NEAR-THRESHOLD EXCITATION OF CERTAIN EMISSIONS FROM QUASIMETASTABLE AIS OF POTASSIUM IN ELECTRON-ATOM COLLISIONS

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It is well-known that among potassium atom AIS both totally metastable [1] and metastable against only the autoionization states do exist. The last allowed one to observe them in the radiative channel [2-4] and were named quasimetastable AIS. Present work is devoted to new data on the optical excitation functions (EFs) in the VUV region for such potassium AISs. The work was carried out by means of the crossed electron and atomic beams apparatus similar to that used earlier in [2]. Contrary to [2], the measuring procedure in our apparatus was automated (using microcomputer and CAMAC system).

For the first time we have measured the excitation function of the 67.4 nm spectral line of the potassium atom corresponding to the radiative decay of the $3p^54s4p\ ^4S_{3/2}$ level. One can see in the figure this EF showing the prominent structure near the threshold, i.e. the sharp peak whose width is equal to that of the energy spread of the electron beam (~1.2 eV). The remeasured EF of the 72.1 nm spectral line arising from the $3p^54s3d\ ^4P^o_{5/2}$ level is also shown in the figure. It posesses the shoulder near the threshold whose energy position coincides with that of the peak in the abovementioned line EF. The insertion in the figure shows comparison of this EF (points) with earlier result [2] (circles).

The EF of the metastable potassium atom $3p^54s3d\ ^4F^o_{5/2}$ level [1] has a similar behaviour near the threshold (see fig.). In the recent high-energy resolution investigations [5] of the EF the abovementioned structure was found to be splitted onto three sharp peaks of approximately equal amplitudes. It was assumed that such structures may be attributed to the negative ion states. Thus, near the threshold, the metastable level is excited primarily via the resonant K^- states lying in the potassium atom autoionizing region. Such K^- states are unknown up to date [6]. One may obtain an additional confirmation of their existence by studying accurately the ejected-electron spectra below 1 eV producted by the decays of these states.

Since the energy position of near-threshold structures in our Efs coincide with those in the metastable-state EF, the origin of the near-threshold structures may be related to the excitation via the K^- resonances. These resonances seem to belong to the $3p^54s3dnl$ and $3p^54s4pnl$ configurations.

1. P.Feldman,R.Novick // Phys.Rev. 1967. v.160. p.143.
2. I.S.Aleksakhin et al.// Zh. Eksp. Teor.Fis. 1981. v.80. p.2187. Sov.Phys.-JETP. 1981. v.53. p.1140
3. Yu.K.Gabrielyan et al.// Phys. Lett. 1984. v.101A. p.198.
4. A.J.Mendelsohn et al.// Phys. Rev. A. 1987. v.35. p.2095.
5. H.L.Rojas et al.// 5th ECAMP Abstracts. 1995. p.123.
6. S.J.Buckman,C.W.Clark // Rev.Mod.Phys. 1994. v.66. p.583.