RECENT ACHIEVEMENTS IN FISSION DYNAMICS INVESTIGATED AT HIGH ENERGIES

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A complete description of the fission process still represents challenge despite the recent progress based on microscopic quantum dynamic calculations. Statistical models provide an optimum tool to describe fission probabilities at excitation energies around the fission barrier, for which statistical times dominate over the typical time scales for the coupling between intrinsic and collective degrees of freedom (~ 10^{-21} s^{-1}). At high excitation energies, pre- and post-scission particle emission and fission probabilities indicate that simple statistical approaches are not valid anymore and models describing the dynamics of the process are required. These models are based on transport equations (e.g. Fokker-Planck or Langevin) including dissipative and stochastic terms where the main ingredients are the potential landscape and the friction and inertia tensors. The friction or viscosity parameter is particularly interesting since it quantifies the magnitude of the coupling between collective and intrinsic degrees of freedom in fission.

During the last years several experiments have addressed this question taking advantage of proton induced reactions at relativistic energies for producing highly-excited fissioning nuclei with low angular momentum. Under such conditions pre-saddle dissipative effects clearly manifest. Moreover, the inverse kinematic used in these experiments help in providing the first complete identification in atomic and mass number of both fission fragments. These high-quality measurements have given access to new observables constraining not only the strength of the nuclear dissipation at low and large deformation but also other key parameters influencing the theoretical description of the fission process such as level densities.