Contribution ID: **58** Type: **not specified**

Primordial Gravitational Waves from Phase Transitions During Reheating

Wednesday, 9 July 2025 17:20 (20 minutes)

We study primordial gravitational waves (GWs) generated from first-order phase transitions (PTs) during cosmic reheating. Using a minimal particle physics model, and a general parametrization of the inflaton energy density and the evolution of the Standard Model temperature, we explore the conditions under which PTs occur and determine the corresponding PT parameters (the PT temperature, duration and strength), which depend on the evolution of the background during reheating. We find that, in certain cosmological scenarios, PTs can be delayed and prolonged compared to the standard post-inflationary evolution. Incorporating these PT parameters, we compute the resulting GW spectrum generated from the various processes occurring during a first-order PT: bubble collisions, sound waves, and magneto-hydrodynamic turbulence. We find that, in comparison to the standard cosmological history, the GW amplitude and peak frequency can be modified by several orders of magnitude due to the additional enhancement or suppression arising from the cosmological evolution during reheating. In particular, the GW spectra could be within the reach of next-generation GW and CMB observatories.
(based on arXiv: 2506.02116)

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Session Classification: Parallel 2