TT 98: Poster Session: Superconductivity

Time: Thursday 15:00–19:00 Location: Poster B

TT 98.1 Thu 15:00 Poster B

A search for superconducting Heusler compounds without inversion symmetry in the AuPdTM set (T = Sc, Y and M = Al, Ga, In) — •Linus Kautzsch, Gerhard H. Fecher, Walter Schnelle, and Claudia Felser — Max Planck Institut CPFS, Dresden, Germany

Superconductivity is well-known in ternary centrosymmetric Heusler compounds like Pd_2YSn. One typical fingerprint in the band structure is a saddle point type van Hove singularity near by the Fermi energy ϵ_F, which leads to an enhanced density of states.

Furthermore, quaternary Heusler compounds with 1:1:1:1 stoichiometry show the Y-structure (LiMgPdSn, $F\bar{4}3m$ (216)) without inversion symmetry. The pairing state in superconductors with a lack of inversion symmetry should be a mixture of singlet and triplet Cooper pairs. Therefore, these compounds are of importance with respect to understanding superconducting pairing mechanisms. This work is dedicated to extend superconductivity to quaternary Heusler compounds and the experimental investigation of their properties. We identify new quaternary Heusler superconductors through prediction of the van Hove singularity in the band structure. Subsequently, samples of the AuPdTM set (T = Sc, Y and M = Al, Ga, In) were prepared by arc melting and their transport properties were characterized. As an example, AuPdScAl exhibits a transition into the superconducting state in the low temperature region (T_c = 3.0 K). Moreover, these findings enhance the understanding of superconductivity in the Heusler compounds.

TT 98.2 Thu 15:00 Poster B

Dielectric properties of thin Sn films near percolation probed with superconducting coplanar microwave resonators — •Nikolaj G Ebensperger, Martin Dressel, and Marc Scheffler — 1. Physikalisches Institut, Universität Stuttgart, Pfaffenwaldring 57, D-70569 Stuttgart, Germany

The two-dimensional limit of thin films at low temperatures opens up a plethora of interesting phenomena and physical processes. Here, knowledge of the dielectric properties at very low temperatures can be of vital help and can offer new insights into fundamental characteristics and interactions. However, the combination of thin films and very low temperatures often exceeds the limits of traditional experimental methods. We present a novel approach utilizing coplanar superconducting microwave resonators, which overcomes these difficulties, allowing precise measurements of the dielectric constant in a temperature range up to 9 K and frequency range up to 30 GHz.

Granular films are known to show peculiar behaviour of the dielectric constant approaching the percolation transition. We apply our experimental approach to thin granular Sn films with thicknesses in the range 36 - 58 nm. We determine the dielectric constant and show that it has diverging behaviour approaching the percolation threshold, similar to behaviour found in other materials with percolation transitions. At low temperatures of about 4 K we find distinct features in our data, indicating a clear superconducting transition of the individual Sn grains.

TT 98.3 Thu 15:00 Poster B

Searching for novel low-dimensional materials with interesting electronic properties: New mixed-valent transition metal chalcogenides — •Mihai I. Sturza[1,2], Alexander J. E. Rettie[2], Daniel Bugaris[2], Fei Han[2], Duck Young Chung[2], Saicharan Askwartham[1], Mercouri Kanatzides[2,3], and Bernd Büchner[1] — [1]Leibniz Institute for Solid State and Materials Research Dresden IFW, Institute for Solid State Research, 01069 Dresden, Germany — [2]Materials Science Division, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, Illinois 60439, United States — [3]Department of Chemistry, Northwestern University, 2145 Sheridan Road, Evanston, Illinois 60208, United States

The class of transition-metal chalcogenides that exhibits mixed valency has been of continuing interest for several decades. The emergence of superconductivity with a high superconducting transition temperature in mixed-valence $A_xFe_{2-y}Se_2$ (A = K, Rb, Cs, and Tl) phases has further increased interest in the chemistry and physics of complex ternary transition-metal chalcogenides. New results from the chemistry of the A/Cu/Q (A=Na, K, Ba, Q=S, Se) system will be reported. The synthesis, structure, and properties of new layered copper chalcogenide compounds, which are mixed-valent will be presented. Single crystals were grown by the reaction of Cu metal in a molten alkali/ alkaline-earth metal/polychalcogenides/flux. Electronic band structure calculations and physical property measurements reveal p-type metallic behavior, with moderately high electrical conductivity.

