RevMexAA (Serie de Conferencias), **12**, 38–38 (2002)

ALIEN: A SOFTWARE PACKAGE FOR NEBULAR SPECTRAL ANALYSIS

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Ionized Gaseous Nebulae (Mexico City, 21-24 November 2000)
Editors: William Henney, José Franco, Marco Martos, & Miriam Peña

ALIEN is a software designed to analyze low dispersion nebular spectra. Dereddening and calculation of physical conditions and ionic abundances by number are included. This software was written in the C language under Linux, the GUI has been developed using XForms (Kubat 1996) to provide a user friendly environment.

ALIEN consists of two phases. The first phase, which is the dereddening process, is handled by xGalRed. This program reads the file *splot.log*, generated by IRAF, distinguishing all the fluxes from different spectra and recognizing all the ions whose wavelength is specified in one of the ALIEN's configuration files.

Spectra are dereddened using the Balmer line ratio and extinction law of Howarth (1983). After the process is completed, the following data is shown:

1. The extinction coefficient, $C_{\mathrm{H}\beta}$.
2. The dereddened flux of Hβ, $I_{\mathrm{H}\beta}$.
3. A table containing all the ions of the emission lines that were loaded, their wavelength (λ), dereddened fluxes (I_λ), and their extinction law (f_λ).
4. The line ratios for the most important ions are calculated automatically: [S II], [O III], [N II]. These are later used to obtain the physical conditions.

The second phase, where we calculate the physical conditions and the ionic abundances by number, is handled by xAbIon. The atomic parameters used to solve the five-level atom model are loaded from files used by the Equib code (Howarth 1983). The system of equations has been solved using algorithms from Numerical Recipes in C (Press et al. 1988).

The electronic temperature (T_e) and density (N_e) are estimated by means of numeric calculations based on the five-level atom model. The line ratios obtained earlier are used in this process. To calculate the T_e and N_e the user has to provide a line ratio (from [O III] or [N II] to calculate the temperature and [S II] for density), the energy level transitions and an initial value for the N_e or the T_e, respectively.

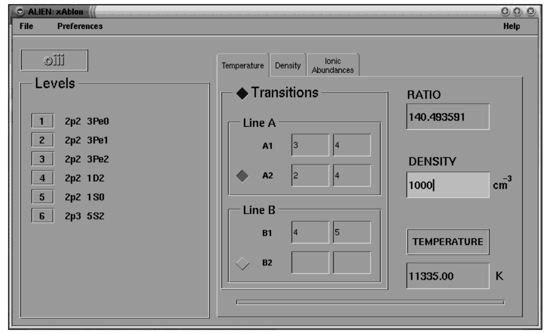

Fig. 1. Screenshot of xAbIon.

After obtaining the T_e and N_e, the ion abundances by number for each ion can be calculated. First, the ionic abundance ratio is estimated and recognized automatically by the system. Then, the ionic abundances by number can be calculated. This process is repeated until the ionic abundances for all the ions are computed.

Both the first and second phase write the results in a LaTeX formatted file. The file written by xGalRed contains a table with the ions, their wavelength, observed and dereddened fluxes and the extinction law. xAbIon write its results in the corresponding file, this way, all the results for one spectrum are contained in one file. The second table contains the ion name, its wavelength, and the ionic abundance by number.

Future releases of ALIEN are being considered in order to expand its application. The latest version of ALIEN can be downloaded from its home page (`http://www.astrosen.unam.mx/~cook/alien`).

This work was supported by CONACyT grant I32815-E.

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