

Gravitational waves from Reheating

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We investigate a novel gravitational wave (GW) production mechanism from gravitons generated during the pre-thermal phase of cosmic reheating, where the energy density is dominated by non-thermalized inflaton decay products, dubbed reheats. We consider multiple production channels, including: i) pure inflaton-inflaton annihilation, ii) graviton Bremsstrahlung from inflaton decay, iii) scatterings between an inflaton and a reheaton, and iv) scatterings among reheats. To determine the resulting GW spectrum, we solve the Boltzmann equation to obtain the graviton phase-space distribution for each channel. We find that the third channel, iii), dominates due to the large occupation number of reheats at highly-energetic states during the pre-thermalization phase. Notably, in scenarios with a low inflaton mass, the GW spectrum could fall within the sensitivity range of future experiments such as the Einstein Telescope, the Cosmic Explorer, the Big Bang Observer, and ultimate DECIGO.

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