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Abstract

- We study quintessential inflation with an inverse hyperbolic type potential $V(\phi) = V_0/\cosh(\phi^n/\lambda^n)$, where V_0, λ and "n" are parameters of the theory. We obtain a bound on λ for different values of the parameter n. The spectral index and the tensor-to-scalar-ratio fall in the 1σ bound given by the Planck 2015 data for $n \geq 5$ for certain values of λ. However for $3 \leq n < 5$ there exist values of λ for which the spectral index and the tensor-to-scalar-ratio fall only within the 2σ bound of the Planck data. Furthermore, we show that the scalar field with the given potential can also give rise to late time acceleration if we invoke the coupling to massive neutrino matter. We also consider the instant preheating mechanism with Yukawa interaction and put bounds on the coupling constants for our model using the nucleosynthesis constraint on relic gravity waves produced during inflation.

- We consider a model of quintessential inflation based upon inverse hyperbolic potential. We employ curvaton mechanism for reheating which is more efficient than gravitational particle production; the mechanism complies with nucleosynthesis constraint due to relic gravity waves. We obtain a lower bound on the coupling constant g that governs the interaction of curvaton with matter fields. We study curvaton decay before domination and decay after domination and plot the allowed region in the parameter space in both cases.

- We examine a scenario in which late-time cosmic acceleration might arise due to the coupling between baryonic matter and dark matter without the presence of extra degrees of freedom. In this case, one can obtain late-time acceleration in Jordan frame and not in Einstein frame. We consider two different forms of parametrization of the coupling function, and put constraints on the model parameters by using an integrated datasets of Hubble parameter, Type Ia supernova and baryon acoustic oscillations. The models under consideration are consistent with the observations. In addition, we perform the statefinder and Om diagnostics, and show that the models exhibit a distinctive behavior due to the phantom characteristic in future which is a generic feature of the underlying scenario.