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## Ant Colony in Sensitivity Studies

In this work, we conduct a detailed analysis of the coefficients associated with the Lorentz Invariance Violation (LIV) for both CPT-violating and CPT-conserving Hamiltonians in the context of neutrino oscillations. Specifically, we explore the behavior of the mixing angle  $\theta_{23}$ , the CP-violating phase  $\delta_{CP}$ , and the phases of two LIV coefficients simultaneously, with particular focus on combinations such as  $a_{e\mu}$  and  $a_{e\tau}$ . Our goal is to uncover potential correlations between these parameters, which could provide new insights into the underlying physics of neutrino oscillations.

This analysis introduces a novel approach to the field, as no prior work, to the best of our knowledge, has addressed the simultaneous examination of these LIV coefficients and their correlations. Furthermore, we utilize an advanced ant colony optimization algorithm, developed by the author, to significantly accelerate the simulation of probabilities within the GLOBES (General Long Baseline Experiment Simulator) framework. This method allows for more efficient exploration of the parameter space, offering a substantial improvement in computational performance compared to traditional techniques. Our findings have the potential to contribute to a deeper understanding of neutrino physics and LIV effects.

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