EMILI - An Aid in Emission Line Identification in Emission-Line Regions

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The identification of weak emission lines in emission-line region spectra is complicated by the incompleteness of laboratory transition lists, the inaccuracy of energies from theoretically calculated levels, and the lack of accurate values for oscillator strengths and cross sections. Furthermore, even if the transition lists were complete it would still be difficult to choose among the multitude of transitions that may be responsible for each particular line, and do so in a rapid and un-biased manner from line to line in a spectrum.

We present here a program dubbed "EMILI", currently under development, that is being created to aid in making such identifications in the spectra of planetary nebulae and H II regions. This program makes use of a comprehensive line list (Atomic Line List v2.04, van Hoof 2001) to calculate expected line strengths, employing generic cross-sections, oscillator strengths, crude ionic abundances ($Z \leq 30$), and observed object attributes. The program then matches these strengths with measured line fluxes, to determine potential source transitions for a list of observed lines in such a spectrum. To reinforce the identification, the code searches for lines belonging to the same multiplet as a transition under consideration as an ID, at the appropriate wavelengths and strengths relative to other lines in the spectrum. Finally the code ranks and presents to the user likely identifications for each observed line.

The use of generic cross-sections and oscillator strengths allows maximum utility to be drawn from large transition databases which may be lacking in such specific information. However the accuracy of the routine would certainly improve with more inclusive transition databases, databases containing larger numbers of transition attributes, and those with increasingly accurate energy level calculations. The latter is the most important requirement for our code's matching and ranking routines, in the absence of other specific transition information.

References:

van Hoof, P.A.M 2001, Atomic Line List v2.04, http://www.pa.uky.edu/~peter/atomic/