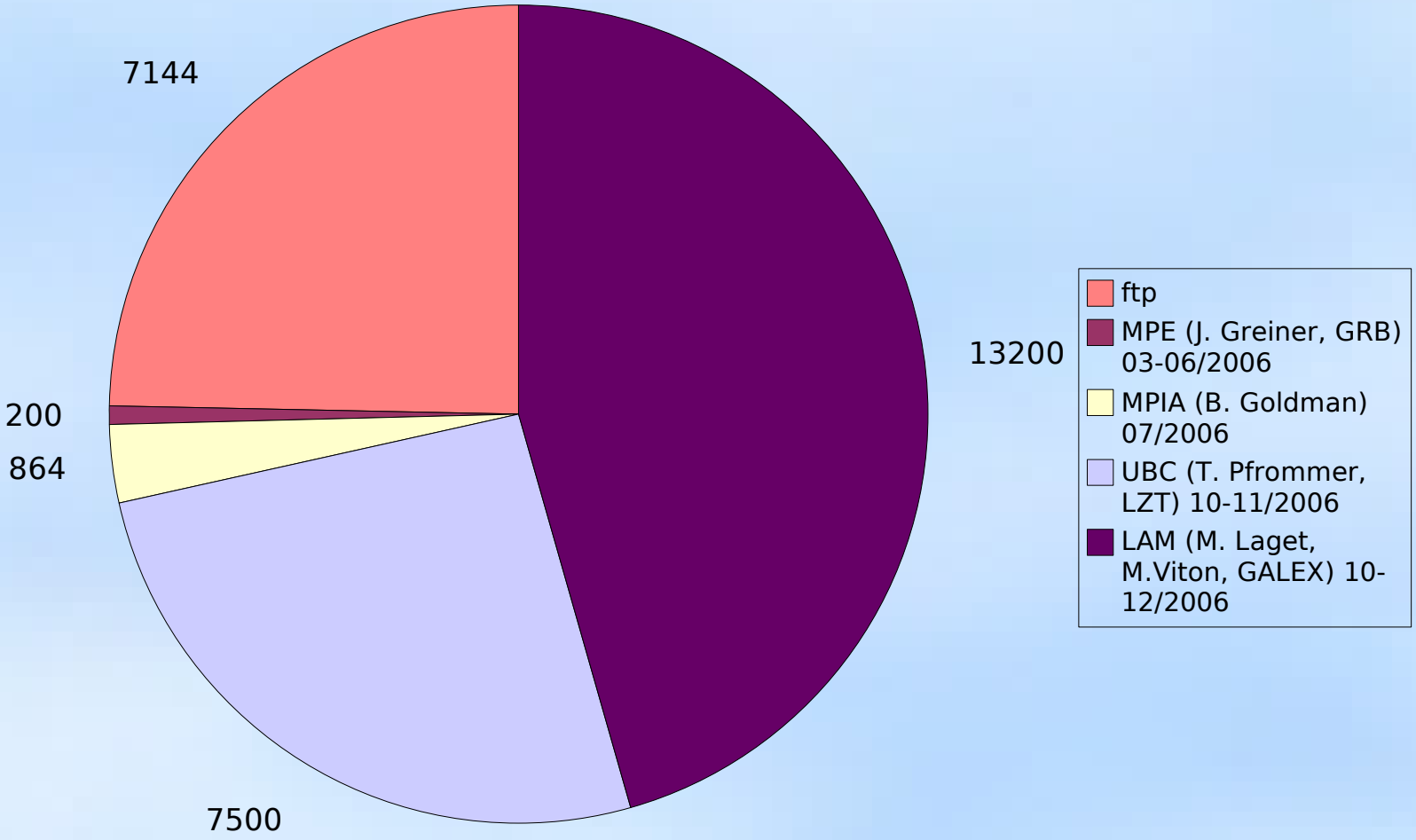
Model of the Galaxy: new requirements

- Since the commissioning of the 2003 version, the number of "big" (size > 100 Mbytes) catalogues of simulated stars has increased
- Regularly, simulations with sizes above 1 Gbyte (... up to 19 Gbytes)
- Several requests to use the model as a "web service" for 2 years:
  - Photometric calibration of optical/near IR of GRBs (*J.Greiner, MPE*)
  - Star counts for *Large Zenith Telescope* (*T. Pfrommer, Univ. British Columbia*)
  - Counts to look for calibrators for interferometry (*JMMC*)
  - Comparaison with counts provided by GALEX (*OAMP-LAM*)

