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Excitation functions of high-lying autoionizing states in Rb atoms

V.Roman*, A.Borovik* [1], 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 dynamics and cross sections for high-lying autoionizing states in rubidium atoms were obtained by accurate measuring the ejected-electron spectra in an incident electron energy range from the excitation thresholds of levels up to 660 eV. These data together with calculations of energies and decay rates are intended for general spectroscopic classification of the $(4p^5n_1l_1n_2l_2)^{2,4}$L states.

The excitation functions of atomic states if measured at appropriate energy resolution contain comprehensive information on processes involved in formation and decay of these states. Such data together with accurate calculations underlie the reliable spectroscopic classification of atomic states.

In the present work, we have measured the excitation functions of the lines observed in elected-electron spectra arising from the decay of the $(4p^5n_1l_1n_2l_2)^{2,4}$L autoionizing states in rubidium atoms. The apparatus, measuring and data processing procedures were described in our earlier works (see e.g. [1] and references therein). The data were obtained at an observation angle of 54.7° with an incident electron energy resolution of 0.2 eV. The obtained relative excitation cross section was put on an absolute scale by normalizing to the excitation cross section of the $(4p^55s^2)^2P_{3/2}$ state obtained earlier for the same impact-energy regime [1]. The total relative uncertainty of the cross section data did not exceed 35%.

Figure 1 shows the electron impact excitation functions for six lines observed in ejected-electron spectra of rubidium atoms (line numbering is taken from [2]. As can be seen, the excitation dynamics of lines definitely points out the quartet and doublet character of corresponding autoionizing states. The assignment of the latter was made by using the calculated data on energies, cross sections and decay rates of the $(4p^5n_1l_1n_2l_2)^{2,4}$L states [3] (see Table 1).

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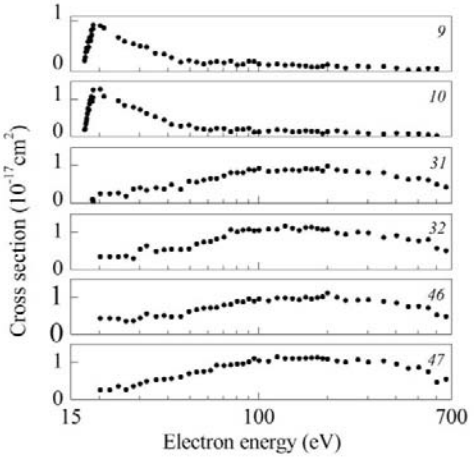

Figure 1. Excitation functions of lines observed in ejected-electron spectra of rubidium atoms.

Table 1. Assignment, excitation thresholds E_{exc} (eV) and cross sections σ_{max} (10^{-17}cm^2) for some high-lying autoionizing states in rubidium.

Line	Assignment	E_{exc}	σ_{max}
9	$(4d5s^3F)^4F_{7/2}$	17.18	0.93
10	$(4d5s^3F)^4F_{5/2}$	17.23	1.27
31	$(4d5s^1P)^2P_{1/2}$	18.82	0.98
32	$(4d5s^1P)^2P_{3/2}$	18.89	1.16
46	$(5s5d^3P)^2P_{1/2}$	19.66	1.11
47	$(5s6s^1P)^2P_{3/2}$	19.73	1.15

References

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