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Search for a CP-even Heavy Higgs Boson in Supersymmetric B-L SM extension at the LHC

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The detection of a heavy neutral CP-even Higgs boson of the $B-L$ Supersymmetric Standard Model (BLSSM), h', with $m_{h'} \simeq 400$ GeV, at the Large Hadron Collider (LHC) for a center-of-mass energy of $\sqrt{s} = 14$ TeV, is investigated. The following production and decay channels are considered: $gg \to h' \to ZZ \to 4\ell$ and $gg \to h' \to W^+W^- \to 2\ell +$Missing Transverse Energy (MET)), where $\ell = e, \mu$, with integrated luminosity $L_{\text{int}} = 300$ fb^{-1} (Run 3). Furthermore, we also look into the di-Higgs channel $gg \to h' \to hh \to b\bar{b}\gamma\gamma$ at the High-Luminosity LHC (HL-LHC) with an integrated luminosity of $L_{\text{int}} = 3000$ fb^{-1}.
We demonstrate that promising signals with high signal-to-background statistical significance ($S/\sqrt{B}$) can be obtained through the three aforementioned channels.

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