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Effective Dirac Neutrino Mass Operator in the Standard Model With a Local Abelian Extension

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We present 48 types of solutions to the anomaly cancellation conditions of local Abelian extensions of the Standard Model (SM) with right-handed SM-singlet chiral fermions. At least two of them acquire effective light Dirac neutrino masses, while the others get heavy masses from the spontaneous symmetry breaking of the local Abelian symmetry, forming a dark sector with multi-component and multi-generational fermionic dark matter. The corresponding effective Dirac neutrino mass operator can be realized at tree-level or radiatively by introducing extra scalars, and in some cases after imposing extra scotogenic conditions. The Dirac Zee model with Dirac fermionic dark matter is presented as an example of model where the neutrino and dark matter phenomenology are basically independent of each other.

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