TT 9: SC: Poster Session

Time: Monday 14:00–18:00 Location: Poster A

TT 9.1 Mon 14:00 Poster A

Calorimetry of high-T_c superconductors at different doping levels obtained with ultrafast spectroscopy — •Martin Scheuch[1,3], Luca Perfetti[2], Tobias Kampfrath[3], Christian Frischkorn[1], and Martin Wolf[1,3] — [1]Fachbereich Physik, Freie Universität Berlin, Arnimallee 14, 14195 Berlin — [2]Laboratoire des Solides Irradiés, Ecole polytechnique, 91128 Palaiseau cedex, France — [3]Fritz-Haber-Institut der MPG, Faradayweg 4-6, 14195 Berlin

A new approach for obtaining the electronic part of the heat capacity of highly correlated electron systems is discussed. When energy is absorbed from an incident femtosecond laser pulse, it is first deposited in the electronic system of a solid and, subsequently, tranferred to the lattice. Using a THz probe pulse directly after optical excitation, before energy is transferred to the lattice, one can determine the instantaneous temperature of the electrons. This has been done for the high-T_c superconductor $Bi_2Sr_2CaCu_2O_{8+\delta}$. In combination with time-domain THz spectroscopy at different sample temperatures, the equivalence of photo- and heat-induced conductivity-changes, especially regarding the phase transition, was shown. With this the electronic heat capacity of $Bi_2Sr_2CaCu_2O_{8+\delta}$ was extracted for different doping levels δ.

TT 9.2 Mon 14:00 Poster A

Angle resolved photoemission spectroscopy (ARPES) studies on Bi2201 and Bi2223 high temperature superconductors — •Jia Wei[1,2], Martin Aeschlimann[1], and Donglai Feng[2] — [1]Department of Physics, University of Kaiserslautern, Fachbereich Physik, Erwin Sch€oodinger Str. 46, 67663 Kaiserslautern, Germany — [2]1Department of Physics, Surface Physics Laboratory (National Key Laboratory) and Advanced Materials Laboratory, Fudan University, Shanghai 200433, P. R. China

The Bismuth-family of high temperature superconductors has played a vital role in the understanding of high temperature superconductivity. For the single layer system Bi2201, We observed the symbolic superconducting coherence peak in antinodal region for the first time. The 19 meV peak dip separation seriously challenges models based on electron*phonon interactions. Meanwhile, this energy scale and temperature dependence intriguingly correlate with the behaviors of spin fluctuations. For the trilayer Bi2223 system, its underdoped (UD) regime has been largely inaccessible so far. With elaborate vacuum annealing, we have succeeded in obtaining a series of UD samples for the first time. And we have identified a new experimental energy scale in the trilayer material, caused by trilayer band splitting, which shows very different behavior for bilayer band splitting in Bi2212.

TT 9.3 Mon 14:00 Poster A

Double Photoemission from LSCO and BiSCO — •Deborah Schneider[1], Robert Wallauer[1], Stefan Voss[1], Tobias Bauer[1], Birte Ulrich[1], Markus Waitz[1], Dawiet Haile[1], Till Jahnke[1], Götz Berner[2], Amit Kanigel[3], Markus Schöffler[4], Horst Schmidt-Böcking[1], and Reinhard Dörner[1] — [1]IKF, Universität Frankfurt — [2]EP4, Universität Würzburg — [3]Technion, Haifa, Israel — [4]ALS, Berkeley, USA

We investigate the emission of two electrons by a single photon from LSCO and BiSCO surfaces. Photon energy used was between 20 and 40 eV. The experiment took place at Bessy, the synchrotron in Berlin (single bunch mode). The detection method [1] was a time of flight spectrometer with a position sensitive detector, so that we are able to calculate the full momentum of each electron.

The theory [2] predicts that the back to back correlation of Cooper pairs should be conserved in the final state. Therefore we expect to be able to distinguish the pairs from the isotropic background of scattered electron pairs. We will show a comparison of spectra obtained in the superconducting state and the normal state.

[1] M. Hattass et. al, Rev. Sci. Instr. 75, 2373 (2004)

[2] K. A. Kouzakov and J. Berakdar, Phys. Rev. Lett. 91, 257007 (2003)

TT 9.4 Mon 14:00 Poster A

Abnormal Temperature Dependence of the Itinerant Hole Density of Bi(Pb)-2201 by X-ray Absorption Spectroscopy (XAS) — •Aliakbar Ghafari, Ahmad Kamal Ariffin, Beate Müller, Rüdiger Mitdank, Helmut Dwelk, Alica Krapf, Christoph Janowitz, and Recardo Manzke — Institut für Physik, Humboldt-Universität zu Berlin, Newtonstr. 15, 12489 Berlin, Germany

It has been reported recently that in $YBa_2Cu_3O_{7-\delta}$, $La_{2-x}Sr_xCuO_4$ and also double layer $Bi_2Sr_2CaCu_2O_{8-\delta}$ some ordering of charges and followed by the formation of Cooper pairs in the CuO_2 plane takes place at $T>>T_c$. In view of this, a polarized X-ray absorption study is made on single layer $Bi_{2-y}Pb_ySr_{2-x}La_xCuO_{6+\delta}$ [Bi(Pb)-2201] single crystals to investigate the temperature dependence of the itinerant hole density within the ab plane on Bi(Pb)-2201 single crystals as well. The XAS measurements were made at the CuL_3 edges by changing the temperature from room temperature (RT) to ∼10K using a liquid helium cryostat. It has been established that there is a strong dependence of itinerant hole density on temperature. This contribution will discuss the results and the possible causes of the abnormal temperature dependence of the itinerant hole density.

TT 9.5 Mon 14:00 Poster A

Static stripe ordering in underdoped Bi2201 and Bi(Pb)2201 single crystals — •Valentina Scherer, Christoph Janowitz, Beate Müller, Lenart Dudy, Alica Krapf, Helmut Dwelk, and Recardo Manzke — Institut für Physik, Humboldt-Universität zu Berlin

Underdoped Bi2201 and Bi(Pb)2201 single crystals with a nominal hole doping of $n_h = 1/10$ and $n_h = 1/8$ were investigated using high resolution photoemission and transport measurements. By photoemission measurements spectral functions, dispersions, and Fermi surfaces were detected that correspond to calculations of the site centered stripe model. The resistivity curves exhibit typical transitions due to spin ordering as already found in other stripe phase materials as LSCO (cite Tranquada, Phys. Rev. B 78, 174529 (2008)). Close correspondence between changes of Fermi surface features and resistivity curves is found. Thus a static site centered stripe phase ordering of charge and spin degrees of freedom is the most plausible explanation for the findings, establishing stripes as playing an important role in another class of HTC materials, namely the Bi-cuprates.

TT 9.6 Mon 14:00 Poster A

Nanostripe structures in as-grown light-rare-earth-based high-T_c superconductors — •Michael R Koblischka[1], Anjela Koblischka-Veneva[2], Miryala Muralidhar[3], Thomas Wolf[4], Nadendla Hari BAbu[5], and Uwe Hartmann[1] — [1]Experimental Physics, Saarland University, Campus C 6 3, D-66123 Saarbrücken, Germany — [2]Functional Materials, Saarland University, Campus C 6 3, D-66123 Saarbrücken, Germany — [3]Superconductivity Research Laboratory ISTEC, 1-10-13, Shinonome, Koto-ku, Tokyo, 135-0062, Japan — [4]Forschungszentrum Karlsruhe GmbH, Institute of Solid State Physics, D-76021 Karlsruhe, Germany — [5]IRC in Superconductivity, University of Cambridge, Madingley Road, Cambridge, CB3 0HE, U. K.

Nanostripes are visualized on as-grown light-rare-earth-based high-T_c superconductors by means of atomic force microscopy (AFM) and scanning tunnelling microscopy (STM) at ambient conditions. The samples investigated are non-superconducting, and hence, twin-free. Our observations of nanostripe structures in these samples directly proof that the nanostripes are formed during the growth of the 123-phase itself, whereas the twin boundaries appear in a second step during the required oxygenation of the samples. This explains the often observed features that the nanostripes are curved towards or away from the twins. Due to the different length scales, the nanostripes in the LRE-materials are filling effectively the space between the twin boundaries and provide flux pinning sites much closer to the size of the coherence length, ξ.

TT 9.7 Mon 14:00 Poster A

Relaxation behaviour of levitation forces of various thin high-T_c superconductor samples — •Michael R Koblischka, Michael Becker, Jerome Meiser, and Uwe Hartmann — Institute of Experimental Physics, Saarland University, Campus C 6 3, D-66123 Saarbrücken, Germany

We present the construction of a so-called levitation balance which is capable of measuring the levitation forces between a permanent mag-

net and a superconducting high-T_c thin film sample. Using this setup, we measure the relaxation behaviour of the levitation forces of different thin high-T_c samples: YBCO thin films as well as a commercial YBCO coated conductor and a piece of an Ag-sheathed Bi-2223 tape. From the relaxation curves, we obtain the pinning energies, which correspond well to the data of conventional relaxation measurements. We further show that a small movement of the sample prior to the relaxation measurement influences the relaxation behaviour drastically, so a situation with practically no relaxation effects can be generated.

TT 9.8 Mon 14:00 Poster A

Charge order in $La_{2-x}Ba_xCuO_4$ studied by resonant soft x-ray diffraction — •Eugen Weschke[1], Victor Soltwisch[1], Enrico Schierle[1], Stuart P. Wilkins[2], Jochen Geck[3], John P. Hill[2], John M. Tranquada[2], and Jörg Fink[1,3] — [1]Helmholtz-Zentrum Berlin für Materialien und Energie, Berlin, Germany — [2]Brookhaven National Laboratory, Upton, New York, USA — [3]Leibniz-Institut für Festkörper- und Werkstoffforschung, Dresden, Germany

$La_{2-x}Ba_xCuO_4$ (x = 0.125 and x = 0.115) was studied by x-ray diffraction at the O-K and the Cu-L_3 resonances, in this way focussing on the O-2p and Cu-3d electronic structure. In both cases, pronounced charge-order superstructure peaks are observed directly below the temperature of the structural transition from the LTO into the LTT phase. This is in contrast to the case of $La_{1.8-x}Eu_{0.2}Sr_xCuO_4$, where charge order occurs at a lower temperature than the structural phase transition. Further differences between the materials are observed in the coherence lengths of the charge order, which is significantly larger in case of $La_{2-x}Ba_xCuO_4$. For the two resonances indications for a different evolution with temperature of the superstructure peaks in $La_{2-x}Ba_xCuO_4$ are found.

