# POLLUX: A DATABASE OF STELLAR SPECTRA - FIRST STEP : SED AND HIGH RESOLUTION SYNTHETIC SPECTRA

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## ABSTRACT

POLLUX is a stellar spectra database under development at the GRAAL laboratory (Montpellier, France). It will be made available online to the community through a VO compliant interface (*http://pollux.graal.univ-montp2.fr*). In its first version, POLLUX will propose theoretical data : high resolution synthetic spectra and spectral energy distribution.

Key words: Virtual Observatory; Spectroscopy; Theoretical data.

## 1. SOURCES FOR THE THEORETICAL DATA

The POLLUX database collects and presents both spectral energy densities (SED) and high resolution synthetic spectra covering the spectral types from O to M at several metallicities.
The SED are direct products of the best available models of stellar atmospheres :

- The CMFGEN code (Hillier & Miller 1998) is used to generate atmosphere models for O and B stars
- the ATLAS12 code (Kurucz 1993) used for atmosphere models of A and F stars
- the MARCS code (Gustafsson et al. 1975, 2003; Plez et al. 1992) for cooler stars.

The synthetic spectra are computed on basis of the atmosphere models generated by these codes, using CMF_FLUX (Hillier & Miller 1998), SYNSPEC (Hubeny & Lanz 1995) and TURBOSPECTRUM (Alvarez & Plez 1998) with CMFGEN, ATLAS12 and MARCS models respectively.

The atomic linelists used to compute these different data are from the VALD database (Kupka et al. 2000). They are complemented by specific molecular linelists for cool stars (Plez, private communication).

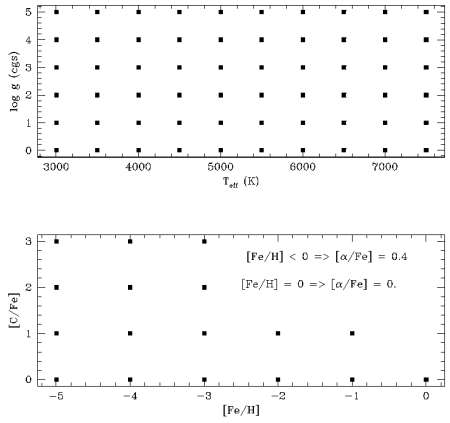


*Figure 1. Representation in the ($T_{eff}$, logg) and the ([Fe/H],[C/Fe]) planes of the grid of high resolution synthetic spectra and SEDs computed for late-type stars with the* MARCS/TURBOSPECTRUM *codes.*

Grids of synthetic spectra have been computed so as to give a substantial coverage of the colour-magnitude diagram in terms of effective temperature, gravity, metallicity and chemical composition ([$\alpha$/Fe] and CNO nuclei). A sample of the coverage provided by the MARCS/TURBOSPECTRUM and CMFGEN/CMF_FLUX synthetic spectra is shown in Figs. 1 and 2.

The high resolution synthetic spectra are computed from 300 nm to 1200 nm at spectral resolution R = 150 000. Both absolute fluxes and fluxes normalised to the continuum are available.

Figures 3 present the SED over the entire wavelength domain for typical stars in the spectral domains covered by MARCS, ATLAS and CMFGEN respectively.

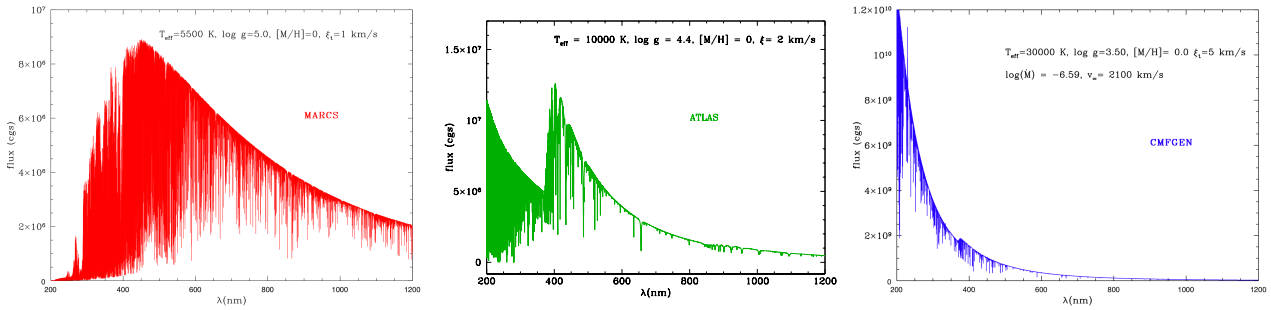


*Figure 3. Spectral energy distributions as obtained over the wavelength domain [300 nm; 12000 nm] by the* ATLAS12, MARCS *and* CMFGEN *codes for typical stars in the spectral type domains covered by each of these codes.*

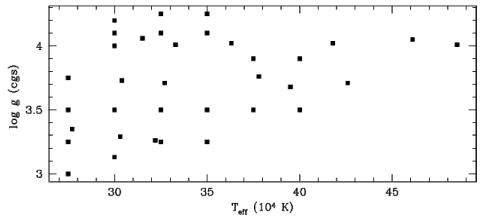


*Figure 2. Grid of high resolution synthetic spectra and SEDs computed for O and B stars with the* CMFGEN code*, represented in the ($T_{eff}$, $logg$) plane. The empty region on the lower right part of the domain corresponds to a region of this plane where no stars can be found.*

## 2. THE POLLUX DATABASE

The POLLUX database will be available through a web-page regrouping a detailed documentation, a retrieval interface for the spectra and SEDs, and several science ready applications.

A header file is attached to each synthetic spectrum and SED. It contains a set of descriptors common to observed and computed data (file structure and conditions of generation of the data) plus specific information for synthetic data (code, input physics, physical parameters characterizing the spectrum and SED ...). This header file is designed to be VO compliant.
The developments required for a proper description of the theoretical data will be exposed to the VO theoretical working group in order to serve the advance of standardization within the VO. The introduction of the POLLUX database requires in particular the possibility to handle theoretical spectra using the Simple Spectra Access Protocol.

A query form made to the database via the web interface allows to retrieve the data in various formats, including VOTable and image formats, to build a library (particularly useful for population synthesis purposes), and to visualise the entire spectrum/SED or portions of it. On-the-flight convolution of synthetic spectra (rotation profile, gaussian, ...) will also be made possible.

The POLLUX database is also designed to serve automatic determination of stellar parameters. This can be done combining the synthetic spectra in POLLUX with observed data and using automated procedures for abundance determination. A project of this nature is already under development for the data in the ESPaDOnS-/NARVAL archive, using the MATISSE software (Recio-Blanco et al. 2006).

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