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Interface Control Document for the Gaia spectral libraries

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reference: GAIA-C8-SP-OCA-FT-002
issue: 1
revision: 0
date: September 25, 2008
status: issued

Abstract

This document defines the format and content of spectral libraries to be validated by CU8 and used by various CUs within the DPAC.

Revision history

Issue	Rev. no.	Date	Author	Comments
1	0	2008-03-28	FT	Addressed issues, minor updates. First release.
D	0	2008-03-24	CBJ	Minor changes to language in section 1,2 and 3.1. Final issues raised.
D	0	2008-02-07	FT	Revised version with comments from various people
D	0	2007-10-19	AMJ	First SVN version: auto-generated content from Dictionary Tool

Contents

1 Introduction & purpose

To make use of spectral libraries of astrophysical objects (stars, galaxies, ...), the CUs need a detailed description of the parameters used to compute the spectra and how they are stored in libraries. The spectra and parameters are used in several parts of the DPAC to simulate the data provided by Gaia and to build classification models.

This document describes the content and format of the various libraries and defines the quantities (e.g. stellar Teff, logg etc.) included. Additionally, details on the chemical element abundances and some additional parameters – like the name of the code used to produce the spectra – are also provided.

1.1 Scope

This ICD is applicable to all libraries of spectra produced under the coordination of and validated by CU8.

1.2 Acronyms

The following table has been generated from the on-line Gaia acronym list:

Acronym	Description
CU	Coordination Unit (in DPAC)
GHOST	Gaia HOt Stars Team
ICD	Interface Control Document
MDB	Main DataBase
QSO	Quasi-Stellar Object

1.3 ICD Change

The library content is defined and maintained using the ICD Dictionary Tool. The tables in this ICD are generated automatically with this tool from the latest approved release of the libraries. Any new library must, as far as is possible, follow this ICD. If this prooves not to be possible we shall add a new description and all modifications will be published in a new version of the ICD.

2 Detailed Interface Specification

2.1 File Naming Convention

All libraries are identified by a class of object and a number. They can be found at the wiki page adress:

`www.rssd.esa.int/SA-general/Projects/GAIA/wiki/index.php?title=CU8:_Training_data`

This identification and numbering will be provided and maintained on this page. Large libraries, in particular the present stellar libraries, are large and must be split into several files. This is described below (section 2.2).

General remark: when a parameter is not provided because it is not relevant in the given context the providers put: -999.

The name of the ICD detailed parameter tables for libraries presented in section 3 are as follows.

StarNormal for all standard stars: MARCS, A0-M Phoenix, OB and A types of the GHOST group, C stars, Supergiant stars, WD. "Normal" implies that these stars exhibit no severe peculiarities, and as such they can be described with a minimum number of atmospheric parameters.

StarPeculiar for all stars with peculiarities, including Be, WR, Ap, and B–A stars with and without anomalies. Example: if a star shows large overabundances of chemical elements due to the presence of a magnetic field then more parameters are needed to describe this object. Another example is Be stars showing emission lines. For handling the latter case, two parameters have been introduced to the description of the spectra. The first is *startype* which refers to the phenomenon (Be, Ap, ...). The second is *numMod* which is an additional label (like a serial number) which simply identifies this particular spectrum within the set of peculiar ones. This label is used instead of a series of physical parameters. This is done because certain pecularities, such as emission lines from a circumstellar disk, are too complex to exactly characterize with a set of physical parameters. So instead we provide a unique numerical label for this particular peculiar spectrum.

Galaxies for the description of spectra of galaxies. For point source galaxies the metallicity is defined as Z=1-X-Y.

QSOs for the simulated quasars. Three QSO libraries identified and described by three README files on the 'Data Training' wiki pages `http://www.rssd.esa.int/wikiSI/index.php?title=CU8:_Spectral_libraries:_general`. One is the library of the observed spectra used to construct the library described in the document. The second the PCA coefficient deduced from the observed spectra (i.e. the spectra expressed on an orthogonal linear basis set). The third library refers to the result of computed spectra to simulate the QSOs.

ObservedSpectra is used for real spectra and will be identical to the "Normal" or "Peculiar" libraries description. If a new library cannot be made to fit with one of these then we shall implement a new table and propose a new version of the ICD. Presently there is one such case: the SDSS semi-empirical library for galaxies, as follows.

GalaxiesSemiEmp is for galaxies from SDSS which have been fitted to and extended by (in wavelength) synthetic spectra, thus the name "semi-empirical".

2.2 Data Files

The data in the libraries are in plain ASCII format. It has been decided in agreement between CU2 and CU8 that the library files should not be too large in order to avoid download and memory problems with any tools operatingon the libraries. The biggest libraries at present, MARCS and Phoenix, have therefore been split into several sub-libraries organized by metallicity. This is identified by *Subnum* in the number of the library. For example, StarNormal4m25 corresponds to the library number 4 for those stars with [Fe/H]$= -2.5$ dex, StarNormal4p05 is for +0.5 dex, etc. The other libraries stick to a 'NameXXX' naming scheme, such as "QSOs1".

