Single particle structure and shapes of exotic Sr isotopes


Motivation

Minima in a nucleus’ binding energy with respect to deformation lead to nuclear states having an identifiable “shape”. One directly measurable characteristic of the shape is the nuclear radius. Some special nuclei have bound states very close in energy with very different shapes, a phenomenon called shape coexistence. A dramatic occurrence of evolving shape and coexisting states is seen for nuclei in the vicinity of Z=40, N=60 [1].

One can probe the single particle configuration of states using a particle transfer reaction allowing both the occupancy and nuclear properties to be studied. Ultimately, these specific details allow for a deeper understanding of shape coexistence.

Single particle structure

The addition of a single neutron is an ideal way to examine the evolution of nuclear structure across a given isotopic chain. For this reason, neutron transfer reactions are a useful tool to study the evolution of ESPEs in the n-rich strontium isotopes.

In this transfer reaction, the proton recoils in addition to emitted gamma rays allowing for one to study excited states in 95Sr. The highly segmented SHARC array facilitates measurements with high angular precision. The deduced limits can then be compared with theoretical calculations enabling the cross section of the reaction and angular momentum of the states to be inferred.

Experiment

A 500 MeV proton beam was impinged on a UCx target. Extracted isotopes were laser ionized, mass separated and transported to the CCB where the isotopes were charge breed to 159Sr with an intensity of 10000 pps impinged upon a deuterated polyethylene target.

Data collected over a 5 day period using the TIGRESS and SHARC detector arrays. These combined arrays allow for efficient proton-gamma coincidence measurements to be made.

Ongoing Analysis

Kinematic curves for various 95Sr reactions

Particle identification plot SHARC box

References


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