  ⇒ new "HTTP web service mode" for "short" simulations

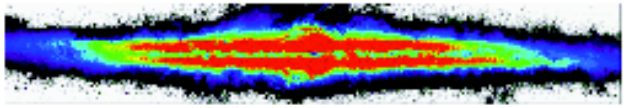
Model use statistics

Simulations 2003/12/01- 2006/12/18



Model of the Galaxy: evolution

- New version (summer 2007) :
  - Galactic extinction model, *Marshall et al.*, 2006
  - IMF for low-mass stars *Schultheis et al.*, 2006
  - Stellar radii supplied in the stellar catalogues
  - Improvement of white dwarf models in Megacam photometric system
  - Megacam+Wircam photometric system
  - SDSS+*JHK* photometric system
  - "On the fly" counts without photometric errors
  - HTTP web service mode
  - Catalogues of simulated stars in VOTable "<TABLEDATA>"
  - "refreshed" web interface



Model of stellar population synthesis of the Galaxy

Observatoire de Besançon

- Model forms
- Description
- References
- Disclaimer
- Changes log

last modification :
Mar 1, 2007, 19:17 CET

This version of the Model of stellar population synthesis of the Galaxy is fully described in the following publication:
A. C. Robin, C. Reylé, S. Derrière and S. Picaud. A synthetic view on structure and evolution of the Milky Way, 2003, *Astron. Astrophys.*, 409:523 ADS (*erratum*: 2004, *Astron. Astrophys.*, 416:157 ADS)

On December 6, 2004, a new version was enabled that allows to use the CFHT-Megacam photometric system. More informations are available here.

Output mode:	direct HTTP output (when using a brov
Photometric system:	SDSS+JHK
Form of the model simulation:	Catalogue simulation
Kinematics:	with kinematics

Display model form

Catalogue simulation with kinematics, SDSS + JHK photometric system

To get help on parameters and values to supply, click on

Output format:

XML-VOTable

Field of view

- Distance interval (kpc):
  [0.000000 , 50.000000]
  Distance step mode: progressive

  specify step value (in parsecs) if linear mode or Δr/r if logarithmic mode: 0.000
- field:
  - *small field* *(defined by the center of the field and its surface)*
    Longitude: 200.00 Latitude: 59.00 Solid angle (deg^2): 1.000000
  - *large field* *(field defined by interval of sky coordinates)*

Extinction law

- diffuse extinction by a dusty disk
- diffuse extinction by a dusty disk with discrete clouds
- *Marshall et al.* extinction model (-100°<l<100° , -10°<b<10°)

