try.This aspect facilitates reliable initialization of the qubit and offers additional fast gate control. Changing the potential barrier height allows for moving the qubit operation point away from parasitic resonances and makes it possible to realize tuneable coupling to common bus. Our two-cell qubits feature asymmetric dc-SQUID readout and on-chip flux controls. To bias the qubit at the optimal working point we use a passive pi-shifter in the superconducting bar separating two cells. The readout is performed by standard pulse sequence consisting of short switching and long latching pulses. Experimental results on testing these devices will be reported.

TT 22.23 Wed 14:00 Poster B

Modeling of quasiparticle transitions in Josephson charge-phase qubits — •Jens Könemann, Hermann Zangerle, Brigitte Mackrodt, Ralf Dolata, and Alexander B. Zorin — Physikalisch-Technische Bundesanstalt, Bundesallee 100, 38116 Braunschweig, Germany

Superconducting circuits, based on the tunneling of single Cooper pairs, enable remarkable charge-phase qubits. The qubit operation relies on the coherent superposition of the macroscopic quantum states, but the unwanted tunneling of unpaired electrons (quasiparticles) changes instantly the charge state and thus, the working point of the qubit.

Recently we have investigated quasiparticle transitions in an Al charge-phase qubit [1] inducing a dynamic change of the qubit states. Non-equilibrium quasiparticles tunnel stochastically on and off the island and may excite the qubit. The relaxation of the qubit by releasing a single quasiparticle to the leads becomes the dominating relaxation mechanism. In this work, we present a numerical modeling of these transitions. Moreover, we discuss the effect of microwave irradiation on the quasiparticle-induced transitions.

[1] J. Könemann *et al.*, Phys. Rev. B **76**, 134507 (2007).

TT 22.24 Wed 14:00 Poster B

Finite-temperature Bell test for quasiparticle entanglement in the Fermi sea — •Wolf-Rüdiger Hannes[1], Mikhail Titov[1,2], and Wolfgang Belzig[1] — [1]Universität Konstanz, Fachbereich Physik, D-78457 Konstanz — [2]School of Engineering & Physical Sciences, Heriot-Watt University, Edinburgh EH14 4AS, UK

Theoretical predictions of the presence of quantum entanglement in solid-state devices commonly make use of Bell-type inequalities formulated in terms of currents and current-current cross correlators. We demonstrate [1] that no such Bell-test can be performed at finite temperatures in the vast majority of setups proposed previously for entanglement generation. This fundamental difficulty originates in a finite probability of quasiparticle emission from Fermi sea detectors. The feedback problem can be overcome by a resonant coupling of the detectors and an additional detector cooling. Application of this simple improvement to a generic beam splitter setup constitutes a device that can be used to determine the critical temperature for the entanglement produced in the absence of fermionic interactions.

In the future we will try to access the temperature dependent entanglement generation of an electronic beam splitter by investigating its full counting statistics.

[1] W.-R. Hannes and M. Titov, Preprint arXiv:0710.0348v1

TT 22.25 Wed 14:00 Poster B

Numerical analysis of shaped coherent pulses — •Peter Karbach, Stefano Pasini, Götz S. Uhrig, and Joachim Stolze — TU Dortmund - Theoretische Physik I

Recently we presented analytical results on the optimization of coherent pulse shapes based on the Magnus-expansion (arXiv:0709.0588, submitted to PRA). The expansion parameter is the pulse duration τ_p. The coefficients for the linear and the quadratic order have been obtained. Depending on the pulse shapes certain coefficients vanish and the resulting pulses are better suited than the plain pulses (i.e. with constant amplitude) for the coherent control of small quantum systems in general and for single quantum bits in particular.

These analytical results are tested numerically for the proposed piecewise-constant pulses in different coupling geometries. It is confirmed that the analytical calculations are valid for a large parameter range (coupling constants, number of spins in the bath).

The numerical results are presented and the limitations of the analytical findings are discussed.

