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Nonstandard Higgs Decays and Dark Matter in the E6SSM

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We study the decays of the lightest Higgs boson within the exceptional

supersymmetric (SUSY) standard model (E6SSM). The E6SSM is based on the SM gauge group together with an extra $U(1)_N$ gauge symmetry under which right–handed neutrinos have zero charge. The low energy matter content of the E6SSM involves three 27 representations of E_6 and a pair of SU(2) doublets from additional 27 and $\overline{27}$.

Thus E6SSM predicts three families of Higgs–like doublets plus three SM singlets that carry $U(1)_N$ charges. One family of Higgs–like doublets and one SM singlet develop vacuum expectation values. The fermionic partners of other Higgs–like fields and SM singlets form Inert neutralino and chargino states. Two lightest Inert neutralinos tend to be the lightest and next-to-lightest SUSY particles (LSP and NLSP). The considered model can account for the dark matter relic abundance if the lightest Inert neutralino has mass close to half the

Z mass. In this case the usual SM-like Higgs boson decays more than 95\% of the time into either LSPs or NLSPs. As a result the decays of the lightest Higgs boson into $l^+l^- + X$ might play an essential role in the Higgs searches. This scenario also predicts other light Inert chargino and neutralino states below 200 GeV, and

large LSP direct detection cross-sections which is on the edge of observability of XENON100.

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