

Non-perturbative approach for scalar particle production in Higgs- R^2 inflation

Thursday 4 December 2025 18:42 (1 minute)

Gravitational particle production in cosmology is a mechanism through which particles of different natures are produced during the very early universe. It is a general mechanism that explains how the universe became populated with the particles of the Standard Model after cosmic inflation and may also account for the origin of dark matter. In this work, we study the non-perturbative production of massive scalar particles in the Higgs- R^2 inflation model, a two-field scalar inflation model within the Einstein frame. We consider spectator scalar fields that are conformally or minimally coupled to the gravitational field through the curvature scalar R which in turn is a time-dependent function determined by the fields driving inflationary dynamics. We numerically compute the production of these particles using the Bogolyubov transformation method for each scenario, aiming to assess the spectrum of the produced particles. For both scenarios, we consider light particles with masses and large masses that exceed the Hubble scale at the end of inflation. We use these numerical results to calculate the relic abundance to find out if the model is viable as a dark matter candidate.

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Session Classification: Posters