

# Mirror Symmetry in the $f_{7/2}$ Shell below $^{56}\text{Ni}$ : Excited States and Electromagnetic Transition Rates in $^{55}\text{Ni}$ and $^{55}\text{Co}$

Thursday, 13 February 2025 20:00 (15 minutes)

Nuclear theories often operate under the assumption that the strong nuclear force is independent of electric charge. As a result, it is expected that exchanging the number of protons with the number of neutrons in a nucleus will produce a mirror nucleus with identical structure after electromagnetic considerations. However, due to the charge dependence of the strong nuclear force, isospin non-conserving interactions give rise to quantities like Mirror Energy Differences between analogous excited states in mirror nuclei which cannot be accounted for by Coulombic forces.

This charge dependence is being explored at TRIUMF, Canada's particle accelerator centre. Stable  $^{20,21}\text{Ne}$  and radioactive  $^{21}\text{Na}$  beam experiments were conducted with  $^{40}\text{Ca}$  targetry for production of  $^{55}\text{Co}$  and  $^{55}\text{Ni}$  through fusion evaporation. These experiments leverage: TRIUMF's Isotope Separator and Accelerator (ISAC) beamline for delivery of high-intensity radioactive beams; the TRIUMF-ISAC Gamma-Ray Escape Suppressed Spectrometer (TIGRESS) for gamma-ray detection; SFU's TIGRESS Integrated Plunger (TIP) for charged particle detection; TRIUMF's Electromagnetic Mass Analyzer (EMMA) for measurement of the A, Z, and energy loss of residual nuclei; as well as specialized  $^{40}\text{Ca}$  targetry carefully protected from oxidation.

This presentation will focus on highlighting the selectivity offered by combining TIGRESS, TIP, and EMMA for lifetime and electromagnetic transition rate measurements, as well as the present state of the ongoing analysis. In the longer term, this work aims to explore the  $f_{7/2}$  hole configurations in  $^{56}\text{Ni}$  and electromagnetic transition rates for excited states of  $^{55}\text{Ni}$  and  $^{55}\text{Co}$ . Ultimately, these measurements enable an investigation into the charge dependence of the strong interaction.

## Your Email

h\_asch@sfu.ca

## Affiliation

Department of Physics, Simon Fraser University

## Supervisor

Krzysztof Starosta

## Supervisor Email

starosta@sfu.ca

## Your current academic level

PhD student

**Primary author:** ASCH, Heinz (Simon Fraser University)

**Co-author:** COLLABORATION, TIP+EMMA+TIGRESS

**Presenter:** ASCH, Heinz (Simon Fraser University)

**Session Classification:** Evening 1 - Nuclear physics

**Track Classification:** Nuclear Physics