

MATHEMATICAL AND THEORETICAL
PHYSICS AFTERNOONS

Friday, 14 December 2018

13.30-14.30: Gizem Şengör Syracuse University, USA

A look at Cosmological Perturbations during Preheating with Effective Field Theory Methods

Abstract: Cosmological backgrounds in general possess time dependence. On these backgrounds scalar degrees of freedom that transform nonlinearly under time diffeomorphisms arise to guarantee the time diffeomorphism invariance of the action. In the early universe these time dependent backgrounds can be attributed to the presence of time dependent scalar fields that dominate the energy momentum density of the universe. Then the species of the scalar degree of freedom that transforms nonlinearly under time diffeomorphisms correspond to perturbations of the scalar field that gives rise to the time dependence of the cosmological background at a given era. Effective field theories (EFT) of cosmological perturbations generalize the interactions between cosmological perturbations of different species based on their transformation properties under diffeomorphisms.

Preheating refers to the stage at the end of inflation where the inflaton field continues to dominate the energy momentum density but transfers its energy to other fields through resonance, as opposed to perturbative decays. The aim of this talk is to consider general interactions between the perturbations of the inflaton and a second scalar field during Preheating, to understand the scales these interactions introduce and the type of effective species they lead to under nonrelativistic limits.

14.30-15.00: Coffee Break

15.00-16.00: Andrew Semenov Lebedev Physical Institute, Moscow, Russia

ImF-method and real-time approach to the dynamics of superconducting bridges and Josephson junctions at low temperature

Abstract: One of the standard approaches for estimation of tunneling rates in quantum systems is so-called ImF-method. It is based on the evaluation of the imaginary part of free energy which originates after some analytic continuation procedure. However, in the experiments one can't measure macroscopic tunneling rates directly but only the observables which are sensitive to these processes. As example, for Josephson junctions one can perform transport measurements and obtain induced voltage or switching current distribution. In order to make the bridge between theory and experiment it is necessary to solve kinetic master equation which is valid only in long-time limit. In result one can estimate transport coefficients only at low frequencies.

In my talk I will present the another approach to these problems which is based on Keldysh technique combined with duality arguments. Considering short superconducting bridge as example I will show the relation between two approaches and discuss how to evaluate voltage cumulants at finite frequencies. Also, I will discuss some general analytical properties of Green functions and their relation to the problem of evaluation of macroscopic tunneling rates.