Thereby we generalize concepts of quantum charge ratchets [1] to the case with spin. Due to the Zeeman term in the Hamiltonian, spin-up and spin-down electrons experience different effective potentials which can be taylored to achieve net spin currents without corresponding charge currents. We consider ballistic, coherent transport in waveguides defined on a 2DEG, where the magnetic field modulation is, e.g., induced from a periodic array of ferromagnetic stripes on top of the 2DEG.

[1] H. Linke, T. E. Humphrey, A. Löfgren, A. O. Sushkov, R. Newbury, R. P. Taylor and P. Omling, Science **286**, 2314 (1999)

TT 26.9 Wed 14:30 P1

Dephasing by transverse gauge field fluctuations — •Thomas Ludwig[1] and Alexander D. Mirlin[1,2] — [1]Institut fuer Nanotechnologie, Forschungszentrum Karlsruhe, 76021 Karlsruhe, Germany — [2]Institut fuer Theorie der Kondensierten Materie, Universitaet Karlsruhe, 76128 Karlsruhe, Germany

We consider the effect of transverse gauge field fluctuations on quantum interference effects in lowdimensional disordered systems. Using a purely diffusive description we reproduce a logarithmic correction to the dephasing rate of the Cooperon in two dimensions first found by Wölfle (2000). In addition, we present new results for the wire geometry where we find a dephasing rate linear in the temperature. Finally, we examine the difference between the dephasing rate due to slow gauge field fluctuations (with frequencies smaller than the dephasing rate) and the dephasing rate due to fast fluctuations (with frequencies larger than the dephasing rate).

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Time-dependent Numerical Renormalization Group for Multi-Level Quantum Dots — •David Roosen and Walter Hofstetter — Theoretische Physik A, RWTH Aachen, D-52056 Aachen, Germany

During the last years Kondo phenomena have been realized in a controlled way in quantum dots with odd and even electron number [1]. Recent extensions of the Numerical Renormalization Group (NRG) [2] allow non-perturbative calculations of time-dependent phenomena in the Kondo regime. Here we investigate a two-level lateral quantum dot, taking into account Hund's rule coupling. For this system it has been shown that a singlet-triplet Kondo effect occurs as a function of the level spacing [3]. Applying the time-dependent NRG algorithm of [2], we focus on the evolution of the system after a sudden change in the Hamiltonian, driving the quantum dot from the singlet to a triplet ground state.

[1] D. Goldhaber-Gordon et al., Nature **391**, 156 (1998)
[2] F. Anders and A. Schiller, cond-mat/0505553
[3] W. Hofstetter and H. Schoeller, Phys. Rev. Lett. **88**, 016803 (2002)

TT 26.11 Wed 14:30 P1

Flow equation method for the non-equilibrium Anderson Impurity Model — •Michael Möckel and Stefan Kehrein — LMU München, Lehrstuhl für Theoretische Festkörperphysik,Theresienstraße 37, D-80333 München, Germany

The Anderson impurity model is of central importance in correlated electron physics and is often used as a minimal model for studying quantum dots with Coulomb blockade effects. Steady state non-equilibrium behaviour can be obtained by applying a constant voltage bias across the impurity site. We examine this steady state by means of the flow equation method at zero temperature in the regime of weak to medium correlation strength.

In particular, we study the impurity orbital density of states and the decay of the quasi-particle resonance far away from equilibrium due to current-induced decoherence.

TT 26.12 Wed 14:30 P1

A diagrammatic approach to adiabatic pumping — •Janine Splettstoesser[1,2], Michele Governale[1,2], Jürgen König[2], and Rosario Fazio[1] — [1]Scuola Normale Superiore, Piazza dei Cavalieri, I-56126 Pisa — [2]Institut für Theoretische Physik, Ruhr-Universität Bochum, D-44780 Bochum

We consider adiabatic charge pumping through an interacting single-level quantum dot. We present a general perturbation theory approach for the adiabatic expansion using a diagrammatic technique [1,2] and apply it to the pumped current up to second order Γ contributions in the self energy. It turns out that second leading order contributions of the perturbation expansion of the adiabatically pumped charge are exclusively due to level renormalization effects.