TT 9.9 Mon 14:00 Poster A

Out-of-plane transport properties of $YBa_2Cu_3O_7/PrBa_2Cu_3O_7$ superlattices — •Ayman El Tahan[1], Fabrizio Porrati[2], Michael Huth[2], Hermann Adrian[1], and Gerhard Jakob[1] — [1]Institut für Physik, Johannes Gutenberg-Universität Mainz, 55099 Mainz — [2]Physikalisches Institut, Goethe-Universität Frankfurt, 60438 Frankfurt

The aim is to show how a change in superlattice modulation effects the transport properties in the c-axis direction, and whether a coherent Josephson coupling between $YBa_2Cu_3O_7$ layers separated by $PrBa_2Cu_3O_7$ sheets can appear or not. The I(V)-characteristic and differential conductivity G(V)=dI(V)/dV at different temperature will be measured. For this purpose we prepared the samples by two methods. The first one by wiring a mesa structure with holes of quadratic shape and dimensions of 30μm × 30μm and 20μm × 20μm, respectively. The second one by focused-ion beam cutting of a bridge with a width 1μm. In these cases the current J will flow vertically through the $YBa_2Cu_3O_7/PrBa_2Cu_3O_7$ multilayers.

TT 9.10 Mon 14:00 Poster A

Modification of high-T_c superconducting thin films by light-ion irradiation — •Marius-Aurel Bodea[1], Johannes D. Pedarnig[1], Bernd Steiger[2], Wilhelm Markowitsch[2], and Wolfgang Lang[2] — [1]Institute of Applied Physics, Johannes Kepler University, A-4040 Linz, Austria — [2]Faculty of Physics, University of Vienna, A-1090 Vienna, Austria

Irradiation of high-temperature superconducting (HTS) $YBa_2Cu_3O_7$ (Y-123) thin films by light ions of low energy modifies the electrical and superconducting properties of layers without destroying the lattice structure of the HTS material. In situ electrical measurements reveal a strong and non-linear increase of film resistance with employed Helium ion dose (ion energy 75 keV) and a relaxation of resistance after irradiation is stopped. The resistance increase during irradiation is described by a simple resistor network model. Ex situ measurements show a substantial decrease of critical temperature T_c with increasing applied dose and a relaxation of T_c and normal state resistivity that continues for several weeks after the ion irradiation. The modification of defect density and charge carrier density of Y-123 films by light-ion irradiation is discussed. Masked ion irradiation enables to pattern Y-123 films into high-T_c superconducting and non-superconducting regions and to produce tracks of high critical current density (3 MA/cm^2 at 77 K) without removal of HTS material.

TT 9.11 Mon 14:00 Poster A

Suppression of the critical current at grain boundaries of high-temperature superconductors — •Siegfried Graser[1], Thilo Kopp[1], Jochen Mannhart[1], Raphael Gutser[1], Peter Hirschfeld[2], and Brian M. Andersen[3] — [1]Zentrum für Elektronische Korrelationen und Magnetismus, Institut für Physik, Universität Augsburg — [2]Department of Physics, University of Florida, Gainesville, FL (USA) — [3]Niels Bohr Institute, University of Copenhagen, Copenhagen (Denmark)

The interface properties of high-temperature cuprate superconductors (HTS) have been of interest for many years, and play essential roles in Josephson junctions, superconducting cables, and microwave electronics. In particular, the maximum critical current achievable in HTS wires and tapes is well known to usually be limited by the presence of grain boundaries, regions of mismatch between crystallites with misoriented crystalline axes. In studies of single, artificially fabricated grain boundaries the striking observation has been made that in a variety of HTS materials, the critical current J_c of a grain boundary junction depends exponentially on the misorientation angle. Until now microscopic understanding of this apparently universal behavior has been lacking. We present here the results of microscopic evaluations in which we construct fully 3D YBCO grain boundaries by molecular dynamics. With these structures the critical current in a *d*-wave superconductor is shown to follow an exponential reduction with grain boundary angle. We identify the build up of charge inhomogeneities to be the dominant mechanism for the suppression of the supercurrent.

TT 9.12 Mon 14:00 Poster A

Consistent description of magnetic excitations and phase diagram of high-T_c cuprates within a strong-coupling approach — Sascha Brehm[1], •Enrico Arrigoni[2], Markus Aichhorn[3], and Werner Hanke[1] — [1]Institute for Theoretical Physics and Astrophysics, University of Würzburg, Am Hubland, 97074 Würzburg, Germany — [2]Institute of Theoretical Physics and Computational Physics, Graz University of Technology, Petersgasse 16, 8010 Graz, Austria — [3]Centre de Physique Theorique, Ecole Polytechnique, 91128 Palaiseau Cedex, France

Poster has been moved to TT 27.84.

TT 9.13 Mon 14:00 Poster A

Fabrication of MgB_2 thin films by co-sputtering — •Savio Fabretti, Patrick Thomas, Günter Reiss, and Andy Thomas — Thin Films and Physics of Nanostructures, Bielefeld University, Bielefeld, Germany

MgB_2 is an intermetallic compound with a high critical temperature of T_c=40K. The simple cristall structure, large coherence lengh and the high critical current density makes thin magnesium diboride films attractive for superconducting applications like Josephson junctions. To fabricate thin MgB_2 films, we used a magnetron co-sputtering system with a Mg and a B target respectively. The films were deposited by dc-magnetron sputtering of Mg and rf-magnetron sputtering of B at a low substrate temperature between 210°C and 260°C without a post annealing process. The differences in vacuum pressure between Mg and B make it essential that the composition ratio is controlled by different sputtering power of each target. The crystal structure was measured by X-ray diffraction and transport investigations at low temperatures were performed.

TT 9.14 Mon 14:00 Poster A

Mechanically alloyed MgB_2: Effect of the Preparation on the Properties of PIT Wires and Tapes — •Marko Herrmann[1], Wolfgang Häßler[1], Christian Rodig[1], Margitta Schubert[1], Ania Kario[1], Konstantin Nenkov[1], Bernhard Holzapfel[1], Ludwig Schultz[1], Ludwig Schmolinga[2], André Aubele[2], Bernd Sailer[2], and Klaus Schlenga[3] — [1]IFW Dresden, Dresden, Germany — [2]Bruker HTS GmbH, Development HTS, Alzenau, Germany — [3]Bruker EAS GmbH, Hanau, Germany

To face the challenge of introducing MgB_2 wires and tapes into low temperature applications, it is essential to adapt its preparation to the industrial scale. Only a reasonable interplay of ampacity and an appropriate preparation route, will lead to a widespread use of MgB_2 conductors. Mechanical alloying is an excellent technique to adjust the microstructure of the precursor powder and allows for high critical current densities in MgB_2. Due to the milling, the morphology and flowability of the powder is affected. To allow for an easy and reliable production of MgB_2 wires on the kilometre scale, it is essential to make use of a precursor which can be deformed properly within the sophisticated architecture of a conductor as required for the application.

In this paper, the influence of different milling parameters on the microstructure and the superconducting properties of MgB_2 is discussed. With increasing milling energy, a refined microstructure and improved homogeneity of the powder and subsequently improved critical current densities are observed. At the same time the changing flowability of the precursor requires an appropriate wire processing.

TT 9.15 Mon 14:00 Poster A

Texture Development of Single Phase (*R*=Y,Ho,Lu) Rare Earth Nickel Borocarbide Thin Films onto MgO Substrates of Different Orientation and Mixed Phase ($Ho_xLu_{1-x}Ni_2B_2C$) Thin Films on MgO(110) — •Tim Niemeier, Karolin Tscharntke, Ruben Hühne, Ludwig Schultz, and Bernhard Holzapfel — IFW Dresden, PF 270116, D-01171 Dresden

Epitaxial thin films of $LuNi_2B_2C$ were deposited on MgO single crystal substrates using Pulsed Laser Deposition from a stoichiometric target. For optimized deposition parameters, a sharp c-axis texture and a high quality of the superconducting phase were achieved on MgO(100) [T_c = 15.6 K] as well as on MgO(110) [T_c = 15.8 K] substrates. Residual resistivity ratios are about 12 – 13 in the unstructured samples. Before this investigation, these properties are have not been reached independently from the substrate orientation. A far higher in-plane order is observed in the MgO(110) case for the chosen deposition parameters. To understand this behaviour, comprehensive texture investigations of the grown films on both substrate types were performed to reveal the differences in the growth processes. It is assumed that the growth mode of the rare earth oxide layer, forming *in situ* at the substrate interface is responsible for the different growth characteristics. Therefore, a detailed investigation of the texture of the oxide interface is performed as well. Finally, the texture formation of epitaxially grown mixed phase films $Ho_xLu_{1-x}Ni_2B_2C$ [see TT.598] is analyzed in dependence on their deposition parameters.

