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Vector boson dark matter in a classically conformal U(1) 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} . The conformal system features a suppressed coupling $g_{h_1 h_2 h_2} \sim \lambda_{\text{mix}} v_h$ ($v_h = 246$ GeV), likely due to the unique nature of the classically conformal potential, leading to a suppressed $h \rightarrow \phi\phi$ process which may evade future experimental limits. We consider the gauge boson of the new $U(1)$ gauge sector, Z' , to be the dark matter candidate in the absence of kinetic mixing, and interpret constraints on the conformal model in the context of observed values for dark matter abundance.

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