Investigation of neutron-rich nuclei from fission fragment spectroscopy studies

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The spectroscopic studies of fission fragments provide direct information on nuclear excited states, which is related to the shape and structure of the nucleus [1-3]. The nuclear shapes in the excited states are strongly influenced by the rearrangement of the constituent nucleons and their collective motion. It is possible that some nuclei may attain even greater quadrupole deformations than those observed in superdeformed nuclei and the search for such hyperdeformed (3:1) shapes has been a goal of nuclear structure for many years. The existence of pear-shaped octupole deformation was predicted from the reflection asymmetric mean field calculations. The occurrence of an island of octupole deformation for Z ~ 56 and N ~ 88 and light actinides (Z ~ 90 and N ~ 134) has been verified from the observation of low-lying negative-parity states by strong electric dipole (E1) transitions [3,4]. Search for new fission modes has always been one of the highlights of the fission-spectroscopy studies and it still remains controversial. To test the theoretical predictions of new physics that may be exhibited by neutron-rich nuclei, data are required over a wide range of isotopes.

These nuclear shapes are expected to deviate significantly from a pure ellipsoid and "necking" degrees of freedom may play an important role in the fission dynamics. Recently the accelerator-based experiments are performed to populate high-spin states in several target-projectile systems to study the mass distribution from the spectroscopy measurements [5,6]. The mass distribution provides a signature of the reaction mechanism and also of the dynamics of the fission process. Some recent results on the fission fragment mass yield distribution from the study of spectroscopy of neutron-rich nuclei produced in $^{18}O+^{238}U$ using Indian National Gamma Array (INGA) setup will be presented.

References:

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