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Simulation studies of Lorentz-violating effects at the DUNE experiment

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The Deep Underground Neutrino Experiment (DUNE) is a next-generation neutrino oscillation experiment that will provide new constraints for Beyond Standard Model (BSM) phenomena. Lorentz invariance is one of the fundamental principles of quantum field theory and is closely related to symmetries such as charge, parity, and time (CPT) reversal, which form the foundation of the Standard Model (SM) of particle physics. Nevertheless, several BSM scenarios allow for Lorentz invariance violation (LIV) at high energy scales. In neutrino physics, LIV has been investigated as a possible explanation for anomalies reported by experiments such as LSND and MiniBooNE. Since LIV effects exhibit characteristic dependencies on neutrino energy and propagation baselines, they may be distinguishable from other BSM mechanisms, such as non-standard interactions (NSI). In this work, we perform simulation studies of Lorentz-violating effects at the DUNE experiment. We perform our analysis using the General Long-Baseline Experiment Simulator (GLOBES), with a modified oscillation probability engine that includes LIV contributions and explore the vast parameter space using a novel method based on Ant Colony Optimization (ACO).

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