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GeV scale neutrinos: meson interactions and DUNE sensitivity

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The simplest extension of the SM to account for the observed neutrino masses and mixings is the addition of at least two singlet fermions (or right-handed neutrinos). If their masses lie at or below the GeV scale, such new fermions would be produced in meson decays. Similarly, provided they are sufficiently heavy, their decay channels may involve mesons in the final state. Although the couplings between mesons and heavy neutrinos have been computed previously, significant discrepancies can be found in the literature. The aim of this paper is to clarify such discrepancies and provide consistent expressions for all relevant effective operators involving mesons with masses up to 2 GeV. Moreover, the effective Lagrangians obtained for both the Dirac and Majorana scenarios are made publicly available as FeynRules models so that fully differential event distributions can be easily simulated. As an application of our setup, we numerically compute the expected sensitivity of the DUNE near detector to these heavy neutral leptons.

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