



Canadian Association  
of Physicists

Association canadienne  
des physiciens et physiciennes

Contribution ID: 2207

Type: Oral (Non-Student) / Orale (non-étudiant(e))

## High-Precision Branching Ratio Measurement for the Superaligned Fermi Beta Emitter $^{22}\text{Mg}$

Wednesday 13 June 2018 14:00 (15 minutes)

High-precision measurements of the  $ft$  values for superallowed Fermi beta decays between  $0^+$  isobaric analogue states have provided invaluable probes of the Standard Model (SM) description of the electroweak interaction. These measurements confirm the CVC hypothesis to 1.2 parts in  $10^4$ , set the tightest experimental limits on the existence of scalar currents in the electroweak interaction (under the assumptions of time-reversal invariance and maximum parity violation also common to vector currents), and set a strict upper limit on the existence of induced scalar currents.

To provide these stringent tests, theoretical corrections must be applied to the experimentally determined  $ft$  values obtained from precise measurements of the half-lives, branching ratios, and  $Q$  values of the decays. Of particular interest is the isospin symmetry-breaking correction ( $\delta_C$ ), which is model-dependent; several theoretical approaches can and have been used to calculate these corrections. In the most recent world survey of the superallowed Fermi  $\beta$  emitters [1] the choice of  $\delta_C$  correction used depended, at least in part, almost entirely with four of the least precisely determined corrected- $ft$  values of the well-determined cases,  $^{22}\text{Mg}$ ,  $^{38}\text{Ca}$ ,  $^{62}\text{Ga}$ , and  $^{74}\text{Rb}$ .

In light of this, we have performed both a half-life and branching ratio measurement for  $^{22}\text{Mg}$  to improve the precision of the  $^{22}\text{Mg}$   $ft$  value by a factor of 2. These results will play a major role in discriminating between different theoretical approaches to the  $\delta_C$  corrections in superallowed decays.

The goal of the experiment performed at TRIUMF's ISAC facility in 2017 using the GRIFFIN spectrometer was to measure the  $^{22}\text{Mg}$  branching ratio to a precision of  $\pm 0.15\%$ . Taking advantage of GRIFFIN's very high  $\gamma$ -detection efficiency allows us to measure the branching ratio using a novel technique based on  $\gamma$ - $\gamma$  coincidences that eliminates the need for high-precision efficiency calibrations that plagued previous measurements.

This presentation will discuss preliminary branching ratio results for  $^{22}\text{Mg}$  as well as comparing these results to previous measurements.

[1] J.C. Hardy and I.S. Towner, Phys. Rev. C 91, 025501 (2015).

\*Work supported by the Natural Sciences and Engineering Research Council of Canada and the National Research Council of Canada.

**Author:** LAFFOLEY, Alex (University of Guelph (CA))

**Co-authors:** ANDREOIU, C. (Simon Fraser University); BALL, G. C. (Physical Sciences Division, TRIUMF, 4004 Wesbrook Mall, Vancouver, British Columbia); BERNIER, N. (Physical Sciences Division, TRIUMF, 4004 Wesbrook Mall, Vancouver, British Columbia); BIDAMAN, H. (Department of Physics, University of Guelph, Guelph, Ontario); BILDSTEIN, V. (Department of Physics, University of Guelph, Guelph, Ontario); BOWRY, M. (Physical Sciences Division, TRIUMF, 4004 Wesbrook Mall, Vancouver, British Columbia); BURBADGE, C. (University of Guelph); Dr CABALLERO-FOLCH, R. (Triumf); DIAZ VARELA, A. (University of Guelph); DUNLOP, M. R. (University of Guelph); DUNLOP, R. (University of Guelph); GARNSWORTHY, A. B. (Physical Sciences Division,

TRIUMF, 4004 Wesbrook Mall, Vancouver, British Columbia); GARRETT, P. E. (Department of Physics, University of Guelph, Guelph, Ontario); HACKMAN, G. (TRIUMF); JIGMEDDORJ, B. (Department of Physics, University of Guelph, Guelph, Ontario ); LEACH, K. G. (Colorado School of Mines); LESLIE, J. R. (Queen's University, Kingston, Ontario, K7L 3N6, Canada); MACLEAN, A. D. (Department of Physics, University of Guelph, Guelph, Ontario); MEASURES, J. (TRIUMF); NATZKE, C. (Colorado School of Mines); OLAIZOLA, B. (Physical Sciences Division, TRIUMF, 4004 Wesbrook Mall, Vancouver, British Columbia); SAITO, Y. (Physical Sciences Division, TRIUMF, 4004 Wesbrook Mall, Vancouver, British Columbia); SMITH, J. K. (Reed College); SVENSSON, C. E. (Department of Physics, University of Guelph, Guelph, Ontario); TURKO, J. (Department of Physics, University of Guelph, Guelph, Ontario); ZIDAR, T. (Department of Physics, University of Guelph, Guelph, Ontario )

**Presenter:** LAFFOLEY, Alex (University of Guelph (CA))

**Session Classification:** W3-8 Nuclear Structure II (DNP) | Structure nucléaire II (DPN)

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