calculated and measured vibration frequencies was obtained however eigenvectors inferred from experiments differ in some cases substantially from the calculated ones. These differences will also be discussed.
[1] K.-P. Bohnen, R. Heid, M. Krauss, Europhys. Lett. **64**, 104 (2003)

TT 23.30 Mo 14:00 Poster TU D

Electronic structure and weak electron-phonon coupling in TiB_2 — •Eugenio Forzani[1] and Helge Rosner[2] — [1]I. Physikalisches Institut, Universität Göttingen — [2]MPI for Chemical Physics of Solids, Dresden

The Fermi surface of TiB_2 was studied with the de Haas-van Alphen (dHvA) effect in order to clarify the electronic analogies with the previously investigated ZrB_2 [1]. This effort intends to revise a past work [2], which accused sample limitations, and to extend the investigation of the transition metal diborides of the fourth group. For a definite assignment of all the dHvA frequencies the angular dependencies of the extremal cross-section areas are estimated from full-potential band structure calculations [3]. In order to explain the absence of conventional superconductivity also in this diboride compound, the electron-phonon coupling constants are deduced from the experimental and theoretical datas. Developments of the measurement technique and new goals are discussed.
[1] S.L. Drechsler et al., J. of Low Temp. Phys. 131, 5/6 (2003)
[2] T. Tanaka and Y. Ishizawa, J. Phys. C: Solid St. Phys. 13, 6671-6 (1980)
[3] H. Rosner et al., Phys. Rev. B66, 024521 (2002)
*With grant of the Göttingen Graduate School of Physics

TT 23.31 Mo 14:00 Poster TU D

Electronic structure and electron phonon coupling in Sc doped MgB2 — •Vivien Petzold and Helge Rosner — MPI for Chemical Physics of Solids

Recently, Agrestini et al. reported a detailed study of the effects of Sc substitution in $Mg_{1-x}Sc_xB_2$ [1]. For the achievable Sc doping levels (x=0.12...0.27), the compound shows only a very small lattice expansion, allowing this way the separation of lattice and doping effects on the critical temperature $T_c(x)$ and on the frequency $\omega_{E_{2g}}$ of the E_{2g} phonon. To investigate the influence of the Sc concentration x on the electronic properties, we present band structure calculations using different levels of approximation: rigid band and virtual crystal approach as well as supercell calculations and coherent potential approximation. We show that the latter two lead to consistent results with respect to lattice expansion and electronic properties (density of states, Fermi surfaces). We demonstrate that the doping dependent changes in the electronic structure are strongly influenced by the sp^2(B)-d(Sc) hybridization. The dependence of the electronic topological transition proposed by Agrestini et al.[1] from the Sc concentration is discussed.
[1] Agrestini et al. Phys. Rev. B **70** 134514 (2004).

TT 23.32 Mo 14:00 Poster TU D

Observation of a second energy gap in Nb_3Sn — •M. Marz[1], R. Lortz[2], A. Junod[2], W. Goldacker[3], and G. Goll[1] — [1]Physikalisches Institut, Universität Karlsruhe, D-76128 Karlsruhe, Germany — [2]Department of Condensed Matter Physics, University of Geneva, CH-1211 Geneva 4, Switzerland — [3]Forschungszentrum Karlsruhe, Institut für Technische Physik, D-76021 Karlsruhe, Germany

Nb_3Sn is a well-known technically applied superconductor with critical temperature $T_c \approx 18\,\mathrm{K}$. Recently, a low-temperature anomaly in the specific-heat data on a particularly dense and homogeneous polycrystalline sample has been interpreted in terms of the presence of a second superconducting gap [1]. We performed point-contact spectroscopy on samples of the same batch using the break-junction technique. A small bar of Nb_3Sn has been broken at liquid-helium temperature in order to obtain a freshly cleaved surface. We measured the differential resistance as a function of applied voltage in the temperature range between 1.5 and 20 K. Several characteristic minima in the dV/dI vs V curves can be interpreted only under the assumption of two superconducting energy gaps in Nb_3Sn. From a comparison with calculated curves for superconductor-superconductor contacts we deduced a large gap $\Delta_L = 3.5 \pm 0.2\,\mathrm{meV}$ and a small gap of $\Delta_S = 0.8 \pm 0.2\,\mathrm{meV}$. This is the first spectroscopic confirmation of two-gap superconductivity in Nb_3Sn. We note that Δ_L is in line with previous tunnelling measurements and the result confirms the interpretation of the specific-heat data.
[1] V. Guritanu *et al.*, Phys. Rev. B (2004) in print.

