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On the origin of lepton masses and dark matter

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We propose the simple extensions of the Standard Model with an extra global or local abelian symmetries for the origin of masses for neutrino and charged leptons. First, we explain small neutrino masses with a Z4 symmetry by the radiative seesaw mechanism with inert doublet Higgs, right-handed neutrinos and extra singlet scalars transforming nontrivially under the Z4. In this model, we discuss the implications of the Z4 symmetry for thermal leptogenesis and direct detection/collider experiments. Moreover, we consider a tree-level seesaw mechanism for generating charged lepton masses in models with vector-like leptons and an extra local SU(2) symmetry, and discuss the constraints on the model coming from the lepton g-2 and lepton flavor violation. In this case, the dark isospin-charged gauge bosons of the extra SU(2) become dark matter candidates with almost the same masses as the dark isospin-neutral gauge boson, which are correlated with electroweak precision measurements such as the W boson mass and the lepton Weinberg angle.

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