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Single Particle Structure and Shapes of Exotic Sr Isotopes

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Nuclei near the so called magic numbers of protons and neutrons are observed to have a spherical shape in their low lying states. Nuclei between magic numbers, where the binding energy tends to be less, are often observed to show deformation in low lying states. These deformations have either a prolate or oblate nature. States within a nucleus that have different shapes that are close in energy are colloquially referred to as shape coexisting. A dramatic occurrence of shape coexisting states is observed in nuclei in the vicinity of Z=40, N=60, which is the subject of substantial current experimental and theoretical effort. An important aspect in this context is the evolution of single particle structure for N<60 leading up to the shape transition region, which can be calculated with modern large scale shell model calculations using a ^{78}Ni core or Beyond Mean Field Models. One-neutron transfer reactions are a proven tool to study single-particle energies as well as occupation numbers.

Here we report on the study of the single-particle structure in ^{95,96,97}Sr via (d,p) one-neutron transfer reactions in inverse kinematics. The experiments presented were performed in the ISAC facility using the TIGRESS gamma-ray spectrometer in conjunction with the SHARC charged-particle detector. Highly charged beams of ^{94,95,96}Sr, produced in the ISAC UCx target and charge-bred by an ECR source were accelerated to 5.5 MeV/A in the superconducting ISAC-II linac before delivery to the experimental station. Other than their clear scientific value, these measurements were the first high mass (A>30) post-accelerated radioactive beam experiments performed at TRIUMF.

A thorough analysis of single particle states will improve our understanding of the onset of these unique structures, encouraging the ongoing theoretical discussions. Through ^{95}Sr(d,p) a strong occupation of the first excited 0^+ state and a weak population of the second 0^+ state was measured. This suggests that there is strong mixing between the ground state and the first 0^+.
These results discussed in the context of the evolution of single-particle structure will be presented.

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