Tuesday, 01.09.2015, Room EI 9

Time	ID	KOND I *Chair: Louis Schlapbach*
13:30	101	**Switching of magnetic domains reveals spatially inhomogeneous superconductivity** *Simon Gerber [1], Marek Bartkowiak [2], Jorge L. Gavilano [2], Eric Ressouche [3], Nikola Egetenmeyer [2], Christof Niedermayer [2], Andrea D. Bianchi [4], Roman Movshovich [5], Eric D. Bauer [5], Joe D. Thompson [5], Michel Kenzelmann [2]* *[1] Stanford Univ. and SLAC National Accelerator Lab, 2575 Sand Hill Road, 94025 Menlo Park, USA* *[2] Paul Scherrer Institut, CH-5232 Villigen PSI* *[3] CEA/UJF Grenoble, 17 Avenue des Martyrs, FR-38054 Grenoble* *[4] Université de Montréal, Pavillon Roger-Gaudry, A-438, CA-Montréal, Québec H3C 3J7* *[5] Los Alamos National Laboratory, P.O. Box 1663, 87545 Los Alamos, USA* The interplay of magnetic and charge fluctuations can lead to quantum phases with exceptional electronic properties, such as magnetically-driven superconductivity, where magnetic correlations fundamentally affect underlying symmetries and generate new physical properties. We show that the spin-density wave domains in the superconducting Q-phase of $CeCoIn_5$ are switched completely by a tiny change of the magnetic field direction, which is naturally explained by the presence of a spatially inhomogeneous Cooper pair-density wave. Further, the Q-phase emerges in a magneto-superconducting quantum critical point and, thus, represents an example where spatially modulated superconductivity is associated with spin-density wave order.
14:00	102	**In-chain impurity doping dependence of coupled spin and orbital dynamics in 1D-cuprates** *Marcus Dantz [1], Jonathan Pelliciari [1], Yaobo Huang [1], Paul Olalde-Velasco [1], Markos Skoulatos [1], Koushik Karmakar [2], Surjeet Singh [2], Thorsten Schmitt [1]* *[1] Paul Scherrer Institut, CH-5232 Villigen PSI* *[2] Indian Institute of Science Education and Research, Dr. Homi Bhabha Road, IN-411008 Pune, Maharashtra* We report RIXS measurements on $Sr_{2-x}TM_xCuO_3$ (TM=Co, Ni, Zn) where Co, Ni and Zn represent spin 1/2, 1 and 0 defects, respectively [1,2]. We show that defect doping strongly affects microscopic magnetism as observed by changes in the spinon continuum. The sharp boundary of the spinon continuum shows significant hardening of up to 50 meV with strongest energy increase upon Zn doping, followed by Ni and Co, revealing strong influence of the impurity doping on superexchange parameter J. [1] Schlappa et al. Nature 485, 82-85, (2012); [2] Simurtis et al. PRL 111, 067204 (2013)
14:15	103	**Ground state of underdoped cuprates** *Petar Popčević [1], Neven Barišić [1], Wojciech Tabis [2], Baptiste Vignolle [2], Mun K. Chan [3], Cyril Proust [2], Martin Greven [4]* *[1] TU Wien, Wiedner Hauptstr. 8-10/138, AT-1040 Wien* *[2] LNCMI, 143, avenue de Rangueil, FR-31400 Toulouse* *[3] LANL, P.O. Box 1663 , 87545 Los Alamos, USA* *[4] University of Minnesota, 3 Morrill Hall, 55455 Minneapolis, USA* Quantum oscillations measurements performed in high-magnetic fields and low temperatures in underdoped cuprate superconductors revealed an electron-pocket Fermi surface [1,2]. In contrast, the superconductivity evolves from a normal state, whose resistivity, Hall effect and magnetoresistivity are well described as Fermi liquid with large effective Fermi energy [3]. We have performed transport measurements in pulsed magnetic fields over a broad temperature range (1.5 - 150 K) on a model cuprate compound Hg1201 [1,3]. Results will be discussed in the context of a possible field-induced phase transition. [1] N. Doiron-Leyraud et al., Nature 447, 565 (2007);. [2] N. Barišić et al, Nature Physics 9, 761 (2013); [3] N. Barišić et al, PNAS 110, 12235 (2013).

