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Primordial Gravitational Waves in Non-Standard Cosmologies

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Assuming that inflation is followed by a phase where the energy density of the Universe is dominated by a component with a general equation of state, we evaluate the spectrum of primordial gravitational waves induced in the post-inflationary Universe. We show that if the energy density of the Universe is dominated by a component ϕ before Big Bang nucleosynthesis, its equation of state could be constrained by gravitational wave experiments depending on the ratio of energy densities of ϕ and radiation, and also the temperature at the end of the ϕ dominated era. Also, we discuss the impact of scale dependence of tensor modes on the primordial gravitational wave spectrum during the ϕ-domination. These models are motivated by beyond Standard Model physics and scenarios for non-thermal production of dark matter in the early Universe. We also constrain the parameter space of the tensor spectral index and the tensor-to-scalar ratio, using the experimental limits from gravitational wave experiments.

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