TT 98.4 Thu 15:00 Poster B

Transport properties of $In_xSn_{1-x}Te$ nanostructures — •Mengmeng Bai, Fan Yang, Zhiwei Wang, and Yoichi Ando — Institute of Physics II, Cologne, Germany

SnTe is a three-dimensional topological crystalline insulator. It is known that superconductivity can be induced in SnTe by indium doping, making $In_xSn_{1-x}Te$ a promising platform for searching for topological superconductivity. Here we present our study on superconducting $In_xSn_{1-x}Te$ nanostructures. $In_xSn_{1-x}Te$ nano-plates and nanowires were grown via vapor-transport method. After the growth, they were fabricated into devices and then measured in a cryostat. A sharp superconducting transition was observed in all devices. Point contact spectroscopy was also taken at low temperatures. The preliminary results are presented and discussed.

TT 98.5 Thu 15:00 Poster B

Growth and Characterizations of Superconducting $In_xSn_{1-x}Te$ Nanomaterials — •Zhiwei Wang, Felix Münning, Mengmeng Bai, Fan Yang, and Yoichi Ando — Institute of Physics II, University of Cologne, D-50937 Cologne, Germany

In recent years, possible existence of Majorana fermion (MF) in condensed matter has attracted extensive interest because of the potential application of MFs to the realization of topological quantum computation. So far, several strategies have been proposed to create and manipulate MFs based on nanowires of topological insulators (TI) and topological superconductors (TSC) [1-2]. In this contribution, we reported the nanomaterial growth and characterizations of one of the candidate TSCs, $In_xSn_{1-x}Te$ (IST). Nanowires and nanoflakes of IST are grown on SiO_2/Si wafer by using a vapour transport method in sealed quartz tubes with and without gold catalyst. Growth parameters such as the composition of source materials, source temperature, temperature gradient and growth time are optimized to obtain expected nanowires and nanoflakes. Scanning electron microscopy (SEM) and energy-dispersive X-ray spectroscopy (EDX) are used to investigate the morphology and composition of as-grown nanomaterials. For electronic transport characterization, devices based on nanowires and nanoflakes are fabricated by e-beam lithography and photo-lithography, respectively. Electronic transport properties are measured on helium-3 cryostat with the temperature down to 0.3 K.

[1] Liang Fu and C. L. Kane, Phys. Rev. Lett. 100, (2008) 096407
[2] Cook and M. Franz, Phys. Rev. B 84 (2011) 201105(R)

TT 98.6 Thu 15:00 Poster B

Superconducting properties of $[(SnSe)_{1+\delta}]_{m\in[1,9]}[NbSe_2]_{n=1}$ ferecrystals — •Theodor U. Griffin[1], Martina Trahms[1], Corinna Grosse[1], Danielle Hamann[2], Omar K. Hite[2], Matti B. Alemayehu[2], Olivio Chiatti[1], David C. Johnson[2], and Saskia F. Fischer[1] — [1]Novel Materials Group, Humboldt-Universität zu Berlin, 12489 Berlin, Germany — [2]Department of Chemistry, University of Oregon, Eugene, OR, 97401, USA

Ferecrystals are artificially layered materials that can be grown with atomically smooth layers in various sequences. Furthermore, as the layers are bound only through van der Waals interaction, strain due to lattice mismatch between layers is negligible and the material has turbostratic disorder. They can provide a model for naturally layered superconductors, including many high T_C superconductors. They also allow embedding interesting monolayers and thin films in buffer material, protecting them from external influences.

