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Electroweak phase transition: state-of-art thermodynamics and gravitational wave production

Robust studies of the electroweak phase transition (EWPT) in scalar extensions of the Standard Model (SM) utilise dimensionally reduced effective field theories (EFT) and lattice studies to determine thermodynamic properties of the transition. We discuss multiple shortcomings of conventional perturbative approaches based on the resummed effective potential and demonstrate that greater accuracy can be achieved with perturbative methods within the EFT.

We argue that a first-order EWPT in any beyond the SM scenario with heavy new fields that can be described by a SM-like EFT will produce gravitational wave (GW) signatures too weak to be observed at existing and planned detectors. Transitions strong enough to be detected at GW experiments require either higher-dimension operators or light BSM fields in the EFT and therefore necessitate dedicated future studies.

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