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Nuclear structure and dynamics with density functional theory[1]

IONEL STETCU, Los Alamos Natl Lab — Even in the absence of *ab initio* methods capable of tackling heavy nuclei without restrictions, one can obtain an *ab initio* description of ground-state properties by means of the density functional theory (DFT), and its extension to superfluid systems in its local variant, the superfluid local density approximation (SLDA). Information about the properties of excited states can be obtained in the same framework by using an extension to the time-dependent (TD) phenomena. Unlike other approaches in which the nuclear structure information is used as a separate input into reaction models, the TD approach treats on the same footing the nuclear structure and dynamics, and is well suited to provide more reliable description for a large number of processes involving heavy nuclei, from the nuclear response to electroweak probes, to nuclear reactions, such as neutron-induced reactions, or nuclear fusion and fission. Such processes, sometimes part of integrated nuclear systems, have important applications in astrophysics, energy production, global security, etc. In this talk, I will present the simulation of a simple reaction, that is the Coulomb excitation of a ^{238}U nucleus, and discuss the application of the TD-DFT formalism to the description of induced fission.

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