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Cosmological implications and LHC signatures of the E_6 inspired SUSY models

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We consider the implications of the E_6 inspired supersymmetric (SUSY) models with an additional $U(1)_N$ gauge symmetry under which right-handed neutrinos have zero charge for collider phenomenology and cosmology. To ensure anomaly cancellation and gauge coupling unification the low energy matter content of these models involve three 27 representations of E_6 and a pair of $SU(2)$ doublets from additional 27 and $\overline{27}$. Thus the considered models predict Z' boson and extra exotic matter beyond the MSSM. We argue that exotic states can play a key role in generation of baryon asymmetry of the Universe through leptogenesis. In particular, the results of our analysis suggest that the successful thermal leptogenesis can be achieved without encountering problems related with the overproduction of gravitinos. Exotic states can also give rise to new channels of Higgs decays. We study the phenomenology of Higgs bosons and explore the two-loop renormalisation group (RG) flow of couplings in the framework of these models. We also consider the production of the Z' and exotic quarks at the LHC that may provide spectacular new physics signals. In the considered models there can be two states which are absolutely stable and can contribute to the dark matter density.

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