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How charming can the Higgs be?

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The coupling of the Higgs boson to first and second generation fermions has yet to be measured experimentally. There still could be very large deviations in these couplings, as the origin of flavor is completely unknown. Nevertheless, if Yukawa couplings are modified, especially for light generations, there are generically strong constraints from flavor-changing neutral currents (FCNCs). Therefore, it is imperative to understand whether there exists viable UV physics consistent with current data that motivates future Higgs coupling probes. In particular, the charm-quark Yukawa is the next quark coupling that could be measured at the LHC {em if} it is a few times larger than the SM and compatible with flavor data. This is difficult to achieve in the context of standard ansatz such as Minimal Flavor Violation. In this paper we show that within the framework of Spontaneous Flavor Violation (SFV), using a Two Higgs Doublet Model as an example, the Higgs can be sufficiently charming that new LHC probes are relevant. In this charming region, we show that new Higgs states near the EW scale with large couplings to quarks are required, providing complementary observables or new constraints on the SM Yukawa couplings. The down-type SFV mechanism enabling the suppression of FCNCs also allows for independent modifications to the up-quark Yukawa coupling, which we explore in detail as well.

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