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Results from Long Baseline Experiments

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The discovery of neutrino mass in 1998 spawned a world-wide effort to better understand neutrino properties using neutrinos from the Sun, the atmosphere, reactors, and from accelerators. Neutrino experiments based at the world's accelerators have been an important component of this program as the proton accelerators provide a nearly pure beam of muon neutrinos at selected energies with which to study neutrino oscillations of muon flavor to other flavors. The underlying structure of the neutrino masses and mixings are revealed through the study of the frequency and amplitude of the flavor oscillations. The smallness of the neutrino mass splittings ($\simeq 0.05\ eV$) means that phase differences between the mass eigenstates accumulate very slowly requiring these experiments to be conducted over great distances ranging from 250 km to 810 km separation between source and detector. Currently there are three long-baseline experiments underway, T2K at the J-PARC facility in Japan, and MINOS$^+$ and NOvA underway at Fermilab in the United States. In this talk, I will review the fundamental physics probed by these experiments, how the experimental setups probe this physics, and summarize the recent results with a particular emphasis on the newest experiment, NOvA.