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Neutron beta-decay studies at LANL

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(UCNA and UCN τ Collaboration)

Beta decay of a free neutron is the simplest form of “semi-leptonic” weak interaction and is free from nuclear structure effects. Despite the simplicity, the lifetime measurement remains one of the most challenging measurements, bearing different results depending on the technique (“bottle” or “beam”) experiment [1, 2]. Another critical measurement from the decay is the correlation (A_0) between the neutron’s initial spin and emitted electron’s momentum. Neutron lifetime and axial neutron charge determined using A_0 are inputs to determine the magnitude of the Cabibbo-Kobayashi-Maskawa (CKM) matrix element (V_{ud}) and provide a means to study physics beyond the standard model.

Los Alamos National Laboratory hosts two experiments (UCN τ and UCNA) to measure the lifetime and beta-asymmetry parameters, exploiting the ultra-cold neutron (UCN) beam. The experiments are undergoing upgradation in terms of the design to achieve more storage of UCNs to gain higher sensitivity limits. This contribution will discuss details of the experiments and expected new results.

References:

1. Golub, R., D. Richardson, and S. K. Lamoreaux, 1991, Ultra-Cold Neutrons (Adam Hilger, Bristol, England).
2. D. J. Salvatet al., Phys. Rev. C89, 052501.

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