Notification No: **523/2022**
Notification Date: **07/11/2022**
Date of Award: **12/10/2022**

Name of Scholar : **Yogesh**
Name of Supervisor : **Prof. Rathin Adhikari**
Department/Centre : **Centre For Theoretical Physics**
Thesis Title: **Probing Models of Inflation in Early Universe with Cosmological Observations**

Thesis Findings

In the thesis, we discussed the different phenomena of the early Universe, some of the basics of the Big Bang model, and the problems associated with this model, like the horizon and flatness problem, which can be solved under the inflationary paradigm. In the latter, when the quantum effects dominate, the interaction of gravity with other known forces of nature- like strong, weak, and electromagnetic comes into play. For such unification between forces, the Supergravity model is more appropriate. In our work, we have considered a Supergravity motivated inflationary potential in which both F and D term scalar potential, or one of them, could play the role of inflationary potential. We have shown that the D-term dominated potential is compatible with the recent Planck observations. Apart from the standard inflationary cosmology, we have also considered the different inflationary potentials in nonstandard inflationary cosmology, such as the braneworld scenario where all the standard model particles are situated on the brane. However, gravity is the only force propagating in bulk. We have also discussed the Randall Sundrum models (RS-I and RS-II). We have shown the implications of the extra spatial dimension, how it modifies the Friedmann equations, and related inflationary parameters. As inflation ends, reheating phase

begins. In our work, we have performed the reheating analysis in both standard inflationary scenarios and the braneworld inflation model. In order to check consistency with String theory, certain conjectures on the inflation potential are imposed, known as the Swampland and Trans-Planckian Censorship Conjectures (TCC). Both of them restrict several inflationary models. In the thesis, we have shown that both conjectures and inflationary observables can be addressed in RS-II. Moreover, we have also discussed the formation of Primordial Black Holes (PBHs) and how the primordial black holes could play a key role in describing the current dark matter density. We have shown that PBHs can be produced over a wide range of mass in our model.