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Disentangling Lorentz Invariance Violation and Non-Standard Interactions in Long-Baseline Neutrino Experiments

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Long-baseline neutrino experiments offer excellent opportunities to probe physics beyond the Standard Model. Non-standard interactions (NSI) and Lorentz-invariance violation (LIV) can both modify neutrino oscillation probabilities and, in certain regions of parameter space, produce similar phenomenological signatures. Such degeneracies may make it difficult to identify the underlying origin of an observed deviation from the standard three-flavor framework.

In this work, we investigate the possibility of distinguishing NSI and LIV effects at future long-baseline neutrino experiments. We study the degeneracies between these two new-physics scenarios and assess the sensitivity of representative experimental configurations to their discrimination. Our analysis highlights the potential of future neutrino oscillation measurements to not only discover deviations from the standard paradigm, but also shed light on the nature of the underlying new physics.

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