Electron impact ionization for neon ions

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In this talk, the main results of the study on the single ionization process in Ne^{2+}, Ne^{3+}, and Ne^{4+} ions will be presented. Calculations are performed for the energy levels of the ground configurations of these ions. The study includes direct ionization (DI) and excitation-autoionization (EA) processes contributing to the single ionization cross sections. The distorted wave (DW) approximation, implemented in the Flexible Atomic Code (FAC) [1], is used to calculate collisional ionization and excitation cross sections. Excitations and ionizations are analyzed from the 2s and 2p subshells of the ground configurations. Convergence of the EA channels is estimated by analyzing excitations up to shells with the principal quantum numbers $n \leq 20$.

The DW approximation produces overestimated cross sections compared to measurements for the Ne^{2+} and Ne^{3+} ions. Therefore, the scaled DW cross sections [2] are used in this study to explain measurements for these ions. Additionally, the value of the single ionization threshold provided by NIST is incorporated into the study to obtain the final ionization cross sections for Ne^{2+}. The EA process contributes ~16% and ~8% to the total ionization cross sections from the ground levels of Ne^{2+} and Ne^{3+} ions, respectively. A good agreement with experimental data is obtained for the single ionization cross sections.

Our study of single ionization cross sections for the Ne^{4+} ion using the DW approximation shows a good agreement with experimental data for the four lowest energy levels of the ground configuration [3]. Excitations from the 2p subshell lead to configurations below the ionization threshold for the Ne^{4+} ion and, therefore, do not contribute to the single ionization process. The indirect ionization process contributes ~12% to the total ionization cross sections for the ground level of the ion. The DI 2p channel dominates for all studied ions.

References:

[1] M. F. Gu, Can. J. Phys. 86, 675 (2008)

[2] V. Jonauskas, Astron. Astrophys. 620, A188 (2018)

[3] A. Kynienė, Š. Masys, V. Jonauskas, J. Quant. Spectrosc. Radiat. Transfer 330, 109224 (2025).