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Recombination Rate Coefficients for NIII and OIV Ions

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Abstract : Electron-ion recombination data are needed for plasma modeling. The recombination processes include radiative recombination (RR), dielectronic recombination (DR), and trielectronic recombination (TR). When a free electron is captured by an ion with simultaneous excitation of its core, a doubly-exited intermediate state may be formed. The doubly excited state relaxes either by electron emission (autoionization) or by radiative decay (photon emission). DR process takes place when the relaxation occurs to a bound state by photon emission. Reliable laboratory astrophysics data (theory and experiment) for DR rate coefficients are needed to determine the charge state distribution in photoionized sources such as X-ray binaries and active galactic nuclei. DR rate coefficients for NIII and OIV ions are calculated using state-of-the-art multi-configuration Breit-Pauli atomic structure AUTOSTRUCTURE collisional package within the generalized collisional-radiative framework. Level-resolved calculations for RR and DR rate coefficients from the ground and metastable initial states are produced in an intermediate coupling scheme associated with $\Delta n = 0$ ($2 \rightarrow 2$) and $\Delta n = 1$ ($2 \rightarrow 3$) core-excitations. DR cross sections for these ions are convoluted with the experimental electron-cooler temperatures to produce DR rate coefficients. Good agreements are found between these rate coefficients and the experimental measurements performed at the CRYRING heavy-ion storage ring for both ions.

Keywords : atomic data, atomic process, electron-ion collision, plasmas
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