Contribution ID : **15** Type : **not specified**

Gravitational-Wave Experiments and Collider Synergies: Unveiling First-Order Phase Transitions

Sunday, 28 September 2025 10:30 (30)

The detection of the stochastic gravitational-wave background (SGWB) offers a powerful window into both astrophysical and cosmological phenomena. In this talk, we provide a brief overview of the current status of SGWB measurements and their implications for cosmological first-order phase transitions. We explore search strategies that future space-based interferometers – using LISA as a benchmark – may employ, and present forecasts for the achievable reconstruction accuracy. The forecasts highlight the significant potential of gravitational-wave observatories to deepen our understanding of first-order phase transitions in the early universe, with profound consequences for particle physics. Indeed, by detecting or constraining the SGWB from such transitions, these experiments can prove the existence of BSM physics and/or tightly restrict the viable parameter space of particle physics models, in compelling synergy with present and future collider experiments.

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Session Classification : Plenary