TT 23.33 Mo 14:00 Poster TU D

Investigation of $CeCoIn_5$/Pt point contacts in the normal and superconducting states — •Stefan Kontermann[1], Gernot Goll[1], Todd Sayles[2], and M. Brian Maple[2] — [1]Physikalisches Institut, Universität Karlsruhe, 76128 Karlsruhe — [2]Institute for Pure and Applied Physical Sciences, University of California, San Diego, La Jolla, CA 92093, USA

The ternary rare-earth compound $CeCoIn_5$ becomes superconducting for temperatures $T \leq 2.3\,\mathrm{K}$, the highest transition temperature among the heavy-fermion superconductors. Power-law behavior of the specific heat and the thermal conductivity in the superconducting state give evidence that the superconductivity in this material is unconventional. We report on investigations of $CeCoIn_5$ by point-contact spectrocopy with Pt as the normal-metal counterelectrode. In the normal state a pronounced asymmetry of the differential resistance dV/dI as a function of applied bias V is observed which becomes more pronounced as the temperature is reduced. For a contact in the ballistic regime the asymmetry can be attributed to the emergence of the coherent heavy-fermion liquid. In the superconducting state Andreev reflection of quasiparticles at a normal metal/superconductor interface leads to characteristic minima in the dV/dI vs V spectra. We measured spectra which show either a reduced resistance for bias $|V| < \Delta/e$ or a single minimum of dI/dV for $V = 0$, i. e. a zero-bias anomaly. The observation of a zero-bias anomaly is expected only if the order parameter exhibits a sign change as a function of $\vec{k}$ which leads to an Andreev bound state at the surface.

TT 23.34 Mo 14:00 Poster TU D

Unusual electronic and magnetic properties of intermetallic antiperovskites — •Claire Loison, Andreas Leithe-Jasper, and Helge Rosner — Max Planck Institut für Chemische Physik fester Stoffe, Nöthnitzerstrasse 40, 01187 Dresden, Germany

In the last years, cubic perovskites XYT_3 (X=Mg,Cu,La..., Y=B,C,N... and T a transition metal) have received considerable attention because of many unusual physical properties caused by different competing interactions. Examples are the recently discovered superconductor $MgCNi_3$ or the non-collinear magnet $CuNMn_3$. Here, we present a systematic study of a series of antiperovskites (RB_xPd_3 where R is a rare-earth metal, and x varies between 0 and 1) using density functional theory (DFT) electronic structure calculations within the local spin density approximation (LSDA). To investigate the role of possible strong Coulomb repulsion we applied as well LSDA+U. We investigate the effects of pressure and doping on the electronic properties and magnetism. In order to interpret the discrepancies between the results on the lattice constants of LaB_xPd_3 as published by Dhar et al.[1] and our theoretical calculations, we examined this compound experimentally too. The insertion of boron in $LaPd_3$ (a=4.1862(1)Å) could not be detected, but the exposure to oxygen resulted in an increased lattice constant of a=4.2368(2)Å close to the value published in [1]. They report a lattice constant independent of x; according to our calculations, it should increase almost linearly and substantially with x. Thus, our results are inconsistent with the formation of LaB_xPd_3.
[1] Dhar et al. Mat. Res. Bull. **16** 1557 (1981).

TT 23.35 Mo 14:00 Poster TU D

Mirage phenomena in quantum corrals of s-wave superconductors — •Markus Schmid and Arno P. Kampf — Theoretical Physics III, Center for Electronic Correlations and Magnetism, Institute of Physics, University of Augsburg, 86135 Augsburg

We investigate the local density of states (LDOS) for an s-wave superconductor in an elliptic quantum corral. Using a T-matrix analysis we explore the spatial structure of the LDOS in the presence of one or two magnetic/non-magnetic impurities and observe a variety of quantum mirage phenomena. In particular, we discuss mirage effects for localized impurity bound states and analyze the interference patterns for the scattering processes from two magnetic impurities in the quantum corral.

TT 23.36 Mo 14:00 Poster TU D

Josephson current through a Pb/Cu/Pb nanobridge — •Jonas Hanisch[1], Alexander Cosceev[1], Christoph Sürgers[1], Hilbert v. Löhneysen[1,2], and Gernot Goll[1] — [1]Physikalisches Institut, Universität Karlsruhe, D-76128 Karlsruhe, Germany — [2]Forschungszentrum Karlsruhe, Institut für Festkörperphysik, D-76021 Karlsruhe, Germany

The superconducting state is a macroscopic quantum state characterized by a macroscopic wave function with amplitude and phase. The