2.3 General library layout

All information for one object is split over two lines (rows) in a file. The first line contains all the parameters, in the order described in the following tables. The second line contains the fluxes.

3 Spectral library content and format

Fluxes are orderded monotonically increasing in wavelength with a constant and linear wavelength step which is also common to all objects in that library. Spectra are provided as flux F_λ in $Wm^{-2}nm^{-1}$, *not* as photons or F_ν.

3.1 Generic Parameters

Type	Number of Bytes
byte	1
boolean	1
char	2
short	2
int	4
long	8
float	4

double	8
String	-
Other table defined already in the dictionary	-

The following descriptions are electronically generated from the dictionary tool. They correspond to the tables presented above.

3.2 SPLIB

3.2.1 Overview of the *StarNormal* Libraries

The following table describes the parameters associated with a library StarNormalXXX. This file is generated by CU8.

Name	Description	Type	Units
object	star	string	
type	BPRP or RVS	string	
provider	name or initials	string	
date	date	string	yyyymmdd
version	0x	string	
code	name of the Code used	string	
fluxnorm	0 or 1	int	
resolution	power of resolution	float	
ntot	nb of points	long	
lambda0	lambda start	float	nm
lambdaEnd	lambda at end of spectrum	float	nm
dlambda	lambda step	float	nm
teff	effective temperature	float	K
logg	log surface gravity	float	cgs
vturb	microturbulence	float	km/s
vrot	rotational velocity	float	km/s
y	helium content (mass fraction)	float	
zmetal	metallicity (mass fraction)	float	
feref	iron abundance (log H = 12)	float	dex
alphaFe	ratio alpha element / Fe	float	dex
cAbund	carbon abundance (log H = 12)	float	dex

Name	Description	Type	Units
nAbund	nitrogen abundance (log H = 12)	float	dex
oAbund	oxygen abundance (log H = 12)	float	dex
mgAbund	magnesium abundance (log H = 12)	float	dex
siAbund	silicon abundance (log H = 12)	float	dex
caAbund	calcium abundance (log H = 12)	float	dex
feAbund	iron abundance (log H = 12)	float	dex
mass	stellar mass	float	Solar Mass
gMag	computed G magnitude otherwise 999	float	
bcG	computed bolometric correction in G otherwise 999	float	
aV	reddening once applied otherwise 999	float	
flux	computed flux	float[ntot]	$Wm^{-}2nm^{-}1$

Parameters Detailed description

- star (**object**): This is the nature of the object. Could be star, galaxy, asteroid
- BPRP or RVS (**type**): Nature of the spectra, could be BPRP or RVS
- name or initials (**provider**): Name of the provider having computed the spectra.
- date (**date**): Date of computation.
- 0x (**version**): version number of the library
- name of the Code used (**code**): name of the code used.
- 0 or 1 (**fluxnorm**): 0 if the spectra are in flux, 1 if they are normalized to the continuum (divided by the continuum).
- power of resolution (**resolution**): This is used for the resolving power of the computed spectra or the observed one.
- nb of points (**ntot**): total number of point computed per spectrum.
- lambda start (**lambda0**): lambda starting point of the computation.
- lambda at end of spectrum (**lambdaEnd**): lambda end point of the computation.
- lambda step (**dlambda**): Step used for the computation of the spectra.
- effective temperature (**teff**): The effective temperature of the star.
- log surface gravity (**logg**): Logarithm of the stellar surface gravity g in cgs.
- microturbulence (**vturb**): Microturbulent velocity adopted.

• rotational velocity (**vrot**): Projected rotational velocity, a priori not used. If given it supplement the GoG computation.

• helium content (mass fraction) (**y**): helium content in mass fraction.

• metallicity (mass fraction) (**zmetal**): Metallicity of the star in the units X+Y+Z=1.

• iron abundance (log H = 12) (**feref**): This is the reference value of Fe in terms of metallicity. Not to be used except may be for GSP-phot. This value could be different to the Fe abundance given in the key Fe. Should be identical to [Z/H] with respect to the Sun.

• ratio alpha element / Fe (**alphaFe**): alpha element abundances compared to Fe abundance. This is a ratio in log with solar value as the reference point. It corresponds to the mean abundance of the alpha elements.

• carbon abundance (log H = 12) (**cAbund**): carbon abundance in log(H)=12

• nitrogen abundance (log H = 12) (**nAbund**): Nitrogen abundance in log(H)=12

• oxygen abundance (log H = 12) (**oAbund**): Oxygen abundance in log(H)=12

• magnesium abundance (log H = 12) (**mgAbund**): Magnesium abundance in log(H)=12

• silicon abundance (log H = 12) (**siAbund**): Silicium abundance in log(H)=12

• calcium abundance (log H = 12) (**caAbund**): Calcium abundance in log(H)=12

• iron abundance (log H = 12) (**feAbund**): Iron abundance in log(H)=12

• stellar mass (**mass**): stellar mass in solar units in case it is used for the computation. In general done for supergiant star models in sherical geometry.

