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Electroweak Symmetry Non-restoration in UV-complete Models with New Fermions

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In certain extensions of the Standard Model(SM), the interactions between the new scalars and the SM Higgs can cause the electroweak(EW) symmetry to remain broken at temperatures well above the electroweak scale. Fermionic-induced EW symmetry non-restoration (EWSNR) effect has also been studied in the context of effective field theories, where EWSNR is linked to some non-renormalizable interactions; thus, fermionic-induced EWSNR only occurs below specific cutoff temperature. In this talk, I will introduce some UV-complete models with new fermions that have unstored EW symmetry at high temperatures. In these models, fermionic-induced EWSNR is not limited by a cutoff temperature because some of the heavy fermions are always decoupled from thermal equilibrium at high temperatures as a consequence of their mass mechanisms. Then, I will identify the parameter space that satisfies the theoretical (stability of effective potential, perturbative unitarity bound, thermal equilibrium conditions) and experimental constraints. Within this parameter space, I will examine the novel thermal histories of these models and their phenomenological implications.

Summary

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