[1] J. König, H. Schoeller, and G. Schön, Phys. Rev. Lett.**76**, 1715 (1996).
[2] J. König, J. Schmid, H. Schoeller, and G. Schön, Phys. Rev. B **54**, 16820 (1996)

TT 26.13 Wed 14:30 P1

Transport properties of a single electron transistor strongly coupled to a nanomechanical resonator — •Charles Doiron[1], Wolfgang Belzig[2], and Christoph Bruder[1] — [1]Department of Physics and Astronomy, University of Basel, Klingelbergstrasse 82, CH-4056 Basel, Switzerland — [2]Department of Physics, University of Konstanz, D-78457 Konstanz, Germany

It is now experimentally possible to create nanometer-sized mechanical resonators and to couple them to quantum point contacts or single electron transistor (SET) to study their behaviour.

Previous theoretical studies of the coupled nanomechanical resonator-SET system have focused on the regime where the coupling between the resonator and the SET is weak. In this regime the electrons tunneling trough the SET act like an effective thermal bath, effectively damping the motion of the oscillator [1]. Until now, the strong coupling regime has not been investigated theoretically.

In this work, we use a master-equation approach to describe the coupled SET-nanomechanical resonator system in the strong coupling regime. We compute the dynamics of the resonator as well as the effect of the coupling on the current and noise characteristics of the SET.

[1]A. D. Armour, M. P. Blencowe, and Y. Zhang, Phys. Rev. B **69**, 125313 (2004)

TT 26.14 Wed 14:30 P1

Rabi spectroscopy in a qubit-oscillator system — •Julian Hauss, Alexander Shnirman, and Carsten Hutter — Institut für Theoretische Festkörperphysik, Universität Karlsruhe, D-76128 Karlsruhe, Germany

In recent years coherent control of JJ-qubits was demonstrated in many experiments. A promising approach towards efficient non-demolition measurement of a JJ-qubit is the readout via a harmonic oscillator coupled to the qubit. In particular, Rabi spectroscopy experiments in such systems were carried out in Jena.

We analyzed theoretically the Rabi spectroscopy in a qubit-oscillator system. We studied the contributions of one- and two-photon processes to the spectroscopic signal and made a comparison with the experimental results.

TT 26.15 Wed 14:30 P1

Creating microwave photon pairs in superconducting cavity QED — •Florian Marquardt — Sektion Physik, Arnold Sommerfeld Center for Theoretical Physics, and Center for NanoScience, Ludwig-Maximilians-Universität München, Theresienstr. 37, 80333 München

With the recent advent of superconducting cavity quantum electrodynamics [1], circuit architectures become possible that process and store quantum information in the form of microwave photons traveling along transmission lines on a chip, interacting with superconducting qubits.

In this talk, I will present and theoretically analyze a setup that may be used to create microwave photon pairs with a very high efficiency. The basic mechanism is parametric down conversion, and the necessary nonlinearity is provided by a charge qubit coupled to a cavity. The main advantage of the scheme is achieved by the fact that the qubit acts as an artificial atom whose parameters are fully tunable and can be optimized. Non-idealities such as non-radiative relaxation and dephasing of the qubit are taken into account employing a Lindblad master equation approach.

[1] A. Wallraff et al., Nature **431**, 162 (2004).

TT 26.16 Wed 14:30 P1

Information transfer in permanently coupled spin chains — •Daniel Burgarth[1], Sougato Bose[1], and Vittorio Giovannetti[2] — [1]Department of Physics & Astronomy, University College London, Gower St., London WC1E 6BT, UK — [2]NEST-INFM & Scuola Normale Superiore, piazza dei Cavalieri 7, I-56126 Pisa, Italy

The transfer of quantum information is a crucial part of any quantum computation. Recently it was suggested to use permanently coupled systems for transferring quantum states. This is especially important in solid state implementations (such as flux qubits) where dynamical control of the couplings is difficult to implement. However, in many cases using permanent couplings leads to dispersion and low fidelity. A proper