• computed G magnitude otherwise 999 (**gMag**): Computed G magnitude. In general not used to construct the libraries.

• computed bolometric correction in G otherwise 999 (**bcG**): Bolometric correction computed by the providers for the G band.

• reddening once applied otherwise 999 (**aV**): Reddening in case we propose to implement it in the library. In general set to 0.0 so 999.

• computed flux (**flux**): Computed flux points (ntot) of the spectrum.

3.2.2 Overview of the *StarPeculiar* libraries

The following table describes the parameters associated with a library StarPeculiarXXX. This file is generated by CU8.

Name	Description	Type	Units
object	star	string	
type	BPRP or RVS	string	
provider	name or initials	string	
date	date	string	yyyymmdd
version	0x	string	
code	name of the Code used	string	
fluxnorm	0 or 1	int	
resolution	power of resolution	float	
ntot	nb of points	long	
lambda0	lambda start	float	nm
lambdaEnd	lambda at end of spectrum	float	nm
dlambda	lambda step	float	nm
teff	effective temperature	float	K
logg	log surface gravity	float	cgs
vturb	microturbulence	float	km/s
vrot	rotational velocity	float	km/s
y	helium content (mass fraction)	float	
zmetal	metallicity (mass fraction)	float	
feref	iron abundance (log H = 12)	float	dex
alphaFe	ratio alpha element / Fe	float	dex
cAbund	carbon abundance (log H = 12)	float	dex

Name	Description	Type	Units
nAbund	nitrogen abundance (log H = 12)	float	dex
oAbund	oxygen abundance (log H = 12)	float	dex
mgAbund	magnesium abundance (log H = 12)	float	dex
siAbund	silicon abundance (log H = 12)	float	dex
caAbund	calcium abundance (log H = 12)	float	dex
feAbund	iron abundance (log H = 12)	float	dex
mass	stellar mass	float	Solar Mass
gMag	computed G magnitude otherwise 999	float	
bcG	computed bolometric correction in G otherwise 999	float	
aV	reddening once applied otherwise 999	float	
startype	type of extrem stars like Be WR ApBp HgMn	string	
numMod	model number for Be WR	long	
heAbund	helium abundance (log H = 12)	float	dex
neAbund	neon abundance (log H = 12)	float	dex
naAbund	sodium abundance (log H = 12)	float	dex
alAbund	aluminium abundance (log H = 12)	float	dex
pAbund	phosphorus abundance (log H = 12)	float	dex
sAbund	sulphur abundance (log H = 12)	float	dex
clAbund	clorine abundance (log H = 12)	float	dex
scAbund	scandium abundance (log H = 12)	float	dex
tiAbund	titanium abundance (log H = 12)	float	dex

Name	Description	Type	Units
vAbund	vanadium abundance (log H = 12)	float	dex
crAbund	chromium abundance (log H = 12)	float	dex
mnAbund	manganese abundance (log H = 12)	float	dex
coAbund	cobalt abundance (log H = 12)	float	dex
niAbund	nickel abundance (log H = 12)	float	dex
cuAbund	copper abundance (log H = 12)	float	dex
znAbund	zinc abundance (log H = 12)	float	dex
gaAbund	gallium abundance (log H = 12)	float	dex
srAbund	strontium abundance (log H = 12)	float	dex
ytAbund	yttrium abundance (log H = 12)	float	dex
zrAbund	zirconium abundance (log H = 12)	float	dex
moAbund	molybdenum abundance (log H = 12)	float	dex
xeAbund	xenon abundance (log H = 12)	float	dex
baAbund	barium abundance (log H = 12)	float	dex
laAbund	lanthanum abundance (log H = 12)	float	dex
ceAbund	cerium abundance (log H = 12)	float	dex
prAbund	praeseodymium abundance (log H = 12)	float	dex
ndAbund	neodymium abundance (log H = 12)	float	dex
smAbund	samarium abundance (log H = 12)	float	dex
euAbund	europium abundance (log H = 12)	float	dex
gdAbund	gadolinium abundance (log H = 12)	float	dex

Name	Description	Type	Units
tbAbund	terbium abundance (log H = 12)	float	dex
dyAbund	dysprosium abundance (log H = 12)	float	dex
hoAbund	holmium abundance (log H = 12)	float	dex
erAbund	erbium abundance (log H = 12)	float	dex
tmAbund	thulium abundance (log H = 12)	float	dex
ybAbund	ytterbium abundance (log H = 12)	float	dex
luAbund	lutetium abundance (log H = 12)	float	dex
ptAbund	platinum abundance (log H = 12)	float	dex
auAbund	gold abundance (log H = 12)	float	dex
hgAbund	mercury abundance (log H = 12)	float	dex
thAbund	thorium abundance (log H = 12)	float	dex
uAbund	uranium abundance (log H = 12)	float	dex
flux	Flux computed	float[ntot]	$Wm^{-}2nm^{-}1$