TT 9.16 Mon 14:00 Poster A

Calorimetric investigations of $HoNi_2B_2C$ — •R. Beyer[1], T. Herrmannsdörfer[1], O. Ignatchik[1], D. Souptel[2], G. Behr[2], and J. Wosnitza[1] — [1]Hochfeld-Magnetlabor Dresden (HLD), Forschungszentrum Dresden-Rossendorf, 01328 Dresden, Germany — [2]Institut für Festkörperforschung, IFW Dresden, 01069 Dresden, Germany

The rare-earth nickel borocarbides show an intriguing competition between magnetism and superconductivity. For $HoNi_2B_2C$, this leads to a rich phase diagram with superconducting and magnetic phase transitions. Besides these competing electronic interactions, also the nuclear magnetic moment of Holmium may influence the superconducting state due to a strong hyperfine-enhanced nuclear polarisation. In order to study this in more detail, we have performed high-resolution specific-heat measurements by use of a continuous relaxation-time method. While the superconducting transition at about 8 K results in a very small, but resolvable specific-heat feature, at lower temperatures there are at least three independent magnetic-ordering transitions. One shows a lambda-like anomaly with a small hysteresis indicating a first-order phase transition. Additionally, susceptibility measurements performed below 1K fully agree with specific heat data indicating a possible re-entrant phase transition driven by hyperfine enhanced nuclear magnetism. This work has been partially supported by EuroMagNET II.

TT 9.17 Mon 14:00 Poster A

Superconductivity in $Na_{1-x}CoO_2{\cdot}yH_2O$ thin films — •Sandra Hildebrandt[1], Philipp Komissinkiy[1], Ingo Fritsch[2], Hanns-Ulrich Habermeier[2], Peter Lemmens[3], and Lambert Alff[1] — [1]Institute for Materials Science, TU Darmstadt — [2]Max Planck Institute for Solid State Research, Stuttgart — [3]Institute for Condensed Matter Physics, TU Braunschweig

Sodium cobaltate ($Na_{1-x}CoO_2$) is a novel material with thermoelectric behavior, charge and spin ordered states dependent on the sodium content in the composition. A superconducting phase was found in water intercalated sodium cobaltate ($Na_{1-x}CoO_2{\cdot}yH_2O$) with x = 0.65 - 0.7 and y = 0.9 - 1.3. The pairing state is still under debate, but there are some indications for a spin-triplet or p-wave superconducting pairing state. First films of $Na_{1-x}CoO_2{\cdot}yH_2O$ with a superconducting transition temperature near 5 K have been successfully grown. Here we report on thin films of $Na_{1-x}CoO_2$ grown by pulsed laser deposition technique. The deposition parameters, sodium deintercalation and water intercalation conditions are tuned in order to obtain the superconducting phase. The instability of this phase might be an indication for triplet superconductivity, which is known to be affected strongly by impurities and defects.This observation is in agreement with the fact that so far also no superconducting thin films of the most famous triplet superconductor Sr_2RuO_4 have been reported.

TT 9.18 Mon 14:00 Poster A

Thin Film Deposition of the Pnictide Superconductors $LaO_{1-x}NiBi$ and $LaO_{1-x}CuBi$ using Reactive Molecular Beam Epitaxy — •Alexander Buckow, Jose Kurian, and Lambert Alff — Institut für Materialwissenschaft, TU Darmstadt, Germany

The discovery of iron-based superconductors with T_C above 50 K [1,2] has renewed the interest in the area of high-temperature superconductors. To establish the mechanism of superconductivity in this new group of superconductors, one needs high quality single crystalline and/or epitaxial thin film samples. Most attempts to grow epitaxial thin films of iron-based superconductors were by Pulsed Laser Deposition (PLD) with limited success.

Reactive Molecular Beam Epitaxy (RMBE) is not only a powerful and flexible tool for the synthesis of thin films, but also an ideal technique for the study of composition dependent properties or in the search for new compounds. Since arsenic is toxic we have grown films of the similar compounds $LaO_{1-x}NiBi$ and $LaO_{1-x}CuBi$ [3] from elemental sources on (100) MgO substrates by RMBE. Thin films were characterized by XRD, ρ – T and ICP-OES. The superconducting transition temperature of $LaO_{1-x}NiBi$ thin film is about 6 K compared to 4.4 K as reported for bulk.

[1] Kamihara *et al.*, J. Am. Chem. Soc. 130, 3296 (2008).
[2] Wang *et al.*, EPL 83, 67006 (2008).
[3] Kozhevnikov *et al.*, JETP Lett. 87, 649 (2008).

TT 9.19 Mon 14:00 Poster A

Preparation and investigation of tunnel junctions based on ironpnictide superconductors — •Stefan Schmidt[1], Sebastian Döring[1], Veit Grosse[1], Frank Schmidl[1], Paul Seidel[1], Martin Kidszun[2], Silvia Haindl[2], Bernhard Holzapfel[2], and Ingolf Mönch[2] — [1]Friedrich-Schiller-University Jena, Institute of Solid State Physics, Helmholtzweg 5, 07743 Jena, Germany — [2]IFW Dresden, Institute for Metallic Materials, Helmholtzstrasse 20, 01069 Dresden, Germany

Examination of superconductor tunnel structures allows experimental proof of theoretical predictions about their superconducting properties. Especially for the new iron arsenide based superconductors those examinations are of great importance, because they lead to basic understanding of physical processes in those materials, such as determination of the energy gap and its temperature dependence.

Based on $LaO_{1-x}F_xFeAs$ thin films grown via pulsed laser deposition (PLD) on $LaAlO_3$ substrates, we prepared superconductor - normal conductor - superconductor (S-N-S) tunnel structures by using photolithography, ion beam etching as well as insulating SiO_2 layers. We present first measuring of a $LaO_{1-x}F_xFeAs$ / Au / PbIn system and discuss possibilities for further examinations, including variation of the barrier respectively covering electrode materials on this basis.

TT 9.20 Mon 14:00 Poster A

Investigation on ironarsenide superconductors for their application in Josephson junctions — •Sebastian Döring[1], Stefan Schmidt[1], Veit Grosse[1], Frank Schmidl[1], Paul Seidel[1], Martin Kidszun[2], Silvia Haindl[2], Bernhard Holzapfel[2], and Ingolf Mönch[2] — [1]Friedrich-Schiller-University Jena, Institute of Solid State Physics, Helmholtzweg 5, 07743 Jena, Germany — [2]IFW Dresden, Institute for Metallic Materials, Helmholtzstrasse 20, 01069 Dresden. Germany

We investigate the possibility to produce and characterize Josephson junctions, based on new ironarsenide superconductors. Starting with $LaO_{1-x}F_xFeAs$ thin films, which were produced by pulsed laser deposition (PLD), we present structures, in which Josephson effects can be studied. Because of the technological requirements, tunnel-like structures with natural or artificial barriers seems to be best suited for such investigations. Therefore the ironarsenide base electrode and subsequently the tunnel area were structured by ion beam etching. Sputtered SiO_2 thin films were used as insulating materials. For the counter electrode, conventional superconductors (e.g. Pb, Nb) can be used. We present the first measurement on such systems.

TT 9.21 Mon 14:00 Poster A

Nernst Effect in $LaFeAsO_{1-x}F_x$ — •Agnieszka Kondrat[1],

Jorge Enrique Hamann-Borrero[1], Norman Leps[1], Martin Kosmala[2], Olaf Schumann[2], Jochen Werner[1], Guenter Behr[1], Markus Braden[2], Ruediger Klingeler[1], Christian Hess[1], and Bernd Buechner[1] — [1]IFW Dresden, Helmholtzstrasse 20, 01069 Dresden, Germany — [2]II. Physikalisches Institut, Universitaet zu Koeln, 50937 Koeln, Germany

We report a study on electrical resistivity, thermoelectric power, Hall effect and Nernst coefficient of polycrystalline $LaFeAsO_{1-x}F_x$ in the temperature range 5-300 K and magnetic field 14 T. We show the evolution of transport properties with electron doping (F content x=0, 0.05, 0.1). The parent compound undergoes two phase transitions at the temperature around 150 K: magnetic to antiferromagnetically ordered spin density wave state and structural - from tetragonal to orthorombic crystal structure. The presence of phase transitions gives rise to changes in charge carrier scattering processes, which is reflected as profound anomalies in investigated transport properties. In the superconducting samples these two transitions are not present, nevertheless in the underdoped compound (x=0.05) we observe features reminiscent of the transitions, in particular change of slope in electrical resistivity and Nernst signal. We discuss the possibility of presence of spin fluctations, which lead to formation of SDW state in parent compound and to anomalies in transport properties in underdoped superconducting samples. At the same time the optimally doped sample (x=0.1) does not show any of these characteristic features.

TT 9.22 Mon 14:00 Poster A

Universal normal state susceptibility in iron pnictides — •Rüdiger Klingeler, Norman Leps, Christian Hess, Ulrike Stockert, Hans-Joachim Grafe, Franziska Hammerath, Guillaume Lang, Mahmoud Abdel-Hafez, Luminita Harnagea, Surjeet Singh, Sabine Wurmehl, Günter Behr, Vladislav Kataev, Igor Morozov, and Bernd Büchner — Leibniz Institute for Solid State and Materials Research (IFW) Dresden, Germany

The normal state magnetisation of iron pnctides exhibits a universal increase upon heating. In $LaFeAsO_{1-x}F_x$, both the slope and the absolute value of the susceptibility at elevated temperatures are independent on doping, irrespectively whether long range antiferromagnetic order or the non-magnetic superconducting ground state appears. Our data on LiFeAs, NaFeAs, Ba- and $Ca(Fe_{1-x}Co_x)_2As_2$ single crystals imply the generic nature of this feature. Remarkably, there is quantitative agreement of the slope well above the ground states. We present a scenario of robust local antiferromagnetic correlations persisting even in the superconducting regime of the phase diagram. In addition, we present the phase diagrams based on our specific heat, thermal expansion, μSR, magnetisation and resistivity data. In particular, our data allow to assessing the size of renormalisation effects and we discuss the particular case of LiFeAs.

