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Dark matter from Yukawa-unified SUSY SO(10)

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Unification of GUT-scale t - b - τ Yukawa couplings is a significant feature of simple SO(10) SUSY GUTs. We present the results of a search that used the Markov Chain Monte Carlo (MCMC) technique to investigate the special parameter space regions having both Yukawa unification and WMAP-compatible dark matter relic density. The regions having better than 10% Yukawa unification are characterized by a spectrum having 1st/2nd generation sfermions in the multi-TeV range, 3rd generation scalars in the TeV range, and gauginos in the ~ 100 GeV range, where however the DM relic density is high in most cases. For such solutions one can reduce the relic density either by allowing for neutralino decay to axino plus photon; by imposing gaugino mass non-universality or by imposing generational non-universality. For the other set of solutions found by the MCMC where DM relic density is already low, neutralino annihilation is seen to occur via the light Higgs resonance. Furthermore, one can impose weak scale Higgs soft term boundary conditions and achieve low μ , m_A solutions with neutralino annihilation via a light A resonance, which however are excluded by CDF/D0 measurements of the $B_s \rightarrow \mu^+\mu^-$ branching fraction. The requirements of Yukawa coupling unification and DM relic density lead to new physics signals at the LHC from pair production of 350-450 GeV gluinos. The events are characterized by very high b-jet multiplicity and a dilepton mass edge around neutralino 2 - neutralino 1 mass ~ 50 -75 GeV.

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