Parameters Detailed description

- star (**object**): This is the nature of the object. Could be star, galaxy, asteroid
- BPRP or RVS (**type**): Nature of the spectra, could be BPRP or RVS
- name or initials (**provider**): Name of the provider having computed the spectra.
- date (**date**): Date of computation.
- 0x (**version**): version number of the library
- name of the Code used (**code**): name of the code used.
- 0 or 1 (**fluxnorm**): 0 if the spectra are in flux, 1 if they are normalized to the continuum divided by the continuum).
- power of resolution (**resolution**): This is used for the resolving power of the computed spectra or the observed one.
- nb of points (**ntot**): total number of point computed per spectrum.
- lambda start (**lambda0**): lambda starting point of the computation.
- lambda at end of spectrum (**lambdaEnd**): lambda end point of the computation.
- lambda step (**dlambda**): Step used for the computation of the spectra.
- effective temperature (**teff**): The effective temperature of the star.
- log surface gravity (**logg**): Logarithm of the stellar surface gravity g in cgs.

- microturbulence (**vturb**): Microturbulent velocity adopted.

- rotational velocity (**vrot**): Projected rotational velocity, a priori not used. If given it supplement the GoG computation.

- helium content (mass fraction) (**y**): helium content in mass fraction.

- metallicity (mass fraction) (**zmetal**): Metallicity of the star in the units X+Y+Z=1.

- iron abundance (log H = 12) (**feref**): This is the reference value of Fe in terms of metallicity. Not to be used except may be for GSP-phot. This value could be different to the Fe abundance given in the key Fe.

- ratio alpha element / Fe (**alphaFe**): alpha element abundances compared to Fe abundance. This is a ratio in log with the solar value as the refrence point. It correspond to the mean abundance value of the alpha elements.

- carbon abundance (log H = 12) (**cAbund**): carbon abundance in log(H)=12

- nitrogen abundance (log H = 12) (**nAbund**): Nitrogen abundance in log(H)=12

- oxygen abundance (log H = 12) (**oAbund**): Oxygen abundance in log(H)=12

- magnesium abundance (log H = 12) (**mgAbund**): Magnesium abundance in log(H)=12

- silicon abundance (log H = 12) (**siAbund**): Silicium abundance in log(H)=12

- calcium abundance (log H = 12) (**caAbund**): Calcium abundance in log(H)=12

- iron abundance (log H = 12) (**feAbund**): Iron abundance in log(H)=12

- stellar mass (**mass**): stellar mass in solar units in case it is used for the computation. In general done for supergiant star models in sherical geometry.

- computed G magnitude otherwise 999 (**gMag**): Computed G magnitude. In general not used to construct the libraries.

- computed bolometric correction in G otherwise 999 (**bcG**): Bolometric correction computed by the providers for the G band.

- reddening once applied otherwise 999 (**aV**): Reddening in case we propose to implement it in the library. In general set to 0.0 so 999.

- type of extrem stars like Be WR ApBp HgMn (**startype**): This indicate which kind of peculiar star we have: WR, Be, Ap, etc. This help to carcterize the peculiar stars and the numMod used to compute and store the spectra of these stars.

- model number for Be WR (**numMod**): numMod is a number that has no physical meaning. Help to extract one spectrum randomly.

- helium abundance (log H = 12) (**heAbund**): Helium content in log(H)=12
- neon abundance (log H = 12) (**neAbund**): Neon content in log(H)=12
- sodium abundance (log H = 12) (**naAbund**): Sodium ab undance in log(H)=12
- aluminium abundance (log H = 12) (**alAbund**): Aluminium bundance in log(H)=12
- phosphorus abundance (log H = 12) (**pAbund**): Helium content in log(H)=12
- sulphur abundance (log H = 12) (**sAbund**): Sulphure abundance in log(H)=12
- clorine abundance (log H = 12) (**clAbund**): Clorine abundance in log(H)=12
- scandium abundance (log H = 12) (**scAbund**): Scandium abundance in log(H)=12
- titanium abundance (log H = 12) (**tiAbund**): Titanium abundance in log(H)=12
- vanadium abundance (log H = 12) (**vAbund**): Vanadium abundance in log(H)=12
- chromium abundance (log H = 12) (**crAbund**): Chromium abundance in log(H)=12
- manganese abundance (log H = 12) (**mnAbund**): Manganese abundance in log(H)=12
- cobalt abundance (log H = 12) (**coAbund**): Cobalt abundance in log(H)=12
- nickel abundance (log H = 12) (**niAbund**): Nickel abundance in log(H)=12
- copper abundance (log H = 12) (**cuAbund**): Helium content in log(H)=12
- zinc abundance (log H = 12) (**znAbund**): Zinc abundance in log(H)=12
- gallium abundance (log H = 12) (**gaAbund**): gallium content in log(H)=12
- strontium abundance (log H = 12) (**srAbund**): Strontium abundance in log(H)=12
- yttrium abundance (log H = 12) (**ytAbund**): Yttrium abundance in log(H)=12
- zirconium abundance (log H = 12) (**zrAbund**): Zirconium abundance in log(H)=12
- molybdenum abundance (log H = 12) (**moAbund**): Molybdenium content in log(H)=12
- xenon abundance (log H = 12) (**xeAbund**): xenon content in log(H)=12
- barium abundance (log H = 12) (**baAbund**): Barium abundance in log(H)=12
- lanthanum abundance (log H = 12) (**laAbund**): Lanthanum abundance in log(H)=12
- cerium abundance (log H = 12) (**ceAbund**): Cerium abundance in log(H)=12
- praeseodymium abundance (log H = 12) (**prAbund**): Praeseodynium abundance in log(H)=12

