INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The inflationary paradigm which was proposed in the 1980s to solve the so-called homogeneity, flatness and monopole problems of the big-bang theory is now an indispensable part of any study about the origin and evolution of our universe. Although a lot of progress has been made in this direction to have a model independent description of inflation from effective theory perspective, it is still largely a model dependent phenomena. A phase of exponential expansion can be easily achieved by a simple scalar field. An inflationary model is usually specified by a potential V(φ). Therefore, the list of inflationary models is thus practically inexhaustible. However, thanks to the remarkable advancements in observational cosmology, which provides us sever constraints on the model building. A large number of well-known inflationary models are found to be tightly constrained or disfavored by the data. For instance, the simple power-law chaotic models $V(\varphi) \propto \varphi^n$ are now ruled out. This motivates us to consider some non-standard modifications to inflationary models such as consider non-polynomial type modification to the simple scalar field potentials or include higher derivative kinetic term such as Galilean terms. Other important aspect is the phase of reheating when the inflaton decays to other particles. Though lack of experimental observations make this phase largely unconstrained, there exists large number of attempts to constrain the reheating phase from data. In this thesis we have extended the existing analysis of reheating and preheating constraints considering more realistic scenario. Finally we also connect the reheating constraint analysis with the dark matter phenomenology in light of cosmic microwave background.