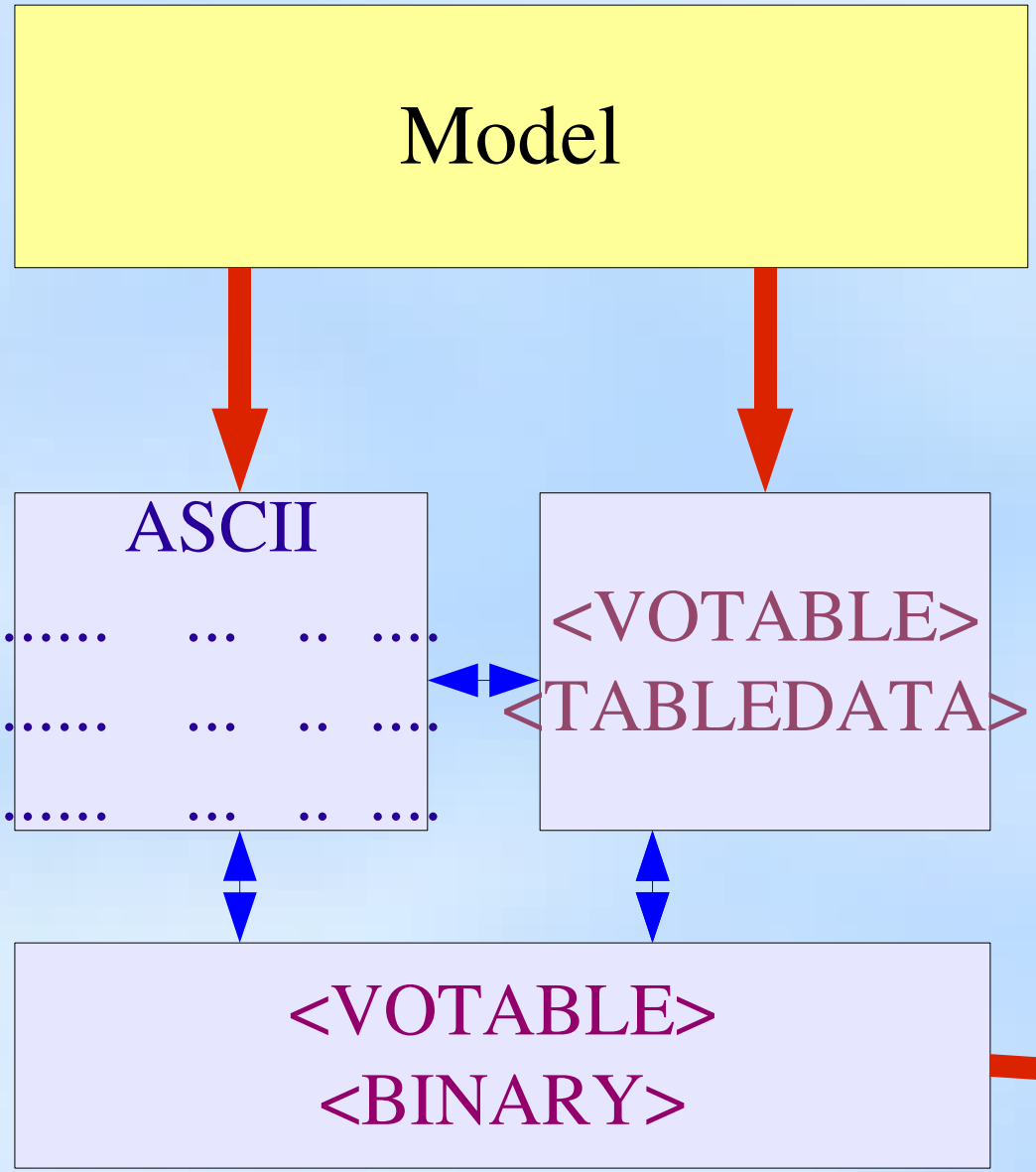
Selection on:

- **absolute magnitude** *(-7< < 20)*: [-7.00 , 20.00]

A data base of Galaxy Model simulations

- At *ADASS XV* conference, we mentioned the possibility to store “generic”, “comprehensive”, time consuming simulations
- Correlated need for an access protocol to such “data”
- Could be used in workflows
- => have “SDSS-like”, “2MASS-like”, “Megacam-Wircam like”, ... virtual skies.