TT 22.26 Wed 14:00 Poster B

Non-equilibrium states in graphene rings driven by ultrashort light pulses — •Andrey Moskalenko and Jamal Berakdar — Institut für Physik, Martin-Luther-Universität Halle-Wittenberg, Germany

Graphene became a hot topic since the demonstration of its fabrication because of the quasi-relativistic properties of its band structure. Mesoscopic effects are of a particular interest as they exhibit features unusual for metallic or semiconductor mesoscopic structures. Recently, mesoscopic graphene rings were fabricated. The properties of the Aharonov-Bohm effect were investigated theoretically and experimentally. We investigate non-equilibrium mesoscopic effects in graphene rings excited by picosecond asymmetric electromagnetic pulses. Ultrafast generation of charge-polarized and current-carrying states is demonstrated and illustrated for the experimentally relevant parameters of the graphene ring.

TT 22.27 Wed 14:00 Poster B

Conductance through a strongly interacting region – LDA versus exact results — •Stefan Schenk, Michael Dzierzawa, Ulrich Eckern, and Peter Schwab — Universität Augsburg

Density functional theory within the local density approximation is the method of choice for calculations of the electronic structure of complex materials. In recent years the method has been adapted to transport problems, in particular to transport through systems of molecular size.

Here we study a one-dimensional model of spinless fermions. This has the advantage that the density matrix renormalization group provides numerically exact results for the conductance. We find that although for weak electron-electron interaction the local density approximation gives reasonable estimates for the location of conductance resonances, the method strongly overestimates the conductance in the non-resonant case. The discrepancies arise from the insufficient accuracy of the ground state density obtained within the local density approximation. Dynamic effects that can be captured within the time-dependent density functional theory are only of minor importance.

TT 22.28 Wed 14:00 Poster B

Resistance measurements on Bismuth nanowire arrays at low temperatures — •Thomas Kaupp[1], Christoph Kaiser[2], Georg Weiss[1], Thomas Cornelius[3], and Reinhard Neumann[3] — [1]Physikalisches Institut, Universität Karlsruhe, 76128 Karlsruhe, Germany — [2]Institut für Mikro- und Nanoelektronische Systeme, Universität Karlsruhe, 76187 Karlsruhe, Germany — [3]Gesellschaft für Schwerionenforschung, 64291 Darmstadt, Germany

Our sample fabrication started with creating nanoporous templates by exposing polymeric foils to heavy ion radiation. Into these templates, single- and poly-crystalline bismuth nanowires were electrochemically deposited. Resistance and magnetoresistance of arrays of these nanowires were studied at temperatures down to 50 mK. Additionally, aged samples of single-crystalline nanowires could be studied.

We observed a reduction of the resistance below 0.5 K of about 3 to 20 percent depending on the type of sample. The magnetoresistance of single-crystalline samples in this temperature range showed a linear behaviour up to 50 mT and then follows a power law with an exponent of 3/2 as previously reported. A linear magnetoresistance was observed for the poly-crystalline sample. The size of the linear increase up to 50 mT corresponds to the temperature dependent resistance reduction below 0.5 K.

Presently the interpretation of our observations is unclear. We discuss both the role of localization effects as well as the possibility that parts of the nanowires become superconducting.

TT 22.29 Wed 14:00 Poster B

Switching Dy break junctions by a magnetic field — •Marc Müller[1], Richard Montbrun[1], Christoph Sürgers[1,2], and Hilbert v. Löhneysen[1,2,3] — [1]Physikalisches Institut, Universität Karlsruhe, D-76128 Karlsruhe — [2]Center for Functional Nanostructures, Universität Karlsruhe, D-76128 Karlsruhe — [3]Forschungszentrum Karlsruhe, Institut für Festkörperphysik, D-76021 Karlsruhe

In search for conductance steps in rare-earth-metal atomic contacts, we study the low-temperature electronic transport properties of mechanically controlled Dy break junctions. The junctions are prepared from Dy wires cut from a dentritic polycrystal which are broken in-situ by means of a three-point bending mechanism. Magnetic fields are applied along the wire axis. In a mechanically pre-adjusted and fixed position of the two electrodes, the contact can be reproducibly opened and closed by variation of the applied magnetic field. The

switching, i.e. the change in resistance vs. contact distance, shows a hysteretic behavior and presumably arises from the large magnetostriction of ferromagnetic Dy. Preliminary measurements show steps in the conductance-distance characteristics which are, however, much larger than one conductance quantum $G_0 = 2e^2/h$.

