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Improving Dielectronic Recombination Rate Coefficients for the Li- and Be-like Isoelectronic Sequences

Evan Garbe[1], Zahra Taghadomi Sarabi[1], Phillip Stancil[1], Isaac Garcia[2], Stuart Loch[2], Michael Fogle[2], Nicholas Sterling[3]

[1]University of Georgia, [2]Auburn University, [3]University of West Georgia

The ionization balance in a collisionally-ionized plasma is controlled primarily by a competition between electron-impact ionization and electron recombination processes. Of these, the rate coefficients for dielectronic recombination (DR) are the most difficult to calculate or measure and therefore contribute the primary driver of uncertainty in ionization balance of low temperature astrophysical plasmas. Focusing on the beryllium and lithium isoelectronic sequences, we will present new calculated rates using the public-domain package AUTOSTRUCTURE. As DR is sensitive to the location of near-threshold doubly-excited states in the continuum, we explore a range of methods beyond the usually adopted Hartree-Fock and Thomas-Fermi-Dirac-Amaldi central field approximations and compare to available experimental data. We also explore the effect of variations in the DR rate coefficients to the ionization balance in benchmark planetary nebula models with the astrophysical plasma package Cloudy. This work is partially supported by NSF grants AST-2108649 and NASA grant NASA-80NSSC21K1465.

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