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Minimal radiative Dirac neutrino mass models

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Neutrinos may be Dirac particles whose masses arise radiatively at one-loop, naturally explaining their small values. In this work we show that all the one-loop realizations of the dimension-five operator to effectively generate Dirac neutrino masses can be implemented by using a single local symmetry: $(1)_-$. Since this symmetry is anomalous, new chiral fermions, charged under $-$, are required. The minimal model consistent with neutrino data includes three chiral fermions, two of them with the same lepton number. The next minimal models contain five chiral fermions and their $-$ charges can be fixed by requiring a dark matter candidate in the spectrum. We list the full particle content as well as the relevant Lagrangian terms for each of these models. They are new and simple models that can simultaneously accommodate Dirac neutrino masses (at one-loop) and dark matter without invoking any discrete symmetries.

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