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Predictive 2HDM as a low energy effective theory

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Two-Higgs-doublet models (2HDM), {\em per se}, cannot predict the values of the nonstandard scalar masses (m_H, m_A and m_+). However, assuming that a type-II 2HDM arises as an effective theory at the electroweak scale from a supersymmetric ultraviolet (UV) completion, where the quartic couplings of the 2HDM potential are related to the gauge couplings of the Standard Model (SM), the ever growing LHC Higgs boson data allow the {\em hitherto} unknown nonstandard scalar masses to be almost uniquely determined from just two input parameters: the supersymmetry breaking scale and $\tan\beta$ (the ratio of the two vacuum expectation values). We highlight some of the salient features of this framework not emphasized previously in the context of the Minimal Supersymmetric Standard Model (MSSM), and make specific predictions on the masses and branching ratios of the nonstandard scalars which can be probed by targeted experimental searches. Our framework is valid even if the UV theory is not supersymmetric but something else but unambiguously predicts the scalar quartic couplings at the high scale.

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