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
gcoe-biep@scphys.kyoto-u.ac.jp , gcoe-office@scphys.kyoto-u.ac.jp

(Year/Month/Day)_____

Invited Student

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Research Project

Title	**Studying the Propagation of Ultra-High Energy Cosmic Ray Nuclei**
Duration	**2011/11/11-2012/01/17**

Please summarize your activities and results during your stay in Kyoto University.
Also please describe how your stay has been beneficial to the graduate students in the host institute. You can add a sheet, if you need more space.
You can also write any comments and requests to the GCOE program.

During my stay in Kyoto University, I discussed two topics with Professor Nagataki and his collaborators: one is "IceCube non-detection of GRBs: Constraints on the fireball properties ", the other is "The anisotropy amplitude constraints on Cosmic Rays from Fermi Bubble".

The former study is on the high-energy neutrino production at Gamma-Ray Bursts (GRBs). Recently, IceCube experiment reported a severe constraint on the production of high-energy Neutrinos from GRBs. However, we found that their analysis contains some mistakes (over-estimate) when they estimate the expected neutrino flux from observed GRBs. Thus we analyzed the estimation correctly, and found that their constraint is not severe for GRB neutrino scenario yet. This study is strongly related with Ultra-High Energy Cosmic Rays (UHECRs), because high energy neutrinos are produced through the interaction
Between UHECRs and GRBs. I am writing a paper on it that will be submitted to a refereed Journal in the very near future.

The latter study is on the propagation of UHECRs in Milky Way. Especially, we considered The propagation from Fermi Bubble that was found in GeV gamma-rays very recently. Fermi Bubble can be a promising source of UHECRs due to its big structure. We calculated Propagation of UHECRs taking into account the bending effects of UHECRs by magnetic fields in Milky Way. We could obtain some sky maps of arrival directions of UHECRs. Then we estimated the allowed fraction of UHECRs from Fermi Bubble by calculating the expected anisotropy of distribution of arrival directions of UHECRs and comparing it with observations. We obtained the upper limit of the fraction which suggests the activity of Fermi Bubble. I will write a paper on it that will be submitted to a refereed journal in the Near future.

I've finished a draft for the first work, and have done most of the second work. I attended a workshop on "Numerical simulation of Supernova explosion" held in Yukawa Institute, and gave a talk on my first work. I attended three seminars during my stay, which are "Hypernova model for ultra-high energy cosmic rays" given by Dr. Xiang-Yu Wang, "Multimessenger signals in cosmic backgrounds" given by Dr. Alexander Kusenko, and "Numerical simulations of relativistic jets" given by Dr. Manel Perucho Pla, respectively. I also attended lunch meetings, New Year Ceremony, and tea parties held in Yukawa Institute. During the two months, I met many new friends including graduate students and post-docs. We had many instructive discussions, not only on astrophysics but also on Japanese and Chinese cultures.

The communications between the graduated students in Kyoto University and me did expend our horizons, including a wider understanding of our different research fields, different analysis methods and different cultures. Furthermore, my works in Kyoto University are relative to the discovery of Fermi Bubble and the negative result for GRB neutrinos of IceCube, which are two important astronomy discoveries in 2011. I believe that my works can bring some new ideas to the graduated students, increasing the diversity of their researches, which is good to their creativations in their graduated study.