TT 9.23 Mon 14:00 Poster A

Magnetic properties of $CeFeAs_{1-x}P_xO$ iron pnictides studied by muon spin relaxation — •Johannes Spehling[1], Hans-Henning Klauss[1], Hemke Maeter[1], Til Dellmann[1], Hubertus Luetkens[2], Alex Amato[2], Anton Jesche[3], Cornelius Krellner[3], and Christoph Geibel[3] — [1]Institut für Festkörperphysik, TU Dresden, Germany — [2]Laboratory for Muon-Spin Spectroscopy, Paul Scherrer Institut, CH-5232 Villigen, Switzerland — [3]Max-Planck-Institut fürChemische Physik fester Stoffe Dresden, Germany

We have investigated the electronic phase diagram of the 1111 Fe-pnictide $CeFeAs_{1-x}P_xO$ by means of muon spin relaxation (μSR). From resistivity and magnetic susceptibility a rich variety of electronic ground states including antiferromagnetism, ferromagnetism and superconductivity is inferred. We find that the examined compounds show a strong polarization of the rare earth moments by the long range ordered iron sublattice for x <= 0.4 and independent order of the Cerium-4f moments and short range ordered iron moments for x > 0.4. The peculiar interplay of the rare earth and iron magnetic order as a function of chemical pressure is examined. We further investigated the ground state properties of the heavy fermion system CeFePO.

TT 9.24 Mon 14:00 Poster A

Electrodynamics of electron doped iron-pnictide superconductors $Ba(Fe_{1-x}M_x)_2As_2$ — •Dan Wu[1], Neven Barisic[1], Natalia Drichko[1], Boris Gorshunov[1], Philipp Kallina[1], Martin Dressel[1], Linjun Li[2], Xiao Lin[2], Guanghan Cao[2], and Zhu-an Xu[2] — [1]1. Physikalisches Institut, Universiät Stuttgart, Germany — [2]Department of Physics, Zhejiang University, People's Republic of China

The temperature dependence of the *ab*-plane optical reflectivity of $Ba(Fe_{0.92}Co_{0.08})_2As_2$ and $Ba(Fe_{0.95}Ni_{0.05})_2As_2$ single crystals is measured in a wide spectral range. In the metallic state, the optical conductivity consists of a broad incoherent background and a narrow Drude-like component which determines the transport properties; only the latter contribution strongly depends on the composition and temperature. Upon entering the superconducting regime, the conductivity below 100 cm^{-1} drops due to the complete opening a gap in the density of states at $2\Delta/k_BT_c \approx 2.5-3$. From the analysis of the complex conductivity spectra we obtain the penetration depth $\lambda = (3500 \pm 350)$ Å for $Ba(Fe_{0.92}Co_{0.08})_2As_2$ and (3000 ± 300) Å for $Ba(Fe_{0.95}Ni_{0.05})_2As_2$. The calculated superfluid density ρ_s of both compounds nicely fits the scaling relation $\rho_s = (125 \pm 25)\sigma_{dc}T_c$.

TT 9.25 Mon 14:00 Poster A

Investiagtion of $A Fe_2As_2$ – compounds by means of x-ray spectroscopy — •Anna Buling[1], Ernst Kurmaev[2], J. A. McLeod[3], Alexander Moewes[3], and Manfred Neumann[1] — [1]Department of Physics, University of Osnabrück, Barbarastr. 7, D-49069 Osnabrück, Germany — [2]Institute of Metal Physics, Russian Academy of Sciences-Ural Division, 620219 Yekaterinburg, Russia — [3]Department of Physics and Engineering Physics, University of Saskatchewan, 116 Science Place, Saskatoon, Saskatchewan, Canada S7N 5E2

The discovery of superconductivity in FeAs – compounds gives rise to a high advance in the research of high – temperature superconductors. Shortly after finding superconductivity in the rare – earth compounds (*RE*OFeAs, *RE*=rare-earth) further compounds with Fe_2As_2 layers were discribed.
Different compounds of the new superconductor family AFe_2As_2 (*A*= Ba, Ca) were investigated by means of x-ray spectroscopy. On the basis of XPS Fe 2*p* core level spectra of doped and undoped compounds we discuss the Fe 3*d* electrons to be not strongly but weakly or at most moderatly correlated. The valence band spectra show that the Fermi level is dominated by the Fe 3*d* states. The influence of doping of the host material with different metals is determined and offers new results in the superconducting behavior of these compounds.

TT 9.26 Mon 14:00 Poster A

Phase diagram of $Ca(Fe_{1-x}Co_x)_2As_2$ single crystals — •Mahmoud Abdel-Hafez, Luminita Harnagea, Surjeet Singh, Norman Leps, Liran Wang, Gerd Friemel, Ulrike Stockert, Sabine Wurmehl, Günter Behr, Christian Hess, Rüdiger Klingeler, and Bernd Büchner — Leibniz Institute for Solid State and Materials Research IFW Dresden, D-01171 Dresden, Germany

We present specific heat, thermal expansion and magnetization data on $Ca(Fe_{1-x}Co_x)_2As_2$ single crystals grown from Sn-flux with $0 \leq x \leq 0.2$. From our measurements we determine the phase diagram depicting the doping dependence of the structural/magnetic and superconducting transition temperatures. With increasing Co doping, the simultaneous first-order structural/magnetic transition at $T_0 = 170$ K of pristine $CaFe_2As_2$ is suppressed and superconductivity for $x \geq 0.045$ emerges. The optimal doping level was found to be $x_0 \sim 0.065$. Below and above this value, the superconducting volume fraction diminishes rapidly. In contrast, the onset T_c remains rather unchanged for $x < x_0$ but decreases slowly to 10 K in the overdoped region of the phase diagram. These observations are discussed in the light of recent studies which show extreme pressure sensitivity of $CaFe_2As_2$ with a pressure induced T_c of 10 K.

TT 9.27 Mon 14:00 Poster A

Local visualization of the disordered vortex lattice in overdoped $BaFe_{2-x}Co_xAs_2$ superconductor — •Henry Stopfel[1], Tetyana Shapoval[1], Dmytro S. Inosov[2], Volker Neu[1], Ulrike Wolff[1], Silvia Haindl[1], Konstantin Nenkov[1], Bernhard Holzapfel[1], Ji Tae Park[2], Dunlu L. Sun[2], Chengtian T. Lin[2], Vladimir Hinkov[2], and Ludwig Schultz[1] — [1]IFW Dresden, Institute for Metallic Materials, P.O. Box 270116, 01171 Dresden, Germany — [2]Max Planck Institute for Solid State Research, Heisenbergstraße 1, 70569 Stuttgart, Germany

Using low temperature magnetic force microscopy (MFM) we imaged the vortex distribution in a slightly overdoped $BaFe_{2-x}Co_xAs_2$ ($x = 0.19, T_c = 23$ K) superconducting single crystal [1]. Our local method reveals that at low fields (3 mT und 6 mT) the superconducting flux lines arrange in a vortex glass phase with only a short-range

order. This denotes a presence of pinning centres which prohibit a formation of the ordered Abrikosov lattice. From the statistical processing of MFM data we have extracted the radial correlation length ζ of the vortex lattice and have established the hexagonal local lattice symmetry. It reveals that the visualized vortex distribution can be treated as a disordered triangular lattice. Moreover, the isothermal magnetization loops measured at various temperatures in a wide field range up to 14 T exhibit the "fishtail" effect that is known to be related to the vortex pinning and to the crossover between two different regimes of the vortex lattice.

[1] D. S. Inosov, T. Shapoval, V. Neu, *et al.*, arXiv:0911.1971v1 (2009).

TT 9.28 Mon 14:00 Poster A

Transport studies on 122 Iron Arsenide superconductors — •Gerd Friemel, Saicharan Aswartham, Luminita Harnagea, Surjeet Singh, Norman Leps, Mahmoud Abdel-Hafez, Ulrike Stockert, Günter Behr, Christian Hess, Rüdiger Klingeler, and Bernd Büchner — Leibniz Institute for Solid State and Materials Research Dresden, Germany

We present the transport properties of $Ca(Fe_{1-x}Co_x)_2As_2$ and $Ba(Fe_{1-x}Co_x)_2As_2$ single crystals. In particular, we develop an electronic phase diagram for $Ca(Fe_{1-x}Co_x)_2As_2$, supported by measurements of magnetization and heat capacity. Our data reveal, that bulk superconductivity exists only in a very narrow doping range. Furthermore, we discuss the impact of different doping schemes on the electronic transport in pnictide superconductors.

TT 9.29 Mon 14:00 Poster A

Superconductivity and magnetism in $Eu_{1-x}K_xFe_2(As_{1-y}P_y)_2$ — •Jannis Maiwald, Hirale S. Jeevan, and Philipp Gegenwart — 1. Physikalisches Institut, Georg-August-Universität Göttingen, Friedrich Hund Platz 1, 37077 Göttingen, Germany

We report on a detailed investigation of superconductivity and magnetism in $EuFe_2As_2$ by doping of K and P. In this new class of FeAs-based superconductors it is found that superconductivity appears close to a magnetic instability, suggesting a possible unconventional pairing mechanism.

We have synthesized single crystals and powder samples of both doped and undoped samples of $EuFe_2As_2$ and investigated their physical properties, by means of heat capacity, resistivity, magnetization, thermal conductivity and seebeck-coefficient measurements. The parent compound shows an antiferromagnetic spin-density-wave accompanied by a structural transition (T_{SDW}) at $\approx$ 190K related to the Fe_2As_2 layers and magnetic ordering of Eu^{2+} (T_N) moments at $\approx$ 20K. Upon doping Eu with K >30%, T_{SDW} and T_N get suppressed and superconductivity appears at $\approx$ 32K. On the other hand P doping to the As site also suppresses the SDW transition and leads to a superconducting phase. However in the latter case the Eu transition temperature remains undisturbed. With further increased P doping the Eu order changes from AFM to FM. We will mainly discuss the thermal conductivity measurements of P and K doped samples.

