# Abstract

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### Title: Unification of Different Cosmological Ages in Modified Gravity Theories and Study of Warm Inflation

The thesis consists of nine chapters and it is divided into two parts. The first part consists of five chapters and it is related to the various cosmological solutions in different modified gravity theories. The first chapter contains an introduction to relativistic cosmology while the next four chapters deal with the research work in various modified gravity theories. The second part consists of three chapters and it deals with warm inflation. The first chapter in this part (i.e. chapter 6) gives an overview of inflation in a nutshell. Then the following two chapters (i.e. chapter 7 & 8) contain the research work on warm inflation. Finally, a brief discussion and future prospect of the research work has been presented in chapter 9. Briefly, this thesis describes different cosmological eras in various modified gravity theories together with a continuous cosmic evolution of the universe.

Recent observations have shown that our universe is going through an accelerated expanding phase. To support this observation, cosmologists have proposed various modified gravity theories. In chapter 2 & 3, two such modified gravity theories, namely Einstein-Cartan-kibble-Sciama (ECKS) gravity, and f(T) gravity theory, have been extensively studied. In both these gravity theories, it has been shown that a continuous cosmic evolution from inflationary era to present time accelerating phase is possible. In chapter 4, the emergent scenario in Hořava-Lifsitz (HL) gravity has been studied. The nature of the fluid required to describe the emergent phase in HL gravity has been examined. Also, the thermodynamic analysis of these models has been presented in these chapters. In chapter 5, a cosmological model in f(R,T) gravity model has been proposed. The detailed cosmological solutions of the model have been studied and different model parameters are estimated through the observational data.

In the early epoch, there was a huge expansion (inflation) of the universe which was fully satisfactory with observations. The idea of reheating phase which is required after the end of cold inflation to make smooth transition to matter dominated phase has been modified by introducing the idea of warm inflation where the inflationary dynamics is governed by the interaction between radiation and inflaton field. In chapter 7, the warm inflationary scenario has been studied in terms of particle creation mechanism in the context of non-equilibrium thermodynamics. In chapter 8, a detailed study of warm inflation in fractal gravity has been presented. Here various models have been presented as well as both the weak and strong dissipative regimes have been studied. Finally, the thesis ends with brief discussions and guidelines for possible future work in chapter 9.

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