

# Probing Charged Higgs Bosons in the 2-Higgs Doublet Model Type-II with Vector-Like Quarks

*Saturday, 20 July 2024 14:47 (17 minutes)*

We study the phenomenology of charged Higgs bosons ( $H^\pm$ ) and Vector-Like Quarks (VLQs), denoted as  $T$ , with a charge equal to the top quark, within the Two Higgs Doublet Model Type-II (2HDM-II) framework. We examine two scenarios: one with a singlet ( $T$ ) (2HDM-II+( $T$ )) and another with a doublet ( $TB$ ) (2HDM-II+( $TB$ )). We find that VLQs significantly influence the 2HDM-II's (pseudo)scalar sector, notably easing the stringent mass constraints on the charged Higgs boson from  $B$ -physics observables like  $B \rightarrow X_s \gamma$ , due to altered charged Higgs couplings to SM top and bottom quarks. The impact differs between the singlet and doublet scenarios. We also explore the effects of oblique parameters  $S$  and  $T$  on VLQ mixing angles and present insights into VLQ  $T$  pair production leading to a  $2t4b$  final state, offering guidance for extended Higgs and quark sector searches at the LHC.

## Alternate track

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