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(G*) Electromagnetic Transition Rate Studies in ^{28}Mg

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Neutron rich Mg isotopes far from stability belong to the island of inversion, a region where the single particle energy state description of the shell model breaks down and the predicted configuration of nuclear states becomes inverted. Nuclei in this region also exhibit collective behaviour in which multiple particle transitions and interactions play a significant role in the nuclear wavefunctions. This is seen through intruder states of opposite parity in highly excited nuclei approaching the island of inversion, and can be observed through electromagnetic transition strength measurements.

In-beam reaction experiments performed at TRIUMF, Canada's particle accelerator centre, allow for precision measurements of nuclei far from stability. Using TIGRESS in conjunction with the TIGRESS Integrated Plunger for charged particle detection, electromagnetic transition rates can be measured to probe nuclear wavefunctions and perform tests of theoretical models using the well-understood electromagnetic interaction.

The approved experiment will use TIGRESS and the TIGRESS Integrated Plunger to measure the lifetime of the first excited state in ^{28}Mg, which due to the relatively long lifetime was unable to be precisely measured in a previous Doppler Shift Attenuation Method (DSAM) measurement. To become sensitive to longer lived states, this experiment will use the Recoil Distance Method (RDM) to exploit the Doppler shift of gamma rays emitted in flight, which when compared to data obtained with Monte Carlo simulations performed using the Geant4 framework allow for the determination of a best fit lifetime. Additionally, this experiment will aim to further investigate an anomalously long-lived, highly-excited, negative parity intruder state seen in the DSAM experiment, the lifetime of which is accessible through RDM experiments. Work done in preparation for this experiment as well as future experiments to probe lifetimes in excited states of island of inversion nuclei $^{30-32}$Mg will be discussed.

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