- neodymium abundance (log H = 12) (**ndAbund**): Neodymium abundance in log(H)=12
- samarium abundance (log H = 12) (**smAbund**): Samarium abundance in log(H)=12
- europium abundance (log H = 12) (**euAbund**): Europium abundance in log(H)=12
- gadolinium abundance (log H = 12) (**gdAbund**): Gadolinium in log(H)=12
- terbium abundance (log H = 12) (**tbAbund**): terbium content in log(H)=12
- dysprosium abundance (log H = 12) (**dyAbund**): dysprosium abundance in log(H)=12
- holmium abundance (log H = 12) (**hoAbund**): Holmium content in log(H)=12
- erbium abundance (log H = 12) (**erAbund**): erbium content in log(H)=12
- thulium abundance (log H = 12) (**tmAbund**): Thulium content in log(H)=12
- ytterbium abundance (log H = 12) (**ybAbund**): Ytterbium content in log(H)=12
- lutetium abundance (log H = 12) (**luAbund**): Lutetium content in log(H)=12
- platinum abundance (log H = 12) (**ptAbund**): Platinum content in log(H)=12
- gold abundance (log H = 12) (**auAbund**): Gold content in log(H)=12
- mercury abundance (log H = 12) (**hgAbund**): Mercury content in log(H)=12
- thorium abundance (log H = 12) (**thAbund**): Thorium content in log(H)=12
- uranium abundance (log H = 12) (**uAbund**): Uranium content in log(H)=12
- Flux computed (**flux**): Computed flux points (ntot) of the spectrum.

3.2.3 Overview of the *Galaxies* libraries

The following table describes the parameters associated with a library GalaxiesXXX. This file is generated by CU8.

Name	Description	Type	Units
object	galaxy	string	
type	BPRP or RVS	string	
provider	name or initials	string	
date	date	string	yyyymmdd
version	0x	string	
code	name of the Code used	string	
fluxnorm	0 or 1	int	
resolution	power of resolution	float	
ntot	nb of points	long	
lambda0	lambda start	float	nm
lambdaEnd	lambda at end of spectrum	float	nm
dlambda	lambda step	float	nm
redshift	galaxy redshift	float	
galType	galaxy type identifier	int	
sfrType	sfr type identifier	int	
sfrP1	star formation rate p1 paramete	float [4]	Myr
sfrP2	star formation rate p2 parameter	float [4]	Solar Mass
sfrP3	star formation rate p3 parameter	float [1]	Myr
Infall	infall timescale	float [3]	Myr
age	age of the populations	float	Myr
massGalNorm	normalized mass of the galaxy	float	Solar Mass

Name	Description	Type	Units
massStarNorm	normalized mass in stars	float	Solar Mass
massWdNorm	normalized mass of WD	float	Solar Mass
massNsBhNorm	normalized mass of neutron S and Black H	float	Solar Mass
massSubStarNorm	normalized mass of substars	float	Solar Mass
massGasNorm	normalized mass of gas	float	Solar Mass
metalISM	metallicity of ISM in mass fraction	float	
metalStarMeanMass	mean metallicity of stars averaged on the mass	float	
metalStarMeanLumBol	mean metallicity of stars averaged on the bolometric luminosity	float	
lumBolNorm	normalized bolometric luminosity	float	erg.s-1
tauV	optical depth in V band from side to side	float	
lumDustLumbol	ratio luminosity from dust to bolo lumi	float	
sfrNorm	normalized star formation rate	float	SolarMass.Myr^{-1}
lymanContNorm	normalized Lyman continuum	float	s-1
snIINorm	normalized SNII rate	float	Myr^{-1}
snIaNorm	normalized SNIa rate	float	Myr^{-1}
ageStarMeanMass	mean age of stars average on mass	float	Myr
ageStarMeanLumbol	mean age of stars average on bolo lum	float	Myr
flux	spectrum flux	float[ntot]	Wm$^-$2nm$^-$1

Parameters Detailed description

- galaxy (**object**): This is the nature of the object. Could be star, galaxy, asteroid
- BPRP or RVS (**type**): Nature of the spectra, could be BPRP or RVS
- name or initials (**provider**): Name of the provider having computed the spectra.
- date (**date**): Date of computation.
- 0x (**version**): version number of the library
- name of the Code used (**code**): name of the code used.
- 0 or 1 (**fluxnorm**): 0 if the spectra are in flux, 1 if they are normalized to the continuum e.g. the computed fluxes have been divided by the computed continuum, then these normalized fluxes have no units and variate in the range [0,1]. .

