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## LHC signatures and cosmological implications of the $E_6$ inspired SUSY models

The breakdown of  $E_6$  gauge symmetry at high energies may lead to supersymmetric (SUSY) models based on the Standard Model (SM) gauge group together with extra  $U(1)_N$  gauge symmetry under which right-handed neutrinos have zero charge.

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  $\bar{27}$ . In these models there are two states which are absolutely stable and can contribute to the dark matter density. One of them is the lightest SUSY particle (LSP) which is expected to be lighter than 1 eV forming hot dark matter in the Universe. The presence of another stable neutral state allows to account for the observed cold dark matter density. The next-to-lightest SUSY particle (NLSP) in these models also tends to be light and can result in the substantial branching ratio of the nonstandard decays of the lightest Higgs boson. We present  $6D$  orbifold GUT construction that lead to the  $E_6$  inspired SUSY models of this type, explore the two-loop renormalisation group (RG) flow of couplings, examine the two-loop upper bound on the lightest Higgs boson mass as well as discuss the implications of the  $Z'$  and exotic states for the LHC phenomenology and cosmology in these models.

### additional information

this talk is based on:

R. Nevzorov, "Quasifixed point scenarios and the Higgs mass in the  $E_6$  inspired supersymmetric models," Phys. Rev. D 89 (2014) 5, 055010 [arXiv:1309.4738 [hep-ph]];

R. Nevzorov, S. Pakvasa, "Exotic Higgs decays in the  $E_6$  inspired SUSY models," Phys. Lett. B 728 (2014) 210 [arXiv:1308.1021 [hep-ph]];

R. Nevzorov, "E6 inspired supersymmetric models with exact custodial symmetry," Phys. Rev. D 87 (2013) 1, 015029 [arXiv:1205.5967 [hep-ph]].

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