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Probing Inflationary Reheating with Graviton Bremsstrahlung

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Reheating is a theory explaining the transition of the Universe from the end of inflation to the radiation phase before Big Bang nucleosynthesis (BBN). Many beyond the Standard Model (BSM) phenomena, such as dark matter production, baryogenesis, and phase transitions, may have occurred before BBN. Probing the physics before BBN is challenging because the background is not transparent to usual messengers like photons or neutrinos. However, using gravitational waves (GWs) is a promising method. In this talk, I will discuss the inevitable stochastic GW spectrum resulting from graviton bremsstrahlung during inflationary reheating. We will focus on an inflaton, denoted as ϕ, oscillating around a generic monomial potential $V(\phi) \sim \phi^n$, while considering two different reheating scenarios: (i) inflaton decay and (ii) inflaton annihilation. I will demonstrate the dependence of GWs on the shape of the inflaton potential as well as the type of inflaton-matter coupling. Finally, I will highlight the novel potential of future high-frequency GW detectors in probing the dynamics of reheating, which could potentially shed light on the BSM physics preceding BBN.

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