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Modeling low-energy induced fission in a discrete-basis formalism with density functional theory

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One of the most challenging problems in nuclear physics is to describe nuclear fission microscopically starting from nucleonic degrees of freedom. Such microscopic description is important particularly for low-energy induced fission, in which the excitation energy of the compound nucleus is relatively low so that an application of the statistical model may be questionable. This includes fission in r-process nucleosynthesis as well as in barrier-top fission. Here we shall discuss our recent attempts with a configuration-interaction approach, for which many-body configurations are constructed based on a constrained density functional theory for shapes along a fission path. We apply this approach to a barrier-top fission of 236U, restricting the model space to seniority zero configurations of neutrons and protons. We find that fission dynamics closely follows that described by the transition state theory, that is the insensitivity of a fission width to post-barrier dynamics as well as a small number of degree of freedom for the distribution of the fission probability. We shall also discuss the sensitivity of the results to a choice of energy functional, such as Skyrme or Gogny functionals, as well as a possible strategy towards more consistent calculations with non-zero seniority configurations.

Presenter: Prof. HAGINO, Kouichi (Kyoto University)

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