UNIVERSITY of WASHINGTON

Undergraduate Research Symposium May 17, 2019 Mary Gates Hall

Online Proceedings

SESSION 1K

PHYSICS: FUNDAMENTAL AND APPLIED

Session Moderator: Alejandro Garcia, Physics
MGH 254
12:30 PM to 2:15 PM
* Note: Titles in order of presentation.

Creating $^{1}9$Ne and Transporting it to a Beta Decay Measuring Experiment
Michael Edward Higgins, Junior, Physics: Comprehensive Physics, Astronomy
Noah C. Hoppis, Junior, Physics: Comprehensive Physics
Mentor: Alejandro Garcia, Physics

At the UW tandem particle accelerator located at the Center for Nuclear Physics and Astrophysics (CENPA), a program is searching for new physics though precision measurements of electron spectra from radioactive decays. The most sensitive searches require very pure Neon-19, which has a halflife of about 17 seconds. Accordingly, we have designed and constructed a system that produces Neon-19. We first bombarded Sulphur Hexafluoride (SF_6) with protons from the accelerator. We then metered the SF_6 and Neon-19 mix out into a cryogenic trap where it freezes only the SF_6. After the trap, we transported the remaining Neon-19 with a turbomolecular pump into the detector. Once the trap had filled with solid SF_6, it was valved off from the target, then heated, at which time the frozen SF_6sublimated into to a storage tank before refilling the target. By using a pair of traps, the experiment can be run continuously; one trap thaws while the other freezes. Through models based on nuclear cross-section data from previous experiments, the system will produce on the order of $10^{1}0$ Neon-19 nuclei per second. Our system will contribute to an effort to better describe the interactions of particles and refine the Standard Model of particle physics.

POSTER SESSION 2

Balcony, Easel 87
1:00 PM to 2:30 PM

Development of an Ultra Stable 6He Monitor
Anni Xiong, Recent Graduate,
Mentor: Alejandro Garcia, Physics

The 6He experiment located at the North Physics Lab aims to reach sensitivity 10^{-3} or better in searching for beyond standard model tensor currents that violates chirality. The Fierz interference coefficient (little b) is linearly depended on tensor couplings and can be experimentally extracted by precisely measuring the 6He beta decay spectrum. The technique of cyclotron radiation emission spectroscopy from Project 8 (A neutrino experiment located at the UW Physics building) will be used to reconstruct 6He beta spectrum by measuring the cyclotron radiation frequency of the decayed electrons. Each piece of the energy spectrum will be measured separately by varying the magnetic field strength. Since the total number of 6He atoms entering the decay volume can vary over time, each part of the spectrum needs to be normalized to the same scale before combination. This requires a monitoring system that counts the total number of 6He atoms over each data taking period. As part of the effort to prepare for the upcoming 6He experimental run, this project is to develop this monitoring system so that it maintains its stability at the level of $10^{-}3$. The test was done on three experimental setups including a pair of gas counter plus silicon detector, a pair of scintillators and a single silicon detector under vacuum. Of the three setups, the single silicon detector reached desired stability on the most recent experimental run although more validations are needed. A successful setup of the monitoring system will help the experiment to reach desired sensitivity with spectrum normalization. And the detection of tensor currents implies the existence of symmetry breaking with chirality in beyond standard model theories.