Contribution ID: **78**                                                                                   Type: **Oral**

# Direct Population and Lifetime Measurement of the $2_1^+$ State in $^{40}$Ca via an Alpha-transfer Reaction

At TRIUMF, Canada's particle accelerator centre, the TIGRESS Integrated Plunger (TIP) and its configurable detector systems have been used for charged-particle tagging and light-ion identification in Doppler-shift lifetime measurements using gamma-ray spectroscopy with the TIGRESS array of HPGe detectors. An experiment using these devices to measure the lifetime of the $2_1^+$ state of $^{40}$Ca has been performed by projecting an $^{36}$Ar beam onto a $^{nat.}$C target. Analysis of the experimental gamma-ray spectra confirmed the direct population of the $2_1^+$ state. Kinematics of the reaction mechanism was identified using Monte-Carlo simulations, which also enabled the use of charged-particle correlations to select reactions that populated a specific excited state in the $^{40}$Ca immediately after its production. Selection of the $2_1^+$ state with this additional sensitivity further eliminated feeding cascades, and therefore restricted the decay kinetics predominantly to first order. The current work is on expanding the simulation to incorporate the stopping of the $^{40}$Ca and enabling the emission of gamma rays to provide a Doppler Shift Attenuation Method measurement of the lifetime of the $2_1^+$ state in $^{40}$Ca. Results of analysis of the experimental data and simulations will be presented and discussed.

**Primary authors:** WU, Frank (Tongan) (Simon Fraser University); Prof. STAROSTA, Krzysztof (Simon Fraser University); Prof. HACKMAN, Greg (TRIUMF); Dr VOSS, Phil (Simon Fraser University); Dr WILLIAMS, Jonathan (TRIUMF); Dr CHESTER, Aaron (NSCL); Prof. ANDREOIU, Corina (Simon Fraser University); Dr BALL, Gordon (TRIUMF); CROSS, David; Dr DRAKE, T. E. (University of Toronto); Prof. GARNSWORTHY, Adam (TRIUMF); Dr PORE, Jennifer (Lawrence Berkeley National Laboratory); Prof. SVENSSON, Carl (University of Guelph); Dr UNSWORTH, Carl David (University of Liverpool)

**Presenter:** WU, Frank (Tongan) (Simon Fraser University)

**Session Classification:** Poster Session

**Track Classification:** Poster Presentations