Recent experiments on Atomic-Nuclear Coupling

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Releasing the energy stored in an isomeric nuclear state in a controlled way with an atomic or electromagnetic trigger is an attractive speculation: the energy gain might be as high as the ratio of nuclear/atomic energies – MeV/keV. Nuclear isomers, therefore, represent an opportunity for a stand-alone energy source if suitable schemes for trigger and control of the energy release can be found. Potential applications include space drive, as well as very bright γ-ray sources [1]. A collaboration of ANL/LANL/LLNL scientists focused on (experimentally) verifying claims of x-ray triggered decay of the ^{178}Hf isomer at 2.4 MeV, with T(1/2) = 31 y. The experiments took advantage of the intense photon beams delivered by the Advanced Photon Source. The null result will be presented. Candidagte mechanisms to initiate isomer decay will be presented, and some experiments which demonstrate nuclear excitation by electronic transition (NEET) will be reviewed.

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[1] See, e.g., Science 283, 769(1999).