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Exploring the Transition to Shape Coexistence with the d(94Sr,p)95Sr Reaction

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The structure of nuclei in the Z ~ 40, N ~ 60 mass region is perhaps best characterized by the sudden onset of deformation seen in the transition from N=58-60 [1]. This sudden onset of deformation can lead to both spherical and deformed gaps near the Fermi energy level for the same combination of nucleon numbers. The distance of the gaps allows a nucleus to have a coexistence of shapes, as has been observed in 96Sr.
Work to better understand the competition and stabilization of different shapes in these nuclei is of substantial interest both experimentally and theoretically. To help drive the ongoing theoretical discussion of both mean field [2,3] and shell model [4] calculations, measurements of the occupations of shape-driving orbitals in this mass region is critical.

The present experiment probes this shape transition region by using a one-neutron transfer reaction with a high mass radioactive beam in inverse kinematics. The d(94Sr,p)95Sr reaction was performed using the TIGRESS gamma-ray spectrometer [5] in conjunction with the SHARC charge particle detector [6]. The ^{94}Sr beam was produced by impinging a 500 MeV proton beam on an ISAC UCx target; the extracted beam was than charge breed using an ECR to 15+ before being accelerated to 5.47 MeV/u and delivered to the experimental station. This is the first high mass (A>30) accelerated radioactive beam experiment at the TRIUMF ISAC-II facility.

The combination of detected gamma-rays as-well-as light charge-particles are being used to extract energy levels, cross-sections, and proton angular distributions of low-lying states. Analysis of Doppler-corrected gamma-ray transitions show evidence for direct population of at least four excited states populated in 95Sr. Results will be presented and discussed in the context of the evolution of single-particle structure and compared to modern shell model calculations.

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