Propagation of uncertainties in atomic data through collisional-radiative models

S.D. Loch[a], C.P. Ballance[a], M.S. Pindzola[a], A. R. Foster[b], R.K. Smith[b], M.G. O'Mullane[c], and M.C. Witthoeft[d]

[a]*Auburn University, Auburn, AL 36849, USA*
[b]*Smithsonian Astrophysical Observatory, Cambridge, MA 02144, USA*
[c]*University of Strathclyde, Glasgow G4 0NG, United Kingdom*
[d]*NASA Goddard Space Flight Center, Greenbelt, MD 20771, USA*

Abstract. The demand for meaningful uncertainties on theoretical atomic data has increased in recent years, with a focus on determining and improving the accuracy of spectral diagnostics in a number of key areas. We present an overview of two methods for the generation of such uncertainties on electron-impact excitation, ionization and recombination rate coefficients. These two methods are referred to as 'baseline' and 'method sensitivity' data. From either method the uncertainties can be carried through collisional-radiative models to produce uncertainties on excited populations, photon emissivities and effective ionization/recombination rate coefficients. Baseline data provides a generous estimate of the uncertainties and reflects the likely spread of values in existing databases, or between two approaches. We show some examples of baseline uncertainties for O^{6+}, and explore issues of distribution functions in the input data and correlation in the derived coefficients. We also discuss possible techniques for the generation of method sensitivity data. Method sensitivity data provides a much tighter constraint on the uncertainties produced by one particular method and includes information on the correlation in the input dataset. We illustrate the potential use of these approaches using some common line ratio diagnostics.