INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student : Abhijit Kumar Saha

Roll Number : 126121001

Programme of Study : Ph.D.

Thesis Title: "Role of scalar fields in particle physics and cosmology"

Name of Thesis Supervisor(s) : Dr. Arunansu Sil

Thesis Submitted to the Department/ Center : Physics

Date of completion of Thesis Viva-Voce Exam : 18.03.2019

Key words for description of Thesis Work : Scalar fields, particle physics and cosmology

---

SHORT ABSTRACT

The primary motivation of my thesis is to study the possibility of explaining few longstanding puzzles of particle physics and cosmology by introduction of additional scalar fields. In the first two chapters, we have attempted to explore successful cosmological inflation by extending the Standard model (SM) of particle physics with extra degrees of freedom (particularly scalar fields) in both supersymmetric and non-supersymmetric framework. One of the works shows a possible direction to realize dynamical supersymmetry breaking at the end of successful inflation. In the other work we have studied the fate of Higgs vacuum during and after inflation. Next we investigate scalar dark matter phenomenology, neutrino mass and Higgs vacuum stability in a combined framework of SM extended by two additional scalar field and three RH neutrinos. After that we have shown how a strongly coupled sector that is responsible for realizing inflation, can at the same time provide the potential candidate for scalar dark matter. In the final work we have studied Higgs vacuum stability in singlet doublet dark matter framework assisted by a scalar field.