

TT 26 Transport - Poster Session

Time: Wednesday 14:30–18:30

Room: P1

TT 26.1 Wed 14:30 P1

Heat transport in ac-driven nanostructures — ●MICHAEL STRASS¹, MIGUEL REY², SIGMUND KOHLER¹, FERNANDO SOLS³, and PETER HÄNGGI¹ — ¹Institut für Physik, Universität Augsburg, 86135 Augsburg — ²Departamento de Física Teórica de la Materia Condensada, Universidad Autónoma de Madrid, 28049 Madrid, Spain — ³Departamento de Física Teórica de Materiales, Universidad Complutense de Madrid, 28040 Madrid, Spain

The charge transport in nanoscale conductors driven by an external, alternating electric field is subject to many recent studies, whereas the mechanisms of heat transfer of nanoconductors far from equilibrium are fairly unknown. In our model calculations, we consider an ac-driven system connected to two leads. The heat current defined by the energy transfer from one metallic lead to the central region is computed with a Floquet theory making use of the time periodicity of the driving. In particular, thermo-electric effects of a ac-driven two-level system induced by a finite temperature difference in the leads are investigated. Open double-quantum dots represent an ideal realization for those kind of systems. The results obtained by the Floquet approach are compared to a different numerical treatment based on a transfer-matrix method.

TT 26.2 Wed 14:30 P1

Conductance Measurements on Ferromagnetic Breakjunctions — ●MAGDALENA HÜFNER, CÉCILE BACCA, MARTINA SUTY, and ELKE SCHEER — Universität Konstanz

We investigate lithographically fabricated breakjunctions of ferromagnetic metals. With the help of a three-point bending mechanism, the bridges can be opened and stabilized to a single-atom contact, broken to a vacuum-tunnel contact and closed again repeatedly at low temperatures ($T \leq 4.2\text{K}$). We observe steps in the conductance that are due to atomic rearrangements in the contact region [1] and calculate the preferred conductance value of a single Co atom with and without magnetic field. In addition we observe very high magnetoconductance effects up to 150% for single-atom or 500% for tunnel contacts in magnetic fields up to 5 T and perpendicular to the sample plane. We analyze the magnetoconductance as a function of the symmetry of the contact and of the free-standing bridge length. We developed a sample preparation method for samples the leads of which are made up of different materials than the contact itself and calculated [2] the magnetization state as a function of the geometry of the contact, the film thickness and its magnetic history. First results are presented.

[1] J.M. Krans et al. Nature 375, 767 (1995)

[2] M.J. Donahue and D.J. Porter, OOMMF's User Guide (see <http://math.nist.gov/oommf>)

TT 26.3 Wed 14:30 P1

Analytic and numeric Green's functions for a two-dimensional electron gas in an orthogonal magnetic field — ●ALESSANDRO CRESTI^{1,2}, GIUSEPPE GROSSO², and GIUSEPPE PASTORI PARAVICINI³ — ¹NEST-INFM and Scuola Normale Superiore, Piazza dei Cavalieri 7, I-56126 Pisa, Italy — ²NEST-INFM and Dipartimento di Fisica 'E. Fermi', Università di Pisa, Largo Pontecorvo 3, I-56127 Pisa, Italy — ³NEST-INFM and Dipartimento di Fisica 'A. Volta', Università di Pavia, Via A. Bassi 6, I-27100 Pavia, Italy

We have derived closed analytic expressions for the Green's function of an electron in a two-dimensional electron gas threaded by a uniform perpendicular magnetic field, also in the presence of a uniform electric field and of a parabolic spatial confinement. A workable and powerful numerical procedure for the calculation of the Green's functions for a large infinitely extended quantum wire is considered exploiting a lattice model for the wire, the tight-binding representation for the corresponding matrix Green's function, and the Peierls phase factor in the Hamiltonian hopping matrix element to account for the magnetic field. The numerical evaluation of the Green's function has been performed by means of the decimation-renormalization method, and quite satisfactorily compared with the analytic results worked out in this paper. As an example of the versatility of the numerical and analytic tools here presented, the peculiar semilocal character of the magnetic Green's function is studied in detail because of its basic importance in determining magneto-transport properties in mesoscopic systems.

