

# Mirror symmetry in the $f_{7/2}$ shell below $^{56}\text{Ni}$ , excited states and electromagnetic transition rates in $^{55}\text{Ni}$ and $^{55}\text{Co}$

*Saturday, 18 February 2023 11:30 (15 minutes)*

Nuclear theories often operate under the assumption that the strong nuclear force is charge independent. As a result, it is expected that mirror nuclei, which are identical under the exchange of total number of protons and neutrons, will have similar nuclear structures when Coulombic contributions are considered. Under the assumption of charge dependence, protons and neutrons are grouped together as nucleons which differ only by their isospin quantum number. However, the charge dependence of the strong nuclear force creates isospin non-conserving interactions which give rise to quantities like Mirror Energy Differences (MED) in analogous excited states for mirror nuclei which cannot be accounted for by Coulombic forces. Building a deeper understanding of isospin non-conserving interactions and how they affect nuclear structure will allow for more robust predictive powers in nuclear theories.

In order to explore the charge dependence of the strong force, a stable  $^{20}\text{Ne}$  beam experiment to produce  $^{55}\text{Co}$  was conducted at TRIUMF, Canada's national particle accelerator centre, with a complimentary radioactive  $^{21}\text{Na}$  beam experiment proposed for production of  $^{55}\text{Ni}$ . These experiments are conducted using TRIUMF's TIGRESS for gamma-rays, SFU's TIGRESS Integrated Plunger (TIP) for charged particle detection,  $^{40}\text{Ca}$  targetry, and the Doppler-Shift Attenuation Method (DSAM). The  $^{55}\text{Ni}$  experiment will also utilize TRIUMF's ElectroMagnetic Mass Analyzer (EMMA) for measurement of the A, Z, and energy of residual nuclei to enhance selectivity of reaction channels.

This talk will discuss how the  $^{55}\text{Co}$  experiment was conducted, the preliminary analysis of the resulting data set, as well as the lessons that will be carried forward for the  $^{55}\text{Ni}$  experiment. In addition to investigating the charge dependence of the strong interaction, this data will be utilized to explore the  $f_{7/2}$  hole configurations in  $^{56}\text{Ni}$  and electromagnetic transition rates for excited states of  $^{55}\text{Ni}$  and  $^{55}\text{Co}$ .

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