

Title: Abelian symmetries in the two-Higgs-doublet model with fermions

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Abstract: We classify all possible implementations of an Abelian symmetry in the two-Higgs-doublet model with fermions. We identify those symmetries which are consistent with nonvanishing quark masses and a Cabibbo-Kobayashi-Maskawa quark-mixing matrix (CKM), which is not block-diagonal. Our analysis takes us from a plethora of possibilities down to 246 relevant cases, requiring only 34 distinct matrix forms. We show that applying $Z(n)$ with $n \geq 4$ to the scalar sector leads to a continuous $U(1)$ symmetry in the whole Lagrangian. Finally, we address the possibilities of spontaneous CP violation and of natural suppression of the flavor-changing neutral currents. We explain why our work is relevant even for non-Abelian symmetries.

KeyWords Plus: Maximal CP Nonconservation; Quark Mass Matrices; Neutral Currents; Higgs Doublets; Violation; Conservation; Scalars

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