TT 9.30 Mon 14:00 Poster A

Possible Mechanism of Small Magnetic Moment in Iron Pnictides — Hunpyo Lee, •Yu-Zhong Zhang, Harald Jeschke, and Roser Valenti — Institut für Theoretische Physik, Goethe-Universität Frankfurt, Max-von-Laue-Straße 1, 60438 Frankfurt am Main, Germany

The experimentally observed small iron magnetic moment in undoped iron pnictides at low temperatures is still not well understood. We propose that the interplay between frustrated and non-frustrated bands could be the origin for the antiferromagnetic metallic state with small magnetization. Our theory is free of assumptions, like, negative U, effective pressure or localization. The proposal is verified by using dynamical mean field theory combined with the continuous time quantum Monte Carlo method to solve a two-band frustrated Hubbard model without artificially ignoring the antiferromagnetic solution. Furthermore, interesting phenomena, like orbital selective metal-to-insulator transitions, are carefully investigated.

TT 9.31 Mon 14:00 Poster A

Electronic dispersion anomalies in Fe-pnictide superconductors — •Andreas Heimes[1], Roland Grein[1,2], Matthias Eschrig[1,2,3], and Gerd Schön[1,2] — [1]Institut für Theoretische Festkörperphysik, Karlsruhe Institute of Technology, D-76131 Karlsruhe, Germany — [2]DFG Forschungszentrum Center for Functional Nanostructures (CFN), Karlsruhe Institute of Technology, D-76128 Karlsruhe, Germany — [3]Fachbereich Physik, Universität Konstanz, D-78457 Konstanz, Germany

We investigate anomalies in the electronic band dispersion in Fe-pnictides that result from a coupling of electrons to spin fluctuations. It is known from inelastic neutron scattering experiments that a magnetic resonance feature appears in the dynamical spin susceptibility when entering the superconducting state, both in Fe-pnictides and in cuprates. This raises the question, if similar mechanisms are at work. An important question related to this is to which extend the dispersion of the electronic bands is modified by the interaction between electrons and this resonant spin excitation, similarly as it is the case for cuprate superconductors. We present a theoretical study of this problem.

TT 9.32 Mon 14:00 Poster A

Gauge modes in non-centrosymmetric superconductors — •Ludwig Klam[1], Dietrich Einzel[2], and Dirk Manske[1] — [1]Max-Planck-Institut für Festkörperforschung, Heisenbergstraße 1, D-70569 Stuttgart — [2]Walther-Meißner-Institut, Bayerische Akademie der Wissenschaften, D-8548 Garching

It is well-known, that the broken gauge symmetry characterizing the ground state of conventional BCS-superconductors is reflected in the existence of a gapless collective mode, the so-called Anderson-Bogoliubov or *gauge mode*. Besides other possible collective mode excitations, it is the gauge mode, that exists also in unconventional superconductors, which can be described by order parameters with more than two components. In this contribution, we investigate the structure and the role of the gauge mode in a class of superconductors without inversion center. In these so-called non-centrosymmetric superconductors (NCS), a parity violating antisymmetric spin-orbit coupling (ASOC) gives rise to a band splitting and causes the possible coexistence of singlet and triplet contributions to the superconducting order parameter. Using the Nambu kinetic equation approach, we present a comprehensive analysis of the gauge mode in NCS. Particular emphasis will be on (i) its ultimate necessity for the existence of the charge conservation law and (ii) the prediction of a splitting of the gauge mode into two branches, located on the two bands, with increasing strength of the ASOC.

TT 9.33 Mon 14:00 Poster A

Transition to a single-sheet Fermi surface in bulk nickelates and in $LaNiO_3/LaAlO_3$ Heterostructures — Philipp Hansmann[1,2], •Alessandro Toschi[1], Xiaoping Yang[2], Giniyat Khaliullin[2], Ryotaro Arita[3], Ole K. Andersen[2], and Karsten Held[1] — [1]Institute of Solid State Physics, Vienna University of Technology — [2]Max Planck Institute for Solid State Research, Stuttgart — [3]Department of Applied Physics, Universtity of Tokyo

The possibility of finding bulk nickelates with an electronic structure analogous to that of high temperature cuprate superconductors was considered a while ago [1]. For the systems available at that time the results were not encouraging so the idea was discarded. However, nowadays, due to new experimental techniques, heterostructures can be engineered offering new possibilities for actual material design. Using the local density approximation and its combination with dynamical mean field theory (LDA+DMFT), we compare the transition to a single sheet (cuprate-like) Fermi surface induced by the strong electronic correlation in bulk nickelates and in $LaNiO_3/LaAlO_3$ Heterostructures [2].

[1] V.I. Anisimov et al., Phys. Rev.B **59**, 7901 (1999).
[2] P. Hansmann et al., Phys. Rev. Lett. **103**, 016401 (2009).

TT 9.34 Mon 14:00 Poster A

De Haas-van Alphen (dHvA) study of the isostructural compounds $YbCoIn_5$ and $LuCoIn_5$ — •A. Polyakov[1], O. Ignatchik[1], M. Bartkowiak[1], A. Bianchi[2], B. Prevost[2], G. Seyfarth[2], Z. Fisk[3], D. Hurt[3], R.G. Goodrich[4], E.S. Choi[5], and J. Wosnitza[1] — [1]Hochfeld-Magnetlabor Dresden (HLD), FZ Dresden-Rossendorf, Dresden, Germany — [2]Department of Physics, University of Montreal, Canada — [3]Department of Physics and Astronomy, University of California, Irvine (CA), USA — [4]Department of Physics, George Washington University, Washington (DC), USA — [5]National High Magnetic Field Laboratory, Tallahassee (FL), USA

The intermetallic compounds $R\mathrm{In}_3$ and $RT\mathrm{In}_5$ (R = rare earth, T = transition metal) have attracted great interest for their large variety of anomalous ground states. Among these are the well-known heavy-fermion superconductors $CeCoIn_5$ and $CeIrIn_5$. We present here a

dHvA study of $YbCoIn_5$ and $LuCoIn_5$, performed by use of a capacitive torque cantilever technique at temperatures down to 0.4 K in magnetic fields up to 13 T. In addition, one single crystal of $LuCoIn_5$ has been measured in magnetic field up to 34 T. Besides their angular-dependent Fermi-surface topologies, we have also determined the effective masses of the different bands by following the temperature-dependent amplitude changes of the dHvA oscillations. A large number of different dHvA frequencies has been observed for the main crystallographic directions. In contrast to $CeCoIn_5$ and $CeIrIn_5$, the cyclotron effective masses for these compounds are in the range from 0.7 to 2.0 m_0.
Work supported in part by EuroMagNET, EU contract No. 228043.

TT 9.35 Mon 14:00 Poster A

Low-temperature thermal expansion of URhGe — •Sebastian Zaum[1,2], Frédéric Hardy[1], Kai Grube[1], Roland Schäfer[1], Christoph Meingast[1], Hilbert v. Löhneysen[1,2], Dai Aoki[3], and Jacques Flouquet[3] — [1]Karlsruher Institut für Technologie, Institut für Festkörperphysik, 76021 Karlsruhe, Germany — [2]Karlsruher Institut für Technologie, Physikalisches Institut, 76128 Karlsruhe, Germany — [3]Commissariat à l'Énergie Atomique, INAC, SPSMS, 17 rue des Martyrs, 38054 Grenoble, France

URhGe is one of the few ferromagnetic superconductors. At ambient pressure, it exhibits superconductivity with an upper critical field of $B_{c2}^{\|b} \approx 2$ T. A characteristic feature of these superconductors is their strong magnetic anisotropy. In URhGe, the magnetic field can be used to tune the system to a metamagnetic transition where the magnetic moment reveals a sudden rotation in the crystallographic bc plane and superconductivity reappears at a magnetic field of $B \approx 12$ T with $B \parallel b$. To study the anisotropic coupling of ferromagnetism and superconductivity to the crystal lattice, we performed thermal expansion measurements of a URhGe crystal in the temperature range 30 mK $< T <$ 15 K and in magnetic fields up to 14 T. At $B = 0$, the measurements show the ferromagnetic transition at $T_C \approx 10$ K and confirm bulk superconductivity below $T_{sc} \approx 0.2$ K. The field dependence of the thermal expansion and first results of the uniaxial pressure dependences of T_{sc} will be presented and discussed in comparison with related U-based superconductors.

TT 9.36 Mon 14:00 Poster A

Superconducting Phase Diagram of $Rh_{17}S_{15}$ — •M. Uhlarz[1], O. Ignatchik[1], J. Wosnitza[1,3], R. Daou[2], M. Doerr[3], A. Haase[1,3], H.R. Naren[4], A. Thamizhavel[4], and S. Ramakrishnan[4] — [1]Hochfeld-Magnetlabor Dresden, Forschungszentrum Dresden-Rossendorf, 01314 Dresden — [2]Max-Planck-Institut für Chemische Physik fester Stoffe, 01187 Dresden — [3]Institut für Festkörperphysik, TU Dresden, 01069 Dresden — [4]Tata Institute of Fundamental Research, Mumbai-400005, India

$Rh_{17}S_{15}$ is a 4*d*-electron metal which becomes superconducting below $T_c = 5.4$ K at zero field. The upper critical field is 19.2 T at $T = 0.07$ K. Above T_c, $Rh_{17}S_{15}$ is a paramagnet. The crystallographic structure (Pm3m) of $Rh_{17}S_{15}$ features a nearest-neighbor Rh-Rh distance even less than in elementary (fcc) Rh, possibly resulting in a high density of 4*d*-electron states at the Fermi level.

Using a polycrystalline sample, we measured the specific heat, resistivity, magnetisation, and magnetostriction in fields up to 14 T as well as the magnetic susceptibility in fields up to 20 T. Our data allow us to present the complete superconducting phase diagram. The assumption of narrow 4*d* band states (and thus of strong electronic correlations not providing magnetic correlations) is supported by the moderately enhanced electronic contribution to the specific heat of 107 mJ/molK^2 and favors the existence of a strong superconducting interaction. Together with the remarkably high upper critical field (exceeding the Pauli limit by a factor of two), our findings make $Rh_{17}S_{15}$ a likely candidate for unconventional superconductivity.

