

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)_____2010/12/09_____

Invited Student

Name	Lev Vidmar
University and Country	Jozef Stefan Institute, Slovenia
Grade	Ph.D. student
Phone and FAX	+386 1 477 3122, +386 1 477 3724
e-mail address	lev.vidmar@ijs.si
URL	www-f1.ijs.si/~vidmar
Name and Position of Ph.D. advisor	Prof. Janez Bonca
e-mail address of Ph.D. advisor	janez.bonca@ijs.si

Responsible Researcher in Kyoto University

Name	Takami Tohyama
Group and Faculty	Group for Solid state physics Yukawa Institute for Theoretical Physics
Position	Professor
e-mail address	tohyama@yukawa.kyoto-u.ac.jp
Phone and FAX	+81-75-753-7022

Research Project

Title	Effect of phonons on Doped-Mott insulators
Duration	2010/10/24 - 2010/12/6

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 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 at Yukawa Institute for Theoretical Physics in Kyoto, my research was devoted to investigation of fully quantum models, driven out of equilibrium. In particular, we investigated the dynamics of charged particles under the influence of constant electric field.

The last few months before coming to YITP in Kyoto, we developed in our research group at Jozef Stefan Institute in Ljubljana (Slovenia) a numerical method which calculates time propagation of the ground state when the external electric field is switched on, via Lanczos time evolution. At YITP we focused on the physical properties of one hole, doped to a Mott insulator, as described in the framework of the t - J model. Additionally, we added lattice degrees of freedom to the Hamiltonian and investigated the competition between charge, spin and phonon degrees of freedom.

When the system is exposed to an external electric field, the hole starts to move and excites additional spins and phonons. As a consequence, the total energy of the system increases with time and a stationary state with a constant current is developed. During our research, we investigated the response of the system, which has already reached a steady state current, when the electric field is switched off. In particular, we were interested in the interplay between kinetic, magnetic and lattice energy. It turned out that the system tends to minimize its kinetic energy during the relaxation process at the expense of increased magnetic and lattice energy. This non-equilibrium relaxation provides us with a valuable information how in a correlated electron models coupled to phonons, different degrees of freedom are coupled.

During my stay, I delivered twice a 15 minutes seminar about my current work. The seminars were attended by other students of the Solid state physics group at YITP. I discussed my work several times with other members of the group, particularly with other students. We also discussed several issues connected to their work. All in all, in my opinion we all took advantage of stimulating discussions and therefore all benefited from my stay at YITP.

I would like to thank the BIEP program for giving me the opportunity to visit a highly appreciated Yukawa Institute. I would also like to thank all members of the Solid state physics group at YITP for warm hospitality during my stay.