TT 22.30 Wed 14:00 Poster B

Point contact spectroscopy of quench-condensed Ag films — •Torben Peichl, Marcel Spurny, Michael Burst, and Georg Weiss — Physikalisches Institut, Universität Karlsruhe, 76128 Karlsruhe, Germany

We report on the progress in fabricating nanostructured point contacts as a result of our structural characterization studies. The point contacts are defined by electron beam lithography on top of silicon nitride membranes. Then the bottom side is covered with a layer of Au before a SF_6 plasma etching from the top side is used to obtain nano-sized holes in the membrane. Finally, a highly disordered Ag layer is prepared by quench-condensing Ag films at low temperatures <10 K on the top side. This results in metallic point contacts with diameters <50 nm and resistances between 1 and 10 Ω.

Electronic transport properties of these point contacts were studied at temperatures from 1.5 to 8 K by measuring the differential resistance using lock-in methods. Within sample series we find reproducible results, in particular a distinct minimum of the differential resistance which we identify as a zero-bias minimum shifted by a DC offset of yet unknown origin. This minimum becomes narrower at increasing temperatures and vanishes at 8 K. Similarly, the minimum diminishes continuously with magnetic field until it vanishes completely at about 2 T. Low energy excitations as well as coulomb blockade effects might be responsible for the observed behavior. Additionally, slight oscillations of the differential resistance curves are reminiscent of weak localisation effects.

TT 22.31 Wed 14:00 Poster B

Charge transport properties of biphenyl molecules and tetrathiafulvalene — •Marius Bürkle[1], Fabian Pauly[1], Janne Viljas[1,2], Juan Carlos Cuevas[3], and Gerd Schön[1,2] — [1]Institut für Theoretische Festkörperphysik and DFG-Center for Functional Nanostructures, Universität Karlsruhe, 76128 Karlsruhe, Germany — [2]Forschungszentrum Karlsruhe, Institut für Nanotechnologie, 76021 Karlsruhe, Germany — [3]Departamento de Física Teórica de la Materia Condensada, Universidad Autónoma de Madrid, 28049 Madrid, Spain

We study theoretically the charge transport properties of single molecule junctions. For this, we use a combination of density functional theory and Green's-function techniques [1]. In our analysis, we consider different types of molecules, namely biphenyl molecules and tetrathiafulvalene. For the biphenyl molecules, the tilt angle of the phenyl rings is changed continuously by means of alkyl chains of varied lengths. We investigate the dependence of both the tilt angle and the conductance on this chain length. In addition, we examine the conductance of tetrathiafulvalene.

[1] F. Pauly, Ph.D. Thesis, Universität Karlsruhe (2007).

TT 22.32 Wed 14:00 Poster B

In-situ fabrication of nanobridges under ultra-high vacuum conditions — •Dominik Stöffler[1], Hilbert v. Löhneysen[1,2], and Regina Hoffmann[1] — [1]Physikalisches Institut and DFG Center for Functional Nanostructures (CFN), Universität Karlsruhe, D-76128 Karlsruhe, Germany — [2]Forschungszentrum Karlsruhe, Institut für Festkörperphysik, D-76021 Karlsruhe, Germany

Contacting single molecules with nanostructured metallic leads remain a challenge, in spite of numerous attempts. We investigate nanocontact formation by thermally assisted electromigration of gold nanowires. The nanowires are prepared by electron beam lithography. An automatic feed-back allows to follow a line of constant dissipated power at the nanocontact, which leads to a gradual thinning of the wire until a small gap is formed. The fabricated gaps are smaller than 10 to 20 nm. By following the line of constant power, we estimate an increase of the temperature of the contact from 350 K in the thermal regime at the beginning, to 650 K in the ballistic regime at the end of the overall electromigration process. Due to the lithography process, leftovers such as PMMA remain on the metallic contacts, which eventually affect transport measurements with molecules. We introduce a promising alternative method to fabricate and contact clean metallic nanostructures, using evaporation through a mask under ultra-high vacuum. These structures can eventually be separated by electromigration to accommodate single molecules.

