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POLLUX: A database of high resolution echelle spectra of standard stars

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Abstract. We present a progress report on the POLLUX database which contains high resolution echelle spectra of standard stars and a library of synthetic spectra. This set of observed and synthetic spectra provides a broad coverage of the atmospheric parameters and spectral types across the HR diagram.

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1. Introduction

We have launched a programme to obtain high resolution high quality spectra of standard stars. We have also undertaken the computation of a grid of synthetic spectra whose physical parameters match those of the observed standard stars. The purpose of the project is to provide a comprehensive library of stellar spectra (both observed and theoretical) which will provide a broad coverage of the atmospheric parameters $T_{\rm eff}$, $\log g$ and [Fe/H] as well as spectral types across the HR diagram.

2. The POLLUX database: observational data

The stars we intend to observe are the MK standards from the lists of Garcia (1989), Gray & Garrison (1987, 1989a, 1989b), and Garrison & Gray (1994) and the secondary spectrophotometric standards pertaining to the ASTRA project (see, e.g., Adelman *et al.* 2005).

Our spectra are obtained with ELODIE (Baranne *et al.* 1996), the echelle spectrometer at the Observatoire de Haute Provence (OHP, France) attached to the 193-cm telescope. Light from the Cassegrain focus is fed into the spectrograph through a pair of optical fibers. In a single exposure, a spectrum at a resolution of $R = 42000$ (at 5000 Å) is recorded on a 1024×1024 CCD. By using a combination of a $\tan\theta = 4$ echelle grating and a combination of a prism and a grism which act as a cross-disperser, the spectra range from λ3906 to λ6811. The instrument is entirely controlled by a computer. A standard data reduction pipeline automatically processes the data and computes cross-corelation functions. ELODIE was indeed primarily designed to perform very accurate velocity measurements. We obtain spectra at S/N ratios varying from 100 to 500 according to the stellar magnitude. For a given magnitude, we as much as possible attempt to get the best S/N ratio.

The spectra are reduced in a uniform manner. We follow Erspamer & North's (2002) procedure based on IRAF routines to extract the spectra from the raw image, correct them for the scattered light and merge the orders. The final product is the merged wavelength calibrated spectrum from λ3920 to λ6800 in form of an ASCII file (λ, flux). The spectra cannot be calibrated in absolute flux as the amount of stellar light entering

the fiber is highly variable (depending on atmospheric conditions) and usually exceeds the diameter of the fiber.

The merged ASCII spectra are being gathered into the POLLUX database which can be accessed at `http://www.isteem.univ-montp2.fr/pollux`. We will eventually make them available to the community via a user-friendly web interface. Users will be able to search for spectra using a variety of criteria (star ID, celestial coordinates, list of objects, date of observation, observer's name, spectral type, etc.).

3. The POLLUX database: synthetic spectra

POLLUX will also host a library of synthetic spectra whose fundamental parameters match those of the observed standard stars. We intend to use various codes to calculate synthetic spectra at $R \simeq 10^6$ and then convolve them with suitable instrumental and rotational profiles. Quick-look analysis tools will also be available to perform simple measurements (radial velocity, equivalent widths, etc.). Provision for making adjustments of the models to better fit the observations will be made. This task is not obvious since it is not always possible to locate accurately the continuum in stellar spectra. The ability to perform automatic determinations of stellar parameters ($T_{\rm eff}$, $\log g$, [Fe/H], $v_{\rm e} \sin i$, etc.) is also foreseen using the TGMET programme (see, e.g., Soubiran *et al.* 1998). So far, POLLUX contains only ELODIE spectra but it is designed to host spectra from future instruments (in particular spectropolarimetric data).

4. Scientific incentive

We expect the homogenized POLLUX spectra will be useful to stellar astrophysicists in at least several respects: i) abundance determinations, ii) accurate derivation of fundamental properties of stars ($v_{\rm r}$, $v_{\rm e} \sin i$, etc.), iii) multiwavelength coverage (they will complement ultraviolet data from the IUE, HST, FUSE archives), iv) testing of the current state of the art of model atmospheres, and v) studies of dynamic phenomena in atmospheres. POLLUX will contain observations that cannot be repeated and, as such, are unique and highly valuable for the study of variable phenomena. POLLUX spectra will also provide reference information to calibrate instruments of future missions. The comparison of spectra of nonvariable standard stars obtained with different instruments should allow astronomers to estimate any systematic effects such as the percentage of scattered light, the flat fielding errors, the nonlinearity of the detector, and the instrumental profiles. We anticipate that for the stars common to the ASTRA project, the POLLUX spectra may ultimately be calibrated in absolute fluxes which will also be of interest to scientists working on stellar population synthesis.

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