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Di-Higgs signatures from R-parity violating supersymmetry as the origin of neutrino mass

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Motivated by the naturalness and neutrino mass generation, we study a bilinear R-parity violating supersymmetric scenario with a light Higgsino-like lightest supersymmetric particle (LSP). We observe that the LSP dominantly decays to νh in a large part of the parameter space, and thus study the pair production of electroweakinos followed by the decays $\tilde{\chi}_1^\pm \rightarrow \tilde{\chi}_1^0 W^{\pm*}$ and $\tilde{\chi}_1^0 \rightarrow \nu h$. This leads to an interesting signature of Higgs boson pair production associated with significantly large missing transverse energy which is grossly distinct

from the di-Higgs production in the Standard Model. We investigate the perspective of probing such signatures by performing a realistic detector level simulation of both the signal and corresponding backgrounds for the high-luminosity high energy phase of the Large Hadron Collider (LHC). We also advocate some observables based on kinematical features to provide an excellent handle to suppress the backgrounds.

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