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Investigating Beyond Standard Neutrino Oscillation Theories at DUNE

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Although the standard neutrino oscillation process induced by neutrino mass is well-established, there may be second-order contributions to this phenomenon from physical mechanisms beyond non-zero neutrino masses that could modify the standard framework. In this study, we systematically evaluate DUNE's capabilities to observe such beyond-standard oscillation (BSO) effects, assessing its ability to distinguish between different BSO hypotheses by varying the size of the effects. The BSO hypotheses considered in this analysis include neutrino decay (visible or invisible), non-standard interactions, violation of the equivalence principle, and quantum decoherence. Our analysis also quantifies the potential distortions that can suffer the measured value of the CP-violating phase parameter, δ_{CP}, when fitted with the wrong BSO hypothesis. We note that the latter even could happen for cases when the BSO mechanisms can be hardly discriminated among them (the true one from the theoretical hypothesis).

Poster prize

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