Title:	Exploring Standard Model Extension Through Neutrinos
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Abstract:	Abstract Neutrino physics offers us the scope to investigate the physics Beyond Standard Model (BSM). The first and foremost signature of the non-zero mass of neutrinos is given by the theory of neutrino oscillation which has now been established by several pioneering experiments. Extensive studies have been done to understand the phenomenon of neutrino oscillation. There still lie unresolved issues in the domain of neutrino oscillation. In the current thesis, we have addressed a few issues in the context of long-baseline (LBL) neutrino oscillation experiments. Various global analyses successfully establish the phenomenon of 3-neutrino oscillation (electron, muon, and tau neutrino). However, a few short-baseline anomalies (LSND and MiniBooNE) indicate the existence of a fourth sterile neutrino (mass of the order of eV). Should the fourth neutrino exist in na- ture, we have investigated how the oscillation parameters, specifically the CP phases, can be bound in case of the ongoing and forthcoming LBL data from DUNE, NOvA, T2K, and T2HK. We have also studied how the parameter space of neutrino-less double-beta decay gets modified due to the inclusion of the sterile neutrino in the oscillation picture. Next, we have focused on one of the neutrino mass generation models, i.e., the left-right symmetric model (LRSM). We have used published data from the ongoing experiments NOvA and T2K to probe the LRSM parameter space in terms of the NSI parameters and explore if we can put a constraint on the lowest neutrino mass. The phenomenon of Lorentz invariance violation (LIV) has also been studied in the context of upcoming LBL experiments P2O and DUNE. The Planck suppressed effect of LIV can be demonstrated in the long-baseline neutrino oscillation data, and that in turn can give us an idea of the bounds on the relevant parameter space. We have done a chi-squared analysis to study the LIV parameters. We have focused on the charged pion production channel and studied how the precision of the measurement can be improved for low-energy pions in MINERvA experimental setups. We will discuss the outcomes of thesis works based on the above proposals.
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