Scission configuration of nuclei

M. Warda
Maria Curie-Sklodowska University, Lublin, Poland

Fission is usually described as the process of increasing quadrupole deformation of a nucleus. A very elongated nucleus consists of two pre-fragments connected by a neck. At the critical point of this evolution, a neck breaks up, and two separated fragments are created. This scission point is crucial for determining many observables. Beyond this point, nucleons cannot be exchanged between fission products, and fragment mass distribution can be deduced from the scission configuration. Also, the total kinetic energy of the fragments can be evaluated from the shape of a nucleus during rupture.

A scission point is intuitively defined as a configuration with the neck reduced to a single point connecting two spheroidal fragments. Such a description cannot be directly applied when realistic leptodermous nuclear matter distribution is considered. Tails of surface diffuseness of both fragments overlap even when their mid-density surfaces are separated by a few fm, and the nuclear interaction between fragments does not vanish then. Thus, the precise definition of scission is not straightforward.

In the self-consistent calculations, it is easy to distinguish between pre-scission and two-fragment solutions as a few-MeV drop of energy usually separates them. On the map of the potential energy surfaces, a scission cliff is created. The calculation with additional constraint on a neck parameter can wipe out this discontinuity. Nevertheless, the question of the definition of a scission point remains open. We will discuss how scission configuration can be defined in this approach.