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Probing Light Sterile Neutrinos in Left-Right Symmetric Models with Displaced Vertices and Neutrinoless Double Beta Decay (17'+3')

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An investigation of relatively light (GeV-scale), long-lived right-handed neutrinos is performed within minimal left-right symmetric models using the neutrino-extended Standard Model Effective Field Theory framework. Light sterile neutrinos can be produced through rare decays of kaons, D-mesons, and B-mesons at the Large Hadron Collider (LHC) and the Long-Baseline Neutrino Facility (LBNF) of Fermilab. Their decays could result in displaced vertices, which can be reconstructed. By performing Monte-Carlo simulations, we assess the sensitivities of the future LHC far-detector experiments ANUBIS, CODEX-b, FACET, FASER(2), MoEDAL-MAPP1(2), MATHUSLA, the recently approved beam-dump experiment SHiP, and the upcoming neutrino experiment DUNE at the LBNF, to the right-handed gauge-boson mass M_{W_R} as functions of neutrino masses. We find that DUNE and SHiP could be sensitive to right-handed gauge-boson masses up to $\sim$ 25 TeV. We compare this reach to indirect searches such as neutrinoless double beta decay, finding that displaced-vertex searches are very competitive.

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