Collision strengths for electron-impact excitation of Ni III

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Forbidden Ni III lines are an important component of the spectra of nebulae and type Ia supernovae, with line ratios providing valuable diagnostics of electron density, plasma temperature, and nickel abundance. For the purpose of accurately modelling these astrophysical spectra, we report collision strengths and effective collision strengths for electron impact excitation of the open 3d-shell ion Ni^{2+}, which are obtained using the R-matrix theory of electron-ion collisions. The target ion model includes 359 fine structure states corresponding to the configurations $3d^8$, $3d^7 4s$, $3d^7 4p$, $3d^7 4d$, and $3d^6 4s^2$, giving rise to a maximum of 2,415 coupled channels, and 64,620 individual forbidden and allowed transitions. The CIV3 configuration interaction program [1] has been used in the construction of our target ion model to optimise those atomic orbitals not occupied within the ground state configuration. R-matrices are constructed using the RMATRXII suite of codes [2], with relativistic effects incorporated by transforming the R-matrices from $LS\pi$ coupling to $J\pi$ coupling at the R-matrix boundary via the transformation code FINE95 [3]. The external region coupled differential equations are solved and collision strengths calculated using the PSTGF program [4]. Effective collision strengths are obtained by integrating over a Maxwellian distribution of electron velocities for a range of temperatures of astrophysical importance. We compare our results with those of the 162 fine-structure level calculation undertaken by Bautista [5], the most extensive previous calculation for this target ion. Results for all the atomic data produced will be presented at the conference.

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