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Study of fission dynamics following prompt gamma-ray spectroscopy

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Although nuclear fission has been discovered more than eight decades ago, the scenario related to the involvement of excitation energy (E_{ex}) and angular momentum (L) in controlling the reaction dynamics of a fissioning system has not been clearly understood. The potential energy surface of a fissioning system gets modified due to an enhancement in either one of the two or both the controlling parameters, which subsequently leads to the development of various fission modes of the concerned system. These observed fission modes are in general described on the basis of the random neck rupture model (i.e. brosa modes) [1]. In the present investigation, these features have been extensively studied for the most common fissioning system of ^{236}U produced at two different E_{ex} through two separate experiments: (i) ^{235}U(n_{th},f) during the EXILL campaign [2] at Institut Laue-Langevin (ILL), Grenoble, France, and (ii) ^{232}Th(α,f) during the INGA campaign [3] at (E_{lab} = 30 MeV) Variable Energy Cyclotron Centre (VECC), Kolkata, India. The later fissioning reaction can be considered as a surrogate to 14 MeV neutron-induced fission of ^{235}U, which is crucial for next-generation reactors. Prompt gamma-ray spectroscopy technique has been utilized to extract the relative even-even charge and mass yield distributions. Comparing the experimental results with the ENDF/B-VII.1 library results [4] reveals several features related to the role of E_{ex} and L in the underlying dynamics of asymmetric and symmetric fission modes. This extensive study showed an interesting enhancement of symmetric fission yield component in surrogate reaction compared to the direct reaction mechanism. Detailed findings and explanations from the investigation will be presented at the workshop.

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