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Investigating the nuclear structure of 33Al through β– decay of 33Mg to probe the island of inversion

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Spectra resulting from the decay reaction of 33Mg were captured using the GRIFFIN γ-ray spectrometer coupled with the SCEPTAR β particle detector at the Canadian laboratory, TRIUMF. A radioactive beam of approximately 104 counts per second of 33Mg was delivered by the Isotope Separator and Accelerator (ISAC) facility. In the past, nuclei away from the valley of stability were experimentally found to have different ground state shell gaps and magic numbers than the ones of those near stability. For example, N=20 is a stable magic number, however the neutron rich 32Mg is known to have a deformed configuration, while 34Si displays a normal configuration. In order to corroborate the theoretical predictions of this inversion mechanism, the nuclear structure of the intermediate 33Al should be known accurately and in detail. A few recent studies have given conflicting results for the branching ratios, spin and parity of the ground state of 33Al. The end goal of this experiment is to determine a fine- grained, conclusive nuclear structure of 33Al through the decay spectroscopy of 33Mg. It is part of a larger experiment using Mg A=34 and 35 isotopes in efforts to map out the island of inversion around N=20. This presentation will focus on the preliminary results from the data processing and analysis done so far, and their significance.

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