14:30	**104**	**On the stability of the vortex lattice of silver sheathed $Sr_{0.6}K_{0.4}Fe_2As_2$ tapes** *Michael Reissner [1], Boris Brunner [2], Pavol Kovac [2], Chao Yao [3], Yianping Zhang [3], Yan-Wei Ma [3]* *[1] Solid State Physics, TU Wien, Wiedner Hauptstrasse 8-10, AT-1040 Wien* *[2] Institute of Electrical Engineering, Slovak Academy of Sciences, Dubravska 9, SK-84104 Bratislava* *[3] Institute of Electrical Engineering, Chinese Academy of Sciences, PO Box 2703, CN-100190 Bejing* According to their T_c-values both MgB_2 and pnictides are good candidates for cryogen-free applications. J_c is higher at lower fields, pnictides are more stable of flux lattice against flux movement in high fields. Best transport properties are found for Sr-122 pnictides, if tapes are prepared by an ex-situ PIT process at temperature around 850 – 950°C, similar to the ex-situ process for MgB_2. Here we report on an investigation of stability of the vortex lattice in a silver sheathed $Sr_{0.6}K_{0.4}Fe_2As_2$ tape by magnetic relaxation measurements. Critical current densities and pinning energies are determined and compared to results from direct transport measurements.
14:45	~~**105**~~	***moved to 140***
15:00	**106**	**The effect of As-chain layers on the electronic structure in '112' iron-pnictides – a high-resolution ARPES study** *Christian Matt [1], Nan Xu [1], Milan Radovic [1], Nick Plumb [1], Joel Mesot [2], Ming Shi [1]* *[1] Spectroscopy of Novel Material, Paul Scherrer Institute, CH-5232 Villigen PSI* *[2] Paul Scherrer Institute & ETH Zürich, CH-5232 Villigen PSI* The recently discovered rare earth substituted $AEFeAs_2$ (AE = Alkaline earth) system differs from all other iron pnictides by its metallic AEAs spacing layer. Our high resolution ARPES measurements reveal that the predicted As-1p states and AE- d sates of the AEAs spacing layer are located around the Fermi level and build an additional Fermi surface sheets around the Γ point and four Dirac cone like cones at the zone boundary close to the X point (π/a,0). This study implies strong constraints on theoretical models for High-T_c superconductivity. Effects on SC will be discussed as well as predicted topological states.
15:15	**107**	**High Precision MC/RG Study of Elastic Fluctuations in Solid Membranes** *Andreas Tröster, Institute of Material Chemistry, TU Wien, Getreidemarkt 9, AT-1060 Vienna* Combining Wilson's momentum shell RG with a recent optimization of Fourier MC, we derive for the first time a numerical estimate for the value of the Wegner correction exponent omega of a crystalline membrane in the flat phase [PRE 91, 022132 (2015)]. Our analysis allows us to refine our FSS estimate for exponent eta [PRB 87,104112 (2013)], helps to explain the dispersion of eta values found in the literature, hints at the reason for the observed bias in functional RG calculations, and provides clear evidence against "intrinsic ripples", whose existence is repeatedly claimed in the graphene-related literature.
15:30		***Coffee Break***
		KOND II *Chair: Alberta Bonanni, JKU Linz*
16:00	**111**	**Electronic stopping and charge exchange of slow light ions in metals and semiconductors** *Dominik Göbl, Institut für Experimentalphysik, Johannes Kepler Universität - Linz* Two different physical phenomena, electronic energy loss and charge exchange, were investigated by means of low energy ion scattering. Regarding energy loss, special attention was devoted to electronic stopping of slow H and He ions in transition metals, where deviations from velocity proportionality are observed for materials with distinct excitations thresholds in their band structure. Regarding charge exchange, the influence of the He level shift on Auger-neutralization was studied. Based on these findings, a model was developed to describe the quasi-resonant neutralization process of He at germanium.

