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Much Ado About (Almost!) Nothing: The Experimental Study of Neutrino Masses and Mixing

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Neutrinos have been described by their discoverer Frederick Reines as “the most tiny quantity of reality ever imagined by a human being.” Yet these particles which verge on nothingness have had an enormous influence on the past and future evolution of the universe and are the subject of an increasingly active program of experimental physics. In this talk I will review some of the basic properties of neutrinos and summarize the recent results on neutrino masses and mixing from studies of neutrinos produced in the Sun, cosmic rays, reactors, and accelerators including searches for zero neutrino double beta decay. Looking ahead, I will outline the future course of experiments in the U.S., Asia, and Europe which will address the questions of the fundamental character of the neutrino, the hierarchy of their masses, and their matter anti-matter symmetries.