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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 λmix. The conformal system features a suppressed coupling $g_{h_1 h_2 h_2} \sim \lambda_{mix} v_h$ (v_h = 246 GeV), likely due to the unique nature of the classically conformal potential, leading to a suppressed $h \to \phi\phi$ 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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