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On the mass spectrum of heavy Higgs bosons in two-Higgs-doublet model in the light of the CDF W-mass anomaly

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We analyze the mass spectrum of the charged and neutral Higgs bosons in the framework of two Higgs doublet model (2HDM) in the light of the precision measurement of the W boson mass by the CDF collaboration. We have considered the most general 2HDM potential with explicit CP violation in the Higgs basis which contains the three CP-mixed neutral mass eigenstates H_1, H_2, and H_3 with $M_{H_1} \leq M_{H_2} \leq M_{H_3}$. The high-precision CDF measurement of the W boson mass is characterized by the large positive value of the T parameter. By identifying the lightest neutral Higgs boson H_1 as the SM-like one discovered at the LHC, we find that it is necessary to have the mass splitting between the charged Higgs boson $H^\pm$ and the second heaviest neutral one H_2 to accommodate the sizable positive deviation of the T parameter from its SM value of 0. By combining the mass splitting between $H^\pm$ and H_2 with the theoretical constraints from the perturbative unitarity and for the Higgs potential to be bounded from below, we implement comprehensive analysis of the mass spectrum of the heavy Higgs bosons taking account of the effects of deviation from the alignment limit and also the mass splitting between H_3 and H_2. We further analyze the behavior of the heavy-Higgs mass spectrum according to the variation of the T parameter. Finally, we discuss some benchmarking scenarios for the searches of heavy Higgs bosons at future colliders such as the high luminosity option of the LHC and a 100 TeV hadron collider.

Secondary category for the parallel session (optional)

Primary authors: Dr JUNG, Dong-Won (Yonsei University); LEE, Jae Sik (Chonnam National University); HEO, Yongtae (Chonnam National University)

Presenter: HEO, Yongtae (Chonnam National University)

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