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Nuclear Isomers in Intense Electromagnetic Fields

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Abstract

The new generation of coherent x-ray [1] and gamma-ray sources [2] may enable new experiments on the nuclear interaction with electromagnetic fields. A special interest presents the study of nuclear isomers, i.e., long-lived excited states, which can be populated, depleted and whose properties can be investigated in the interaction with intense fields in direct or secondary processes. A short theoretical overview will be given spanning several interaction mechanisms and a broad electromagnetic field frequency range. Starting with the rather exotic vacuum-ultraviolet nuclear transition of $^{229}\mathrm{Th}$, to x-ray interactions at the intense x-ray free electron laser involving secondary processes via nuclear coupling to the electronic shell [3], and finally to intense coherent gamma-rays which lead to single-particle excitations and the formation of proton-rich decay products [4].

References

[1] European X-ray Free Electron Laser, URL: www.xfel.eu (2015).

[2] Extreme Light Infrastructure, URL: www.extreme-light-infrastructure.eu (2015).

[3] J. Gunst, Y. A. Litvinov, C. H. Keitel and A. Pálffy *Phys. Rev. Lett* **112** (2014) 082501.

[4] A. Pálffy and H. A. Weidenmüller, *Phys. Rev. Lett.* **112** (2014) 192502.