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Prospects of Heavy Higgs scalar in the natural SUSY at LHC upgrades

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Under supersymmetry (SUSY) models with low electroweak naturalness (natSUSY), which have been suggested to be the most likely version of SUSY to emerge from the string landscape, we examine the viabilities of future search for the heavy SUSY Higgs bosons H, A, Hˆ\pm through various their decay signatures in LHC. The traditional H, A -> tautau, as well as Hˆ\pm -> tau+nu, t+b, with a spectator top-jet channels are considered. In particular, we also examine H/A/Hˆ\pm -> W/Z/h + MET. These decay channels only come from natSUSY, in which the higgsinos are expected at the few hundred GeV scales whilst electroweak gauginos inhabit the TeV scale, such that for TeV-scale heavy SUSY Higgs bosons as the current LHC limits required, their decays modes into gauggino plus higgsino are kinematically open. We evaluate these signals against several Standard Model backgrounds to get both the 95% CL exclusion and 5σ discovery reach in the mA vs. tan β plane for the future high luminosity LHC (HL-LHC) with 3000 fbˆ-1 of integrated luminosity.

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