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Evolution of Mass-Mixing Parameters in Matter with Neutrino NSIs

We explore the role of matter effect in the evolution of neutrino oscillation parameters in the presence of all possible lepton-flavour-conserving and lepton-flavour-violating non-standard interactions (NSIs) of the neutrino. We derive simple approximate analytical expressions for the mass-mixing parameters in matter in presence of NSIs. We observe that only the NSIs in 2-3 block($\varepsilon_{\mu\mu}, \varepsilon_{\tau\tau}$,and $\varepsilon_{\mu\tau}$) affect the running of θ_{23}. Though all the NSIs influence the evolution of θ_{13}, but, $\varepsilon_{e\mu}$ and $\varepsilon_{e\tau}$ have prominent impact at the energies relevant for DUNE. We demonstrate the utility of our approach in addressing several important features related to neutrino oscillation such as: a) estimating the resonance energy in presence of NSIs when θ_{13} in matter becomes maximal, b) figuring out the required baseline length and neutrino energies to have maximal matter effect in ν_μ to ν_e transition, and c) unraveling interesting degeneracies between θ_{23} and NSI parameters.

Mini-abstract

Analytical expressions for running of oscillation parameters in matter with NSIs & their utilities

Experiment/Collaboration

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