Nuclear Dissipation Studies by Means of Peripheral Heavy Ion Collisions at Relativistic Energy with Radioactive Beams

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Peripheral heavy-ion collisions at relativistic energy are proposed as a new experimental approach to induce fission and further study the influence of nuclear dissipation on the splitting of a nucleus into two fragments. It will be shown that such a reaction mechanism is especially relevant for tracking down transient effects which are responsible for the inhibition of fission at the early stage of the de-excitation chain. That might constitute a real asset as compared to the commonly used fusion-fission process. Within this frame, the fission properties of hundreds of nuclei produced at various energies by means of fragmentation of 58 radioactive actinides have been studied at GSI, Darmstadt. The inverse kinematics combined to an innovative set-up permitted to detect both fission fragments in coincidence and determine their nuclear charge with high accuracy. The sensitivity of the fragment distribution width σ_Z on the transient delay caused by nuclear friction will be demonstrated. The comparison of the newly proposed experimental σ_Z signature with elaborate model calculations allows to extract information on the strength β of dissipation and the related transient time τ_{trans}. The unusual broad range of systems investigated strongly constrains the uncertainty of the extracted quantities and allows to draw most reliable conclusions. Furthermore, our study sheds some light on apparently conflicting results obtained in the past. In particular, the influence of temperature and fissility as well as the importance of sizeable initial deformation on properly accounting for transient effects are investigated.