The neutron lifetime: a haiku

Daniel Salvat, University of Washington

Thursday, October 12, 2017 - 3:45pm to 4:45pm
CENPA Conference Room, Rm 178

Precise knowledge of the free neutron lifetime is required for the prediction of primordial light element abundances, and is a probe of the charged-current weak interaction at low energies. The lifetime is primarily measured by either counting the decay products in a neutron beam of absolutely-known flux, or by trapping ultracold neutrons (UCN) in material bottles and counting the survivors after varying time intervals. There is currently a 3.9 standard deviation discrepancy between these two methods, and new techniques are needed to address this discrepancy and resolve the neutron lifetime with high precision. The UCNtau experiment at the Los Alamos Neutron Science Center (LANSCE) consists of a magnetic UCN trap to eliminate systematic effects related to the absorption and scattering of neutrons from the walls of previously-used material traps. In addition, we have developed a novel UCN detector to count the UCN in situ, providing a powerful check of potential systematic effects. Using the UCNtau apparatus, we have measured the neutron lifetime to be 877.7 ± 0.7 (stat) ±0.3/-0.1 (sys) seconds, with systematic corrections smaller than their associated uncertainties. In this talk, I will provide the motivation and context for the measurement, describe the novel characteristics of the UCNtau experiment, present the results of the blinded analysis, and discuss potential improvements to the apparatus.