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Isotopic fission yields of 240Pu around the fission barrier from 2p-transfer reactions

Complete isotopic fission-fragment distributions of 240Pu have been measured, for the first time, as a function of the initial excitation energy. The 240Pu fissioning system was produced through the two-proton transfer reaction between a 238U beam and a 12C target, a surrogate reaction for the neutron-induced fission 239Pu(n,f).

The reaction was measured in inverse kinematics, allowing the fission fragments to be fully identified with the VAMOS Spectrometer and the target-like recoil, 10Be, with a silicon telescope surrounding the target. This technique gives access to new correlations such as the evolution of the neutron content and the proton even-odd staggering of fission fragments with the excitation energy. This new information allows for the experimental determination of the dissipation energy in fission as a function of the fragment split.

When compared to neutron-induced fission, the observed prompt-neutron multiplicity shows a clear reduction in the surrogate two-proton transfer, revealing an unexpected influence of the entrance channel in the fission output, driven by the additional angular momentum induced in the multi-nucleon transfer reactions, which excites the fissioning system to higher-spin states, increasing the probability of the gamma emission that competes with neutron evaporation, in particular from the fission barrier to the scission point.

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