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First Order Electroweak Phase Transition from Weakly Coupled sub-GeV Physics

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We propose that the dynamics of a scalar ϕ of mass $O(10)$ MeV, weakly coupled to the Higgs, can give rise to a first order electroweak phase transition. Vacuum stability close to the weak scale requires a suppressed (maybe vanishing) top Yukawa coupling before the transition, rising to the Standard Model (SM) value later. All SM flavor could appear similarly, after the electroweak phase transition, through dimension-5 interactions of ϕ suppressed by scales from $O(10^3)$ TeV to near Planck mass. The scalar ϕ is long-lived and can yield missing energy signals in rare kaon decays.

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