

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) _____ 02/26/2011 _____

Invited Student

Name	Wanming Qi
University and Country	Brown University, USA
Grade	Doctor 1 (i.e, 3rd-year graduate student)
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e-mail address	Wanming_Qi@brown.edu
URL	http://www.brown.edu/Research/ Environmental_Physics/Environmental_Physics/Welcome
Name and Position of Ph.D. advisor	John Bradley Marston; Professor of Physics
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Responsible Researcher in Kyoto University

Name	Glenn Curtis Paquette
Group and Faculty	Nonlinear Dynamics group in physics department
Position	GCOE Associate Professor
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Research Project

Title	Renormalization-Group Approach to Non-Equilibrium Fluid Dynamics
Duration	From 01/10/2011 to 02/28/2011

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.

My stay in Kyoto University has been very fruitful for both the researchers in Kyoto University and me.

During my stay, I studied with Prof. Paquette about the properties of the renormalization group (RG) to apply it to non-equilibrium fluid dynamics. We were able to derive an important theorem about this RG, which states what the system does not have to flow to the exact diagonalized form in order to produce the exact statistics, and only the zero-generator condition is sufficient. That theorem largely extends the validity of the method, and leads to deeper understanding about Wegner's flow equation. We plan to further explore this property and find out how to extract exact non-equilibrium statistics using RG.

In the meantime, I have learnt much about non-equilibrium dynamics from Prof. Paquette as he has been developing a generalized free energy for non-equilibrium systems. That is closely related to my research. We will start cooperation on this subject too after my visit.

I also participated in other academic activities. I gave seminars about my research both in the nonlinear-dynamics group in physics department and in Prof. Michio Yamada's research group in Research Institute of Mathematical Sciences. The direct statistical approach we are developing for turbulence interests many researchers who study the general nonlinear systems and also those study the phenomenology of fluid dynamics. I also learnt a lot about other phenomena of turbulence observed by Prof. Yamada's group through direct numerical simulation, and this opens up the future possibility of cooperation in which we can provide a theoretical explanation for Prof. Yamada's group's observation.

My visit has been especially beneficial for the graduate students in both the nonlinear dynamics group and Prof. Yamada's group, as I have been in frequent contact with them. Firstly, my existence has created an English language environment for them over these 50 days. They have gained much practice in using English to convey ideas both in academic discussion and everyday life. Secondly, they have also learnt a lot from my seminars and other research experience that I shared with them. That has broadened their view about their research field and is beneficial for their academic career.

Finally, I would like to thank the GCOE program for this opportunity which has yielded fruitful results.

