RevMexAA (Serie de Conferencias), **40**, 193–193 (2011)

ANNEB: A NEBULAR ANALYSIS SOFTWARE

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Deriving physical conditions and chemical abundances of an ionized nebula involves a sequence of simple but large amount of calculations. ANNEB is a software developed to help in those calculations and to get a proper approach to uncertainties in all derived quantities.

When studying an ionized nebula, a large but simple amount of calculations are involved in order to derive physical quantities and chemical abundances. If a large group of objects are being studied this calculations can become a time consuming process. The same can happen when the variation on physical quantities (T_e, N_e) and chemical abundances due to changes of a given set of parameters (extinction law, $c(H\beta)$) is analyzed. ANNEB is a software intended to derive physical conditions and chemical abundances of a given ionized nebula in an efficient and simple manner. This allows the user to repeatedly calculate a whole set of physical and chemical parameters in a few seconds and with a number of alternative input parameters. The program estimates uncertainties for every derived quantity by proper propagation of emission line flux errors.

The input for ANNEB is a file with fluxes in the same format as that generated by the IRAF task *splot*. In order to get an estimate of the uncertainties associated to all derived quantities, the user must provide flux uncertainties in the input file as an additional column.

ANNEB uses a direct method where lines are identified by their proximity to a reference line list. A good wavelength calibration is required. Currently, the reference list includes more than 400 nebular lines typically found in planetary nebulae, HII regions, supernova remnants and HH objects.

There are several extinction laws defined in ANNEB. Among the galactic ones, extinction laws by Savage & Mathis (1979), Cardelli et al. (1989), Kaler (1976, based on Whitford 1958) and Fitzpatrick & Massa 2005 (for $R_V = 3.1$ only) are available. Among the extragalactic, those by Howarth (1983) and Prevot et al. (1984) are included.

ANNEB calculates ionic abundances for helium ions following the methods found in Vázquez et al. (1998) and Benjamin et al. (1999). Ionic abundances for heavier ions are calculated using the IRAF task *ionic* which is based in Shaw & Dufour (1994) five-level atom code. A weighted mean is calculated by each identified ion. The observed flux of each emission line is used as weight. Elemental abundances are calculated using the equations from Kingsburgh & Barlow (1994), although another set of ionization correction factors (ICFs) can be implemented.

Each new version of ANNEB receive an identification number and a nickname to honor the language of a native Indian group of the northwest of Mexico. The current version is 10.8 and it's nickname is Pápago.

Finally, results for He 2-429 using ANNEB were presented in a poster at the conference and will appear in a forthcoming paper (Olguín et al. 2011 in preparation).

This work was supported by CONACyT grants 49002 and 45848, and PAPIIT-UNAM grants IN111903 and IN109509. L.O. acknowledges a CONACyT postdoctoral scholarship at Universidad de Sonora. ANNEB can be downloaded from `http://www.astro.uson.mx/~lorenzo/anneb/anneb_nps.html`.

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