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Structural evolution of nuclei along the r-process path around A=100

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RIBF can produce very neutron rich nuclei in the A=90-110 region with unprecedented intensities. The structural evolution in this mass region is particularly rich since substantial energy gaps between various deformation driving Nilsson orbitals exist and configurations of different shape compete at low excitation energies. At the same time the properties of these nuclei are relevant for the dynamics in time and isospin of the material flow of the astrophysical rapid neutron capture process through this mass region. The recent half-live measurements at RIBF in this mass region have indicated that the r-process flow may be faster through this mass region than anticipated from using traditional models for the prediction of the ground state properties. However, more detailed structural information will be very helpful in understanding the details of the structural evolution in this region and further constrain theoretical models. In particular the half-lives of very neutron-rich Rb isotopes beyond A=102 and the structural evolution in the very neutron rich Sr, Zr, Mo, Pd isotopes would be of great interest in this investigation. We are also particularly interested the decay spectroscopy of neutron-rich As allowing access to Se isotopes around A=100, which lie between the single-particle dominated Ge and the collective Kr isotopes in this mass region. This transition has yet to be mapped out. The Se isotopes around 92−94Se are particularly noteworthy. In the Sr and Kr isotopes, there is a sudden change from transitional behavior to strong prolate deformation at neutron number N=60. However, in the Ge isotopes heavier than 82Ge, there is recent evidence pointing to the emergence of a new shell closure at N=58 arising due to the tensor forces responsible for other emergent behavior at the extremes of neutron excess. These Se isotopes, then, are likely to lie not only along the r-process, but along a frontier beyond which the tensor forces dominate the nuclear structure. These nuclei are truly on the frontier; nothing is known about them, beyond being nucleon-bound. RIBF's particle identification and separation techniques are ideally suited to unambiguous measurement and assignment of decay properties (half-lives, gamma rays, etc) to these exotic nuclei.

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