Electron impact ionization for N^+ and N^{2+} ions

V. Jonauskas, A. Kynienė, Š. Masys

Institute of Theoretical Physics and Astronomy, Vilnius University, Lithuania

Electron impact ionization and recombination define charge state distribution in collisional plasma. Line intensities in the spectra from plasma strongly depend on the population of ions.

The aim of this work is to study electron impact ionization from the ground configuration levels of N^+ and N^{2+} ions. The study includes both direct and indirect ionization processes. The indirect process is investigated as excitation to autoionizing states, followed by Auger transitions.

The Flexible Atomic Code (FAC) [1] is used to calculate energy levels, radiative and Auger transition probabilities, electron-impact ionization, and excitation cross sections. The ionization and excitation cross sections are investigated in the distorted wave (DW) approximation. The DW cross sections are estimated in the potential of the ionizing ion.

The study includes direct ionization from the $2s$ and $2p$ subshells of the ions. The direct process contributes to ~90% and ~80% of the total ionization cross sections for the N^+ and N^{2+} ions, respectively. The scaled DW cross sections have to be used to explain measurements [2, 3] for the N^+ ion.

The DW cross sections obtained for the ground configuration levels of the N^{2+} ion show good agreement with experimental data. It should be noted that the three lowest energy levels of the $2s\,2p^2$ configuration have lifetimes lower than $\sim 10^{-3}$ s. These levels can also contribute to the experimental data [4]. The EA channels corresponding to excitations from the $2s$ and $2p$ subshells are included in the study for the $2s\,2p^2$ configuration of the N^{2+} ion. Excitations up to shells with $n \leq 20$ are considered for the indirect process. The study shows that the excitations from the $2p$ subshell provide a similar contribution to the excitations from the $2s$ subshell. It should be noted that the EA channels corresponding to excitations from the $2p$ subshell converge more slowly compared to the excitations from the $2s$ subshell.

References:

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