Galaxy Model simulations DB: data format



- as proposed in Victoria, simulations are stored in VOTABLE “BINARY”
- conversions of formats make use of the STILTS library

Galaxy Model simulations DB: selection of simulations

- Query parameters:
  - General : model version
  - Great categories of simulations (“keys”):
    - photometric system
    - extinction model
    - with/without parameters
    - (error mode)
  - observational/intrinsic stellar parameters
- still needs to see how simulations are organized (DB population) -> query optimization

Model of stellar population synthesis of the Galaxy

Observatoire de Besançon

ON-LINE HELP

FORM

Kinematics

Photometric System

Field

Age / Population

Extinction Law

Error function

Spectral Type

SIMULATIONS

Name

Date

Galactic Coordinates

Download

FORM

Kinematics :

- no selection
- Without kinematic
- Proper motion in equatorial coordinates
- Proper motion in galactic coordinates

Photometric System :

- No selection
- Johnson-Cousins (UBVRIJHKL)
- CFHT-Megacam
- CFHT-Megacam+Wircam
- SDSS+JHK

Field :

- No selection
- Small field ("field mode")
- Large field ("field mode")
- Field mode with loops
- Flux in cartesian coordinates for the whole Galaxy

Luminosity :

I Supergiants
II bright giants
III giants
IV subgiants
V main sequence
VII white dwarfs
TTauri

Search

Reset to default values

SIMULATIONS

Name	Date	Photometric System	Galactic Coordinates (deg)				Kinematics	Number of stars	Version	Download
			Longitude		Latitude					
			min	max	min	max				
ASC_def_mega	2007-06-06 09:14:23	CFHT-Megacam+Wircam	200	50			Without kinematic	338	06-11	Download
def	2007-06-11 13:22:07	Johnson-Cousins (UBVRIJHKL)	200	50			Without kinematic	624	06-11	Download
def_cloud	2007-05-29 15:27:39	Johnson-Cousins (UBVRIJHKL)	200	50			Without kinematic	619	06-11	Download
kine_sdss	2007-05-29 15:27:56	SDSS+JHK	200	50			Proper motion in equatorial coordinates	329	06-11	Download
kine_sdss2	2007-06-11 13:51:42	SDSS+JHK	200	50			Proper motion in equatorial coordinates	39	06-11	Download

Number of Simulations : 5

SIMULATIONS

Name	Date	Photometric System	Galactic Coordinates (deg)				Kinematics	Number of stars	Version	Download
			Longitude		Latitude					
			min	max	min	max				
ASC_def_mega	2007-06-06 09:14:23	CFHT-Megacam+Wircam	200		59		Without kinematic	338	06-11	Download
def	2007-06-11 13:22:07	Johnson-Cousins (UBVRIJHKL)	200		59		Without kinematic	624	06-11	Download
def_cloud	2007-05-29 15:27:39	Johnson-Cousins (UBVRIJHKL)	190	219	41	59	Without kinematic	419	06-11	Download
kine_sdss	2007-05-29 15:27:56	SDSS+JHK	200		59		Proper motion in equatorial coordinates	329	06-11	Download
kine_sdss2	2007-06-11 13:51:42	SDSS+JHK	200		59		Proper motion in equatorial coordinates	39	06-11	Download

Number of Simulations : 5

FORM

Kinematics :

- (•) No selection
- ( ) Without kinematic
- ( ) Proper motion in equatorial coordinates
- ( ) Proper motion in galactic coordinates

Photometric System :

- (•) No selection
- ( ) Johnson-Cousins (UBVRIJHKL)
- ( ) CFHT-Megacam
- ( ) SDSS+JHK

Field :

- (•) No selection
- ( ) Small field (*field mode*)
- ( ) Large field (*field mode*)

Luminosity :

Selection of Parameters

Select all
Tout decocher

- Table : GM_catalog

- [x] Distance of the simulated star from the Sun
- [x] Absolute V magnitude
- [ ] Luminosity class
- [ ] Spectral type [1=O, 2=B, 3=A, 4=F, 5=G, 6=K, 7=M, 8.0=carbon AGBs, 8.1=oxygen rich AGBs, 9=white dwarfs
- [x] log10 of effective temperature
- [x] log10 of gravity
- [x] Age / Population
- [x] Mass
- [ ] B-V color index
- [ ] U-B color index
- [ ] V-I color index
- [ ] V-K color index
- [ ] V apparent magnitude
- [x] Metallicity
- [x] Galactic longitude
- [x] Galactic latitude
- [x] Extinction
- [x] Bolometric magnitude
- [x] Stellar radius