Here, we used ferecrystals composed of monolayers of the superconducting transition-metal dichalcogenide $NbSe_2$ and bilayers of the semiconductor SnSe. These layers are stacked in repeated sequences of a monolayer $NbSe_2$ with between one and nine bilayers of SnSe. We investigate the electrical transport properties near the superconducting transition. The aim is to ascertain at which, if any, ratio of $NbSe_2$ to SnSe the ferecrystals begin to show two-dimensional superconduct-

ing behaviour, using the angular dependence of the critical magnetic field. We hope to gain further insight into layered superconductors and 2D-superconductivity. For $m < 6$, 3D behaviour was observed.

TT 98.7 Thu 15:00 Poster B

Characterization of $Bi_2Sr_2CaCu_2O_8$ thin film and nanowire networks synthesized from sol-gel precursor — •XianLin Zeng[1], Fabian Laurent[1], Thomas Karwoth[1], Michael Koblischka[1], Crosby Chang[2], Thomas Hauet[2], and Uwe Hartmann[1] — [1]Institute of Experimental Physics, Saarland University, Campus C 6 3, D-66123 Saarbrücken, Germany — [2]Institut Jean Lamour, UMR CNRS-Université de Lorraine, 54506 Vandoevre-lès-Nancy, France

Thin films on $SrTiO_3$ substrates and substrate-free networks of superconducting $Bi_2Sr_2CaCu_2O_8$ (Bi-2212) were fabricated using the spin coating method and the electrospinning technique. To enable a comparison of the superconductivity of the two-dimensional and one-dimensional materials, both samples are prepared from the same sol-gel precursor. The morphologic characterization was done by scanning electron microscopy (SEM). The phases were confirmed by X-Ray diffraction (XRD). The magnetic properties characterized from SQUID measurements show that the nanowire samples have a lower T_c than the respective thin film samples. The electric properties reveal further differences. A double-step behavior in the $R(T)$ curves and an obvious residual resistance in the superconducting regime in the $U(I)$ curves were found for the nanowire samples. The hysteretic effect of the nanowire network sample is much weaker than in the thin film sample, and it vanishes at weak fields (0.6 T). This work is part of DFG-project Ko2323/8.

TT 98.8 Thu 15:00 Poster B

Magnetic and structural phase transition in $Fe_{(1+y)}Te$ — •Maik Barth, Kai Grube, Sebastian Kuntz, Thomas Wolf, Michael Merz, and Frank Weber — Institute for Solid State Physics, Karlsruhe Institute of Technology, Karlsruhe, Germany

To verify the established phase diagram of $Fe_{(1+y)}Te$ [1], we studied the temperature-dependent structural and magnetic properties on single crystals with an Fe content between 1.08 and 1.19. Independent of the excess Fe content, a magnetic transition from paramagnetic to antiferromagnetic is observed around $T_N \approx 60$ K. The lattice, on the other hand, undergoes a structural phase transition from tetragonal to monoclinic for Fe contents below 1.11 while a structural phase transition from tetragonal to orthorhombic is observed for Fe contents above 1.13; in the range between 1.11 and 1.13 a mixture of both phases appears. Moreover, the order of the structural phase transition changes continously from first to second order when going from 1.08 to 1.19. The structural characterization was done using x-ray diffraction, the magnetic measurements by utilizing a MPMS with a SQUID.
[1] Koz et al., Phys. Review B 88, 094509 (2013)

