

WEDNESDAY

OCTOBER 28

3:00 P.M.

RM 123 NSH

Refreshments
in Rm 202 NSH
@ 2:30 pm

The Proton and the Future of Particle Physics

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The venerable proton continues to play a central role in fundamental particle physics. Neutrinos scatter from protons in neutrino oscillation experiments, Weakly Interacting Massive Particles (WIMPs) are expected to scatter from protons in dark matter searches, and electrons or muons are bound by protons in precision atomic spectroscopy. Our understanding of the proton is an obstacle to the success of next generation experiments hoping to discover CP violation in the lepton sector and determine the neutrino mass hierarchy, discover the particle nature of dark matter, or reveal new interactions such as those that violate lepton universality. In this talk I present (i) an overview of the current state of knowledge in the neutrino sector, and theoretical advances that will determine a crucial missing ingredient in the predicted signal process of neutrino-nucleus scattering at long baseline neutrino oscillation experiments (ii) the first complete calculation of the scattering cross section of a proton on a static electroweak source, which determines WIMP-nucleus scattering rates at underground direct detection experiments and (iii) the status of the proton radius puzzle, whose most “mundane” resolution requires a 5 standard deviation shift in the value of the Rydberg constant. I describe how each of these problems has spurred the development of powerful new methods in effective quantum field theory.