

Higher-order-operator corrections to phase transitions in dimensionally reduced EFTs

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The potential observation of a gravitational wave background compatible with a first-order phase transition (FOPT) would be a striking signature of BSM physics. In order to be able to reconstruct the underlying fundamental model, however, it is crucial to increase the precision of theoretical predictions from the thermal QFT side.

The usual approach to the computation of FOPT parameters is through matching to a dimensionally reduced effective field theory (3D EFT), where the effect of the temperature only enters the Wilson coefficients. The construction of 3D EFTs has been taken to unprecedented levels of precision in the recent years, considering effects up to 3-loop order both in matching and renormalization group running of the renormalizable operators. However, as far as the authors know, the effect of higher-dimensional effective operators (EO) that arise at the same order in the power counting have been generally neglected in the literature.

In this talk, we will make a comparative analysis of the contribution of higher-order EO in a full 3-loop order FOPT computation. For concreteness, we shall inspect a model resembling the Higgs sector of the SMEFT up to dimension 6 in the strong transition regime, which has the most interest for its potential for detection, and where EO are expected to be non-negligible. Finally, we will also highlight the challenges to overcome in order to extend these computations to more complex models.

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