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Constraining the General Oscillatory Inflaton Potential with Freeze-in Dark Matter and Gravitational Waves

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Abstract

The reheating phase after inflation is one of the least observationally constrained epochs in the evolution of the Universe. The forthcoming gravitational wave observatories will enable us to constrain at least some of the non-standard scenarios. For example, if the radiation bath is produced via the perturbative inflaton decay that oscillates around a flat minimum of the potential of the form V∞ ϕ^(2n), with n > 2. In such scenarios a part of the inflationary gravitational wave spectrum becomes blue tilted, making it observable, depending on the inflation energy scale and the reheating temperature. The degeneracy between the latter two parameters can be broken if dark matter in the Universe is produced by the freeze-in mechanism. The combination of the independent measurement of dark matter mass with gravitational wave observations makes it possible to constrain the reheating temperature and the energy density at the end of inflation.

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