

Dark Matter in S_3 -Symmetric Three-Higgs Doublet Model With Spontaneous CP Violation

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Models with an extended scalar electroweak sector can have vanishing vacuum expectation values. Such behaviour is a result of an underlying symmetry. If a symmetry prevents couplings between fermions and additional scalars, such scalars could become viable dark matter candidates. We catalogue S_3 -symmetric three-Higgs-doublet models, based on whether a specific model could possibly accommodate a dark matter candidate. In our study we assume that the dark matter candidate is stabilised by the $\mathbb{Z}_2$ symmetry, which survived spontaneous symmetry breaking, and not superimposed over S_3 . We explore two models; with and without CP violation. These models have a single dark and two active scalar sectors. The dark matter candidate masses, in two cases, are different from the known models with three scalar doublets. After investigating two models in detail, identifying parameters compatible with both theoretical and experimental constraints, we found that the dark matter candidate mass could be within the range of $[52.5, 89]$ GeV or $[6.5, 44.5]$ GeV for a model with CP violation.

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