Nonequilibrium properties of Mott insulators

Zala Lenarčič

Institute for theoretical physics, University of Cologne

Mott insulators represent a paradigmatic system for studying the effects of strong electron correlations and have opened fundamental questions when driven out of equilibrium. When exposed to a constant or a pulsed electric field their insulating nature can be modified due to the creation of excitations, which can be represented with effectively charged holons and doublons. It is a great theoretical challenge to understand how charge carriers are created, but also how stable they are, on what time scales they relax, how they interact with other bosonic degrees of freedom, and eventually recombine.

I will present our contribution to the understanding of dielectric breakdown in spin polarized Mott insulators, establishing the threshold constant electric field for substantial creation of charged excitations. Addressing the reversed process, as relevant for femtosecond pump-probe experiments on Mott insulators, I will consider charge relaxation and recombination in effectively two- and one-dimensional systems. After giving a brief insight into the short-time dynamics of excited charges I will show that in two-dimensional systems the observed charge recombination can be quantitatively explained with emission of spin excitations. In one dimensional systems, on the other hand, the coupling to phonons plays an essential role. Both studies are unified under conclusion that the recombination rate is exponentially suppressed with the number of bosonic excitations that are created during such process.