Cross Sections for Electron Impact Excitation of Astrophysically Abundant Atoms and Ions

S. S. Tayal*

16 December 2005

Abstract

Electron collisional excitation rates and transition probabilities are important for computing electron temperatures and densities, ionization equilibria, and for deriving elemental abundances from emission lines formed in the collisional and photoionized astrophysical plasmas. The electron excitation rates including cascades are needed. Oscillator strengths for the UV and FUV lines of abundant and trace elements are needed to study absorption by gases in the interstellar medium. Accurate representation of target wave functions that properly account for the important correlation and relaxation effects and inclusion of coupling effects including coupling to the continuum are essential components of a reliable collision calculation. Non-orthogonal orbitals technique in multiconfiguration Hartree-Fock approach is used to calculate oscillator strengths and transition probabilities. Comparison of the computed excitation energies and oscillator strengths with experiment can provide a check on the accuracy of target wave functions. The effect of coupling to the continuum is included through the use of pseudostates which are chosen to account for most of the dipole polarizabilities of target states. The B-spline basis is used in the R-matrix approach to calculate electron excitation collision strengths and rates. Recent results for oscillator strengths and electron excitation collision strengths for transitions in N I, O I, O II, O IV, S X, and Fe XIV will be presented.
This research work is supported by NASA.

*Clark Atlanta University, Atlanta, Georgia