Dark Matter in SO(10) GUTs

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In this work, we have studied the possible dark matter candidate in the context of SO(10) grand unified theories (GUTs). Motivated by the long list of attractive features of such class of models, we have studied all the possible TeV scale dark matter candidates in SO(10) GUTs without extending the group structure of the model and keeping the fine-tuning minimal. It is well-known that if the $U(1)$ corresponding to $B - L$ which resides in $SO(10)$ is broken by 126-plet, a discrete group Z_2 remains unbroken and can ensure the stability of appropriate dark matter candidate. While the simplest case - a singlet fermionic (1_F) dark matter with a singlet scalar to ensure renormalizable coupling with the SM higgs boson via higgs portal- is a viable scenario, we also investigate other possibilities which include fermionic 10-plets (10_F) with or without a fermionic singlet. One important consequence of using particles from 10_F as dark matter candidate is that the multiplet also contains color triplet which can produce detectable signature in LHC and one can either establish or exclude the model in near future. We concluded that most interesting case is one where we introduce a 10_F with a 1_F which corresponds to the doublet-singlet dark model. The fact that these multiplets can be unified with SM fermions (16_F) as 27-plet under the larger group E_6 opens up an aesthetically pleasing possibility of unifying SM matter with dark matter.

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