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A suppressed Higgs coupling in a classically confromal extension of the standard model

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We consider a classically conformal $U(1)$ extension of the Standard Model (SM). The $U(1)$ symmetry is radiatively broken by the Coleman-Weinberg mechanism, after which the $U(1)$ Higgs field ϕ drives electroweak symmetry breaking through a mixed quartic coupling with the SM Higgs doublet with coupling constant λ_{mix}. We calculate the Higgs triple couplings in this system and find a suppression of the coupling $g_{h\phi\phi}$ when compared to the naively expected value $g_{h\phi\phi} \sim \lambda_{mix} v_h$ ($v_h = 246$ GeV), likely due to the unique nature of the classically conformal potential. The suppression opens up parameter space for the mixing angle θ between SM Higgs and $U(1)$ Higgs eigenstates. We consider experimental signals for such conformal structure via the anomalous Higgs decay $h \to \phi\phi$ and anomalous SM Higgs couplings. The conformal structure would allow for a sizeable anomalous SM Higgs coupling alongside a heavily suppressed $h \to \phi\phi$ decay mode.

Summary

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