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Minimal Non-Abelian Discrete 3HDMs with Neutrino Masses and Dark Matter Stability

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We present minimal three-Higgs-doublet models (3HDMs) based on global non-Abelian discrete symmetries that simultaneously explain neutrino masses and dark matter stability. A residual Z_2 parity from the spontaneous breaking of the new symmetry stabilizes the dark matter candidate, which runs in the loop generating neutrino masses at one loop alongside a tree-level type-I seesaw contribution. We identify S_3 and D_4 as the smallest non-Abelian groups realizing this framework and determine the minimal models in both cases that are consistent with current neutrino oscillation data. The resulting models conserve CP in both the Yukawa and scalar sectors.

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