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Electromagnetic Transition Rate Studies in 28Mg

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Neutron rich Mg isotopes far from stability belong to the island of inversion, a region where the configuration of single-particle nucleon states becomes inverted with respect to the predicted ordering of the spherical shell model. Nuclei in this region also exhibit collective behaviour in which multiple particle interactions play a significant role in nuclear wavefunctions and transitions. This can be observed through electromagnetic transition rate measurements.

In-beam reaction experiments performed at TRIUMF, Canada's particle accelerator centre, allow for precision measurements of nuclei far from stability. Using the TRIUMF-ISAC Gamma-Ray Escape Suppressed Spectrometer (TIGRESS), an array of high purity germanium detectors, in conjunction with the TIGRESS Integrated Plunger for charged particle detection, electromagnetic transition rates in nuclei far from stability can be precisely measured. This allows for the use of the well-understood electromagnetic interaction to probe nuclear wavefunctions and test theoretical models of the nuclear interaction.

In this talk, I will discuss a fusion-evaporation experiment performed using TIGRESS and the TIGRESS Integrated Plunger to measure the lifetime of the first excited state in 28Mg. This experiment utilized both the Doppler Shift Attenuation Method and the Recoil Distance Method, which exploit the Doppler shift of gamma rays emitted in flight, in order to be sensitive to both short- and long-lived states in the nucleus. The current state of data analysis and the impacts on nuclear physics will be discussed.

Authors: MARTIN, Matthew (SFU); Dr STAROSTA, Krzysztof (SFU)

Presenter: Dr STAROSTA, Krzysztof (SFU)

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