We apply an antiferromagnetic symmetry breaking implementation of the dynamical cluster approximation (DCA) to the two-dimensional hole-doped Kondo lattice model with hopping t and coupling J.

Precise calculations of single particle spectral functions compare well with exact BSS results at the particle-hole symmetric point. However, our DCA version, combined with a QMC cluster solver, also allows simulations away from particle-hole symmetry and has enabled us to map out the magnetic phase diagram of the model as a function of doping, coupling J/t and band structure.

At half-filling, our results show that the linear behaviour of the quasi-particle gap at small values of J/t is a direct consequence of particle-hole symmetry, which leads to nesting of the Fermi surface. Breaking the symmetry, by inclusion of a diagonal hopping term, results in a greatly reduced gap which appears to follow a Kondo scale.

Upon doping the magnetic phase observed at half-filling survives and ultimately gives way to a paramagnetic phase. Across this magnetic order disorder transition, we track the topology of the Fermi surface.

TT 17.15 Wed 17:45 H18

Berechnung von Spektralfunktionen stark korrelierter 5f-Systeme — •Martin Reese und Gertrud Zwicknagl — Institut für Mathematische Physik, Technische Universität Braunschweig, Braunschweig

Es werden Aktinidsysteme mit stark korrelierten 5f-Elektronen mit orbitaler Entartung betrachtet. Der verwendete Ansatz kombiniert die Ergebnisse aus ab-initio Elektronenstrukturrechnungen mit Clusterstörungsrechnungen an zweidimensionalen Clustern. Dieses Vorgehen gestattet es, die komplexen Korrelationen angemessen zu berücksichtigen. Die berechneten Spektren zeigen sowohl dispersive Quasiteilchenbänder als auch inkohärente lokale Anregungen. Die Ergebnisse der Rechnungen sind in guter qualitativer Übereinstimmung mit experimentell gewonnenen Daten aus Photoemissionsspektroskopie.

TT 18: Nanoelectronics I - Quantum Dots, Wires, Point Contacts

Time: Wednesday 14:00–17:15 Location: H19

TT 18.1 Wed 14:00 H19

Charge transfer statistics through multi-terminal Kondo and Anderson impurities — •Andrei Komnik[1], Thomas Schmidt[1], and Alexander Gogolin[2] — [1]Physikalisches Institut, Albert-Ludwigs-Universität Freiburg, Hermann-Herder-Str. 3, 79104 Freiburg — [2]Department of Mathematics, Imperial College London, 180 Queen's Gate, London SW7 2AZ, United Kingdom

We investigate the charge transfer statistics through a quantum dot in the Kondo regime coupled to an arbitrary number of terminals. Using the effective Hamiltonian valid at energies far below the Kondo temperature we calculate the generating function for the full counting statistics (FCS) perturbatively in the leading irrelevant operators. The transport seems to be mediated not only by single electron tunnelling but by correlated transport of electron pairs as well. We propose a measurement of cross correlations of Hanbury Brown and Twiss type in a multi-terminal geometry which is able to explicitly discern both processes in experiments. Furthermore we make predictions for generalised Fano factors to be universal and parameter-free. By comparison of perturbative expansions for weak and strong couplings we make predictions for the FCS of a more realistic multi-terminal Anderson impurity model, which are valid at all energy scales as long as the applied transport voltage is small.

