Contribution ID: **185** Type: **Oral**

UCNtau: a measurement of the neutron lifetime using ultra-cold neutrons stored in an asymmetric magnetic trap

Tuesday, October 18, 2016 9:50 AM (20 minutes)

Recent measurements of the neutron lifetime have individually reported uncertainties of about 1 s but disagree by as much 7 s, resulting in a shift of about 6.5 sigma in the accepted value over recent years. Measurements based on the decay in flight of cold neutron beams appear to yield longer lifetimes than those based on counting surviving ultra-cold neutrons after storage in material-walled traps. The present storage experiments are challenged by the existence of multiple neutron loss mechanisms in the trap that act with characteristic times similar to the neutron lifetime, such as absorption or upscatter of the neutrons on the material trap walls and escape of unbound neutrons from quasi-stable orbits within the trap. The efficiency of detection of the surviving trapped neutrons can vary with time due to evolution of neutron population into different regions of phase space within the trap. Therefore, a new experiment, UCNtau, has been developed at Los Alamos National Lab to eliminate these systematic effects by storing the ultra-cold neutrons in an asymmetric magneto-gravitational trap, in which the neutrons: 1) do not interact with any material surface during their storage time in the trap; 2) rapidly populate all of the energetically accessible phase space; and 3) are detected rapidly at the end of the storage time by a novel in-trap active time-sensitive detector. The trap consists of a bowl-shaped Halbach array of neodymium-iron permanent magnets capable of repelling neutrons with a kinetic energy of up to 50 neV and is closed on the top by gravity. The neutron detector consists of a scintillator coated with boron which is lowered into the trap from above to individually detect the surviving neutrons. We will present preliminary results of the recent Los Alamos accelerator cycle, including a summary of the experiment's assessed sources of systematic uncertainty and statistical reach. Our immediate goal is to reach sufficient precision to resolve the difference between the beam and bottle experiments.

Primary author: Dr MORRIS, Christopher (Los Alamos)

Presenter: Dr MORRIS, Christopher (Los Alamos)

Session Classification: Tu - 1

Track Classification: Low energy precision tests of the Standard Model