Josephson effect which occurs through a weak link between two superconductors is a direct consequence of the macroscopic phase carried by each superconductor. There exist several possibilities to manufacture a weak link. Here we report on a simple fabrication method and the characterization of planar Josephson contacts between two Pb electrodes weakly coupled through a Cu nanobridge on a sapphire substrate. In these superconductor (S)/normal metal (N)/superconductor junctions the Josephson coupling is mediated via the proximity effect at the S/N interfaces. For a long dirty junction ($l \ll \xi_N$, where l is the mean-free-path and ξ_N is the coherence length in N) the Josephson current I_c is proportional to $L/\xi_N \cdot \exp(-L/\xi_N)$ which gives an upper limit for the length L of the normal-metal bridge in order to observe Josephson coupling. A Josephson current of up to 750 μA at 1.5 K was observed in junctions with L well below 1 μm which is only 1/8 of the theoretically expected value. The reduction might originate from oxide layers at the normal metal/superconductor interfaces. The temperature and magnetic-field dependence of the Josephson current was investigated as well.

TT 23.37 Mo 14:00 Poster TU D

Alternative mechanism of the sign-reversal effect in Superconductor-Ferromagnet-Superconductor Josephson Junctions — •Alexandra Anishchanka[1] and Anatoli Volkov[1,2] — [1]Theoretische Physik III, Ruhr-Universität Bochum, D-44801, Germany — [2]Institute of Radioengineering and Electronics of the Russian Academy of Sciences, 103907 Moscow, Russia

We consider a simple model of a multidomain superconductor-ferromagnet-superconductor (SFS) Josephson junction. Sign-alternating magnetization M in domains leads to a spatial modulation of the phase difference $\phi(x)$. Due to this modulation the Josephson critical current I_c may have a different sign depending on the ratio of the magnetic flux in a domain, $4\pi Ma(2d_F)$, and the magnetic flux quantum. Just this, but not a nonmonotonic dependence of the local critical current density j_c, may be the reason for oscillations of the current I_c as a function of the F layer thickness $2d_F$ or temperature, observed in experiments.

TT 23.38 Mo 14:00 Poster TU D

Superconducting/ferromagnetic proximity effect mediated by Cr-spacer layers in the Fe/Cr/V/Cr/Fe thin film system — •M. Fattakhov[1], I. Garifullin[2], L. R. Tagirov[3], K. Westerholt[1], and H. Zabel[1] — [1]Institut für Experimentalphysik/Festkörperphysik Ruhr-Uni 44780 Bochum — [2]Zavoisky Physical-Technical Institute, 420029 Kazan, Russia — [3]Kazan State University, 420008 Kazan, Russia

We have studied the superconducting proximity effect in the thin film system Fe/Cr/V/Cr/Fe where the Cr layers play the role of screening layers between the superconducting V-layer and the strongly pair breaking Fe-layers. When keeping the thickness of the Fe-layers d_{Fe} fixed and varying the thickness of the Cr-layers d_{Cr}, the superconducting transition temperature T_c first rises reaching a maximum at d_{Cr}=40 Å and then sharply drops for larger Cr-thickness. Keeping d_{Cr} constant and varying d_{Fe} the superconducting transition temperature becomes independent on d_{Fe} for $d_{Cr} > 40$Å. The results demonstrate that the Cooper pairs penetrate into the Cr-layer to a depth of about 40 Å. From our experimental results we suggest that the Cr-layer is nonmagnetic for $d_{Cr} < 40$ Å and undergoes a transition to an incommensurate spin density wave state for $d_{Cr} > 40$Å.

TT 23.39 Mo 14:00 Poster TU D

Non-ideal artificial phase discontinuity and fractional vortex dynamics in long Josephson 0-κ-junctions. — •Edward Goldobin[1], Tobias Gaber[1], Dieter Koelle[1], Reinhold Kleiner[1], Michael Siegel[2], and Manfred Neuhaus[2] — [1]Physikalisches Institut — Experimentalphysik II, Universität Tübingen, Auf der Morgenstelle 14, 72076 Tübingen — [2]Institut für Mikro- und Nanoelektronische Systeme, Universität Karlsruhe, Hertzstr. 16, 76187 Karlsruhe

We investigate the creation of an arbitrary κ-discontinuity of the Josephson phase in a long Nb-AlO_x-Nb Josephson junction (LJJ) using a pair of tiny current injectors, and study the formation of fractional vortices formed at this discontinuity. The current $I_{\rm inj}$, flowing from one injector to the other, creates a phase discontinuity $\kappa \propto I_{\rm inj}$. The calibration of injectors is discussed in detail. The small but finite size of injectors leads to some deviations of the properties of such a 0-κ-LJJ from the properties of a LJJ with an ideal κ-discontinuity. These experimentally observed deviations in the dependence of the critical current on $I_{\rm inj}$ and magnetic field can be well reproduced by numerical simulation assuming a finite injector size. The physical origin of these deviations is discussed. Furthermore, we present new experimental results on the dynamics of arbitrary fractional vortices and report the observation of semi-integer zero field steps corresponding to $n = \frac{3}{2}$ and $n = \frac{5}{2}$.