- power of resolution (**resolution**): This is used for the resolving power of the computed spectra or the observed one.
- nb of points (**ntot**): total number of point computed per spectrum.
- lambda start (**lambda0**): lambda starting point of the computation.
- lambda at end of spectrum (**lambdaEnd**): lambda end point of the computation.
- lambda step (**dlambda**): Step used for the computation of the spectra.
- galaxy redshift (**redshift**): Redshift adopted
- galaxy type identifier (**galType**): Type of the galaxy
Range: [1, 4]
- sfr type identifier (**sfrType**): sfr type used for the galaxy simulation.
Range: [1, 4]
- star formation rate p1 parameter (**sfrP1**): First parameter of the Star Formation Rate. The units of sfrP1 is Myr for sfrTYpe=3 and it has no units for sfrType=1, 2.
- star formation rate p2 parameter (**sfrP2**): Second parameter of the Star Formation Rate. The units of sfrP2 is solar mass for sfrType=3 and Myr/solar Mass for sfrType=1, 2.
- star formation rate p3 parameter. (**sfrP3**): Third parameter of the Star Formation Rate in Myr.
- infall timescale (**Infall**): Time scale for the infall of gas
- age of the populations (**age**): Adopted age of the population
- normalized mass of the galaxy (**massGalNorm**): normalized mass of the galaxy
- normalized mass in stars (**massStarNorm**): Normailzed mass of stellar content
- normalized mass of WD (**massWdNorm**): Normalized mass of WD contained in the galaxy
- normalized mass of neutron S and Black H (**massNsBhNorm**): Normalized mass of stellar renant contained by the Galaxy: NS and Black holes.
- normalized mass of substars (**massSubStarNorm**): normalized mass of substellar objects.
- normalized mass of gas (**massGasNorm**): Normalize mass of gas in the galaxy
- metallicity of ISM in mass fraction (**metalISM**): Interstellar Medium metallicity
- metallicity of stars mean in mass (**metalStarMeanMass**): mean metallicity of stars averaged on the mass

- metallicity of stars mean in bolom lumi (**metalStarMeanLumBol**): mean metallicity of stars averaged on the bolometric luminosity
- normalized bolometric luminosity (**lumBolNorm**): normalized bolometric luminosity
- optical depth in V band from side to side (**tauV**): optical depth in V band from side to side
- ratio luminosity from dust to bolo lumi (**lumDustLumbol**): Ratio of the luminosity from dust material to bolometric luminosity
- normalized SFR (**sfrNorm**): normalized star formation rate
- normalized Lyman continuum (**lymanContNorm**): normalized lyman continuum
- normalized SNII rate (**snIINorm**): normalized SNII rate
- normalized SNIa rate (**snIaNorm**): normalized SNI rate
- mean age of stars avarage on mass (**ageStarMeanMass**): mean age of stars average on mass
- mean age of stars avarage on bolo lum (**ageStarMeanLumbol**): mean age of stars averaged on bolometric luminosity
- spectrum flux (**flux**): computed flux points (ntot) of the spectrum.

3.2.4 Overview of the *QSOs* libraries

The following table describes the parameters associated with a library QSOsXXX. This file is generated by CU8.

Name	Description	Type	Units
object	QSOs	string	
type	BPRP or RVS	string	
provider	name or initials	string	
date	date	string	yyyymmdd
version	0x	string	
code	name of the Code used	string	
fluxnorm	0 or 1	int	
resolution	power of resolution	float	
ntot	nb of points	long	
lambda0	lambda start	float	nm
lambdaEnd	lambda at end of spectrum	float	nm
dlambda	lambda step	float	nm
z	redshift	float	
Alpha	slope of the continuum	float	
EW	equivalent width	float	Å
flux	flux computed	float[ntot]	$Wm^{-}2nm^{-}1$

Parameters Detailed description

- QSOs (**object**): This is the nature of the object. Could be star, galaxy, asteroid
- BPRP or RVS (**type**): Nature of the spectra, could be BPRP or RVS
- name or initials (**provider**): Name of the provider having computed the spectra.
- date (**date**): Date of computation.
- 0x (**version**): version number of the library
- name of the Code used (**code**): name of the code used.
- 0 or 1 (**fluxnorm**): 0 if the spectra are in flux, 1 if they are normalized to the continuum (divided by the continuum).
- power of resolution (**resolution**): This is used for the resolving power of the computed spectra or the observed one.
- nb of points (**ntot**): total number of point computed per spectrum.
- lambda start (**lambda0**): lambda starting point of the computation.
- lambda at end of spectrum (**lambdaEnd**): lambda end point of the computation.
- lambda step (**dlambda**): Step used for the computation of the spectra.

