XXVIII International Conference on Photonic, Electronic and Atomic Collisions (ICPEAC 2013) IOP Publishing
Journal of Physics: Conference Series **488** (2014) 042003 doi:10.1088/1742-6596/488/4/042003

Excitation-autoionization cross section of alkali atoms by electron impact.

A. Borovik[†] [1] **and A. Kupliauskienė**[‡] [2]

[†]Department of Electron Processes, Institute of Electron Physics, Uzhgorod, 88017, Ukraine

[‡]Institute of Theoretical Physics and Astronomy, Vilnius University, A.Goštauto 12, LT-01108 Vilnius, Lithuania

Synopsis The excitation-autoionization cross section of sodium atoms was studied as a function of the incident electron energy over the range from the lowest autoionization threshold at 30.77 eV up to 400 eV. The present data are compared with the similar excitation-autoionization cross sections for Li, K, Rb, and Cs atoms.

In the present work the $2p^6$ excitation-autoionization (EA) cross section of sodium atoms and its comparison with the similar data for other alkali atoms are reported. The data were obtained as a sum of normalized intensities of lines observed in ejected-electron spectra arising from the decay of the $2p^5 n_1 l_1 n_2 l_2$ autoionizing states and measured over the incident electron energy range from the lowest excitation threshold at 30.77 eV up to 400 eV. The measurements were performed by using the apparatus described in detail elsewhere [1]. The obtained relative data were put on the absolute scale by normalizing to the cross section of the $(2p^5 3s^2)^2P_{3/2}$ state obtained earlier for the same impact-energy regime [2]. The relative error did not exceed 30% below 33 eV, and reaches 45% for higher impact energies.

In figure 1, the EA cross section of Na atoms is compered with similar data for other alkalies Li-Cs. As can be seen, at near-threshold energies all cross sections possess the evident resonance character. This behavior reflects the efficient formation of negative-ion resonances in electron impact excitation of autoionizing states in all alkali atoms. At higher impact energies, the shape and magnitude of the cross sections are determined by the doublet states in Li and Na, and by the quartet states in K and Rb atoms. In Cs, the quartet and doublet autoionizing states contribute to the EA cross section in approximately equal proportion. A comparison of the EA cross sections with available ionization data [4, 3] shows that the relative autoionization contribution to the total ionization cross section does not exceed 5% in Li and Na, and reaches 26% in K, 32% in Rb, and 37% in Cs atoms.

This research was funded by the European Social Fund under the Global Grant measure (AK) (project VP1-3.1-ŠMM-07-K-02-013).

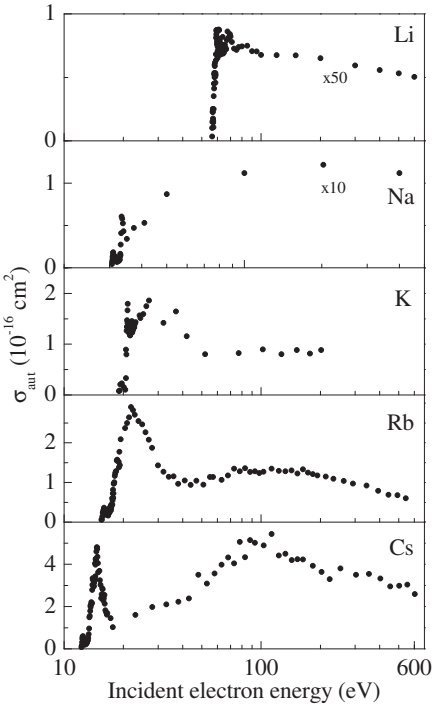

Figure 1. EA cross sections of alkali atoms excited by electron impact.

References

[1] Borovik A *et al* 2005 *J. Phys. B* **38** 1081

[2] Borovik A *et al* 2008 *J. Phys. B* **41** 035206

[3] Kieffer L J and Dunn G H 1966 *Rev. Mod. Phys.* **38** 1

[4] Nygaard K J 1975 *Phys. Rev. A* **11** 1475

[1]E-mail: sasha@aborovik.uzhgorod.ua
[2]E-mail: alicija.kupliauskiene@tfai.vu.lt