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Muon $g-2$ in the 2HDM: updates on maximum results and phenomenology

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In this work, we categorize and discuss the maximum contributions to the muon magnetic moment a_μ as well as to the Yukawa and triple Higgs couplings in the flavour-aligned two-Higgs doublet model (2HDM). We focus on the most promising case of a light pseudoscalar Higgs A with large Yukawa couplings to leptons and quarks. By taking into account experimental constraints from LHC, Higgs and flavour physics, we find maximum possible Yukawa couplings of a light A of around $50 \cdots 100$ (leptons) and $O(0.5)$ (quarks). An overall maximum for a_μ of more than 45×10^{-10} is possible in a very small parameter region around $M_A = 20\,GeV$. For M_A up to $100\,GeV$, the maximum possible value of a_μ is compatible with the currently observed deviation if the A couplings to quarks and leptons are both large, making this scenario promising for LHC searches. We also analyse the subleading bosonic two-loop contributions to a_μ , finding values up to 3×10^{-10}.
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