Validate

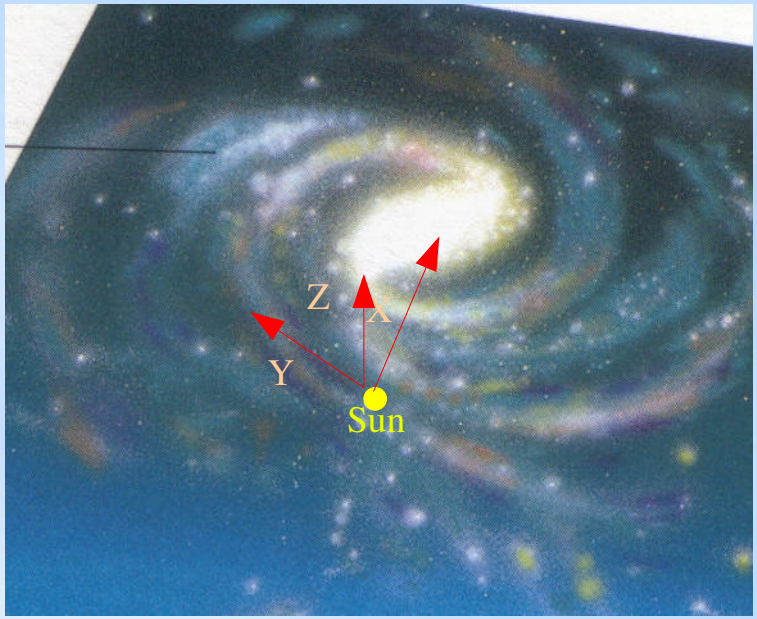
TABLEDATA : sortie HTTP Output

TABLEDATA : Download

Galactic Model simulations DB and Snap *(v 0.5, 20070329)*

.. a few answers and many questions...

- SNAP is coord. oriented, relative to the simulation box size
  - Spatial coordinates will be supplied as well as gal. & eq. coord



  - box side -> implies the “box” is the whole Galaxy ?
    (simulation size of several tens of Tbytes...)

Galactic Model simulations DB and Snap

- Particles = simulated stars (intrinsic+observational properties)
- Selection of simulations -> *ok* (web)
- Spherical selection can allow to select e.g. the bulge
- getFields, getUnits -> *ok* (web)
  UCDs file relative to FIELDs, PARAMs used for VOTable output
- Data cutout :
  - will be supplied
  - Mandatory getThumb -> is that relevant for *ALL* theory data ?

Galactic Model simulations DB and Snap

- setSnap input:
  - ROI: already discussed in a former slide
  - Selection of fields -> *ok* (web)
  - DATASERVICE and DATASOURCE: *does DATASOURCE need to be specified as a URI (link with staging ?)*
  - Data format : data/votable
  - Service specific parameters: *still to be thought of*

Galactic Model simulations DB and Snap

- setSnap output:
  - Metadata in <VOTABLE>
    -> *some adjustments needed* <RESOURCE type="results">, DATASERVICE REQUEST_ID REQUEST_STATUS
  - FIELDS : *ucds, units, names*, ... defined in special file for VOTABLE output -> *ok*
- Staging:
  - -> *to be thought of thoroughly*
  - Job monitoring methods : *getSnapInfo ,cancelSnap -> related work done in GWS Working Group?*

Galactic Model simulations DB and Snap:

a tentative very provisional conclusion...

- Some elements of SNAP (0.5...) can be easily implemented for the Besançon model of the Galaxy (some less easily)
- SNAP will likely not be sufficient to fulfill all the requirements to access simulations with the Model of the Galaxy in the VO
- e.g. : need “cone search-like” service to access simulated data