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Investigation of N=32 Shell Closure through ^{50}Ca(d,p)^{51}Ca

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Abstract

The study of exotic nuclei has led to the discovery of new and unexpected characteristics of the nucleus. One of the discoveries is the changes in the shell configuration, causing the well-known magic numbers, i.e. shell closures, to disappear as well as the emergence of new magic numbers. The neutron number $N = 32$ is one of the unconventional new shell closures that has been observed in various experiments. The neutron-rich calcium isotope, ^{52}Ca, has been investigated through excitation energy, mass measurement, and nucleon orbitals, providing support for proving $N = 32$, making it a doubly magic nucleus. To gain a better understanding of the new shell closure, it is crucial to study the neutron occupancies in the $1f_{7/2}$ and $2p_{3/2}$ orbitals, evolving from ^{48}Ca to ^{52}Ca. The spin of the ground and the first excited state of ^{51}Ca is yet to be established experimentally.

In this project, a spectroscopic study of ^{51}Ca was performed via ^{50}Ca(d,p)^{51}Ca, where a radioactive ^{50}Ca beam interacts with a deuteron target. The experiment was conducted at the IRIS facility at TRIUMF, using the ^{50}Ca beam re-accelerated to 7.2AMeV and the thin windowless deuterium target. The presentation will contain a description of the experiment and the preliminary observations from the data.

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