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Asymmetric and symmetric fission of ^{256}No nuclei formed in the ^{24}Mg+^{232}Th reaction

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The fission fragment mass and kinetic-energy distribution measurements of the low-energy fission of actinides show significant structural deviations from those expected in the liquid drop model (LDM) of a nucleus [1]. The super asymmetric mode due to the influence of double magic Ca (Z= 20, N = 28) and double magic Pb (Z = 82, N = 126) has been observed in the fission of excited ^{260}No compound nuclei, populated by the reactions ^{12}C+^{248}Cm [2] and ^{22}Ne+^{238}U [3]. To study the asymmetric and symmetric nuclear fission modes in the ^{256}No nuclei in dependence on the excitation energy, we have measured the mass-energy distributions of fission fragments of ^{256}No compound nucleus.

The experiments were carried out at the Flerov Laboratory of Nuclear Reactions using the beam of ^{24}Mg ions from the U-400 cyclotron at energies of 125, 146, 155 and 181 MeV. The ^{232}Th targets of thickness 100 μg/cm^2 on 30 μg/cm^2 carbon backing were used. The mass-energy distributions of binary reaction events measured using the two-arm time-of-flight (TOF-TOF) spectrometer CORSET [4]. Each arm of the spectrometer consists of a compact start detector and a position-sensitive stop detector based on microchannel plates (MCP). The size of each MCP-detector in the Stop assembly is 18 cm × 7 cm in size. The arms of the spectrometer were positioned in an optimal way according to the kinematics of the reaction. The data were analysed event by event, the mass (M) and total kinetic energy (TKE) of the fragments were calculated from measured velocities and angles in the lab-system using the mass and momentum conservation laws.

The fission-like fragments are well separated from the products of elastic and quasi-elastic scattering events. To obtain the fission fragment mass and kinetic-energy distribution characteristics of the ^{256}No fission, we have fitted the mass distribution of fission fragments into multi-Gaussian. For the lowest energy the mass distribution of the fragments is of a clear-cut asymmetric form. The contributions of the symmetric fission mode are the smallest for fission at lowest excitation energy and the yield of symmetric fission increases with increasing the excitation energies. With
increasing excitation energy, the asymmetric fission modes fade out due to the disappearance of shell effects.

References
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