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Effects of Scalar NSI on Measurements of Neutrino Oscillation Parameters in JUNO Experiment

Determining the neutrino mass ordering (MO) remains one of the major unknowns in the standard three flavor neutrino oscillation physics. At present we only know that $m_2 > m_1$ from solar neutrino data, i.e sign of Δm^2_{21} is positive. However, we do not know if $m_3 > m_1$ (normal ordering) or $m_3 < m_1$ (inverse ordering). The future reactor based neutrino experiment JUNO is expected to measure MO with more than 3σ significance. However, the presence of neutrino non-standard interactions (NSIs) may affect the sensitivity of JUNO towards measuring the neutrino mass hierarchy. In this work, we perform a phenomenological study of neutrino oscillation along with the scalar non-standard interaction in determining neutrino mass hierarchy at JUNO. We find that in the presence of scalar NSI which appears as a correction to the neutrino mass term, the survival probabilities P_{ee} and $\bar{P}_{ee}$ depend upon the $\delta_{\rm CP}$ and octant of θ_{23} even in a vacuum, which is not the case, had the scalar NSI been absent in the Hamiltonian. We explore the role of diagonal scalar NSI parameters η_{ee}, $\eta_{e\mu}$, and $\eta_{\tau\tau}$ and it is noted that η_{ee} significantly affects the mass ordering determination of JUNO. We have also found that the presence of scalar NSI parameters can affect the measurement of θ_{12}.

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