TT 98.9 Thu 15:00 Poster B

ω/T Scaling in Optimal Co-Doped $BaFe_2As_2$ — •Jakob Burgi[1], Florian Wasser[1], Chul-Ho Lee[2], Kunihiro Kihou[2], Jitae Park[3], and Markus Braden[1] — [1]II. Physikalisches Institut, Universität zu Köln, Zülpicher Straße 77, D-50937 Köln, Germany — [2]National Institute of Advanced Industrial Science and Technology (AIST), Tsukuba, Ibaraki 305-8568, Japan — [3]Heinz Maier-Leibnitz Zentrum (MLZ), Technische Universitä München, Lichtenbergstr. 1, D-85748, Garching, Germany

The phase diagram of iron-based superconductors, in particular of $BaFe_2As_2$, indicates the existence of a quantum critical point (QCP) beneath the superconducting (SC) dome, where T_c is highest and the antiferromagnetic (AFM) phase terminates. Considering an AFM order parameter the associated susceptibility follows a simple scaling relation $\chi''(\boldsymbol{q}_{AFM}, \omega, T) = T^{-\alpha} f\left(\frac{\omega}{T^{-\alpha}}\right)$ within the Hertz-Millis scenario. In this regard, we performed inelastic neutron scattering experiments on 6 % Co doped $BaFe_2As_2$ ($T_c = 24$ K) and showed that magnetic fluctuations between 28 K and 400 K follow the scaling relation and thus indicate the presence of a QCP. Our observations are similar to the heavy fermion system $CeCu_{5.9}Au_{0.1}$ as the scaling function for both compounds seems well approximated by a simple mean-field approach. Moreover, the scaling law seems to be applicable over the nematic regime without any impact indicating that the nematic transition just follows the magnetic.

TT 98.10 Thu 15:00 Poster B

Mixed magnetic order and superconductivity in multiorbital Hubbard models — •Chris Koschenz and Carsten Timm — Institute of Theoretical Physics, Technische Universität Dresden, Germany

We extend a generalized Hartree-Fock theory that allows mixed phases [1] to multiorbital Hubbard models. Multiband and multiorbital physics are crucial for the understanding of superconductivity and magnetism and their possible coexistence in high-temperature superconductors. Handling that kind of system can be numerically expensive and is in general restricted to a limited number of ordering vectors in the standard Hartree-Fock approach. Applying a generalized Hartree-Fock theory including the minimization of the grand canonical potential allows to overcome these drawbacks and thereby permits extensive studies of phases of mixed magnetic order [1]. Furthermore, we have enhanced the usual tetrahedron integration method [2] by an adaptive refining algorithm at zero and finite temperatures. Using these methods, we are able to employ realistic multiorbital models to study the coexistence and competition of magnetic ordering or mixing and superconductivity. We elucidate the role played by orbital effects and compare with previous work [3]. Furthermore, we study the possibility of additional phase transitions in the coexistence regime.
[1] E. Langmann and M. Wallin, J. Stat. Phys. **127**, 825 (2007)
[2] P. E. Blöchl et al., Phys. Rev. B **49**, 16223 (1994)
[3] J. Schmiedt et al., Phys. Rev. B **85**, 214425 (2012)

TT 98.11 Thu 15:00 Poster B

Evolution of the nematic susceptibility in a superconducting dome without structural transition — •Xiaochen Hong[1], Rhea Kappenberger[1], Federico Caglieris[1], Saicharan Aswartham[1], Bernd Büchner[1,2,3], and Christian Hess[1,3] — [1]IFW-Dresden, Dresden, Germany — [2]Institute of Solid State Physics, TU Dresden, Germany — [3]Center for Transport and Devices, TU Dresden, Germany

The first step towards understanding the mechanism of the mysterious high-temperature superconductivity is to clarify the phase diagram of these compounds. The superconducting transition temperature of them always show dome-shaped dependence on tuning parameter(s). In the case of iron based superconductors (FeSC), a prevailing picture is that magnetic, structural and nematic transition are all entangled into the dome. Among these orders, the one which is "on the driver seat" should be most relevant to the formation of Cooper pairs.

