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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 $\bar{27}$.

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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