Contribution ID: **36** Type: **not specified**

Self Consistent Thermal Resummation: A Case Study of the Phase Transition in 2HDM

Tuesday 20 May 2025 16:45 (15 minutes)

An accurate description of the scalar potential at finite temperature is crucial for studying cosmological first-order phase transitions (FOPT) in the early Universe. At finite temperatures, a precise treatment of thermal resummations is essential, as bosonic fields encounter significant infrared issues that can compromise standard perturbative approaches. The Partial Dressing (or the tadpole resummation) method provides a self consistent resummation of higher order corrections, allowing the computation of thermal masses and the effective potential including the proper Boltzmann suppression factors and without relying on any high-temperature approximation. We systematically compare the Partial dressing resummation scheme results with the Parwani and Arnold Espinosa (AE) ones to investigate the thermal phase transition dynamics in the Two-Higgs-Doublet Model (2HDM). Our findings reveal that different resummation prescriptions can significantly alter the nature of the phase transition within the same region of parameter space,confirming the differences that have already been noticed between the Parwani and AE schemes. Notably, the more refined resummation prescription, the Partial Dressing scheme, does not support symmetry non-restoration in 2HDM at high temperatures observed using the AE prescription. Furthermore, we quantify the uncertainties in the stochastic gravitational wave (GW) spectrum from an FOPT due to variations in resummation methods, illustrating their role in shaping theoretical predictions for upcoming GW experiments. Finally, we discuss the capability of the High-Luminosity LHC and proposed GW experiments to probe the FOEWPT-favored region of the parameter space.

Mini Symposia (Invited Talks Only)

Plenary (Invited talks only)

Authors: WAGNER, Carlos E.M.; BITTAR, Pedro; Dr ROY, Subhojit (Argonne National Laboratory)

Presenter: Dr ROY, Subhojit (Argonne National Laboratory)

Session Classification: Gravitational Waves

Track Classification: Gravitational Waves and Particle Physics