Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Exact steady state non-equilibrium DOS of the Hubbard model ALEXANDER JOURA, JIM FREERICKS, Georgetown University, USA, THOMAS PRUSCHKE, University of Goettingen, Germany — Using a non-equilibrium Kadanoff-Baym-Keldysh formalism, we derive exact equations relating the retarded Green's function to the retarded self-energy for lattice electrons in presence of a constant and uniform electric field E. Such an approach allows us to go beyond linear response theory and study the behavior of systems for arbitrarily large electric fields. We find that the conventional dynamical mean-field theory (DMFT) algorithm is the same as in equilibrium except for a significantly modified lattice Dyson equation which couples together frequencies separated by the Bloch frequency. We apply the method to the Hubbard model and solve the model within the DMFT framework. As an impurity solver, we employ the numerical renormalization group (NRG). We discuss how the density of states (DOS) evolves as the electric field strength E and interaction strength U change. In particular, when both $E \ll 1$ and $U \ll 1$ the DOS is a set of equally spaced peaks (the so called Wannier-Stark ladder). Increasing U leads to a broadening of the peaks, which finally merge and then evolve into a DOS that is quite similar to the equilibrium DOS. Increasing E while keeping $U \ll 1$ splits the peaks, resulting in novel behavior for the DOS, which is reminiscent of a metal-insulator transition (but the system carries current).

Alexander Joura
Georgetown University, USA

Date submitted: 27 Nov 2007

Electronic form version 1.4