INTERFERENCE EFFECTS IN RECOMBINATION PROCESS OF ELECTRON WITH HYDROGENLIKE MULTICHARGED ION

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Studies of the spectra of relativistic atomic systems, such as hydrogenlike and heliumlike high-Z ions, provide unique tests of the interesting QED effects arising in the very strong field of the nuclei. One of these effects is the radiative overlap of the low-lying levels with the same total angular momentum and parity, which gives rise to the interference terms in the total cross section of processes. Contrary to the case of the neutral atoms, where the radiative overlap of the levels with identical quantum numbers is very rare, it can take place in the spectra of highly charged heaviest ions [1]. Herewith, if there are not special exclusions, the magnitude of the radiative interference effect turns out to be of order $(\alpha Z)^3$, where α is the fine-structure constant. The overlap effect of the levels $[2s^2_{1/2}]_0$ and $[2p^2_{1/2}]_0$ in the process of resonance recombination of an electron with U^{91+} ion was investigated in ref.[2]. The total cross section of the recombination process includes dielectronic recombination (DR) and radiative recombination (RR) cross sections, and a term which describes the interference between DR and RR. So, experimentally, extracting pure radiative interference from the total cross section does not seem to be possible. Nevertheless, difference from the superposition of the Lorentz shapes was found to be quite measurable.

In ref.[3] the radiative interference effects in the recombination process on the groups of mutually overlapping doubly excited levels of hydrogenlike uranium were investigated. This situation differs from one considered in ref.[2], since not only initial but also intermediate states of heliumlike ion arising in the process of DR overlap in the case. This gives rise to the additional interference terms in the total cross section. Numerical calculations have been performed in the framework of the $1/Z$ expansion with taking into account the finite size of the nucleus, the radiative corrections and the exact one-photon interelectron interaction corrections. The results obtained for DR with the hydrogenlike uranium indicate on existence of sufficiently strong radiative interference in the cross sections, and suggest that taking into account the contributions of RR does not essentially suppress this effect.

REFERENCES

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