PHYSICS COLLOQUIUM
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Why is there something rather than nothing? Neutrino-less double beta-decay may point toward the answer.

The universe appears to have evolved from an initial condition of symmetry between matter and anti-matter to a state where anti-matter is extremely rare. Some unknown dynamical processes must have broken the symmetry early in the evolution of the universe. One very attractive class of theories, known collectively as leptogenesis, can not only explain the excess of matter quantitatively, but also predicts the value of the extremely tiny but non-zero mass of the neutrino, in pretty good agreement with experiment. I describe the primary experimental path to probe leptogenesis: neutrino-less double beta decay in neutron-rich nuclei. The astonishing discovery two decades ago of oscillations between types of neutrinos establishes the scale of sensitivity needed: the decay rate may be one atom per 10^{27} years! International teams of experimenters are designing ton-scale detectors to search for this hitherto unseen decay mode, which if observed would also indicate non-conservation of lepton number. I will focus on my favorite approach, the use of ^{136}Xe in the gas phase. If the decay mode is observed, the neutrino must be its own anti-particle, in accord with leptogenesis ideas. The elusive and surprising neutrino may yet provide crucial insight as to why there is something, rather than nothing.

Seminar in Room SC234 at 3:40
Refreshments in Room SC103 at 3:00