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Contribution ID: **3840** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) PENeLOPE: Measuring a precise neutron lifetime with a magneto-gravitational trap for ultracold neutrons

Tuesday 20 June 2023 15:15 (15 minutes)

The neutron lifetime from beta decay, τ , is a significant value for predictions in particle physics and cosmology. It is used to verify the unitarity of the Cabbibo-Kobayashi-Maskawa (CKM) matrix, the weak force quark mixing matrix in the Standard Model, and for evaluating the abundances of light elements such as Helium-4, created during big bang nucleosynthesis. Furthermore, there is a 3.6 σ discrepancy of neutron lifetime results from beam experiments (τ beam = 887.7 ± 1.2 ± 1.9s), and ultracold neutron (UCN) trap experiments (τ trap = 877.75± 0.28(+ 0.22/− 0.16s)). The measurements should agree, since beam experiments measure daughter particles from beta decay, and trap experiments measure surviving neutrons. The discrepancy may be evidence of Physics beyond the Standard Model or an undiscovered systematic effect. A more precise value of the neutron lifetime from beam or trap experiments provides more constraint on the predictions in particle physics and cosmology that are dependent on neutron lifetime. PENeLOPE (Precision Experiment on the Neutron Lifetime Operating with Proton Extraction), developed by Technical University of Munich, Germany, is a UCN magneto-gravitational trap experiment with a goal of determining the neutron lifetime to a precision of 0.1s. In this presentation, I will briefly discuss the motivation for the measurement, how UCN are trapped in PENeLOPE, and how the experiment cycle of PENeLOPE is optimized to reach a sensitivity of 0.1s.

Keyword-1

UCN

Keyword-2

neutron

Keyword-3

lifetime

Primary author: SALAZAR, Dennis

Presenter: SALAZAR, Dennis

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