Recently, an elegant technique based on piezoelectric apparatus was introduced to study the nematic susceptibility. Soon after, signatures of a nematic quantum critical point were found in many FeSCs by this technique. Here we present our study on cobalt doped LaOFeAs, which does not exhibit a structural transition inside its superconducting dome. We observe a divergent nematic susceptibility across the dome which peaks near the optimal doping. Our finding strongly suggest that the nematic fluctuation is intimately related to the superconductivity in FeSCs.

TT 98.12 Thu 15:00 Poster B

Quasiparticle Interference structure in the Spin Density Wave State of Iron Based Superconductors — •Dustin Altenfeld[1], Felix Ahn[1], Peter J. Hirschfeld[2], and Ilya Eremin[1] — [1]Institut für Theoretische Physik III, Ruhr-Universität Bochum, D-44801 Bochum, Germany — [2]Department of Physics, University of Florida, Gainesville, Florida 32611, USA

Using 10-orbital model Hamiltonian we present quasiparticle interference (QPI) calculations in the spin density wave phase (SDW) of Fe-based superconductors (FeSc). We find that the QPI structure can be regarded as a robust way of studying the orbital driven effects on the magnetically ordered phase. In particular, we study the phase-relevant changes induced by the SDW order parameters with orbital structure starting from two-band model up to ab initio based band structure calculation using a realistic model Hamiltonian. We provide the detailed insight for the one dimensional QPI maps seen by STM experiment.

TT 98.13 Thu 15:00 Poster B

High field transport properties of 1111 parent compounds — •Martina Meinero[1,2], Federico Caglieris[3], Alessandro Leveratto[2], Ilaria Pallecchi[2], Gianrico Lamura[2], Fabio Bernardini[4], Alessia Provino[1,2], Pietro Manfrinetti[1,2], Maryam Shahrokhvand[5], Uli Zeitler[5], and Marina Putti[1,2] — [1]SPIN-CNR, C.so Perrone 24, 16152 Genova, Italy — [2]University of Genova, Via Dodecaneso, 16146 Genova, Italy — [3]IFW Dresden, 01069

Dresden, Germany — [4]CNR-IOM-Cagliari and University of Cagliari, 09042 Monserrato, Italy — [5]HFML-EMFL, Radboud University, Toernooiveld 7, 6525ED Nijmegen, Netherlands

The Fermi surface and the band structure of the 1111 family of Fe-based superconductors have been vastly theoretically investigated but a direct experimental insight is still lacking. We performed low-temperature transport measurements in high magnetic fields up to 30 T in several 1111 parent compounds. We detected Shubnikov de Haas oscillations in both the magnetoresistance of a single crystal of SmFeAsO and in the thermopower of a policrystalline sample of LaFeAsO. We also investigated the thermoelectric properties of polycrystalline CeFeAsO, PrFeAsO, NdFeAsO. Our results bring to the identification of a dominating cylindrical pocket, whose corresponding carrier density matches with the one obtained from Hall effect measurements. In addition we verified a good agreement with prediction of DFT calculations of the band structure.

TT 98.14 Thu 15:00 Poster B

Crystal growth of the iron pnictide superconductor $NdFeAsO_{1-x}F_x$ — •Marius Peters, Mahmoud Abdel-Hafiez, Abanoub Refat Hanna, and Cornelius Krellner — Goethe-Universität Frankfurt

The single crystal growth of the iron pnictide superconductor NdFeAsO in a NaCl/KCl-salt flux at ambient pressure has been improved optimizing growth temperature settings and profiles and developing a new growth geometry. Single crystaline samples of the 1111-system $NdFeAsO_{1-x}F_x$ were investigated with structural, magnetic and transport methods and are in overall agreement with the polycrystalline material [1,2]. For lower doping levels (up to about $x = 0.1$) the system shows a spin density wave transition (below $154\,K$), which is suppressed strongly with increased doping, and with higher doping levels yields unconventional superconductivity ($T_C = 50\,K$ for $x = 0.2$) [3]. We will present details of the optimization procedure of the crystal growth together with structural and magnetic characterization down to 2 K.

