Canadian Association of Physicists

Association canadienne des physiciens et physiciennes

Contribution ID: **71** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

Electromagnetic Transition Rate Studies in 28Mg

Thursday 11 June 2020 14:00 (15 minutes)

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 rate studies of these nuclei can be performed. These measurements provide a probe of nuclear wavefunctions and tests of theoretical models using the well understood electromagnetic interaction. Of particular interest are neutron rich Mg isotopes far from stability as the shell model's single particle energy state description breaks down, closing the $N = 20$ shell gap. In this region, occupation of single particle energy states is \textit{inverted} with respect to the predicted configuration of the shell model and that near stability, motivating this region to be called the \textit{island of inversion}.

Nuclei in the island of inversion also exhibit collective behaviour, in which multiple particle transitions and interactions play a significant role in the nuclear wavefunction. This collectivity is also seen in highly excited states of nuclei approaching the island of inversion, and can be observed through electromagnetic transition strength measurements. By performing measurements on $^{28-32}$Mg, the degree to which nucleons display collective behaviour can be observed both in and approaching the island of inversion. This allows for the evolution of single particle energy states of the nucleus to be studied, providing an avenue for deepening the fundamental understanding of the nuclear interaction.

In this talk, I will discuss our experimental approach to studying the island of inversion, focusing on the approved experiment for measuring the lifetime of the first excited state in ^{28}Mg. This experiment will use the Recoil Distance Method to exploit the Doppler shift of gamma rays emitted in flight along with Monte Carlo simulations using the \textsc{Geant4} simulation framework to determine the best fit lifetime of the state. I will also discuss future experiments to probe lifetimes in excited states of $^{30-32}$Mg.

Authors: Mr MARTIN, Matthew (Simon Fraser University); Dr WILLIAMS, Jonathan (TRIUMF); Dr STAROSTA, Krzysztof (Simon Fraser University)

Presenter: Mr MARTIN, Matthew (Simon Fraser University)

Session Classification: R-DNP-1 : Best student competition

Track Classification: Nuclear Physics / Physique nucléaire (DNP-DPN)