

# Theoretical Physics Seminar

## Setting Initial Conditions for Inflation with Reaction-Diffusion Equation.

**Speaker:** Mr. Arpan Das

**From:** Institute of Physics Bhubaneswar

**When:** 21<sup>st</sup> september 2017, Thursday 4:00 pm

**Place:** Room No. 469

We discuss the issue of setting appropriate initial conditions for inflation. Specifically, we consider natural inflation model and discuss the fine tuning required for setting almost homogeneous initial conditions over a region of order several times the Hubble size which is orders of magnitude larger than any relevant correlation length for field fluctuations. We then propose to use the special propagating front solutions of reaction-diffusion equations for localized field domains of much smaller sizes. Due to very small velocities of these propagating fronts we find that the inflaton field in such a small field domain changes very slowly, contrary to naive expectation of rapid roll down to the true vacuum. Continued expansion leads to the energy density in the Hubble region being dominated by the vacuum energy, thereby beginning the inflationary phase. Our results show that inflation can occur even with a single localized field domain of size much smaller than the Hubble size. We discuss possible extensions of our results for different inflationary models, as well as various limitations of our analysis (e.g. neglecting self gravity of the localized field domain).