[1] A.Marcinkova et al., Chemistry of Materials **21**, 2967 (2009)
[2] G.Lamura et al., Phys.Rev.B **91**, 024513 (2015)
[3] A. Adamski et al., Phys. Rev. B **96**, 100503(R) (2017)

TT 98.15 Thu 15:00 Poster B

Electronic phase diagram of CeFeAsO as a function of hydrostatic pressure and As by P substitution — •Philipp Materne[1,2], Wenli Bi[2,3], Esen Ercan Alp[2], Jiyong Zhao[2], Michael Yu Hu[2], Dongzhou Zhang[2], Til Goltz[1], Anton Jesche[4], Christoph Geibel[4], Rhea Kappenberger[5], Saicharan Aswartham[5], Sabine Wurmehl[5,1], Bernd Büchner[5,1], and Hans-Henning Klauss[1] — [1]Institute of Solid State and Materials Physics, TU Dresden, D-01069 Dresden, Germany — [2]Argonne National Laboratory, Argonne, IL 60439, USA — [3]Department of Geology, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801, USA — [4]Max Planck Institute for Chemical Physics of Solids, Nöthnitzer Str. 40, 01187 Dresden, Germany — [5]Leibniz Institute for Solid State and Materials Research (IFW) Dresden, D-01069, Germany

We present a local probe study of the electronic properties of hydrostatic and chemical (due to As by P substitution) pressure in CeFeAsO by means of energy- and time-domain Mössbauer spectroscopy. The application of pressure results in a compression of the unit cell. We investigated the magnetic hyperfine field, the electric field gradient, and the electron density at the Fe nucleus. We found a distortion of the FeAs tetrahedra with increased P-substitution level while it remains unchanged in the case of hydrostatic pressure. We observed a nearly linear suppression of the magnetic hyperfine field to zero between 0 and 40 % P-substitution level while the field is reduced by 25 % between 0 and 4.5 GPa followed by an abrupt decrease to zero at 5.2 GPa.

TT 98.16 Thu 15:00 Poster B

Nernst effect of Rh-doped $BaFe_2As_2$: Evidence for superconductivity driven by nematic fluctuations — •Christoph Wuttke[1], Frank Steckel[1], Federico Caglieris[1], Steffen Sykora[1], Xiaochen Hong[1], Seunghyun Kim[1], Sabine Wurmehl[1], Sheng Ran[2], Paul C. Canfield[2], Bernd Büchner[1,3,4], and Christian Hess[1,4] — [1]Leibniz-Institute for Solid State and Materials Research, IFW-Dresden, 01069 Dresden, Germany — [2]Ames Laboratory and Department of Physics and Astronomy, Iowa State University, Ames, Iowa 50011, USA — [3]Institut für Festkörperphysik, TU Dresden, 01069 Dresden, Germany — [4]Center for Transport and Devices, Technische Universität Dresden, 01069 Dresden, Germany

The nematic phase of iron-based superconductors is a very debated topic since the role of nematic fluctuations in the appearance of high temperature superconductivity is still controversial. In this work we systematically investigate the phase diagram of $BaFe_2As_2$ as a function of Rh-doping through Nernst effect measurements. In particular we obtained an anomalously high Nernst coefficient in the tetragonal phase. Moreover, we observe, that upon doping its magnitude strikingly mimics the shape of the superconducting dome. Using a minimal orbital model for iron-based superconductors we show that the Nernst coefficient couples directly to the nematic fluctuations. Our experimental results therefore provide direct evidence for nematic fluctuations playing a crucial role for the mechanism of superconductivity in Rh-doped $BaFe_2As_2$. We discuss our findings using a comparison with the nematic susceptibility obtained from elastoresistance measurements.

