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matter vs vacuum oscillations at long-baseline accelerator neutrino experiments

The neutrino oscillation probabilities at the long baseline accelerator neutrino experiments are expected to be modified by matter effects. We search for evidence of such modification in the data of T2K and NOvA, by fitting the data to the hypothesis of (a) matter modified oscillations and (b) vacuum oscillations. We find that vacuum oscillations provide as good a fit to the data as matter modified oscillations. Even an extended run of these experiments, with 5 years in neutrino mode and 5 years in anti-neutrino mode, can not make a 3σ distinction between vacuum and matter modified oscillations. DUNE, by itself, can rule out vacuum oscillations at 5σ with one year neutrino run if the hierarchy is NH. For IH, one needs to add the data of T2K and NOvA to ten years of DUNE data to obtain 5σ exclusion of vacuum oscillations.

Mini-abstract

Distinction between vacuum and matter modified oscillations at accelerator neutrino experiments.

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