XXIX International Conference on Photonic, Electronic, and Atomic Collisions (ICPEAC2015) IOP Publishing
Journal of Physics: Conference Series **635** (2015) 052005 doi:10.1088/1742-6596/635/5/052005

Classification of the $5p^5n_1l_1n_2l_2$ LSJ autoionizing states of Cs excited by 30 eV electron-impact

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Synopsis Classification of the $5p^5n_1l_1(L'S')n_2l_2$ LSJ autoionizing states of Cs excited by 30 eV electron-impact was performed by using more accurate calculations of energy levels, excitation cross sections and autoionization probabilities obtained in the Dirac-Fock-Slater approximation. Calculated parameters were used for simulation of the ejected Auger electron intensity spectrum and identification of the experimental ejected-electron spectrum of Cs excited by 30 eV electrons taking into account the asymmetry of the angular distribution of Auger electrons.

Configuration interaction calculations of energy levels, 400 eV electron-impact excitation cross sections and autoionization probabilities of the $5p^5n_1l_1n_2l_2$ LSJ (n_1l_1 = 5d, 6s; n_2l_2 = 5d, 6(s – d), 7(s, p), 8s) autoionizing states of Cs were performed in [1] by using the jjJ coupling scheme. Calculated data were applied for an identification of 37 lines of the experimental ejected-electron spectrum [2] excited by 400 eV electrons, i. e. classification and identification of all levels of [2] was not performed. The main task of the present work is to perform a revised classification of calculated energy levels in the LSJ coupling scheme and apply it for a more precise and full identification of the experimental spectrum excited by 30 eV electrons and observed at 75° angle [2]. For this purpose, new calculations of energies, electron-impact excitation cross sections and autoionization probabilities more suitable for simulation of the intensities of ejected Auger electron spectrum were performed. The basis of mixed relativistic configurations was constructed by using the Flexible atomic code [3]. In order to optimize the local central potential with approximated exchange part, $5p^66s$ configuration was used. The following singly excited and 5p-core excited configurations were used to take into account the correlation effects: $5p^6n_0l_0$, n_0l_0 = (4, 5)f, (7 – 12)(s – d); $5p^5n_1l_1n_2l_2$, n_1l_1 = (4, 5)f, (5 – 7)d, (6 – 8)(s, p, f); n_2l_2 = (4 – 8)f, 5d, (6 – 11)(s – d).

Values of the level energies and simulated Auger electron emission spectra for 30 eV impacting electrons taking into account the asymmetry of the angular distribution of emitted Auger electrons were used for identification of the experimental spectrum measured at 75° with respect to the direction of impacting electrons [2]. The simulated spectrum is shown in figure 1 together with the measured spectrum [2] for comparison. Compared with the 400 eV case, largest intensities were obtained for the quartet and other dipole-forbidden lines as 30 eV energy of impacting electrons is close to the 5p-core excitation threshold. The latter lines blend with dipole-allowed lines which dominate in 400 eV case [1].

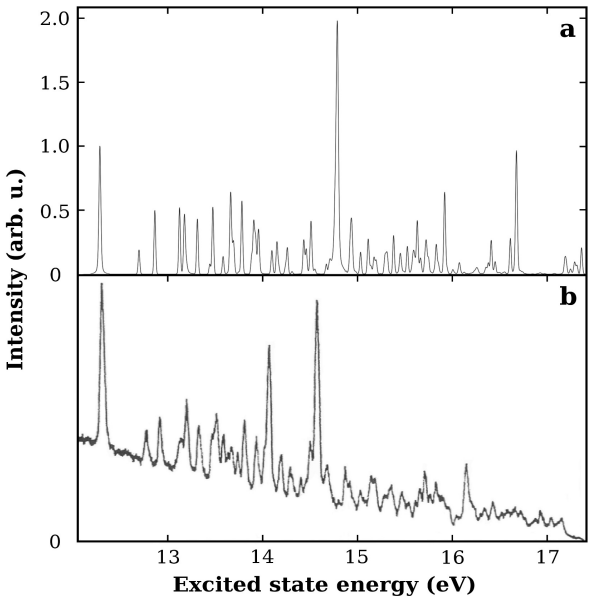

Figure 1. Simulated (a) and measured (b) [2] spectra of Auger electrons ejected from 5p-core excited states of Cs excited by 30 eV electron-impact.

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

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