tion and arbitrary disorder. The replacement makes the averaging over disorder and further manipulations straightforward and we come to a supermatrix sigma-model containing an interaction term. The structure of the model is rather similar to the replica one, although the interaction term has a different form. We study the model by perturbation theory and renormalization group calculations. We check the renormalizability of the model in the first loop approximation and in the first order in the interaction. In this limit we reproduce the renormalization group equations known from earlier works. We hope that the new supermatrix sigma-model may become a new tool for non-perturbative calculations for disordered systems with interaction.

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TT 8.15 Fr 14:00 Poster TU C

Cotunneling and coherent tunneling through quantum dots — •Bernhard Wunsch, Michael Tews, and Daniela Pfannkuche — 1. Institut für Theoretische Physik, Universität Hamburg

We study transport through a quantum dot coupled to two electronic reservoirs. Including all transport processes up to fourth order in tunneling [1] we go systematically beyond a master equation approach with transition rates obtained from Fermi's Golden rule. Thus we are able to describe transport structures within the coulomb blockade regime due to cotunneling which allow to measure the excitation spectrum of the dot. In particular we identify peaks in the differential conductance inside the coulomb blockade which are due to a sequential tunneling process out of an excited state allowed by a previous inelastic cotunneling event[1]. Furthermore we investigate the effect of coherent tunneling, where different transport channels may interfere with each other and the quantum dot may be in a superposition of eigenstates [3].

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[2] M. Tews, Annalen der Physik **13** 249-304 (2004)
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TT 8.16 Fr 14:00 Poster TU C

Switching an Electrical Current with Atoms: the Reproducible Operation of a Multi-Atom Relay — •Fangqing Xie[1], Christian Obermair[1], and Thomas Schimmel[1,2] — [1]Institute for Applied Physics, University of Karlsruhe, D-76128 Karlsruhe, Germany — [2]Institute of Nanotechnology, Forschungszentrum Karlsruhe, D-76021 Karlsruhe, Germany

The demonstration of a multi-atom quantum point contact relay is reported, which can be reversibly switched between a quantized conducting "on-state"and an insulating "off-state"by applying an electrochemical control potential to a separate, third electrode, the control or gate electrode [1,2]. The transition occurs directly from the conducting "on-state"at $5\,G_0$ ($G_0 = 2e^2/h$ being the conductance quantum) to the insulating "off-state". No stable intermediate levels are observed during the switching process, indicating a reproducible bistable reconfiguration of one single multi-atom contact rather than a deposition and dissolution of different parallel contacts. The results demonstrate the feasibility and reproducible operation of a configurable electronic device based on a multi-atom contact, which exhibits the functionality of an atomic relay or a transistor, opening intriguing perspectives for electronics and logics on the atomic scale.

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TT 8.17 Fr 14:00 Poster TU C

Aharonov-Bohm Interferometry with Quantum Dots — •Stefan Legel[1], Jürgen König[2], Jan Martinek[3], and Gerd Schön[1] — [1]Universität Karlsruhe — [2]Ruhr-Universität Bochum — [3]Institute of Molecular Physics, PAS, Poznan, Poland

The manifestations of quantum coherence are in the foundations of the physics of mesoscopic systems. The presence of quantum coherence is detectable through interference experiments.

We study electron transport through a closed Aharonov-Bohm interferometer containing two single-level quantum dots. We address the question how electron-electron interaction on the dots affects the coherence of the transport. The method of real-time transport theory enables us to treat these systems both in equilibrium as well as in non-equilibrium. A perturbation expansion in the coupling strength of the quantum dots to the leads allows us to make predictions for the signatures of quantum interference in the conductance of the considered systems in first and second order (so-called cotunneling) in the coupling strength.

TT 8.18 Fr 14:00 Poster TU C

Adiabatic Pumping through interacting Quantum Dots — •Janine Splettstoesser[1,2], Michele Governale[1], Rosario Fazio[1], and Jürgen König[2] — [1]Scuola Normale Superiore, Pisa — [2]Ruhr-Universität Bochum

There has been much recent experimental and theoretical interest in adiabatic quantum pumping through mesoscopic electronic devices such as quantum dots. A systematic framework exists to analyze such a system in the non-interacting limit starting from the so-called Brouwer's formula. In interacting systems a general formalism to describe adiabatic pumping is not available until now. Using the nonequilibrium-Green-function approach for transport through interacting systems (by Jauho, Wingreen and Meir), we write a formula to calculate adiabatic pumping through an interacting quantum dot.

TT 8.19 Fr 14:00 Poster TU C

Conductance Measurements on Ferromagnetic Breakjunctions — •Cécile Bacca, Magdalena Hüfner, H.-F. Pernau, and Elke Scheer — Fachbereich Physik, Universität Konstanz

We investigate lithographically fabricated breakjunctions of ferromagnetic metals. With the help of a three-point bending mechanism, the bridges can be opened to a single-atom contact, broken to a vacuum-tunnel contact and closed again repeatedly at low temperatures ($T \leq$ 4.2K). 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. However, the details of the magnetoconductance curves are not yet fully understood. In order to separate the contributions of the different possible effects (magnetostriction, TMR, BMR, AMR,...) we analyse the magnetoconductance as a function of the symmetry of the contact, of the free-standing bridge length, and for different materials (Co, Ni). In parallel we calculate [2] the magnetization state as a function of the geometry of the contact, the film thickness and its magnetic history. [1] J.M. Krans et al. Nature 375, 767 (1995)
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TT 8.20 Fr 14:00 Poster TU C

Exactly solvable model of three interacting particles in an external magnetic field — E. P. Nakhmedov[1,2], •K. Morawetz[1,2], M. Ameduri[3], A. Yurtsever[4], and C. Radehaus[1] — [1]Chemnitz University of Technology, 09107 Chemnitz, Germany — [2]Max Planck Institute for the Physics of Complex Systems, Nöthnitzer Str. 38, 01187 Dresden, Germany — [3]Weill Cornell Medical College in Qatar, Qatar Foundation, Doha, Qatar — [4]Azerbaijan Academy of Sciences, Institute of Physics, H. Cavid 33, 370143 Baku, Azerbaijan

The quantum mechanical problem of three identical particles, moving in a plane and interacting pairwise via a spring potential, is solved exactly in the presence of a magnetic field. Calculations of the pair–correlation function, mean distance and the cluster area show a quantization of these parameters. Especially the pair-correlation function exhibits a certain number of maxima given by a quantum number. We obtain Jastrow prefactors which lead to an exchange correlation hole of liquid type, even in the presence of the attractive interaction between the identical electrons.

[1] E. P. Nakhmedov, K. Morawetz, M. Ameduri, A. Yurtsever, C. Radehaus, Phys. Rev. B 67 (2003) 205106

TT 8.21 Fr 14:00 Poster TU C

Spin-dependent transport through quantum dots with three ferromagnetic leads — •Daniel Urban, Matthias Braun, and Jürgen König — Institut für Theoretische Physik III, Ruhr-Universität Bochum

We examine a single-level quantum dot weakly tunnel-coupled to three ferromagnetic leads. A current between two leads gives rise to spin accumulation and spin blockade. Two effects allow to modify the spin on the dot by changing the magnetization direction of the floating third lead.

The first of these effects is anisotropic spin damping. Spin components in the direction of the third lead have an increased lifetime. The second is