Nuclear Seminar

Probing properties of the weak interaction using trapped atoms and ions

Prof. Daniel Melconian
Texas A&M University

Monday, February 3 ◆ 4 P.M.
Room 124 Nieuwland Science Hall

Nuclear β decay has a long-standing history of shaping and testing the standard model of particle physics, and it continues to this day with elegant, ultra-precise low-energy nuclear experiments. Experiments observing the (un)polarized angular correlations between the electron, neutrino and recoil momenta following nuclear β decay can be used to search for exotic currents contributing to the dominant (V – A) structure of the weak interaction. Precision measurements of the correlation parameters to $\lesssim$0.1% would be sensitive to (or meaningfully constrain) new physics, complementing other searches at large-scale facilities like the LHC.

This talk will discuss two avenues of research I am pursuing to investigate the fundamental symmetries of the electroweak interaction. As part of the TRINT collaboration at TRIUMF, we are utilizing neutral atom trapping techniques with optical pumping methods to highly-polarize ($\gtrsim$ 99%) a very cold and localized ($\lesssim$ 1 mK and $\lesssim$ 1 mm^3) source of short-lived ^{37}K atoms. Locally at the Cyclotron Institute, we are nearing completion of building the Texas A&M University Penning trap (TAMUTRAP) facility, which will be the world's largest-diameter cylindrical ion trap of radioactive nuclei. The unprecedented open-area of TAMUTRAP is ideal for 4π collection of the delayed protons following the superallowed β decays of very proton-rich nuclei. I will describe both of these "tabletop" research programs and especially try to relay how they are fun, interdisciplinary approaches of answering fundamental questions about the nature of our universe.

Notre Dame Science
Department of Physics