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Higgs couplings in Two Higgs Doublet models with controlled flavour changing interactions

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Extended scalar sectors such as Two Higgs Doublet models are an interesting class of extensions of the Standard Model. Flavour changing couplings of the neutral scalars, if not tamed, may constitute a serious source of concern attending to the impressive body of existing experimental constraints. In particular, mixing of the different neutral scalar fields present in such scenarios can yield a would-be Standard Model 125 GeV scalar with (1) modified flavour conserving couplings, (2) flavour changing couplings to (a) quarks in the up or down sectors, and (b) to charged leptons. Considering constraints from the LHC run I and from flavour data, an analysis of a class of Two Higgs Doublet Models where flavour changing interactions arise in a symmetry-controlled manner is presented. In particular attention is devoted to the prospects for flavour changing processes such as lepton flavour changing decays $h \to \mu\tau$, to Higgs decays to down quarks $h \to bs, bd$ and to top decays $t \to hq$ of interest for LHC run II and future colliders.

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