16:30	**112**	**Single-layer MoS_2: Electronics in two dimensions** *Branimir Radisavljevic, ABB Corporate Research, CH-5405 Baden-Dättwil* With the discovery of carbon nanotubes in 1991 and graphene in 2004 carbon materials revolutionized field of nanoelectronics. Graphene as a two-dimensional material with its tremendous electrical properties is supposed to shape the nowadays electronics. Its zero-bandgap in pristine form became one of the biggest obstacles in digital electronics application since the direct consequence of that was low current on/off ratio. Recently, other semiconducting layered materials, such as transition-metal dichalcogenides, due to some complementary properties to graphene attracted attention of the electronics research community. Their advantage over graphene lies in finite bandgap that allows high current on/off ratio required for switching applications. This work, for the first time, explores electronic properties of one layered transition-metal dichalcogenide – single-layer MoS_2, and demonstrates the first transistors and integrated circuits with characteristics that outperform graphene electronics in many aspects and have comparable properties to nowadays silicon electronics.
17:00	**113**	**High performances normally-off AlGaN/GaN True-MOS with sub-micrometric gate features** *Mattia Capriotti [1], Eldad Bahat-Treidel [2], Clément Fleury [1], Ole Bethge [1], Frank Brunner [2], Oliver Hilt [2], Joachim Würfl [2], Dionyz Pogany [1], Gottfried Strasser [1]* *[1] Institut für Festkörperelektronik, TU Wien, Floragasse 7, AT-1040 Vienna* *[2] F.-Braun-Inst., Leibniz-Inst. f. Höchstfrequenztechnik Gustav-Kirchhoff-Str. 4, DE-12489 Berlin* III-N based metal insulator semiconductor heterojunction field effect transistors MISHFETs are attractive for power electronic applications. Nevertheless, due to high density of charge N_{int} at the III-N/insulator interface the MISHFETs are intrinsically normally-on, although normally-off operation would be highly desired. In this contribution we present high performances normally-off MISHFET with full recess of the barrier layer and ZrO_2 high-k gate insulator True-MOS. The devices have positive V_{th}= 1.5 V with an on/off ratio of 10^8 at V_g= 0 V. The sub-micrometric gate length mitigates the effect of mobility degradation due to the barrier recess, allowing a high maximum output current of 450 mA/mm.
17:15	**114**	**Vertical breakdown in AlGaN/GaN high electron mobility transistors.** *Clément Fleury [1], Mattia Capriotti [1],Matteo Rigato [1], Oliver Hilt [2], Joachim Würfl [2], Joff Derluyn [3], Gottfried Strasser [1], Dionyz Pogany [1]* *[1] Institut für Festkörperelektronik, Technische Universität Wien, Floragasse 7, AT-1040 Wien* *[2] F.-Braun-Inst., Leibniz-Inst. f. Höchstfrequenztechnik Gustav-Kirchhoff-Str. 4, DE-12489 Berlin* *[3] EpiGaN, Kempischesteenweg 293, BE-3500 Hasselt* AlGaN/GaN HEMTS on silicon substrate are promising candidates for high voltage and high temperature power switching applications [1]. Nevertheless, the vertical leakage and breakdown of the GaN buffer are currently limiting the voltage range and affect the reliability of these devices. We present here a study of the mechanisms involved in these phenomena. Study with temperature up to 180 °C showed activation energies of .46 eV for the leakage current, and backside optical methods showed filamentation of the current during breakdown. Finally, a time-dependent behavior indicating trap creation and formation of a percolation path has been observed [2]. [1] Hilt et al, TED 60(2013); [2] Fleury et al, MR 53(2013)
17:30	**115**	**Topological band order and optical properties of InAs, InSb and their ternary alloys under biaxial lattice expansion.** *Shirin Namjoo [1,2], Amir. S. H Rozatian [2], Peter Puschnig [1]* *[1] University of Graz, Institute of Physics, NAWI Graz, Universitatsplatz 5, AT-8010 Graz* *[2] Department of Physics, University of Isfahan, Hezar Jarib Street, IR-81835 Isfahan* We have investigated the electronic band structures and optical properties of the III-V semiconductor alloys $InAs_xSb_{1-x}$ (x=0, 0.25, 0.5, 0.75, 1) by employing density functional theory using the WIEN2k package. In their unstrained states, these alloys are in a topologically trivial phase and have small gap. By applying a biaxial lattice expansion the $InAs_xSb_{1-x}$ alloys are converted to a topologically nontrivial phase with a small band gap at the Γ point [1,2]. [1] S. Namjoo et al., Phys. Rev. B 91, 205205 (2015); [2] S. Namjoo et al., J. Alloys Compd. 628, 458 (2015).

17:45	116	**MBE Growth Optimization of GaAsSb** *Tobias Zederbauer [1], Aaron Maxwell Andrews [1], Don MacFarland [1], Hermann Detz [2], Werner Schrenk [3], Gottfried Strasser [1]* *[1] TU Wien, Karlplatz 13, AT-1040 Wien* *[2] Österreichische Akademie der Wissenschaften, Dr. Ignaz Seipel-Platz 2, AT-1010 Wien* *[3] Zentrum für Mikro- und Nanostrukturen, Floragasse 7, AT-1040 Wien* The InGaAs/GaAsSb material system is an interesting option for intersubband devices such as quantum cascade lasers (QCLs) and detectors (QCDs) due to its low effective mass in both the well and barrier. Laser operation in this material system was shown in the mid-infrared (MIR) and terahertz (THz) regimes. Regardless of its success, the growth of the barrier material is still challenging to control. In this work we show an extensive study on the impact of growth parameters on the GaAsSb epilayers. The effect of III/V ratio, Sb/As ratio, and substrate temperature on crystal quality and uniformity will be shown.
18:00		***Postersession and Apéritif***
19:45		***Public Lecture***

