TRIUMF

Canada's national laboratory for particle and nuclear physics
Laboratoire national canadien pour la recherche en physique nucléaire
et en physique des particules

Single particle structure and shapes of exotic Sr isotopes

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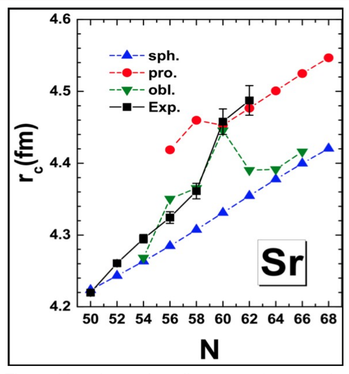
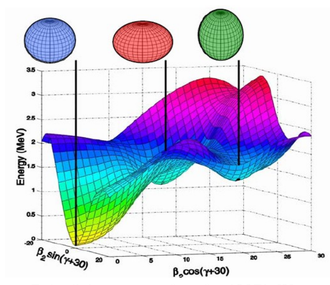
Motivation

Minimums 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.



The sudden change in radius suggests competing shapes in strontium isotopes [3].



Potential energy surface for 186Pb [2].

Experiment

A 500 MeV proton beam was impinged on a UCx target. Extracted isotopes were laser ionized, mass seperated and transported to the CCB where the isotopes were charge breed to 15^+. To optimize the purity and rate of ^{94}Sr, stripping and filtering techniques were developed and utilized to deliver a ionized beam (Q=22^+) at 5.5 MeV/u to TIGRESS. The ^{94}Sr with an intensity of ~10000 pps was 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.

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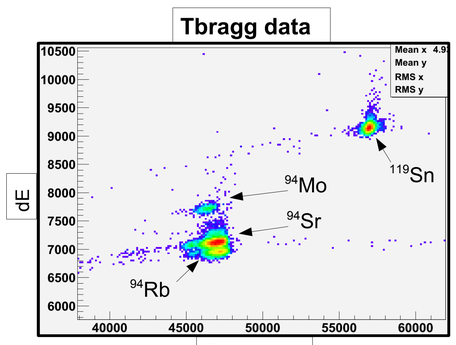
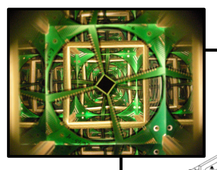
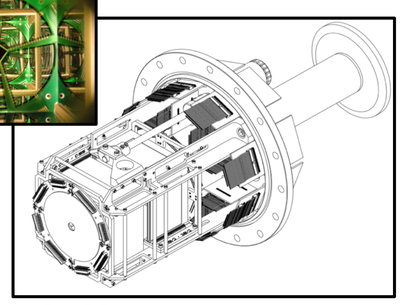
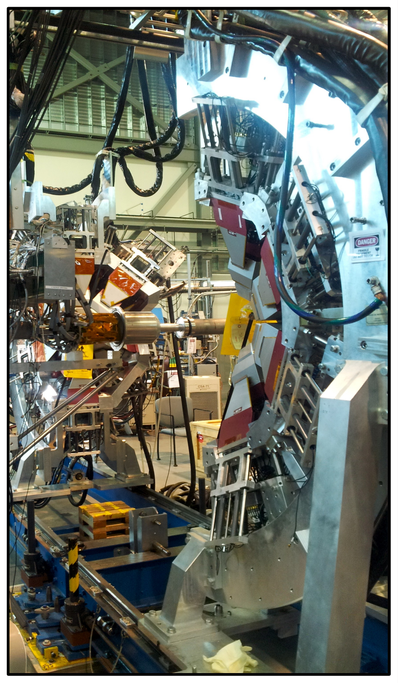






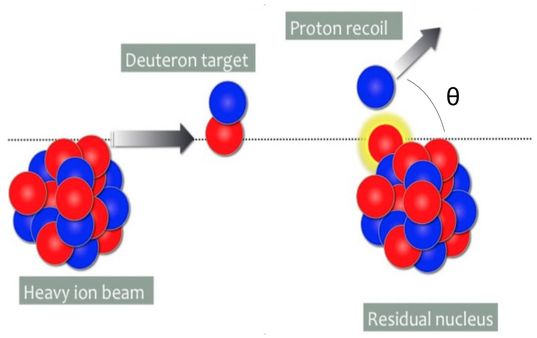
SHARC *(Silicon Highly-segmented Array for Reactions and Coulex).*



