Selective ionization of atoms by electric and light field. Autoionization rydberg resonances in heavy atoms. Optimal isotope-separation selective excitation schemes

S.V. Ambrosov[1], A.V. Glushkov[2]

[1] *Comput. Dept. OHMI, a/c 108, Odessa-9, 65009, Ukraine*
[2] *Atom.-Mol.-Laser Spectr. Centre & Inst. Appl.Math. OHMI a/c 108, Odessa-9, 65009, Ukraine*
E-mail: glushkov@paco.net

It has been studied the optimal scheme for the selective ionization of atoms method [1], based on the selective resonance excitation of atoms by laser radiation into states near ionization boundary and further autoionization decay of excited states under action of external electric field [2,3]. It's given the exact numeral solution for atomic autoionization under the external electric field action . There are presented the numeral data for autoionization of states with n=7-12 for the Rb atom in electric field (10(4) V/cm). There are presented the results of the theoretical study of the autoionization resonances (AR)in complex multielectron heavy atoms (rare-earth atom:Yb, Tm etc) in the external electric and laser field .There have been analysed the unussual especialities of their behaviour in a field, in particular,an effect of giant broadening of the AR widths in the relatively weak external field . There are considered 2 main channels for the AR decay. One of them is the traditional Beutler-Fano channel.Another one is a new decay type (the reorientational decay (RD) .An appreciable dependence of the RD velocity at the moderately weak ($\sim$ 100 V/cm) electric field has been analysed . Detailed information about the AR is needed to optimize the excitation and ionization of atom.The optimal scheme presumes the compromise between the high excitation probability and high decay rate that determines the lower and upper boundaries for AR decay rate. The use of the RD channel essentially increases the possibility of such a compromise. New possibilities of the optimization for the laser resonance ionization scheme with account of these effects are indicated. The problem of the search for optimal isotope-selective vibration levels excitation scheme (for UF6) is also considered [4].

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