EP Seminar

SPEAKER: Kevin Hickerson (UCLA)

TITLE: **Searching for hot new physics using ultracold neutrons: fundamental symmetries above the TeV scale.**

DATE: Tue 19/05/2015 11:00

PLACE: Main Auditorium

ABSTRACT

Ultracold neutrons (UCN) are an exotic variant of the familiar unbound nucleon, but down-scattered to 1 mK. At this temperature, UCN propagate extremely slowly, a few meters per second, with only a few 10^{-7} electron volts of kinetic energy. By definition, UCN can be trapped inside of material bottles via strong interaction with the nuclei in the walls. They can also be magnetically polarized and guided by magnetic fields of a few Tesla. They even fall along parabolic paths due to earth's gravity, unable to ascend more than a few meters. Along with β decay, these interactions make UCN an ideal laboratory for testing all four forces and fundamental symmetries of the Standard Model in novel ways.

As it stands now, the Standard Model surely requires an extension to explain dark matter, baryon number asymmetry and unification with gravity. While assured near the Planck scale, the lower energy limit of these extensions have not yet been discovered at the LHC or anywhere. I'll show how precision UCN experiments can explore these symmetries at the 10 TeV scale, potentially competitive with accelerators. Several experiments such as UCNA, UCNb, UCNB and UCN τ at Los Alamos National Laboratory measure β decay correlation parameters such as the axial-vector coupling constant, g_A, the Fierz interference term, b_n, and the neutron lifetime, τ_n. The neutron electric dipole moment (nEDM) may contribute to a non-zero θ-term, typically removed from the QCD Lagrangian. A non vanishing θ may help find the CP violation necessary to explain the matter-antimatter imbalance of the universe. An experiment under development in the US, aims to measure the nEDM with an expected sensitivity of one hundred times previous attempts, sufficient to rule out (or rule in) predictions from SUSY and other popular theories. Other UCN experiments aim to discover neutron-antineutron oscillations, fifth-force Yukawa couplings and even extra dimensions.
    These UCN experiments together can be used to constrain beyond the Standard Model physics and give new insight where to look for it next.</p>

Organised by: C. Lourenco, G. Unal..... **Tea and Coffee will be served at 10h30**