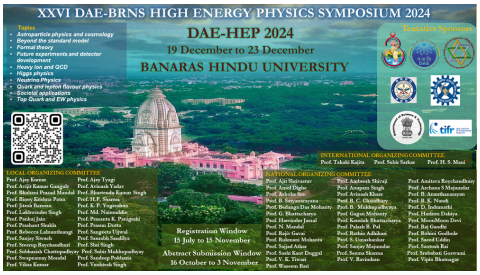

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Probing Lorentz Invariance Violation via Neutrino Oscillations at DUNE

Lorentz Invariance Violation (LIV) represents a potential violation in Lorentz symmetry, a fundamental symmetry underlying all physical laws. LIV may exist inherently, even in vacuum. Analyzing the effects of LIV on neutrino oscillation probabilities provides a promising avenue for evaluating potential violations of Lorentz invariance. Since the contribution of LIV is expected to be sub-dominant, it can be incorporated as a small perturbation to the standard matter Hamiltonian. The effective Hamiltonian for Lorentz Invariance Violation (LIV) can be studied using the Standard Model Extension (SME) framework. In our study, we implement this effective LIV Hamiltonian to numerically calculate the altered neutrino oscillation probabilities. We independently examine the effects of the LIV CPT-odd ($a_{\alpha\beta}$) and CPT-even ($c_{\alpha\beta}$) terms on neutrino oscillations, with the Deep Underground Neutrino Experiment (DUNE) serving as a case study for long-baseline experiments. Our analysis explores potential correlations among different LIV parameters and other oscillation parameters. The energy dependence of the CPT-even term in LIV looks particularly interesting, and we investigate how its influence contrasts with that of the CPT-odd term. We further explore the impact of LIV parameters on the sensitivities of CP measurements.

Field of contribution

Phenomenology

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