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Enhanced Isomer Population in Solid-Density Targets using Laser-Plasma Accelerators

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Excitation of long-lived states in bromine nuclei using a table-top laser-plasma accelerator providing pulsed (<100 fs) electron beams provided a sensitive probe of gamma strength and level densities in the nuclear quasicontinuum, and may indicate angular momentum coupling through electron-nuclear interactions. Solid-density LaBr_3 active targets absorb real and virtual photons up to 35 ± 2.5 MeV and de-excite through gamma cascade into different states. A factor of 4.354 ± 0.932 enhancement of the $^{80m}\text{Br}/^{80g}\text{Br}$ isomeric ratio was observed following electron irradiation, as compared to bremsstrahlung. Additional angular momentum transfer could possibly occur through nuclear-plasma or electron-nuclear interactions enabled by the ultra-short electron beam. Extension of this enhanced angular momentum coupling into heavy nuclei is being explored as a potential method for production of ^{225}Ac , an isotope of strong interest to the radiopharmaceutical and research communities, through the enhanced alpha-decay of ^{229}Th .

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