TT 9.37 Mon 14:00 Poster A

Surface induced superconductivity of Bi nanowires? — T. Kaupp[1,2], T.W. Cornelius[3], R. Neumann[3], •T. Peichl[1], and G. Weiss[1,2] — [1]Physikalisches Institut — [2]Centrum für funktionelle Nanostrukturen, KIT 76128 Karlsruhe — [3]GSI Darmstadt

Owing to its large Fermi wavelength and very long mean free paths, Bi is a fascinating metal for studies of transport phenomena in samples of reduced dimensions. Previous experiments explored the influence of the wire diameter on the resistance and the magnetoresistance in a wide temperature range above 1 K. Here, we present to our knowledge for the first time transport measurements below 1 K of crystalline Bi wires with diameters in the 100 nm range. At temperatures below about 0.3 K we find a remarkable decrease of the sample resistances and related effects of an external magnetic field. At first glance, some of our measurements are reminiscent of weak localization. By considering the observed conductance variations of up to 600 e^2/h this can be ruled out after all. Although the measurements suggest that the band structure of our wires are close to that of bulk crystalline Bi, which is not superconducting, one might speculate whether surface states can change the electronic structure in favor of superconductivity.

TT 9.38 Mon 14:00 Poster A

Charge Transport through One-dimensional Arrays of Small Capacitance Josephson Junctions — •Jochen Zimmer, Hannes Rotzinger, and Alexey V. Ustinov — Physikalisches Institut, Karlsruhe Institute of Technology

We investigate one-dimensional arrays of small capacitance Josephson junctions fabricated by conventional e-beam lithography techniques. The arrays are designed to operate in the vicinity of the Coulomb blockade regime. It has been suggested that charges propagate though these arrays in a form similar to solitary waves, following the sine-Gordon model. This system is dual to a long Josephson junction, in which magnetic flux solitons have been thoroughly investigated in the past. Localized charge excitations are of metrological interest because they might offer access to very accurate frequency-to-current conversion. Although previous experiments appear consistent with the existence of solitary charge transport, conclusive evidence is still missing. We present our recent fabrication and measurement results obtained at millikelvin temperatures.

TT 9.39 Mon 14:00 Poster A

Numerical analysis of small charge solitons in 1D arrays of Josephson junctions — •Jens Homfeld, Alexander Shnirman, and Ivan Protopopov — Institut für Theorie der Kondensierten Materie and DFG Center for Functional Nanostructures, Karlsruhe Institute of Technology, 76128 Karlsruhe, Deutschland

We investigate numerically a one-dimensional array of Josephson junctions in the regime of small charge solitons, $\Lambda E_J > E_C > E_J$. Here E_C and E_J are the charging and the Josephson energies of the junction, respectivly, and Λ is the bare screening length (measured in number of junctions). Our investigation is based on the many-body tight binding approach developed in Ref. [1]. We have developed an efficient algebraic method which allowed us to take into account many charge states and confirm the observations of Ref. [1], namely i) the flattening of the dispersion relation in the outer region of the Brillouin zone; ii) the broadening of the soliton in the flat band regime.

[1] S. Rachel and A. Shnirman, Phys. Rev. B 80, 180508(R) (2009).

TT 9.40 Mon 14:00 Poster A

Simulation of the I-V characteristics of short arrays of small Josephson junctions — •Felix Maibaum and Alexander Zorin — Physikalisch-Technische Bundesanstalt Braunschweig

Small single Josephson junctions and short serial arrays of these elements whith comparable charging- and Josephson energies can exhibit constant-current steps in their I-V characteristics when an AC signal is applied. This effect is due to phase locking of the Bloch oscillations associated with coherent tunneling of single Cooper pairs and is in many ways dual to the Shapiro steps, which appear at a constant voltage in arrays of larger junctions. To observe the current steps, the circuit needs to be embedded in a high-impedance environment, with an impedance significantly larger than the resistance quantum at the characteristic frequencies of the system. Such an impedance can be provided by high-ohmic on-chip thin-film resistors. Stray capacitances of these resistors will in reality result in a frequency-dependent impedance of the environment. We have performed circuit simulations to evaluate the influence of different electromagnetic environments on the step size as well as optimized the delivery of the AC drive. We have also examined the influence of noise in the on-chip resistors on the shape of the steps which can be observed in this system.

TT 9.41 Mon 14:00 Poster A

Critical disorder effects in Josephson-coupled quasi-one-dimensional superconductors — •Enver Nakhmedov and Reinhold Oppermann — Institut für Theoretische Physik, Universität Würzburg, D-97074 Würzburg, Germany

Effects of non-magnetic randomness on the critical temperature T_c and diamagnetism are studied in a class of quasi-one dimensional supercon-

ductors. The energy of Josephson-coupling between wires is considered to be random, which is typical for dirty organic superconductors. We show that this randomness destroys phase coherence between the wires and T_c vanishes discontinuously when the randomness reaches a critical value. The parallel and transverse components of the penetration depth are found to diverge at different critical temperatures $T_c^{(1)}$ and T_c, which correspond to pair-breaking and phase-coherence breaking. The interplay between disorder and quantum phase fluctuations results in quantum critical behavior at $T = 0$, manifesting itself as a superconducting-normal metal phase transition of first-order at a critical disorder strength.

TT 9.42 Mon 14:00 Poster A

Surface superconductivity controlled by electric field — •Klaus Morawetz[1,2], Pavel Lipavský[3,4], and Jan Kolaček[4] — [1]University of Applied Science Münster, Stegerwaldstrasse 39, 48565 Steinfurt, Germany — [2]International Center for Condensed Matter Physics, Universidade de Brasília, 70904-910, Brasília-DF, Brazil — [3]Faculty of Mathematics and Physics, Charles University, Ke Karlovu 3, 12116 Prague 2, Czech Republic — [4]Institute of Physics, Academy of Sciences, Cukrovarnická 10, 16253 Prague 6, Czech Republic

We discuss an effect of the electrostatic field on superconductivity near the surface. First, we use the microscopic theory of de Gennes to show that the electric field changes the boundary condition for the Ginzburg-Landau function. Second, the effect of the electric field is evaluated in the vicinity of H_{c3}, where the boundary condition plays a crucial role.We predict that the field effect on the surface superconductivity leads to a discontinuity of the magnetocapacitance. We estimate that the predicted discontinuity is accessible for nowadays experimental tools and materials. It is shown that the magnitude of this discontinuity can be used to predict the dependence of the critical temperature on the charge carrier density which can be tailored by doping.

TT 9.43 Mon 14:00 Poster A

Measurement of Dielectric Losses in Amorphous Thin Films at GHz Frequencies Using Superconducting Resonators — •Sebastian Skacel[1], Christoph Kaiser[1], Stefan Wünsch[1,2], Michael Siegel[1,2], Ralf Dolata[3], Brigitte Mackrodt[3], and Alexander Zorin[3] — [1]Institut für Mikro- und Nanoelektronische Systeme (IMS), Karlsruher Institut für Technologie — [2]Center for Functional Nanostructures, Karlsruher Institut für Technologie — [3]Physikalisch-Technische Bundesanstalt (PTB), Braunschweig

Josephson junctions (JJs) are employed for many applications involving microwave signals, so that low microwave losses in the structures are desirable. We have developed a reliable method for the direct measurement of dielectric losses in thin films. Thus we obtain quantitative values for the losses in the film volume as well as the metal/dielectric interfaces. Using different resonator geometries we studied the losses in dielectric thin films usually used for JJ fabrication, such as Nb_2O_5, SiO, SiO_2 and SiN_x, at 4.2K and low GHz frequencies. The results show that for such amorphous materials, the bulk losses clearly exceed the interface losses. Furthermore, the frequency dependence of the losses in this working regime was studied for the first time. Our results are in good agreement with the universal law and suggest that the losses are due to many-body interacting dipoles, which is an important fact for the theoretical modelling of two-level-fluctuators. Further investigations of dielectric multi-layer films are in good agreement with the theoretical expectations, which allows the optimisation of such multi-layers usually used in JJ and qubit fabrication.

TT 9.44 Mon 14:00 Poster A

Dc SQUIDs with sub-micron-sized Nb/HfTi/Nb Josephson junctions for operation in high magnetic fields — •Joachim Nagel[1], Oliver Kieler[2], Konstantin Konovalenko[1], Johannes Kohlmann[2], Alexander Zorin[2], Reinhold Kleiner[1], and Dieter Koelle[1] — [1]Physikalisches Institut – Experimentalphysik II and Center for Collective Quantum Phenomena and their Applications, Universität Tübingen, Auf der Morgenstelle 14, D-72076, Germany — [2]Fachbereich 2.4 "Quantenelektronik", Physikalisch-Technische Bundesanstalt, 38116 Braunschweig, Germany

We investigate the suitability of dc superconducting quantum interference devices (SQUIDs) for operation in high magnetic fields (up to $B \approx 100\,\mathrm{mT}$) at temperature $T = 4.2\,\mathrm{K}$. The micro SQUIDs with superconductor (S) - normal metal (N) - superconductor (S) submicrometer Josephson junctions were realized using Nb electrodes and HfTi for the normal interlayer. Our fabrication technology combines e-beam lithography and chemical-mechanical polishing which enables junction sizes down to $200\,\mathrm{nm} \times 200\,\mathrm{nm}$, integrated into small superconductor rings with inner dimensions down to $0.5\,\mu\mathrm{m} \times 0.5\,\mu\mathrm{m}$. The characteristic voltage of the SNS junctions is typically $30 - 40\,\mu\mathrm{V}$ with a McCumber parameter $\beta_C < 0.1$, and a screening parameter of the SQUIDs $\beta_L \approx 0.2$. The SQUIDs where characterized by measurements of electric transport and noise (using a Nb dc SQUID amplifier) in a magnetically shielded environment as well as in high magnetic fields. The SQUIDs show very low flux noise which is a major prerequisite for their application as detectors for magnetic properties of nanoparticles.

