The research of strongly correlated system out of equilibrium is becoming an important branch in condensed matter as well as in statistical physics. Experiments on non-linear transport and photo-induced phase transition in Mott insulators show that strong DC and AC electric fields can induce metallization of the system. It was proposed that the “seed” of the metallization in Mott insulators are pairs of doublons and holes produced through quantum mechanical tunneling processes [1]. An analytical expression for the tunneling probability was derived using the DDP method (imaginary time method [2]) combined with the exact Bethe ansatz solution of the one dimensional Hubbard model [3]. This was confirmed numerically by the time-dependent density matrix renormalization group method. Recently, we have calculated the IV-characteristics in the infinite dimensional Hubbard model in finite temperature using the non-equilibrium dynamical mean field theory with results consistent with the tunneling picture[4].

We push this approach forward and calculate the photo-carrier creation rate in strong AC electric fields which is important in understanding photo-induced phase transitions. We discuss the nature of the crossover from the weak field multi-photon processes to the strong field tunneling regime.

[2] V. Popov, JETP 34, 709 (1972)  