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Non-thermal moduli production during preheating in α-attractor inflation models

Abstract: Production of gravitationally coupled light moduli fields must be suppressed in the early universe, so that its decay products do not alter Big Bang Nucleosynthesis (BBN) predictions for light elements. On the other hand, the moduli quanta can be copiously produced non-thermally during preheating after the end of inflation. In this work, we study the production of moduli in the α-attractor inflationary model through parametric resonances. For our case, where the inflationary potential at its minimum is quartic, the inflaton field self-resonates, and subsequently induces large production of moduli particles. We find that this production is suppressed for small values of α. Combining semi-analytical estimation and numerical lattice simulations, we infer the parametric dependence on α and learn that α needs to be less than 10^{-8} m_{pl} to be consistent with BBN. This in turn predicts an upper bound on the energy scale of inflation and on the reheating temperature. Further, it implies an extremely small tensor-to-scalar ratio that quantifies the amplitude of primordial gravitational waves over large scales.

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