TT 23.40 Mo 14:00 Poster TU D

Polarised SANS measurements of the FLL in niobium — •Sebastian Mühlbauer[1], Robert Georgii[2] und Peter Böni[1] — [1]TU-München Physikdepartment E21 — [2]ZWE FRM II TU-München

We report on polarised small angle neutron scattering (SANS) on the flux line lattice (FLL) of a well known classic superconductor, niobium on the reflectometer MIRA at the FRM-II in Garching. The six-fold symmetry of the scattering pattern of the FLL was recorded with a two-dimensional position sensitive SANS detector using a horizontal and vertical field geometry and an incident wavelenght of 10 Å. Even the second order peaks could be observed. We examined the chirality of the FLL, especially close to the on-set of the so-called flux line melting. The results of these measurements will be dicussed with special emphasis on future measurements on high T_c superconducters.

TT 23.41 Mo 14:00 Poster TU D

Surface potential in superconductors — P. Lipavský[1], •K. Morawetz[2,3], Jan Koláček[1], J.J. Mares[1], E.H. Brandt[4], and M. Schreiber[2] — [1]Institute of Physics, Academy of Sciences, Cukrovarnická 10, 16258 Praha 6, Czech Republic — [2]Institute of Physics, Chemnitz University of Technology, 09107 Chemnitz, Germany — [3]Max-Planck-Institute for the Physics of Complex Systems, Nöthnitzer Str. 38, 01187 Dresden, Germany — [4]Max-Planck-Institute for Metal Research, D-70506 Stuttgart, Germany

The electrostatic potential close to the surface of superconductors in the Meissner state is discussed. We show that beside the Bernoulli potential, the quasiparticle screening, and the thermodynamic contribution due to Rickayzen, there is a non-local contribution which is large for both type-I and weak type-II superconductors [1]. A generalization of the Budd-Vannimenus theorem is found which allows one to evaluate the observed potential without the explicit solution of the charge profile at the surface [2]. The electrostatic potential above the Abrikosov vortex lattice is evaluated numerically. We propose an experimental measurement by NMR [3] to access this field which can yield informations about material parameters.

[1] P. Lipavský, K. Morawetz, J. Koláček, J. J. Mareš, E. H. Brandt, M. Schreiber, Phys. Rev. B 69 (2004) 024524-1-7
[2] P. Lipavský, K. Morawetz, J. Koláček, J. J. Mareš, E. H. Brandt, M. Schreiber, Phys. Rev. B 70 (2004) 104518-1-7
[3] P. Lipavský, J. Kolacek, K. Morawetz, E. H. Brandt, Phys. Rev. B 66 (2002) 134525

TT 23.42 Mo 14:00 Poster TU D

Vortex dynamics in Nb films on faceted substrate surfaces — •Oleksiy K. Soroka[1], Michael Huth[2], Valerij A. Shklovskij[3], Jens Oster[1], and Hermann Adrian[1] — [1]Institute of Physics, Johannes Gutenberg-University, Staudinger Weg 7, D-55099 Mainz, Germany — [2]Institute of Physics, Johann Wolfgang Goethe-University, Robert-Mayer-Str. 2-4, D-60054 Frankfurt, Germany — [3]Kharkiv National University, Physical Department, 4 Svobody Sq., 61077 Kharkiv, Ukraine

Anisotropy of the viscous damping force in superconductor can lead to the existence of the preferred directions for the vortices to move. Such a guided vortex motion leads to the appearance of new components in the galvanomagnetic response of the sample: an additional odd longitudinal and even transversal magnetoresistive components with respect to magnetic field reversal.

Perfect vortex guiding alon the facet rigdes was proved in Nb-films on faceted α-Al_2O_3 by magnetoresistivity measurements. The thin film sample consisted of five microbridges oriented at the angles 0°, 30°, 45°, 60° and 90° with respect to the facet ridges. Field inversion was used to separate the even and odd components of the magnetoresistivities to obtain the contributions caused by the guided vortex motion.

The temperature dependences of the even longitudinal magnetoresistivity of the samples could be well fitted within the theoretical approach proposed by V. A. Shklovskij, using for the isotropic and anisotropic pinning potential a simple potential with a symmetric triangular wells whose depths were estimated from the experimental data.