

528th ASRC Seminar

Date: 10:30 ~12:00, 3 September

Location: Meeting room 302, ASRC Building

Speaker: Prof. Janez Bonca

(University of Ljubljana)

Title: Numerical study of relaxation dynamics
in a lightly doped Mott insulator

I will focus on a fundamental question of how many-body states behave when driven far from their equilibrium by a finite external driving. Many theoretical studies have recently focused on the dielectric breakdown of the Mott insulator mostly within the framework of the half filled Hubbard model. Much less is known about non-equilibrium properties of strongly-correlated systems away from half filling, where unconventional superconductivity may possibly emerge. I will present a fundamental study of a single hole and two holes in the two dimensional t - J model and the t - J Holstein model driven away from the equilibrium by a constant electric field. Taking fully into account quantum effects we follow the time-evolution of systems from their ground state as the constant electric field is switched on at $t=0$, until they reach a steady state.

In the case of the t - J model we demonstrate that there exist three distinct regimes of the electric field (adiabatic, dissipative and the Bloch-oscillations regime) which differ with respect to the real-time response [1]. As a counterintuitive result, the *d.c.* current is shown to be maximal for a finite value of the electric field. When introducing relevant coupling to phonons, most of the gained energy from the electric field flows predominantly into magnon excitations [2].

We show that when driving a bound hole pair in the t - J model, the pair dissociates as soon as the electric field is strong enough to induce a steady-state current. Holes dissociate predominantly in the direction perpendicular to the electric field [3].

Finally, I will discuss relaxation dynamics after the excitation of the system by an optic pulse.

[1] M. Mierzejewski, L. Vidmar, J.Bonca, P. Prelovsek, Phys. Rev. Lett. 106, 196401 (2011).

[2] L. Vidmar, J.Bonca, T. Tohyama, and S. Maekawa, Phys. Rev. Lett., 107, 246404 (2011).

[3] J.Bonca, M. Mierzejewski, and L. Vidmar, Phys. Rev. Lett. 109, 156404 (2012).

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