- redshift (**z**): Redshift adopted
  Range: [0, 5.5]
- slope of the continuum (**Alpha**): Slope of the energy continuum
  Range: [- 4, 3]
- equivalent width (**EW**): Sum of the equivalent widths of emission lines
- flux computed (**flux**): ntot computed flux points.

3.2.5 Overview of the DPC/CU8/SPLIB/GalaxiesSemiEmp

The following table describes the parameters associated with a GalaxiesSemiEmp, this file is generated by CU8.

Contributor:Frederic Thevenin

Name	Description	Type	Units
object	galaxy	string	
type	BPRP or RVS	string	
provider	name or initials	string	
date	date	string	yyyymmdd
versionEmp	version of library	string	
versionSynLibFit	version of library synth used to fit	string	
codeSynLibFit	name of code used for Synth lib to fit	string	
fluxnorm	0 or 1	int	
resolution	power of resolution	float	
ntot	nb of points	long	
lambda0	lambda start	float	nm
lambdaEnd	lambda at end of spectrum	float	nm
dlambda	lambda step	float	nm
galType	galaxy type identifier	int	
sfrType	sfr type identifier	int	
sfrP1	star formation rate p1 paramete	float [4]	
sfrP2	star formation rate p2 parameter	float [4]	
sfrP3	star formation rate p3 parameter	float [1]	Myr
Infall	infall timescale	float [3]	Myr
age	age of the populations	float	Myr
massGalNorm	normalized mass of the galaxy	float	Solar Mass

Name	Description	Type	Units
massStarNorm	normalized mass in stars	float	Solar Mass
massWdNorm	normalized mass of WD	float	Solar Mass
massNsBhNorm	normalized mass of neutron S and Black H	float	Solar Mass
massSubStarNorm	normalized mass of substars	float	Solar Mass
massGasNorm	normalized mass of gas	float	Solar Mass
metalISM	metallicity of ISM in mass fraction	float	
metalStarMeanMass	mean metallicity of stars averaged on the mass	float	
metalStarMeanLumBol	mean metallicity of stars averaged on the bolometric luminosity	float	
lumBolNorm	normalized bolometric luminosity	float	$erg.s^{-1}$
tauV	optical depth in V band from side to side	float	
lumDustLumbol	ratio luminosity from dust to bolo lumi	float	
sfrNorm	normalized star formation rate	float	$SolarMass.Myr^{-1}$
lymanContNorm	normalized Lyman continuum	float	s^{-1}
snIINorm	normalized SNII rate	float	Myr^{-1}
snIaNorm	normalized SNIa rate	float	Myr^{-1}
ageStarMeanMass	mean age of stars average on mass	float	Myr
ageStarMeanLumbol	mean age of stars average on bolo lum	float	Myr
sdssObjID	Object ID in SDSS	int	
sdssSpecObjID	SDSS spectra ID	int	
sdssRa	SDSS right ascension	double	deg
sdssDec	SDSs declination	double	deg

Name	Description	Type	Units
sdssFiberMagR	fiber magnitude in r band of SDSS	float	mag
sdssFiberMagErrR	error in the fiber magnitude in r band of SDSS	float	mag
sdssModelMagR	model magnitude in r band of SDSS	float	mag
sdssModelMagErrR	error in model magnitude in r band of SDSS	float	mag
sdssPetroR90R	Petrosian R90 radius	float	arcsec
sdssPetroR90ErrR	error in Petrosian R90 radius	float	arcsec
sdssPetroR50R	Petrosian R50 radius	float	arcsec
sdssPetroR50ErrR	error in Petrosian R50 radius	float	arcsec
sdssRedshift	Galaxy redshift	float	
sdssRedshiftErr	error in galaxy redshift	float	
sdssSnr	S/N ratio	float	
sdssMjd	MJD of observation in SDSS	int	Julian Days
sdssPlate	plate ID	int	
sdssFiberID	fiber ID	int	
sdssEClass	classification	float	
x2Diff	difference in chi^2	float	
flux	spectrum flux	float[ntot]	$\mathrm{Wm^{-}2nm^{-1}}$

Parameters Detailed description

- galaxy (**object**): This is the nature of the object. Could be star, galaxy, asteroid
- BPRP or RVS (**type**): Nature of the spectra, could be BPRP or RVS
- name or initials (**provider**): Name of the provider having computed the spectra.
- date (**date**): Date of computation.
- version of library (**versionEmp**): version number of the library
- version of library synth used to fit (**versionSynLibFit**): version number of the library of synthetic spectra used to fit.
- name of code used for Synth lib to fit (**codeSynLibFit**): name of the code used to create the synthetic spectra.
- 0 or 1 (**fluxnorm**): 0 if the spectra are in flux, 1 if they are normalized to the continuum (divided by the continuum).

