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A plethora of long-range neutrino interactions probed by DUNE and T2HK

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Upcoming neutrino experiments will soon search for new neutrino interactions more thoroughly than ever before, boosting the prospects of extending the Standard Model. In anticipation of this, we forecast the capability of two of the leading long-baseline neutrino oscillation experiments, DUNE and T2HK, to look for new flavor-dependent neutrino interactions with electrons, protons, and neutrons that could affect the transitions between different flavors. We interpret their sensitivity in the context of long-range neutrino interactions, mediated by a new neutral boson lighter than 10^{-10} eV, and sourced by the vast amount of nearby and distant matter in the Earth, Moon, Sun, Milky Way, and beyond. For the first time, we explore the sensitivity of DUNE and T2HK to a wide variety of $U(1)'$ symmetries, built from combinations of lepton and baryon numbers, each of which induces new interactions that affect oscillations differently. We find ample sensitivity: in all cases, DUNE and T2HK may constrain the existence of the new interaction even if it is supremely feeble, may discover it, and, in some cases, may identify the symmetry responsible for it.

Working Group

WG 5: Neutrinos Beyond PMNS

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