Wednesday, 02.09.2015, Room EI 9

Time	ID	**KOND III** *Chair: Christophe Rossel, IBM Rüschlikon*
13:30	121	**Fractional excitations in the square lattice quantum ferromagnet** *Bastien Dalla Piazza, Nanolive SA* Manifestations of quantum mechanics are traditionally expected for infinitesimally small systems. But dimensionality is also a key element. While three-dimensional systems behave mostly classically, strongly interacting one-dimensional ones display exotic phenomena such as the emergence of quasi-particles which are fractions of the fundamental ones found in vacuum. Two-dimensional systems lie marginally in the quantum or classical regime depending on their geometries and interactions. In this work we show that the square lattice quantum antiferromagnet, while hosting classical long-range order, might also give rise to fractional quasi-particles in the high-energy/short wavelength excitation regimes.
14:00	122	**Doping dependence of the magnetic excitations in electron doped NaFeAs** *Jonathan Pelliciari [1], Yaobo Huang [1], Marcus Dantz [1], Valentina Bisogni [1], Paul Olalde Velasco [1], Tanmoy Das [2], Chuang Qing Jin [3], Thorsten Schmitt [1]* *[1] Paul Scherrer Institute, 5232 Villigen, Switzerland* *[2] Indian Institute of Science, Raman Ave, Bengaluru, Karnataka, IN-560012 Bangalore* *[3] Institute of Physics, Chinese Academy of Sciences, P.O.Box 603, CN-100190 Beijing* We present a high resolution Fe L_3 RIXS study of parent and Co-doped NaFeAs. Spectral shape decomposition reveals the presence of dispersive magnetic excitations in all the compounds measured. Unlike previous RIXS experiments [1], the energy of such modes is not affected by doping. Their magnetic weight per iron atom is constant with doping, but decreasing per formula unit. We show that this is in agreement with DFT based calculations of the spin susceptibility. Cobalt-doping is tuning the electronic correlation, thereby affecting the intensity of antiferromagnetic fluctuations but not their energy. [1] K. J. Zhou et al, Nat. Comm., 4, 1470 (2013)
14:15	123	**Spatially resolved ferromagnetic resonance (FMR) detected by a microresonator** *Taddäus Schaffers [1], Ralf Meckenstock [2], Michael Farle [2], Andreas Ney [1]* *[1] Institut für Halbleiter- und Festkörperphysik JKU Linz, Altenbergerstr. 69, AT-4040 Linz* *[2] Universität Duisburg Essen, Forsthausweg 2, DE-7057 Duisburg* In modern physics it is essential to investigate the magnetic properties of single nano-sized objects. By detecting FMR with microresonators it is possible to achieve a sensitivity down to 10^6 spins [1]. In conventional FMR experiments only integral responses of the system are measurable. Through

thermal excitation it is possible to achieve spatially resolved FMR measurements [2] to study magnetic properties locally. Combining thermal excitation with microresonator detection we are able to study the influence of inhomogeneous stray fields on the FMR position and linewidth of two perpendicular Co-microstripes and compare the results to the integral detection.

[1] Narkowicz,JMagnReson175(2005)275; [2] Meckenstock,RevSciInstrum79(2008)041101

14:30 **124**

High-field Mössbauer and structural investigation on $FeSb_2$

Michael Reissner [1], Klaudia Hradil [2], Walter Steiner [1], Andreas Leithe-Jasper [3]
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[2] X-ray center, TU Wien, Getreidemarkt 9, AT-1060 Wien
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$FeSb_2$ is investigated since several decades, because of its interesting magnetic and electronic properties. It crystallizes in the marcasite structure type, where Fe occupies only one crstallographic site, surrounded by Sb octahedra. In contrast high field Mössbauer measurements show very complex spectra, which cannot be explained by only one Fe site. From neutron and X-ray investigations it is shown that part of the Fe atoms are shifted within the basal plane out of the center of the octahedra explaining the found Mössbauer spectra.

