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Light charged Higgs boson in $H^\pm h$ associated production at the LHC

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In this work, we investigate the production of charged Higgs boson via $pp \rightarrow H^\pm h$ at the LHC in the Two-Higgs Doublet Model (2HDM) Type-I. By focusing on the case where H is identified as the observed Higgs boson of mass 125 GeV, we study the aforementioned Higgs boson production channel and explore their bosonic decays, namely $H^\pm \rightarrow W^\pm h$ and $H^\pm \rightarrow W^\pm A$, which can reach a sizeable Branching Ratio (BR) and often dominate over the fermionic decays in the theoretically and experimentally viable parameter space. In this regard, we demonstrate that the production process $pp \rightarrow H^\pm h$ followed by $H^\pm \rightarrow W^\pm h$ and/or $H^\pm \rightarrow W^\pm A$ could well be the most promising discovery channel for light H^\pm at the LHC.

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