TT 9.45 Mon 14:00 Poster A

Experimental Test for "Münchhausen Effect" in an Asymmetric dc-SQUID — •Susanne Butz, Kirill G. Fedorov, Alexey K. Feofanov, and Alexey V. Ustinov — Physikalisches Institut, Karlsruher Institut für Technologie, 76131 Karlsruhe, Germany

We will report experiments aimed at observation of the so called "Münchhausen effect" - a coupling of one classical and one quantum mechanical degree of freedom. It has been theoretically predicted in [1] that this effect can be realised in an asymmetric dc-SQUID. The two junctions in the superconducting loop are made to have the same critical current but different capacitances. This creates a system with strongly asymmetric dynamical parameters. The capacitively shunted junction behaves classically and thus cannot tunnel out of a metastable state. In turn, the quantum mechanical junction can leave its metastable minimum via macroscopic quantum tunneling. This process distorts the potential for the classical junction resulting in an effective decrease of the potential barrier height. If the coupling between the juntions is strong enough this distortion is sufficient to turn the metastable minimum into an inflection point of the classical junction.

We will report switching current histograms taken and investigated for different dc-SQUID parameters, temperatures and flux biases. In addition we performed numerical simulations using classical noise and compared the results with experimental data.

[1] A.U. Thomann, V.B. Geshkenbein and G. Blatter, Phys. Rev. B **79**, 184515 (2009).

TT 9.46 Mon 14:00 Poster A

Microwave Fluxon Readout for Superconducting Qubits — •Kirill G. Fedorov and Alexey V. Ustinov — Physikalisches Institut, Karlsruhe Institute of Technology, Karlsruhe, Germany

We are experimentally investigating a new type of detector for very fast and weakly perturbing readout of superconducting qubits. The detection principle is based on measuring the delay time of a ballistic magnetic fluxon moving in a Josephson transmission line when passing by a qubit [1,2]. Due to magnetic perturbation the fluxon propagation delay depends on the state of the qubit. On the way towards experimental realization of fluxon detector, we report measurements of such fluxon radiation from annular Josephson junctions using a cryogenic microwave amplifier. We have measured fine structure of fluxon step on current-voltage characteristic by detecting fluxon radiation frequency. The fluxon delay by an external magnetic perturbation of 0.1 nT induces fluxon oscillations frequency shift of 1.9 MHz. This suggest that a phase shift of fluxon oscillator can be used for non-destructive repetitive measurements of the qubit state.

[1] D.V. Averin, K. Rabenstein, and V. K. Semenov, Phys. Rev. B **73**, 094504 (2006).

[2] A. Fedorov, A. Shnirman, G. Schön, and A. Kidiyarova-Shevchenko, Phys. Rev. B **75**, 224504 (2007).

TT 9.47 Mon 14:00 Poster A

Experiments with phase qubits and two-level-fluctuators — •Grigorij J. Grabovskij, Pavel Bushev, Juergen Lisenfeld, Alexander Lukashenko, and Alexey V. Ustinov — KIT, Physikalisches Institut, Wolfgang-Gaede-Strasse 1, 76131 Karlsruhe

We explore the complexity of the dynamical behaviour of a system consisting of a Josephson phase qubit and several two-level-fluctuators (TLF) coupled to it. Coherent driving of a qubit at the resonance with a TLF results in formation of a hybrid system consisting of 4 levels [1]. In our study we aim at a more detailed understanding of the physical nature of TLFs and their interaction with the qubit and electromagnetic environment. The presence of TLFs clearly appears in excitation spectrum of the qubit as avoided level crossings. The measured relaxation dynamics of individual TLFs yields the value for decay time T_1 and decoherence time T_2. Surprisingly, the measured

T_1 and T_2 of some of TLFs exceed those of the qubit ($\sim$ 100 ns). We show that quantum beating between qubit and TLF reveals the presence of weak fluctuators which are hardly detectable in a standard spectroscopy. We will report new data on swap-spectroscopy, in which a microwave pulse and population swap between qubit and fluctuator is followed by the qubit readout. Using this method, it becomes possible to study direct interaction of microwave excitation. [1] J. Lisenfeld et al., arXiv:0909.3425

TT 9.48 Mon 14:00 Poster A

The influence of magnetic stray field on the critical current in NbN/$SmCo_5$-bilayers — •Jan Engelmann, Silvia Haindl, Ingolf Moench, Ludwig Schultz, and Bernhard Holzapfel — IFW Dresden, P. O. Box 27 01 16, 01171 Dresden, Germany

The coexistence of superconductivity (sc) and ferromagnetism (fm) in artificially grown heterostructures, sc/fm-bilayers in the simplest case, leads to new interesting phenomena like field compensation- and stray field effects. The intermetallic permanent magnet $SmCo_5$ is especially known for its large magnetic anisotropy energy. Thin films of $SmCo_5$ have been prepared with extremely high coercivity fields up to 3 T (at room temperature) and up to 5 T at 10 K. To investigate the influence of the magnetic stray field on a conventional superconductor, 50 nm NbN layers have been grown on $SmCo_5$ thin films using pulsed laser deposition (PLD). The magnetic properties were determined by VSM and MFM measurements. Critical current measurements were made by a standard four-probe technique. The angular-dependent critical current has been investigated.

TT 9.49 Mon 14:00 Poster A

Inverse Proximity Effect in FSF Heterostructures — Christian Wagner[1], Roland Grein[1], Matthias Eschrig[1,2], and •Gerd Schön[1] — [1]Institut für Theoretische Festkörperphysik and DFG Center for Functional Nanostructures (CFN), Karlsruhe Institute of Technology, D-76128 Karlsruhe, Germany. — [2]Fachbereich Physik, Universität Konstanz

We employ the quasiclassical theory of superconductivity to study the inverse proximity effect in FSF trilayer structures, where F is a strongly spin-polarized ferromagnet and S a singlet superconductor. In particular, we focus on effects induced by spin-dependent scattering phases at the S/F-interfaces. The resulting triplet pairing component will lead to a suppression of the superconducting gap. This enables us to investigate the influence of the relative magnetization orientation of the two ferromagnetic layers on the superconducting transition temperature.

TT 9.50 Mon 14:00 Poster A

Planar S-(S/F)-S Josephson junctions induced by inverse proximity effect — •Andreas Pfeffer[1], Ondrej Vavra[1], Wolfgang Pfaff[1], Marco Aprili[2], and Christoph Strunk[1] — [1]Institute for Experimental and Applied Physics, University of Regensburg, 93040 Regensburg, Germany — [2]CSNSM-CNRS, Université Paris-Sud, 91405 Orsay Cedex, France

We investigate Josephson contacts made from crossed Nb and Fe strips. The weak link is created by the inverse proximity effect in the contact area between superconductor and ferromagnet. If we vary the width of the ferromagnetic strip and the ferromagnetic material, we observe a reduction of the critical current with increasing Fe strip width, which can be explained qualitatively by a reduced coupling between the superconducting reservoirs. A more detailed investigation has been performed on a sample with a 200 nm wide Fe strip and strong coupling between the superconducting leads. A quasiparticle current injected via the Fe strip has a strong impact on the critical current I_c. For comparison, samples with pure Pd instead of Fe were studied. This enables us to compare the effect of charge imbalance, spin injection and electron heating.

TT 9.51 Mon 14:00 Poster A

Investigation of nanoscale superconductor-ferromagnet hybrids using very low temperature STS — •Michael Wolz and Elke Scheer — Fachberich Physik, Universität Konstanz, 78457 Konstanz

We investigate laterally structured superconductor-ferromagnet hybrids using a very low temperature STM. A STM is the ideal instrument to investigate the quasiparticle density of states (DOS) with high lateral resolution.The DOS in the superconductor is influenced by proximity effect as well as by the electromagnetic interaction with the ferromagnet. In an external magnetic field B, this can lead to interesting effects such as the oscillatory dependence of the critical temperature on B or the nonuniform nucleation of superconductivity. For a review see [1]. The proximity effect can be suppressed by spatial separation of the superconductor from the ferromagnet using an insulating layer. We present first results obtained on arrays of ferromagnetic Co dots covered by Al as a superconductor.

[1] A. Y. Aladyshkin, A. V. Silhanek, W. Gillijns, and V. V. Moshchalkov, Superconductor Science and Technology 22, 053001 (2009).

TT 9.52 Mon 14:00 Poster A

Ferromagnet-superconductor hybrids with perpendicular magnetization: current-perpendicular-to-plane measurements — •Richard Montbrun[1], Christoph Sürgers[1], and Hilbert v. Löhneysen[1,2] — [1]Karlsruher Institut für Technologie, Physikalisches Institut, D-76131 Karlsruhe — [2]Karlsruher Institut für Technologie, Institut für Festkörperphysik, D-76131 Karlsruhe

Ferromagnet (F)/superconductor (S)/F hybrid structures - with S = Nb and Co/Pt multilayers as F electrodes - were fabricated by e-beam lithography and reactive ion-etching using silicon-nitride shadow masks on Si/SiO_2. The perpendicular magnetization of the F electrodes was confirmed by measurements of the anomalous Hall effect. The sample layout was developed to allow for four-point resistivity measurements with the current perpendicular to the F/S interface. In the normal state (temperature T = 10 K) the magnetoresistance $R(H)$ shows a spin-valve effect due to the different coercivities of the top and bottom F electrode arising from different Co-layer thicknesses and deposition temperatures. At lower temperatures we investigate the resistance $R(H,T)$ of the superconducting spin-valve for different S-layer thicknesses and transport currents. Preliminary data demonstrate a current dependence of the transition temperature T_c in the magnetically saturated state but only a minor influence of the relative orientation of the two F-layer magnetizations on T_c. Effects of the magnetic stray fields arising from the nanostructured F electrodes and the spin-dependent scattering on the superconducting properties are discussed.