TT 22.33 Wed 14:00 Poster B

Conductance measurements on palladium breakjunctions with superconducting leads — •Stefan Egle, Cécile Bacca, Christian Schirm, and Elke Scheer — Department of Physics, University of Konstanz

We will present our recent results of palladium nanobridges connected by superconducting leads of aluminium. The structures are fabricated by using electron beam lithography and two-step shadow evaporation. By means of the mechanically controllable break junction (MCBJ) technique we are able to open the bridges to a one-atom contact and close again repeatedly at low temperatures, thus obtaining conductance histograms. Studying the properties of these palladium atomic point contacts at 270mK, we show the influence of the superconducting leads onto the electronic properties of palladium (proximity effect) by measuring the differential resistance. As expected, we observe a decrease of the dV/dI for voltages $|V| \leq 120\mu V < \Delta_{Al} = 180\mu V$ which increases again when either the external magnetic field or the temperature is raised. Investigating the disappearence of this effect, we determine the critical values B_c and T_c.

TT 22.34 Wed 14:00 Poster B

Reversible Switching Effect in Atomic-Size Contacts — •Christian Schirm, Hans-Fridtjof Pernau, and Elke Scheer — University of Konstanz, Department of Physics, 78457 Konstanz, Germany

We investigate electromigration effects in atomic-size contacts of aluminum fabricated with the mechanically controllable break junction technique at $T \leq 1.5$K. We observe current-driven conductance changes ΔG and analyze their influence on the conductance histogram. In particular situations a reversible switching between two conductance values is observed (> 100 repetitions) which attribute to the formation of preferred atomic configurations. A correlation between these configurations and conductance channels shall be established via the analysis of MAR in the superconducting state [1].

[1] E. Scheer et al., Phys. Rev. Lett. **78** (1997) 3535-3538

TT 22.35 Wed 14:00 Poster B

Breakjunctions on Membranes — •Reimar Waitz, Olivier Schecker, and Elke Scheer — Universität Konstanz, Germany

A so-called "mechanically controlled breakjunction" is made of a metallic wire with a suspended constriction. This constriction can be elongated until having - just before breaking - a diameter of one atom. In this project we developed a new kind of breakjunctions on silicon membranes. The wire is made by electron-beam lithography on top of a 600x600 micrometer crystalline silicon membrane with a thickness of a few hundred nanometers. In contrast to the "standard" breakjunction technique, we use the strain of the membrane to control the elongation of the wire. In our poster we present the process of sample fabrication and a mechanism for controlled breaking, which has successfully been used to measure the conductance of single atom contacts.

TT 22.36 Wed 14:00 Poster B

Bias-dependent electronic transport in nanowires — •Neng-Ping Wang and Stefan Heinze — Institute of Applied Physics, University of Hamburg, Jungiusstrass 11, 20355 Hamburg, Germany

Transport of electrons in nanoscale structures is of interest from a fundamental as well as an application point of view. Often nanoscale systems display nonlinear current-voltage characteristics, which make them interesting for device applications. Here, we report first principles calculations of bias-dependent ballistic transport in nanowires using the non-equilibrium Greens function method. The system under consideration is divided into a central scattering region attached to semi-infinite left and right leads. First, we use density functional theory (DFT) to calculate the electronic structure of the system. The DFT eigenstates are then transformed into a set of maximally localized Wannier functions (WFs). Using the WFs as localized orbitals, we construct the Hamiltonian of scattering region and leads, which is used for transport calculation. The coupling of the scattering region to the semi-infinite leads is described by the self-energies of the leads which we obtain with the particularly efficient decimation technique. We solve for the Green function of the system and calculate the transmission and current at low bias voltages.

As a first application of our approach, we study the I-V characteris-