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Scalar Non Standard Interactions at long baseline experiments

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The discovery of neutrino oscillation confirms neutrinos have mass and the Standard Model(SM) of particle physics is not complete. It needs an extension in order to accommodate the masses and mixing of neutrinos, which essentially leads to beyond SM(BSM) physics. The unknown couplings involving neutrinos, so-called the Non-Standard Interactions(NSIs)[1] may appear as a 'new physics' in different neutrino experiments. Neutrino NSI can have a sizable impact on neutrino oscillation and can impact the measurements of different mixing parameters in various neutrino experiments. The recent work on scalar NSI[2] has shown a great potential to probe it further. Unlike vector NSI, scalar NSI appears as a correction to the neutrino mass matrix rather than acting as a matter potential. This may lead to a significantly different phenomenological consequence in different neutrino experiments. Moreover, as scalar NSI affects the mass matrix, it also gives a possibility of probing it to different neutrino mass models.
In this work, we explored the effect of scalar NSI in different long-baseline experiments (DUNE, T2HK, etc). We point out that scalar NSI can considerably affect the neutrino oscillation in Long baseline(LBL) experiments and can complicate the measurement of the CP phase. Also as it appears as a correction to the neutrino mass matrix its effect is energy independent, unlike the vector NSI. We also studied the sensitivity of different LBL experiments towards finding the effects of scalar NSI. Also, we put up the possibility of probing it further to various neutrino mass models.

References:

[1] O.G.Miranda and H.Nunokawa, New Journal of Physics, 2015, 17, 095002.

[2] S.F. Ge and S.J. Parke, Phys. Rev. Lett., 2019, 122, 211801.

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