- power of resolution (**resolution**): This is used for the resolving power of the computed spectra or the observed one.
- nb of points (**ntot**): total number of point computed per spectrum.
- lambda start (**lambda0**): lambda starting point of the computation.
- lambda at end of spectrum (**lambdaEnd**): lambda end point of the computation.
- lambda step (**dlambda**): Step used for the computation of the spectra.
- galaxy type identifier (**galType**): Type of the galaxy
  Range: [1, 4]
- sfr type identifier (**sfrType**): sfr type used for the galaxy simulation.
  Range: [1, 4]
- star formation rate p1 parameter (**sfrP1**): First parameter of the Star Formation Rate. The units of sfrP1 is Myr for sfrTYpe=3 and it has no units for sfrType=1, 2.
- star formation rate p2 parameter (**sfrP2**): Second parameter of the Star Formation Rate. The units of sfrP2 is solar mass for sfrType=3 and Myr/solar Mass for sfrType=1, 2.
- star formation rate p3 parameter. (**sfrP3**): Third parameter of the Star Formation Rate in Myr.
- infall timescale (**Infall**): Time scale for the infall of gas
- age of the populations (**age**): Adopted age of the population
- normalized mass of the galaxy (**massGalNorm**): normalized mass of the galaxy
- normalized mass in stars (**massStarNorm**): Normailzed mass of stellar content
- normalized mass of WD (**massWdNorm**): Normalized mass of WD contained in the galaxy
- normalized mass of neutron S and Black H (**massNsBhNorm**): Normalized mass of stellar renant contained by the Galaxy: NS and Black holes.
- normalized mass of substars (**massSubStarNorm**): normalized mass of substellar objects.
- normalized mass of gas (**massGasNorm**): Normalize mass of gas in the galaxy
- metallicity of ISM in mass fraction (**metalISM**): Interstellar Medium metallicity

- metallicity of stars mean in mass (**metalStarMeanMass**): mean metallicity of stars averaged on the mass
- metallicity of stars mean in bolom lumi (**metalStarMeanLumBol**): mean metallicity of stars averaged on the bolometric luminosity
- normalized bolometric luminosity (**lumBolNorm**): normalized bolometric luminosity
- optical depth in V band from side to side (**tauV**): optical depth in V band from side to side
- ratio luminosity from dust to bolo lumi (**lumDustLumbol**): Ratio of the luminosity from dust material to bolometric luminosity
- normalized SFR (**sfrNorm**): normalized star formation rate
- normalized Lyman continuum (**lymanContNorm**): normalized lyman continuum
- normalized SNII rate (**snIINorm**): normalized SNII rate
- normalized SNIa rate (**snIaNorm**): normalized SNI rate
- mean age of stars average on mass (**ageStarMeanMass**): mean age of stars average on mass
- mean age of stars average on bolo lum (**ageStarMeanLumbol**): mean age of stars averaged on bolometric luminosity
- Object ID in SDSS (**sdssObjID**): Unique SDSS ID
- SDSS spectra ID (**sdssSpecObjID**): unique spectral SDSS ID
- SDSS right ascension (**sdssRa**): J2000 right ascension
- SDSs declination (**sdssDec**): J2000 declination from SDSS.
- fiber magnitude in r band of SDSS (**sdssFiberMagR**): fiber magnitude in R band SDSS
- error in the fiber magnitude in r band of SDSS (**sdssFiberMagErrR**): Error in fiber magnitude R band
- model magnitude in r band of SDSS (**sdssModelMagR**): model magnitude in R band of SDSS
- error in model magnitude in r band of SDSS (**sdssModelMagErrR**): error in model magnitude R band of SDSS

- Petrosian R90 radius (**sdssPetroR90R**): radius containing 90 pourcents of petrosian flux in r band
- error in Petrosian R90 radius (**sdssPetroR90ErrR**): error in radius containing 90 pourcents of the flux.
- Petrosian R50 radius (**sdssPetroR50R**): radius containing 50 pourcents of the flux in r band of SDSS
- error in Petrosian R50 radius (**sdssPetroR50ErrR**): error in the radius of the 50 pourcents flux.
- Galaxy redshift (**sdssRedshift**): galaxy redshift
- error in galaxy redshift (**sdssRedshiftErr**): error in galaxy redshift
- S/N ratio (**sdssSnr**): median S/N ratio in r
- MJD of observation in SDSS (**sdssMjd**): MJD of SDSS observations.
- plate ID (**sdssPlate**): plate ID in SDSS
- fiber ID (**sdssFiberID**): fiber ID in SDSS.
- classification (**sdssEClass**): index of classification of galaxies in SDSS.
- difference in chi^2 (**x2Diff**): χ^2 fitting difference with synthetic library of galaxy spectra.
- spectrum flux (**flux**): ntot computed flux point of the spectrum.