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Implementation of the Doppler Shift Attenuation Method using TIP/TIGRESS at TRIUMF

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Electromagnetic transition rate measurements serve as a fundamental probe of nuclear structure and provide a stringent test for theoretical models. Doppler shift lifetime measurements offer an opportunity to directly access information about electromagnetic transition rates and discriminate between model calculations. The TIGRESS Integrated Plunger device (TIP), constructed at SFU, supports Doppler shift lifetime measurements via gamma-ray spectroscopy with the TIGRESS segmented HPGe clover array as part of the experimental program at the ISAC-II facility of TRIUMF.

A method for determining lifetimes of excited states in nuclei populated using fusion-evaporation and measured using the Doppler-shift attenuation method (DSAM) will be presented. This method is applied to data collected for the benchmark nucleus ^{22}Ne during a commissioning experiment for TIP and TIGRESS which employed the ^{12}C(^{18}O,2α) ^{22}Ne fusion-evaporation reaction. Mean lifetimes of populated states in ^{22}Ne were measured via a comparison of the experimental data to Monte-Carlo lineshape simulations developed using the GEANT4 framework. Best fit lifetimes obtained using χ^2 analysis were in agreement with the existing evaluated data, validating the analysis method used. Recent improvements in the TIP setup and planned future experiments will also be discussed.

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