Contribution ID: **30** Type: **not specified**

Electron-impact single ionization for N^+ ion

Impurities of the low- and medium-Z elements injected into the fusion reactors are used to control the heat load from the hydrogen plasma. The radiative cooling from the injected impurities depends on the charge state distribution of ions. Radiative recombination and electron-impact ionization define the charge state distribution in the fusion plasma. Nitrogen is one of the elements that can be used to protect plasma-facing components in fusion reactors.

The aim of the current work is to analyze single ionization for the N^+ ion by including both direct and indirect processes from the levels ($^3P_0$, $^3P_1$, $^3P_2$, $^1D_2$, $^1S_0$) of the ground configuration. The indirect process being investigated is electron impact excitations to autoionizing states followed by Auger transitions. The indirect process includes the excitations from the $2s$ subshell up to shells with the principal quantum numbers $n \leq 10$. The excitations from the $2p$ subshell lead to configurations below the single ionization threshold. The direct ionization is analyzed from the $2s$ and $2p$ subshells of the ground configuration of the N^+ ion.

The scaled distorted wave (SDW) [1] cross sections are employed to analyze experimental data for the N^+ ion [2, 3] since the distorted wave calculations strongly overestimate measurements. Contribution of the indirect process to the total ionization cross sections is $\sim$10% at its maximum for levels of the ground configuration. It should be noted that previous studies [2, 3] did not take into account the contribution from the indirect process in determining the total ionization cross sections.

The SDW cross sections for the ground term match well with measurements [3] taken at energies starting from the ionization threshold and extending up to near peak energy. The peak cross sections are $\sim$4% lower than the measured ones. Difference between the theoretical and experimental values indicates the presence of metastable states in the ion beam.

Modeling shows that population of the excited terms does not exceed $\sim$50% for the latest experimental data [3]. However, the larger population of the excited states is obtained in the previous measurements [2]. In addition, an onset of the cross sections below the ionization threshold in the experimental data [3] further supports the existence of metastable states in the measurements. It should be noted that the experimental data obtained using the crossed electron - ion beam technique [2] show a better agreement with the theoretical cross sections for the $^1D_2$ level of the ground configuration.

References
[1] V. Jonauskas, Astron. Astrophys. **620**, A188 (2018).
[2] I. Yamada *et al.*, J. Phys. Soc. Jpn **58**, 1585 (1989).
[3] J. Lecointre *et al.*, J. Phys. B: At. Mol. Opt. Phys. **46**, 205201 (2013).

Presenting Author

Valdas Jonauskas

Presenting Author Affiliation

Vilnius University

Presenting Author Gender

Male

Country

Lithuania

Presenting Author Email Address

valdas.jonauskas@tfai.vu.lt

Author: Dr JONAUSKAS, Valdas

Presenter: Dr JONAUSKAS, Valdas

Session Classification: Poster Session

Track Classification: Fundamental Data and Modelling