TT 18.2 Wed 14:15 H19

Co-tunneling effects in transport through interacting quantum dots — •Jasmin Aghassi[1,2], Matthias Hettler[1], and Gerd Schön[1,2] — [1]Forschungszentrum Karlsruhe, INT, Postfach 3640, 76201 Karlsruhe — [2]Institut für theoretische Festkörperphysik, Universität Karlsruhe, 76128 Karlsruhe

We study charge transport in quantum dot systems within a diagrammatic technique. The current-voltage characteristics as well as the current noise are calculated within second-order perturbation expansion in the coupling parameter Γ. We allow for an intermediate coupling regime up to coupling constants of $\Gamma = k_B T$, where k_B is the Boltzmann constant and T the temperature. We explicitly account for intra- and inter-dot Coulomb interactions and the resulting many-body states of the quantum dots. For a single multilevel quantum dot we investigate the co-tunneling effects on the conductance and noise of the system in dependence of an applied gate voltage. In the Coulomb blockade region super-Poissonian noise is observed at the inelastic co-tunneling energy scale. This energy scale is also observable in the conductance in some cases. For non-local systems such as chains of coupled quantum dots ("artificial molecules") sequential tunneling results for transport under asymmetric conditions, i.e. non-resonant dots or asymmetric couplings are compared to second order results.

A. Thielmann *et.al.*, Phys. Rev. Lett., **95**, 146806 (2005)
J. Aghassi *et.al*, Appl. Phys. Lett. **89**, 052101 (2006), Phys. Rev.B **73**, 195323 (2006)

TT 18.3 Wed 14:30 H19

Frequency dependent quantum shot noise — •Jan C. Hammer and Wolfgang Belzig — University of Konstanz, Department of Physics, 78457 Konstanz, Germany

We study frequency-dependent quantum shot noise in the coherent charge transport through a double barrier quantum dot. In the framework of the scattering formalism we show how electron transport through such a Fabry-Perot-like setup reveals a super-Poissonian and an asymmetric noise spectrum for large frequencies. It depends on the applied bias voltage, the structure of the energy levels inside the scattering region and the coupling to the leads. For example, well separated energy levels lead to steps in the noise due to the emission and absorption of photons which get washed out as the width of the levels broadens. These can be shifted with respect to frequency by varying a gate voltage. At low frequency the Fano factor gets reduced and the spectrum is found to be symmetric.

TT 18.4 Wed 14:45 H19

Generation of Nonlocal Spin Entanglement in Nonequilibrium Quantum Dots — •Stefan Legel[1], Jürgen König[2], Guido Burkard[3], and Gerd Schön[1] — [1]Institut für Theoretische Festkörperphysik and DFG-Center for Functional Nanostructures (CFN), Universität Karlsruhe — [2]Institut für Theoretische Physik III, Ruhr-Universität Bochum — [3]Department of Physics and Astronomy, University of Basel

We propose schemes for generating nonlocal spin entanglement in systems of two quantum dots with onsite Coulomb repulsion weakly coupled to a joint electron reservoir. In nonequilibrium situations with one extra electron on each dot, we find the double-dot system in so-called Werner states with a fidelity exceeding 1/2, which indicates spin entanglement. We consider two specific setups. In the first setup we study the transient behavior of the system after rapidly pushing the dot levels from above to below the Fermi energy of the joint lead. We find the formation of an enhanced probability of the singlet state as compared to the triplet. In the second setup we analyze the stationary state with an applied bias voltage between the joint reservoir and two additional leads, which are weakly coupled to the dots. Depending on the polarity of the bias, we find an enhanced probability for either the singlet or the triplet states.

TT 18.5 Wed 15:00 H19

Non-equilibrium Josephson current through interacting quantum dots — •Marco G. Pala[1], Michele Governale[2], and Jürgen König[2] — [1]IMEP-MINATEC (UMR CNRS/INPG/UJF), F-38049 Grenoble, France — [2]Institut für Theoretische Physik III, Ruhr-Universität Bochum, D-44780 Bochum, Germany

We study transport through a quantum dot weakly coupled to both normal and superconducting leads. To this aim, we generalize a diagrammatic real-time transport theory[1] to account for superconductivity in the leads. In particular, we consider a system consisting of a quantum dot tunnel coupled to one normal and two superconducting leads. A finite voltage can be applied between the normal and the superconducting leads to drive the dot out of equilibrium. The dot is described by a single, spin-degenerate level, with arbitrary Coulomb