TT 98.17 Thu 15:00 Poster B

Magnetic and electronic excitations in underdoped YBCO — •Ulrike Zweck, Mirko Riedl, Andreas Baum, Daniel Jost, Andreas Erb, and Rudolf Hackl — Walther-Meissner-Institut, Bayerische Akademie der Wissenschaften, 85748 Garching, Germany

The interrelation of magnetism, charge order and superconductivity is among the most complex open problems in the cuprates and possibly the key for understanding unconventional superconductivity. $YBa_2Cu_3O_{6+x}$ is a laboratory for systematic studies since single crystals with extremely high purity can be prepared. In addition, the most interesting doping range $0 \leq p \leq 0.18$ with p the number of holes per CuO_2 formula unit can be accessed by varying x between 0 and 1. For the intended Raman scattering experiments homogeneously doped and highly ordered crystals are crucial since impurities or residual strain compromise the results. In a first step crystals with oxygen contents of approximately $x = 0.56$ and $x = 0.67$ were prepared. For improving the order in the crystals the temperature and the oxygen partial pressure were reduced simultaneously after the initial annealing step at constant temperature in order to keep the oxygen concentration in the crystals constant. In this way the ordering was already substantially improved. After detwinning the crystals were equilibrated following the protocol of Liang *et al.* [Physica C **336**, 57 (2000)]. The resulting transition temperatures were 60 and 66 K. For $x = 0.56$ the two-magnon excitation in B_{1g} symmetry was found in the expected energy range as opposed to what was observed earlier in quenched samples.

TT 98.18 Thu 15:00 Poster B

Plaquette Valence Bond Theory of High-Temperature Superconductivity — •Malte Harland[1], Mikhail I. Katsnelson[2], and Alexander I. Lichtenstein[1] — [1]Universität Hamburg, Hamburg, Germany — [2]Radboud University Nijmegen, Nijmegen, The Netherlands

We present a strong-coupling theory of high-temperature superconductivity in the cuprates based on a quantum critical point of the two-by-two Hubbard Plaquette. This point is characterized by the crossing of the particle number sectors $N = 2, 3, 4$. The groundstates close to the quantum critical point are spin-doublets and spin-singlets supporting the idea of resonating valence bonds on the Plaquette. Embedding the Plaquette in an environment of other Plaquettes we find a $d_{x^2-y^2}$-wave superconducting order parameter where the electrons are on the border between itinerant and localized behavior and investigate its competition with other orders. The bottom-up approach enables us to investigate the superconductivity's dependence on microscopic parameters such as, e.g. the next-nearest-neighbour hopping. We provide finite-temperature results obtained by the Dynamical Mean-Field theory, that gives an exact solution of our model.

TT 98.19 Thu 15:00 Poster B

Higgs spectroscopy of superconductors in nonequilibrium — •Lukas Schwarz, Benedikt Fauseweh, and Dirk Manske — Max-Planck-Institut für Festkörperforschung, D-70569 Stuttgart, Germany

In superconductors, a fundamental collective excitation of Cooper pairs exists which arises due to the spontaneous U(1) symmetry breaking. This mode is called Higgs mode in analogy to high-energy physics. In recent years, Higgs oscillations in s-wave superconductors in nonequilibrium excited by short THz laser pulses were intensively studied. We show that such pump-probe experiments on unconventional superconductors with non-trivial gap symmetry can excite multiple different Higgs modes. As these modes can be classified by the underlying lattice point group, an identification of these modes allows to draw conclusions about the gap symmetry. Therefore, Higgs oscillations have a

great potential to become a spectroscopic method for investigations of gap symmetries in superconductors.

