MULTI-MODAL NUCLEAR FISSION OF ACTINIDE NUCLEI IN HEAVY ION INDUCED REACTIONS

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Low energy heavy ion induced fission of actinide nuclei have been an intriguing problem in nuclear physics in recent years. Actinide nuclei around mass region A_{CN}~226 show three-humped structure of the mass distribution reflecting contributions from both symmetric and asymmetric mass components. However, a transition takes place from the symmetric to the asymmetric fission modes is not very clearly visible in this region. Hence, present work, report on experimental mass distribution measurements of fission fragments from isotopes of Th, U, Pa nuclei producing through the fusion of ^{16}O, ^{19}F projectiles with lead and bismuth targets around 30 MeV excitation energies. The selected reactions has low Z_pZ_T (<800) and the fission fragment angular distribution data already exist for these system. By choosing the targets to be spherical, the influence of deformation effects can be eliminated. It is worth to mention that for these system under studies, entrance channel mass-asymmetry and Coulomb interaction would be almost identical. It is expected that the mass distribution of these systems follows the predictions of standard normal fusion–fission dynamics within the range of measured energies.

Interestingly, isotopes of these nuclei differ only by two neutrons and fall on either side of the transition mass limit of nuclei A_{CN} = 226 [1], these reaction can determine if the neutron number make any observable differences on the width of their mass distributions that might be expected due to different fission modes existing in this mass region. We observed that variance of the mass distribution increases at lower excitation energies where shell effects responsible for multi-mode fission become dominant. The presence of multi-mode fission in low energy fission has been verified by multi-dimensional potential energy surface (PES) calculation of the fissioning systems. We show the results of the multi-dimensional PES calculation performed for the fission of Th, Pa, U actinide nuclei using the standard macro–microscopic model based on Strutinsky shell correction method. The macroscopic energy is calculated within the framework of finite-range liquid-drop model (LDM) and the shell correction is applied based on the well known two-center shell model (TCSM) as proposed by Zagrebaev, et al [2].

REFERENCES:

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