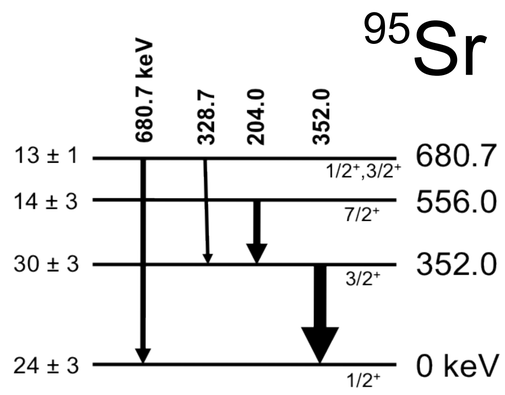
TIGRESS *(TRIUMF-ISAC Gamma Ray Escape-Suppressed Spectrometer).*

Single particle structure

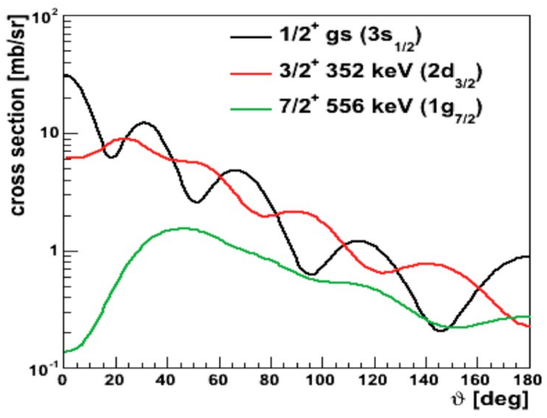
The addition of a single neutron is an ideal way to examine the evolution of nuclear structure across a given isotopic chain. For this reason, neutron transfer reactions are a useful tool to study the evolution of ESPEs in the n-rich strontium isotopes.



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

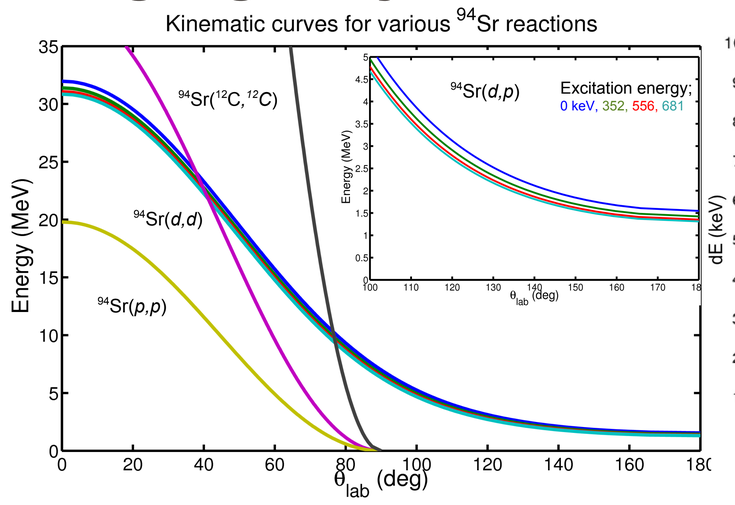


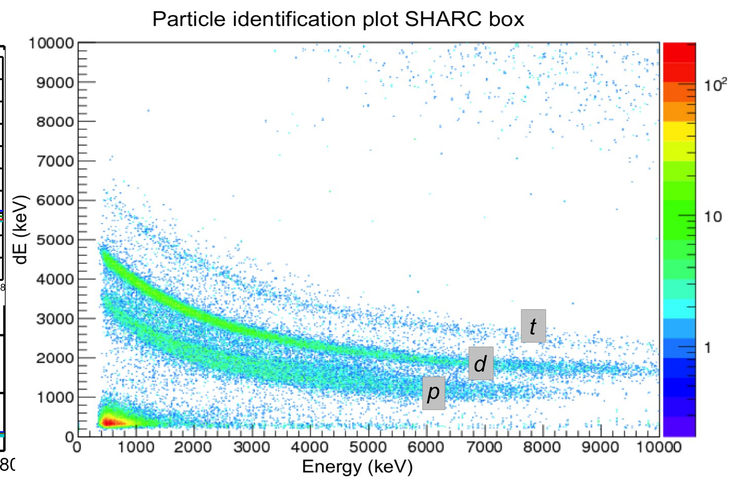
Energy level scheme for low lying states in 95Sr, modified from reference [4]

