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Can CP be conserved in the two-Higgs doublet model?

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We study the conditions under which the CP violation in the quark mixing matrix can leak into the scalar potential of the real two-Higgs-doublet model (2HDM) via divergent radiative corrections, thereby spoiling the renormalizability of the model. We show that any contributing diagram must involve 12 Yukawa-coupling insertions and a factor of the hard $U(1)_{PQ}$ -breaking scalar potential parameter λ_5 , thereby requiring at least six loops; this also implies that the 2HDM with only softly-broken $U(1)_{PQ}$ is safe from divergent leaks of CP violation to all orders. In both the type-I and -II 2HDMs, we demonstrate that additional symmetries of the six-loop diagrams guarantee that all of the divergent CP-violating contributions cancel. We also show that the CP leak can occur at seven loops and enumerate the classes of diagrams that can contribute, providing evidence that the real 2HDM is theoretically inconsistent.

Mini Symposia (Invited Talks Only)

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