Dielectronic Recombination of C, N, and O Ions

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Abstract

Electron temperature and elemental abundance determinations are of paramount importance to models used in spectral analysis. There have been recent indications in planetary nebulae observations that collisionally excited lines and optical recombination lines result in elemental abundances that are up to 20 times different. In an effort to clarify the available recombination data, electron-ion recombination has been investigated for Be-like C^{2+}, N^{3+}, and O^{4+} and B-like N^{2+} and O^{3+} using the heavy ion storage ring CRYRING. A detailed comparison of calculations made with the AUTOSTRUCTURE code and various literature recombination rates is made for each ion and recommended Maxwellian temperature dependent rate coefficients are produced. Special attention is given to dielectronic recombination at low temperatures where theoretical models have historically encountered discrepancies with experiment. The formation of triply excites states, via double excitation of core electrons in a process analogous to dielectronic recombination, in some Be-like ions has been observed; termed "trielectronic recombination". In the case of O^{4+}, a large trielectronic recombination resonance at low energy has a drastic effect on the low temperature recombination rate.

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