Relativistic calculations of ionization probabilities in low-energy heavy-ion collisions

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Heavy-ion collisions may provide a valuable tool to examine quantum electrodynamics in extremely strong electromagnetic fields. In the supercritical regime the total charge of the nuclei of the colliding ions exceeds a critical value $Z_C = 173$, that corresponds to the diving of the ground state of the transiently formed quasi-molecule into the negative-energy Dirac continuum [1,2]. One may expect that the investigation of the ionization probability can allow us to find a possibility to observe the diving phenomenon in low-energy heavy-ion collisions.

In the present work the ionization probability in the low-energy collision of a heavy H-like ion with a neutral atom is evaluated. The approach employs the active-electron approximation, in which only the electron of the H-like ion participates in the excitation and ionization processes while the electrons of the neutral atom provide a screening potential [3]. The time-dependent Dirac wave function of the active electron is obtained using the dual kinetically balanced *B*-spline basis-set method [4]. The time-dependent Dirac equation is solved utilizing the exponential evolution operator method.

References:

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