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# Dark matter and lepton sector phenomenology of a radiative inverse seesaw model

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We propose a Standard Model (SM) extension where neutrinos get masses through a two-loop inverse seesaw mechanism. This naturally explains the smallness of the neutrino masses and allows seesaw mediators to be at the TeV scale with testable phenomenology. The model adds two real singlet scalars and four electrically neutral leptons to the SM. The extension considers the existence of two global Abelian symmetries, a continuous $U(1)$ and a discrete $Z_3$. The latter, remains unbroken after spontaneous symmetry breaking and forbids tree-level and one-loop neutrino masses, and stabilizes the dark matter (DM) candidates. This setup accommodates neutrino-oscillation data, yields two pseudo-Dirac heavy pairs with small active–sterile mixing, and predicts an effective Majorana mass $m_{ee}$ in the $2.1 - 4.4$ meV range for normal ordering. Charged-lepton flavor violation is naturally suppressed yet testable: for a representative benchmark we obtain $BR(\mu \to e\gamma) \simeq 1.6 \times 10^{-14}$, with correlated signals in $\mu \to eee$ and $\mu - e$ conversion within next-generation experimental reach. Altogether, the radiative origin of neutrino masses links low-energy flavor observables to collider signatures, delineating discovery targets for MEG~II, Mu2e/COMET, and the HL-LHC and distinguishing this framework from conventional inverse- and radiative-seesaw models.

## Academic position of the presenting author

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