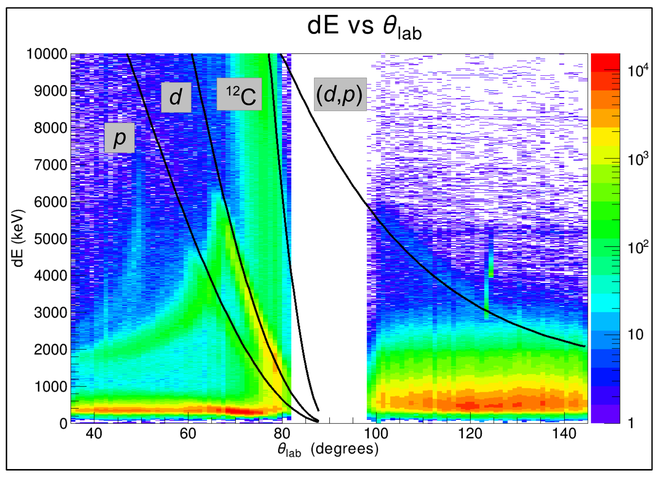


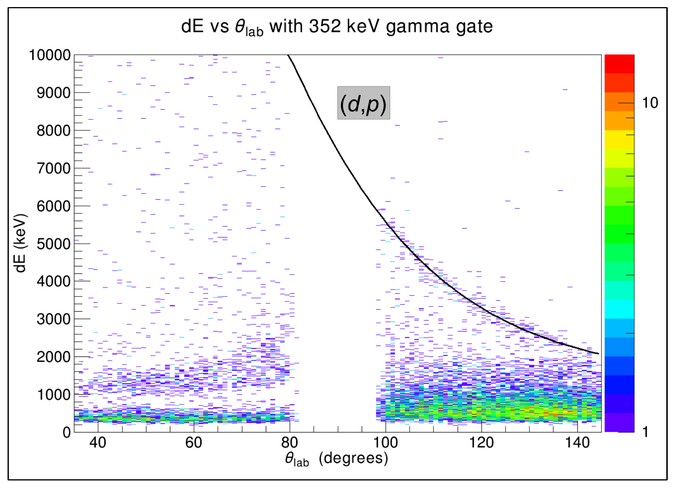
Differential cross sections of these states using the reaction code FRESCO.

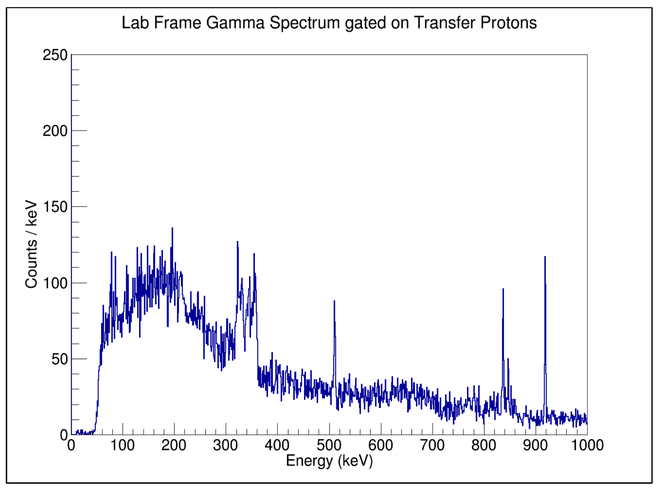
Ongoing Analysis

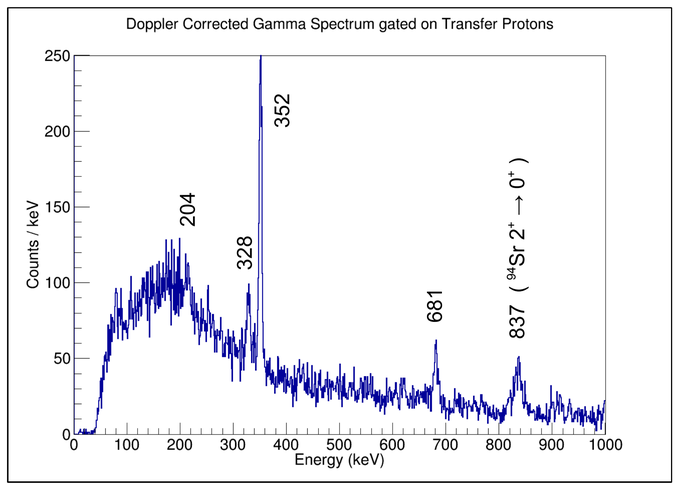












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Acknowledgments

Many thanks to everyone who contributed to the effort that made this experiment successful, both scientifically and through the delivery of beam. This work has been partially supported by the Natural Sciences and Engineering Research Council of Canada and the Science and Technology Facilities Council of the United Kingdom. TRIUMF is funded via a contribution agreement with the National Research Council of Canada.