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Mapping the new asymmetric fission island with the R3B/SOFIA setup

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The low energy fission in the actinide region is known to be mainly asymmetric, driven by structure effects of the nascent fragments. Moreover, we know that there is a transition from asymmetric to symmetric splitting for Thorium isotopes. It was assumed that this latter split would be the main fission mode for lighter nuclei. However, unexpected asymmetric splits have been observed again in neutron-deficient exotic nuclei. This observation triggered a lot of theoretical and experimental work, and further studies in this region confirmed the unexpected asymmetric fission mode, which seems to characterize the fission of neutron-deficient nuclei in the sub-lead region.

To explore this newly identified island of asymmetric fission, a dedicated experiment was conducted at GSI, Darmstadt, Germany, using inverse kinematics at relativistic energies with the state-of-the-art R^3B/SOFIA setup. We present measurements of fission fragment charge distribution from 100 exotic fissioning systems, establishing a connection between the neutron-deficient sub-lead region and the well-known actinide region. These new data provide a comprehensive mapping of the asymmetric fission island, offering clear experimental evidence of the important role played by the deformed $Z = 36$ proton shell in the fission of sub-lead nuclei.

Following a detailed description of the experimental apparatus, we will discuss the fission-fragment charge yields, highlighting the significant role of $Z = 36$ in the light fragment in the splitting process within this region. Additionally, we will compare our findings with both microscopic and phenomenological models.

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