# TT 31: Transport: Nanoelectronics I - Quantum Dots, Wires, Point Contacts 2

Time: Thursday 11:45–13:00 Location: EB 202

TT 31.1 Thu 11:45 EB 202

**Time-Dependent Transport Phenomena and the History Dependence of the Time-Dependent Current** — •Elham Khosravi[1], Stefan Kurth[1], Gianluca Stefanucci[2], and Eberhard Gross[1] — [1]Institut für Theoretische Physik, Freie Universität Berlin,Berlin, Germany — [2]Department of Physics, University of Rome Tor Vergata, Rome, Italy

We propose a time-dependent approach to investigate transport phenomena within open boundary time-dependent density functional theory which is based on a numerical algorithm for the time propagation of the non-interacting time-dependent Schrödinger or Kohn-Sham equation. The algorithm is used to study time-dependent transport phenomena such as bound state oscillations, transients, AC effects, electron pumps. It has been shown [Phys. Rev. B 75, 195115 (2007)] that the presence of at least two bound states in the biased electrode-device-electrode system of non interacting electrons, leads to persistent oscillations in the total current. Here we study how the amplitude of oscillations depends on the applied bias or gate voltage and on the initial state.

TT 31.2 Thu 12:00 EB 202

**Correlation effects in charge and spin transport properties of quantum impurity models** — •Thomas Schmidt[1], Andrei Komnik[1], and Alexander Gogolin[2] — [1]Physikalisches Institut, Universität Freiburg — [2]Imperial College, London, UK

We have investigated the spin and charge transport properties of the Anderson impurity model (AIM) under non-equilibrium conditions. While in the non-interacting case the spin-resolved full counting statistics (FCS) is described by a purely binomial distribution, a small Coulomb interaction $U$ induces correlated electron-pair transport which changes the FCS profoundly. In order to address the complementary large-$U$ domain, we analysed the strong-coupling Kondo fixed point and derived an exact result for a special choice of parameters. The results agree for all regimes. Finally, we propose an experimental setup based on a Hanbury Brown and Twiss interferometer in which these effects can be observed.

**Invited Talk** TT 31.3 Thu 12:15 EB 202

**Electronic transport through nanostructures** — •Peter Schmitteckert — Institut für Nanotechnologie, Forschungszentrum Karlsruhe, Karlsruhe Institute of Technology

The Density Matrix Renormalization Group (DMRG) method is now a well established method to study interacting, low-dimensional quantum systems. In this talk I review various approaches within the DMRG method to obtain the conductance of strongly interacting nanostructures attached to non-interacting leads. First I discuss the embedding method where the transmission amplitude is calculated from the ground state stiffness, which is then used to obtain the conductance. Next I review the Kubo approach within DMRG. By switching to a momentum space representation of the leads, this approach allows the study of systems with very small energy scales, including Kondo physics. These calculations can also be used to extract exact functionals to be used within the framework of Density Functional Theory (DFT). Then I present the approach of calculating the nonequilibrium differential conductance from real-time simulations within DMRG with special emphasis on the Interacting Resonant Level model. Finally I discuss the Lippmann-Schwinger approach to obtain multi-particle scattering states.

TT 31.4 Thu 12:45 EB 202

**Is spin-charge separation observable in transport experiments?** — •Tobias Ulbricht[1] and Peter Schmitteckert[2] — [1]Institut für Theorie der Kondensierten Materie, Karlsruhe Insitute of Technology, Germany — [2]Institute of Nanotechnology, Karlsruhe Insitute of Technology, Germany

We consider a one-dimensional chain consisting of an interacting area coupled to non-interacting leads. Within the area, interaction is mediated by a local onsite repulsion. Using real time evolution within the Density Matrix Renormalization Group (DMRG) scheme, we study the dynamics of wave packets in a two-terminal transport setup. In contrast to previous works, where excitations were created by adding potentials to the Hamiltonian, we explicitely create right moving single particle excitations in the left lead as the starting condition.