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Discovering a light charged Higgs boson at the LHC

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Most of the current experimental searches for charged Higgs bosons at the Large Hadron Collider (LHC) concentrate upon the $t\bar{b}$ and $\tau\nu$ decay channels. In the present study, we analyze instead the feasibility of the bosonic decay channel $W^{\pm}h$, with the charged gauge boson being off-shell and h being a neutral light Higgs boson, which decays predominantly into $b\bar{b}$. We perform a Monte Carlo (MC) analysis for the associate production of a charged Higgs with such a light neutral one, $pp \rightarrow H^{\pm}h$, at the LHC followed by the aforementioned charged Higgs boson decay, which leads to a $W^{\pm*} + 4\gamma/W^{\pm*} + 4b/W^{\pm*} + 2b2\tau$ final state. The analysis is performed within the 2-Higgs Doublet Model (2HDM) with Yukawa texture of Type-I. We take into account all available experimental constraints from LEP, Tevatron and the LHC as well as the theoretical requirements of selfconsistency of this scenario. In order to study the full process, we provide several Benchmark Points (BPs) amenable to further analysis, with $M_{H^{\pm}} + M_b < M_t$, for which we prove that there is a strong possibility that this spectacular signal could be found at the LHC with center of mass energy of 14 TeV and luminosity of 300 fb^{-1} .

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