The Global COE Program
"The Next Generation of Physics, Spun from Universality and Emergence"
Bilateral International Exchange Program (BIEP, invite) report

Send report to: Your responsible Professor in Kyoto University
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(Year/Month/Day) 2010/03/09

Invited Student

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Responsible Researcher in Kyoto University

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Research Project

Title	**1-loop corrections to DBI Inflation**
Duration	**2 months**

Research:

-With Professor David Wands and Professor Misao Sasaki we are looking at perturbations from the waterfall field in Hybrid Inflation Model. Traditionally perturbations from Hybrid Inflation models only come from the inflaton field. Several works have looked at perturbations in the waterfall field during the tachyonic instability that ends inflation concluding that no relevant perturbations would arise from the second field. Recently, Mulryne et al. have argued that the waterfall field could produce large scale perturbation. They claimed that the tachyonic instability would enhance small fluctuations acquired during inflation. Although such perturbations wouldn't have a direct effect on the observed power spectrum of primordial perturbations, they could affect the bispectrum. We revisited this model to study the perturbations of the waterfall field and its evolution during inflation. We saw no mathematical evidence for such claim so far;

-With Professor Takahiro Tanaka and Dr. Frederico Arroja we are looking at 1-loop corrections of the power spectrum of inflationary models. Loop corrections were thought to be unimportant during inflation for many years. Recently people became interested in the higher order statistics of perturbations generated during inflation as future cosmic microwave observations, such as PLANCK, may bring more information about them. Throughout the investigation of the higher order correlation functions, people started to notice that loop corrections may have some non-negligible effect on observations. One is the logarithmic running of the power spectrum due to loop corrections first pointed out by Steven Weinberg. Another related issue is about the screening of the cosmological constant (or vacuum energy) during inflation. There are repeated claims that the cosmological constant may decay due to loop corrections during inflation, which may solve the graceful exit problem in the simple old inflation model. However, recently it was pointed out that there was a mistake in many previous works about the treatment of renormalisation in the inflationary universe. We are planning to apply this argument to a particular model, DBI inflation, in which a large observational effect could be expected.

We have identified the terms that have not been studied in the literature. We are looking at whether the same mechanism to eliminate logarithm works for these different type of terms.

Activities

I attended to several talks and seminars in Yukawa Institute of Theoretical Physics. I also participated on the Cosmology Journal Club held every Tuesday lunch. I participated in the GCOE Symposium "Symmetry Breaking and Quantum Phenomena"

My stay here gave to the graduate students and extra opportunity to interact and discuss science with a foreign person. So we could discuss and in a complementary way understand a particular issue.

The BIEP Program is an incredible opportunity for students to work on international collaborations when they exist.