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Maximally Symmetric Three Higgs Doublet Model

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I discuss the general Three-Higgs Doublet Model (3HDM) and identify all limits that lead to exact SM alignment. I focus on the most economic setting, called here the Maximally Symmetric Three-Higgs Doublet Model (MS-3HDM). The potential of the MS-3HDM obeys an $Sp(6)$ symmetry, softly broken by bilinear masses and explicitly by hypercharge and Yukawa couplings through renormalisation-group effects, whilst the theory allows for quartic coupling unification up to the Planck scale. Besides the two ratios of vacuum expectation values, $\tan\beta_{1,2}$, the MS-3HDM is predominantly governed by only three input parameters: the masses of the two charged Higgs bosons and their mixing angle σ . Most remarkably, with these input parameters, we obtain definite predictions for the entire scalar mass spectrum of the theory, as well as for the SM-like Higgs-boson couplings to the gauge bosons and fermions. The predicted deviations of these couplings from their SM values might be probed at future precision high-energy colliders.

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