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Shape evolution in exotic neutron-rich nuclei around mass 100

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The shape of a nucleus is one of its fundamental properties. The nuclei in the neutron-rich region around mass 100 are well known to exhibit rapid shape changes. The simplest estimate of nuclear deformation in even-even nuclei can be obtained from the energy of the 2+1 state. For Sr (Z = 38) and Zr (Z = 40) isotopes this energy is observed to decrease dramatically at N = 60, while its evolution is much more gradual in Mo nuclei (Z = 42) [1]. Precise lifetime measurements provide a key ingredient in the systematic study of the evolution of nuclear deformation and the degree of collectivity in this region.

Neutron-rich nuclei in the mass region of A = 100-120 were populated through the fusion-fission reaction of a 238U beam at 6.2 MeV/u on a 9Be target. The compound nucleus 247Cm was produced at an excitation energy of ~45 MeV before undergoing fission. The setup used for this study comprised the high-resolution mass spectrometer VAMOS [2] in order to identify the nuclei in Z and A, the Advanced γ-ray Tracking Array AGATA [3] of 35 germanium detectors to perform γ-ray spectroscopy, as well as a plunger mechanism to measure lifetimes down to a few ps using the Recoil Distance Doppler Shift method (RDDS) [4]. In addition, the target was surrounded by 24 Lanthanum Bromide (LaBr3) detectors for a fast-timing measurement of lifetimes longer than 100 ps.

In this contribution, we will report on new lifetime results for short-lived states in neutron-rich A~100 nuclei, with an emphasis on the Zr and Mo chains. We will discuss the experimental techniques used to evaluate the lifetimes as well as their interpretation in terms of state-of-the-art nuclear structure models.

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