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Triplet-Quadruplet Fermionic Dark Matter

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We explore a dark matter model extending the standard model particle content by one fermionic SU(2)_L triplet and two fermionic SU(2)_L quadruplets, leading to a minimal realistic UV-complete model of electroweakly interacting dark matter which interacts with the Higgs doublet at tree level via two kinds of Yukawa couplings. After electroweak symmetry breaking, the physical spectrum of the dark sector consists of three Majorana fermions, three singly charged fermions, and one doubly charged fermion, with the lightest neutral fermion serving as a dark matter candidate. A typical spectrum exhibits a large degree of degeneracy in mass between the neutral and charged fermions, and we examine the one-loop corrections to the mass differences to ensure that the lightest particle is neutral. We identify regions of parameter space for which the dark matter abundance is saturated for a standard cosmology including coannihilation channels. Constraints from precision electroweak measurements, searches for dark matter scattering with nuclei, and dark matter annihilation are important, but leave open a viable range for a thermal relic.

Summary

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