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Degeneracies in long-baseline neutrino experiments from nonstandard interactions

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We study parameter degeneracies that can occur in long-baseline neutrino appearance experiments due to nonstandard interactions (NSI) in neutrino propagation. For a single off-diagonal NSI parameter, and neutrino and antineutrino measurements at a single L/E , there exists a continuous four-fold degeneracy (related to the mass hierarchy and θ_{23} octant) that renders the mass hierarchy, octant, and CP phase unknowable. Even with a combination of $\text{NO}\nu A$ and T2K data, which in principle can resolve the degeneracy, both NSI and the CP phase remain unconstrained because of experimental uncertainties.

A wide-band beam experiment like DUNE will resolve this degeneracy if the nonzero off-diagonal NSI parameter is $\epsilon_{e\mu}$. If $\epsilon_{e\tau}$ is nonzero, or the diagonal NSI parameter ϵ_{ee} is $\mathcal{O}(1)$, a wrong determination of the mass hierarchy and of CP violation can occur at DUNE. The octant degeneracy can be further complicated by $\epsilon_{e\tau}$, but is not affected by ϵ_{ee} .

Summary

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