Weighing in on Neutrinos

Over the past generation, a series of challenging experiments have revealed that neutrinos have unexpected properties and non-zero masses. These revolutionary discoveries revealed shortcomings in the standard model of fundamental interactions and in our understanding of the role neutrinos play in astrophysics and cosmology. Many intriguing questions remain with profound implications. Might neutrinos offer an explanation of the observed matter-antimatter asymmetry in the universe? What are the masses of the neutrinos and what is the underlying mass mechanism? Can hints of sterile neutrinos be substantiated? This talk will review our current understanding of neutrinos and then turn to the question of how does one “weigh” neutrinos? The latest results from cosmology, double beta decay and direct kinematical methods will be presented, including a first result from the Karlsruhe Tritium Neutrino experiment (KATRIN). As part of the story, the neutrino’s intertwined relationship with and impact on nuclear physics, astrophysics, and cosmology will be explored.