3:30 pm • Friday April 20, 2012 • 2241 Chamberlin Hall • Coffee at 4:30 pm

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The Neutrino at Eighty

A Remarkable Journey and a Feisty Future

Department of Physics Colloquium

WISCONSIN

Eighty years ago the neutrino was postulated by Pauli to explain the puzzling observations of nuclear beta decay. At the time many thought neutrinos would never be observed, but a quarter century later Reines and Cowan successfully detected their elusive signal. Following their discovery, a broad set of experiments were undertaken that culminated in the past decade with a remarkable transformation of our understanding of neutrino properties and the revelation that the standard model of particle interactions is incomplete. We have found that neutrinos morph from one species to another as they journey through matter and space. And based on these observations we know that neutrinos are not massless particles, but have tiny masses, being at least 250,000 times lighter than electrons. Even with such diminutive masses, neutrinos influence the largest scales of the cosmos. Today much remains unknown about neutrino properties. What do neutrinos "weigh?" — Why are their masses so light compared to other particles? Are neutrinos and anti-neutrinos indistinguishable from one another (Majorana particles), indicating lepton number violation? A number of next-generation experiments aim to address these questions, but the reticent nature of neutrinos presents daunting challenges for experimentalists. The talk will focus on how nuclear beta decay and double beta decay serve as sensitive probes of neutrino properties.

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