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Title of the Thesis: Cosmological Inflation and Late Time Acceleration of Universe

Thesis Abstract

We analyze the viability of a vacuum Gauss-Bonnet cosmology by examining the dynamics of the homogeneous an anisotropic background in 4+1 dimensions. The trajectories of the system either originate from the standard singularity or from non-standard type, the later is characterized by the divergence of time derivative of the Hubble parameters for its finite value. At the onset, the system should relax to Einstein phase at late times as the effect of Gauss-Bonnet term becomes negligible in the low energy regime. However, we find that most of the trajectories emerging from the standard big-bang singularity lead to future re-collapse whereas the system beginning its evolution from the non-standard singularity enters the Kasner regime at late times. This leads to the conclusion that the measure of trajectories giving rise to a smooth evolution from a standard singularity to the Einstein phase is negligibly small for generic initial conditions. Most importantly our study conclude that the nonstandard singularity discussed earlier by J. Wheeler is not a very particular case of the dynamics, it rather represents a typical feature of the cosmological dynamics which frequently occurs during the evolution.

We also study brane inflation in a warped deformed conifold background that includes general possible corrections to the throat geometry sourced by coupling to the bulk of a compact Calabi-Yau space.

We focus specifically, on the perturbation by chiral operator of dimension 3/2 in the CFT. We find that the effective potential in this case can give rise to required number of e-foldings and the spectral index nS consistent with observation. The tensor to scalar ratio of perturbations is generally very low in this scenario. The COBE normalization, however, poses

certain difficulties which can be circumvented provided model parameters are properly fine tuned. We find the numerical values of parameters which can give rise to enough inflation, observationally consistent values of density perturbations, scalar to tensor ratio of perturbations and the spectral index.

We also study the possibility of obtaining dark energy solution in a D-brane scenario in a warped background that includes brane-position dependent corrections for the non-perturbative superpotential. The volume modulus is stabilized at instantaneous minima of the potential. Though the model can account for the existence of dark energy within present observational bound – fine-tuning of the model parameters becomes unavoidable. Moreover, the model does not posses a tracker solution. This scenario was applied to inflation earlier. We have shown that de-Sitter is a late time attractor of the model. The present value of the cosmological constant can be obtained by fine tuning the value of the constants in potential . The absence of a tracker solution gives rise to additional dependency on the initial conditions of the field.