

EFT framework for (precision) cosmological phase transition thermodynamics

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Gauge theories at finite temperature exhibit a rigorous scale hierarchy and their bosonic sector is rendered non-perturbative in the infrared. To reliably describe the thermodynamics of a hot electroweak phase transition both perturbative and non-perturbative methods are needed. At the intersection between these methods, one can construct a three-dimensional effective theory (3d EFT) that systematically includes thermal resummations to all orders. Focusing on generic scalar extensions beyond the Standard Model, I determine their 3d EFT and the corresponding effective potential using the in-house software package DRalgo [1]. Finally, I present a minimal approach [2] that reconciles both gauge invariance and thermal resummation for computing thermodynamics of cosmological first-order phase transitions.

[1] A. Ekstedt, P. Schicho, and T. V. I. Tenkanen, DRalgo: a package for effective field theory approach for thermal phase transitions, [2205.08815]

[2] P. Schicho, T. V. I. Tenkanen, and G. White, Combining thermal resummation and gauge invariance for electroweak phase transition, [2203.04284]

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