Study of fission with 5D Langevin equation – Fluctuation-dissipation dynamics of fission

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Abstract

Fission is the most drastic shape change of nuclei. We study the dynamics of nuclear fission based on fluctuation-dissipation dynamics. The nuclear shape is described by a few numbers of collective parameters that interact with a heat bath representing the randomness of the nucleonic motion. We adopt the Cassini parameters to describe the nuclear shape. The potential energy of deformation is calculated with the liquid drop model together with the shell correction. The first results of the 5-dimensional (5D) Langevin calculation for actinide nuclei will be presented focusing on the fragment mass distribution. By comparing the results with those of 3D and 4D calculations, we will discuss the role of each shape parameter. Though the basic characteristics of the mass distribution of the fragments are mainly determined by the potential energy surface, it is shown that the transport coefficients, such as inertia mass and friction, also play important roles. We will also talk about the application of 5D Langevin calculation in the super-heavy mass region.