TT 26.4 Wed 14:30 P1

A Setup to measure the influence of defects on conductance fluctuations in metallic nanowires — ●MICHAEL WOLZ, VOJKO KUNEJ, CHRISTIAN DEBUSCHEWITZ, and ELKE SCHEER — Fachbereich Physik, Universität Konstanz, D-78457 Konstanz

The goal of the project is to investigate the influence of individual artificial defects on the conductance fluctuation of metallic nanowires. An STM working in a conventional cryostat at 4 K and in magnetic fields up to 1 T has been developed for creating the defects. In order to position the sample with respect to the STM tip the system is equipped with an x-y-table. The nanostructures are fabricated by electron beam lithography and reactive ion etching [1]. The accessibility of the samples by the STM tip is realized by shadow evaporation of the metal (Au) onto the substrate. First low-temperature transport measurements are presented. [1] T. Hoss et al., Physica E 14 (2002) 341

TT 26.5 Wed 14:30 P1

Electron transport and current fluctuations in short coherent conductors — ●DMITRY GOLUBEV, ARTEM GALAKTIONOV, and ANDREI ZAIKIN — Forschungszentrum Karlsruhe, Institut fuer Nanotechnologie, 76021 Karlsruhe, Germany

Employing a real time effective action formalism we analyze electron transport and current fluctuations in comparatively short coherent conductors in the presence of electron-electron interactions. We demonstrate that, while Coulomb interaction tends to suppress electron transport, it may *strongly enhance* shot noise in scatterers with highly transparent conducting channels. This effect of excess noise is governed by the Coulomb gap observed in the current-voltage characteristics of such scatterers. Our results illustrate a direct relation between electron-electron interaction effects and current fluctuations in disordered mesoscopic conductors.

TT 26.6 Wed 14:30 P1

The role of contacts in transport through Luttinger liquid — ●KATHARINA JANZEN, VOLKER MEDEN, and KURT SCHÖNHAMMER — Friedrich Hund Platz 1, 37077 Göttingen

We investigate how the linear conductance through a clean Luttinger liquid (quasi one-dimensional quantum wire of correlated electrons) is effected by the contacts. Two models are studied. In the first the inhomogeneous system is described by an effective hydrodynamic model (local Luttinger liquid) obtained from bosonization. Within this approach analytical results can be obtained that generalize earlier findings. In addition, we study a microscopic lattice model applying the functional renormalization group method. This allows a more detailed analysis of problem.

TT 26.7 Wed 14:30 P1

Anomalies in Coupled Quantum Chains as resonances of the bands — ●LUCA ALLOATTI¹ and GIUSEPPE GROSSO² — ¹Max-Planck Institut fuer Metallforschung, Heisenbergstr. 3, D-70569 Stuttgart, Germany — ²NEST-INFM and Dipartimento di Fisica 'E. Fermi', Università di Pisa, Via F. Buonarroti 2, I-56127 Pisa, Italy

We consider the disordered quasi-one-dimensional single particle tight-binding hopping model and we show that the anomalies in the density of states, in the mean conductance and the even-odd effect are related to a resonance of the band structure of the perfect system underlying the disorder and not necessarily to the $E=0$ point. For the one-dimensional case we calculate the coefficients of the perturbation expansion of the mean conductance up to the twelfth order for both the pure diagonal and real off-diagonal disorder. This calculation evidences a profound difference between the two cases. In the case of two coupled chains we calculate the same expansion to the fourth order and for general disorder. This is sufficient to make important predictions well verified numerically.

TT 26.8 Wed 14:30 P1

Zeeman Ratchets for Ballistic Spin Currents — ●MATTHIAS SCHEID, DARIO BERCIOUX, and KLAUS RICHTER — Institut für Theoretische Physik, Universität Regensburg, Germany

We investigate the possibility of creating directed spin-polarized currents in a two-dimensional electron gas (2DEG) subject to an asymmetric, spatially-periodic magnetic field and an external adiabatic rocking.