Production of Kr nuclear isomers using laser-driven electrons in a gas-cluster jet

Sedov M.V.[1,@] **and Scobelev I.Yu.**

[1] Joint Institute for High Temperatures of the Russian Academy of Sciences, Izhorskaya 13 Bldg 2, Moscow, 125412, Russia

[@] sedov_max@mail.ru

Nuclear isomers are metastable (lifetime more than 0.1 ms) excited states of the atomic nucleus. Isomeric states are typically observed when a low-lying excited state near the ground state of the nucleus differs significantly from the ground state in spin. Nuclear isomers are currently being actively studied within the framework of nuclear astrophysics, nuclear batteries, nuclear lasers and nuclear clocks. We numerically investigated the optimal conditions for generating nuclear isomers in experiments involving the interaction of intense femtosecond pulses of relativistic intensity with gas-cluster targets. Such experiments are promising as an alternative approach to producing nuclear isomers without the use of accelerators or nuclear reactors. Using 3D particle-in-cell simulations, we investigated the interaction of femtosecond (30 fs) laser radiation with a krypton cluster of 25–100 nm diameter over a wide intensity range. The laser intensity and cluster size optimal for generating the Kr nuclear isomer have been determined, and the calculation results have been verified by comparison with recent experiments. The results obtained are of interest for future experiments on the efficient generation of krypton isomers, and the numerical calculation methods developed in this work can be easily applied to other elements.