TT 98.20 Thu 15:00 Poster B

Triplet superconducting correlations and spin imbalance in magnet-superconductor hybrid structures — •Kevin Marc Seja[1], Oleksii Shevtsov[2], and Tomas Löfwander[1] — [1]Chalmers University of Technology, Göteborg, Sweden — [2]Northwestern University, Evanston, IL, United States

We examine a superconductor that is in contact with a normal metal via a spin-active interface. Using quasiclassical theory of superconductivity, we study the system in equilibrium as well as in nonequilibrium induced by a voltage bias. Earlier investigations have shown that in equilibrium the interface gives rise to Andreev bound states that induce a spin magnetization in the superconductor. It was found that this equilibrium magnetization is related to non-trivial triplet superconducting correlations, a key feature of unconventional superconductivity. Out of equilibrium there is an additional contribution to spin imbalance related to spin-filtering and spin-mixing mechanisms. [1,2] However, in non-equilibrium the possible connection between magnetization and superconducting triplet correlations is not yet understood. The aim of this work is to examine this relation as well as the change in distribution and the spatial behavior of these correlations in non-equilibrium configurations.

[1] O. Shevtsov, T. Löfwander, *J. Phys Conf. Ser.* **568** 2 (2014)
[2] O. Shevtsov, T. Löfwander, *Phys. Rev. B.* **90** 085432 (2014)

TT 98.21 Thu 15:00 Poster B

Properties of self-consistent random matrices: Case study for the superconductor-insulator transition — •Matthias Stosiek and Ferdinand Evers — Institute of Theoretical Physics, University of Regensburg, Germany

Our general interest is in the properties of ensembles of random Hamiltonians that satisfy a self-consistency property. Such ensembles typically appear in mean-field treatments of interacting systems. The example we here consider is the Superconductor-Insulator Transition (SIT) where the superconducting gap is calculated self-consistently in the presence of short-range disorder. Our focus is on disordered films with conventional s-wave pairing that we study numerically employing the negative-U Hubbard model within the standard BogoliubovdeGennes approximation. The general question that we would like to address here concerns the auto-correlation function of the pairing amplitude: How does it decay in real space and in what way does it change across the SIT?

These correlations are typically neglected in analytical theories. Our research might have significant impact on the understanding of the SIT, if the correlations turn out sufficiently long-ranged, so that they influence properties of the critical point.

We present preliminary data that indicates the existence of very long ranged (power-law) correlations that may indeed change the critical behavior in a significant way.

TT 98.22 Thu 15:00 Poster B

Delocalized Shiba bands in magnetic clusters at superconducting surfaces — •Simon Körber, Oleksiy Kashuba, and Björn Trauzettel — Institute for Theoretical Physics and Astrophysics, University of Würzburg, D-97074 Würzburg, Germany

If a number of magnetic atoms is placed sufficiently close to each other on the surface of a superconductor, their Shiba states hybridize and form a band structure inside the superconducting gap. We show that for particular cases a degenerate delocalized flat band emerges in the energy spectrum. We solve the problem analytically for arbitrary spin configuration and analyze both trivial and non-trivial solutions. The wave functions of the trivial solutions effectively decouple from the total magnetic moment of the cluster. This is the reason why they form flat bands. The energies of the dispersing bands corresponding by two non-trivial solutions can be characterized solely by the net magnetic moment of the cluster.

TT 98.23 Thu 15:00 Poster B

Non-uniform superconducting phases generated by spin-orbit interaction — •Julie Baumard[1,2], Jerome Cayssol[1], and Alexandre Buzdin[1] — [1]LOMA - UMR 5798, Bordeaux, France — [2]DIPC, Donostia-San Sebastián, Spain

Non-uniform superconducting states raise great interest in the scientific community. One of the most famous is the FFLO state, predicted in the 1960's. It is characterized by a higher critical field than the uniform superconducting state. The FFLO state appears at low critical temperature, which makes it difficult to observe experimentally. In this presentation, we will show that adding spin-orbit interaction allows the modulated phase to appear at high critical temperature.The system studied consists of a superconducting nanowire with Zeeman field and Rashba spin-orbit interaction.