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Running couplings in the high-temperature effective theory of the Standard Model

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In this work, we study the renormalization-group evolution of parameters in the dimensionally reduced three-dimensional effective field theory (3D EFT) that describes thermally driven electroweak phase transitions of the Standard Model Higgs field, triggered by Beyond the Standard Model physics.
We compute the two-loop running of the 3D EFT including the effect of the leading non-renormalizable terms. We then analyze how the running affects the thermodynamic observables characterizing the phase transition, such as the critical temperature and the transition strength.
By incorporating higher-order corrections in the mass parameter evolution, as well as the running of other effective operators, we set the stage for testing their impact on phase transition dynamics in lattice simulations.

Abstract

Primary author(s) : DASHKO, Andrii (University of Granada); Prof. CHALA, Mikael (Universidad de Granada); Dr. GUEDES, Guilherme (CERN, Theoretical Physics Department)

Presenter(s) : DASHKO, Andrii (University of Granada)

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