TT 9.53 Mon 14:00 Poster A

Supercurrents through carbon nanotubes with Nb contacts — •Thomas Geiger — Institute for Experimental and Applied Physics, University of Regensburg

Based on previous work in our group, proximity induced supercurrents through a MWCNT of length 1.3 μm and diameter about 15 nm was measured. The sample was connected in 3-point geometry using a Pd/Nb 2.5/45 nm bilayer as direct contact material. Since Nb is the strongest elementary superconductor, it promises advantages over other materials like Al. Contact separation was about 300 nm, exceeding the typical scattering length in the tube. An elaborate on-chip RC-environment consisting of high-Ohmic leads and large bonding pads made of AuPd was used to ensure good electrical filtering in direct vicinity of the structure. In addition to thorough electrical filtering of the measurement lines this enabled us to perform sensitive measurements of the critical current.

The sample was covered with 50 nm Al_2O_3 and a local 2.6 μm wide and 55 nm thick Pd-topgate directly above the nanotube. This gate showed very effective and reliable operation. Despite the coverage of the nanotube, supercurrent was still detectable.

We found a peculiar subgap structure in the dI/dV- and IV-characteristics and investigated its temperature and gate voltage dependence.

TT 9.54 Mon 14:00 Poster A

Spatially Resolved Photoresponse of NbN Nanowires — •Philipp Jung[1], Alexander Lukashenko[1], Alexander P. Zhuravel[2], Stefan Wuensch[1], Matthias Hofherr[1], Konstantin Ilin[1], Michael Siegel[1], and Alexey V. Ustinov[1] — [1]Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany — [2]B. Verkin Institute for Low Temperature Physics & Engineering, Kharkov Ukraine

We are investigating optical response of superconducting nanowires patterned from thin NbN films deposited on sapphire and Si substrates. These structures are often used for radiation detectors like single-photon detectors and hot-electron bolometer mixers. In our experiments, we precisely position a focused laser beam on the detector to correlate the response to a local excitation. Scanning the laser spot over the sample surface allows us to obtain response maps of the investigated wires.

We have found spatially localized weak areas in case of NbN films on sapphire substrates, which can be attributed to grain boundaries

with suppressed superconducting properties. In opposite, the strongest response of NbN bridges on Si substrates was obtained at the edges of bridges. We are going to present and analyze the dependence of response of NbN thin film bridges on light intensity and operation temperature.

TT 9.55 Mon 14:00 Poster A

Progress in the development of large-scale MMC detector arrays — •Sebastian Kempf, Andreas Fleischmann, Loredana Gastaldo, Thomas Wolf, and Christian Enss — Kirchhoff-Institut für Physik, Universität Heidelberg, Germany.

During the last decade low-temperature particle detectors like metallic magnetic calorimeters (MMCs) became interesting instruments for numerous experiments in atomic and nuclear physics, material science and x-ray astronomy. Since large detection areas, high count rates or especially imaging capabilities are often required, significant effort is put into the development of large detector arrays. To accommodate constraints on cryogenic wiring and to reduce parasitic heat load, sophisticated techniques for reading out large arrays with a small number of wires have to be designed.

We discuss possible multiplexing techniques for MMCs and present recent results of the development of a frequency-domain multiplexed MMC detector array based on a dissipationless microwave SQUID multiplexer. This includes a systematic study of the properties of the fabricated superconducting CPW microwave resonators, a full characterization of the microwave setup and a preliminary design of a microwave rf-SQUID. We present performance tests of a single pixel MMC optimized for high-resolution x-ray spectroscopy and outline the properties of a room-temperature microwave electronics needed to read out a fully working MMC detector array.

TT 9.56 Mon 14:00 Poster A

Micro-fabrication of metallic magnetic calorimeters — •S. Schäfer, S. Kempf, A. Pabinger, C. Pies, J-P. Porst, F. v. Seggern, T. Wolf, L. Gastaldo, A. Fleischmann, and C. Enss — Kirchhoff Institut für Physik, INF 227, 69120 Heidelberg

Metallic magnetic calorimeters (MMC) are energy dispersive particle detectors with very high resolving power that are operated at temperatures below 100 mK. Our presently fabricated MMCs consist of a particle absorber made of electroplated gold, in tight thermal contact to a temperature sensor. The sensor is made of the paramagnetic alloy Au:Er and placed in a weak magnetic field. A temperature rise upon the absorption of a particle is detected via the change of the sensor's magnetization monitored by a dc-SQUID. A planar meander shaped coil made of niobium underneath the sensor is used to generate the necessary bias magnetic field and to pick-up the change of magnetization. An on-chip persistent current switch with Au:Pd heater is used to inject the field generating current. We describe the fabrication steps for the Au:Er sputter target and the co-sputter process for the deposition of the sensor material. We discuss the challenge of electroplating high quality gold into a mold of photo resist to fabricate overhanging absorbers on top of the sensors and present the processes for the sputter deposition and micro-structuring of niobium, SiO_x and Au:Pd. We report on measurements of all relevant material properties at low temperatures, e.g. the critical current density of the niobium structures as well as the specific heat and the magnetization of the sensor material, and compare them to those of the corresponding bulk materials.

TT 9.57 Mon 14:00 Poster A

Metallic magnetic calorimeters for high-precission QED tests at GSI/FAIR — •Christian Pies, Andreas Pabinger, Sebastian Kempf, Andreas Fleischmann, Loredana Gastaldo, and Christian Enss — Kirchhoff-Institut für Physik, Universität Heidelberg, Germany.

Quantum electrodynamics belongs to the best tested and established theories in modern physics. However, the evaluation of high order processes, as necessary in strong fields, is still demanding. A precission test of QED in strong fields is the comparison of the calculated and measured Lamb-shift of the ground state in hydrogen-like heavy ions.

For the spectroscopy of hydrogen-like Uranium at GSI/FAIR, we recently started the development of a detector for hard x-rays emitted during the transition into the ground state. The detector consists of four independent, gradiometric metallic magnetic calorimeters (MMCs) forming a linear 8-pixel array and is completely microfabricated. Each pixel covers an area of 1 mm^2 and is equipped with a 200 μm thick electrodeposited gold absorber. The detectors are designed to provide an energy resolution better than 30 eV in the relevant energy range up to 100 keV with a stopping power larger than 85 %.

We present the considerations which lead to our present detector design, the methods used for the fabrication of the MMC array as well as first characterization measurements.

TT 9.58 Mon 14:00 Poster A

Low temperature detectors for direct neutrino mass measurements — •Jan-Patrick Porst, Falk v. Seggern, Andrea Kirsch, Loredana Gastaldo, Andreas Fleischmann, and Christian Enss — Kirchhoff-Institute for Physics, INF 227, 69120 Heidelberg

Presently one of the great challenges in neutrino physics is to determine the mass hierarchy of the neutrino mass eigenstates as well as the absolute values of the masses. The spectrum of a beta decay or an electron capture decay contains the mass information and is thus a main focus of studies in this field. Besides the already well established examination of the shape of the tritium beta spectrum with large scale spectrometers also other isotopes and experimental methods are under investigation. We present two promising experiments studying the beta decay of ^{187}Re and the electron capture decay of ^{163}Ho. Both isotopes have low Q-values and are therefore well suited for neutrino mass investigations. In both experiments the decay spectrum is measured calorimetrically with an energy resolution as high as $\Delta_{FWHM} = 2\,eV$. Low temperature metallic magnetic calorimeters were developed and fabricated for these applications.
We present currently developed detector prototypes and results of characterization measurements. Furthermore, we discuss the sensitivity of future mid- or large-scale experiments on the neutrino mass assuming the presently achieved detector performance.

TT 9.59 Mon 14:00 Poster A

Investigation of superconductors as particle absorbers of metallic magnetic calorimeters — •Jan-Patrick Porst, Andrea Kirsch, Philipp Ranitzsch, Richard Weldle, Loredana Gastaldo, Andreas Fleischmann, and Christian Enss — Kirchhoff-Institut for Physics, INF 227, 69120 Heidelberg

The choice of an absorber material for low temperature calorimeters is a crucial one. Generally, the absorber should possess high stopping power for incoming energetic particles or photons and have low heat capacity. Currently mostly gold and bismuth are used for this purpose. The very small specific heat of superconductors far below their T_c makes them very promising candidates as absorber material. However, these materials show different thermalization behaviour, of which the underlying thermalization processes are so far not understood. In superconducting rhenium this thermalization is of particular interest with regard to the development of detectors for neutrino mass measurements. We investigated three different superconducting materials (Re, Al and Al:Mn) as absorbers of metallic magnetic calorimeters (MMCs). MMCs are low temperature energy dispersive detectors composed of an energy absorber well thermally connected to a paramagnetic temperature sensor which resides in a small magnetic field. The change of magnetization following the absorption of energy is measured as a change of flux in a low noise high bandwidth dc-SQUID. We present the observed dependence of the energy thermalization on temperature and geometry for all three materials and discuss the importance of the diffusive transport of heat as well as of quasiparticle recombination.

TT 9.60 Mon 14:00 Poster A

Inductance of thin metal strips in broadband Corbino microwave spectroscopy — •Katrin Steinberg, Marc Scheffler, and Martin Dressel — 1. Physikalisches Institut, Universität Stuttgart, Stuttgart, Germany

Broadband microwave spectroscopy is a emerging technique to study the electronic properties of different materials in a huge range of frequency. Using a Corbino setup, where the sample is pressed against an open end of a coaxial cable, we investigate a broad range of samples from semiconducting crystals to metallic or superconducting thin films. To increase the measurement sensitivity for the metallic and superconducting samples, one can use a strip-shaped sample geometry instead of samples covering the complete Corbino probe. This geometry increases sample impedance but also leads to additional effects in the measured sample impedance, which have to be taken into account. We present the analysis of the strip-shaped film inductance for different geometric film parameters like thickness, width and length. The frequency and temperature dependence of these effects was investigated for different materials. We compare the theoretical predictions with our experimental data covering a broad frequency range (45 MHz - 40

GHz) and varying sample geometries and materials, including metals and superconductors at temperatures between 1 K and 300 K. Our results apply to conductive strips at microwave frequencies in general.