14:45 **125**

Towards broad-band x-ray detected ferromagnetic resonance in longitudinal geometry

Andreas Ney [1], Katharina Ollefs [2], Ralf Meckenstock [3], Detlef Spoddig [3], Florian Römer [3], Christoph Hassel [3], Christian Schöppner [3], Verena Ney [1], Michael Farle [3]
[1] Solid State Physics Division, Johannes Kepler University, Altenberger Str. 69, AT-4040 Linz
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[3] Fakultät für Physik, Universität Duisburg-Essen, Lotharstr. 1, DE-47057 Duisburg

An ultrahigh-vacuum-compatible setup for broad-band X-ray detected ferromagnetic resonance (XFMR) in longitudinal geometry is introduced which relies on a low-power, continuous-wave excitation of the ferromagnetic sample. A simultaneous detection of the conventional FMR and the XFMR signal of the X-ray absorption is possible. First experiments on the Fe and Co L_3-edges of a permalloy film covered with Co nanostripes and the Fe and Ni K-edges of a permalloy film are presented and discussed. Two different XFMR signals are found, one of which does not provide element-selective information. The other signal detects the dynamic magnetic properties element-selectively.

15:00 **126**

Using the far field of ring lasers to characterize their whispering gallery modes

Rolf Szedlak, Martin Holzbauer, Donald MacFarland, Tobias Zederbauer, Hermann Detz, Aaron Maxwell Andrews, Werner Schrenk, Gottfried Strasser
Vienna University of Technology, Floragasse 7, AT-1040 Vienna

We introduce ring quantum cascade lasers with a dual second order distributed feedback grating. This grating forms a continuous pi phase shift and therefore modifies the modal outcoupling. The asymmetry of the predominant whispering gallery mode (WGM) induces a rotation of the far field's symmetry axis. A direct correlation between this rotation and the location of the WGM relative to the grating is found. A counter clockwise rotation for a 1st order and a clockwise rotation for a 2^{nd} order WGM were observed. Consequentially, a simple analysis of the emission beam facilitates detailed insights into the mode characteristics.

15:15 **127**

Thermal optimization of ring quantum cascade lasers

Martin Holzbauer, Rolf Szedlak, Donald MacFarland, Tobias Zederbauer, Hermann Detz, Aaron Maxwell Andrews, Werner Schrenk, Gottfried Strasser
Institute for Solid State Electronics, TU Wien, Floragasse 7, AT-1040 Wien

Ring quantum cascade lasers (QCLs) are light sources covering the spectral range from the mid-infrared to the terahertz region. However, a huge amount of heat is dissipated in the active region, typically in the range of hundreds of MW/cm^3, which limits the operation to low pulse rates. To improve the thermal management we study the heat transport in ring QCLs using a finite element based approach including temperature dependent anisotropic thermal conductivities in the material layers. We processed devices with metal gratings, which allow an improved heat extraction together with light emission through the substrate.

15:30	**128**	**Quantum Cascade THz Random Lasers** *Sebastian Schönhuber [1], Martin Brandstetter [1], Christoph Deutsch [1], Michael Krall [1], Hermann Detz [2], Aaron Maxwell Andrews [2], Werner Schrenk [2], Gottfried Strasser [2], Karl Unterrainer [1]* *[1] Photonics Insitute, TU Wien, Gusshausstrasse 27-29, AT-1040 Wien* *[2] Center for Micro- and Nanostructures, TU Wien, Floragasse 7, AT-1040 Wien* Quantum Cascade Random Lasers in the terahertz regime are presented. Contrary to traditional lasers, random lasers trap the light via multiple scattering rather than in a classical cavity. Random lasers were fabricated using standard microelectronic processing techniques by etching a random pattern through the active region of the QCL. The resulting air holes then act as scatters and influence the structure of the modes. The devices show broadband surface emission with excellent far field properties.
15:45	**129**	**Quantitative statistics in super-continuum probed transient absorption spectroscopy** *Bernhard Lang, Arnulf Rosspeintner* *Dép. de Chimie-Physique, Université de Genève, 30, quai Ernest Ansermet, CH-1211 Genève 4* Femtosecond transient absorption is widely used to monitor the course of photochemical reactions in realtime. We show how the technique can be improved such that the single remaining source of experimental noise is counting statistics in detection. In consequence, the statistics on the experimental data is given analytically and methods based on maximum likelyhood without need for further adjustable parameters can be employed in data analysis. The possibility to model non-exponential kinetics and features with non-constant spectral shape like solvation dynamics, being beyond rate-based techniques like target analysis, is one of the benefits, besides greatly improved signal-to-noise quality and a substantial reduction of measuring time.
16:00		***Coffee Break***
		KOND IV *Chair: NN*
16:30	**131**	**Electron-Optics in suspended Graphene** *Peter Rickhaus [1], R. Maurand [1], M.-H. Liu [2], S. Hess [1], E. Tovari [3], P. Makk [1], M. Weiss [1], K. Richter [2], C. Schönenberger [1]* *[1] Dept. of Physics, University of Basel, CH-4056 Basel* *[2] Institute of Theoretical Physics, University of Regensburg, Germany* *[3] Dept. of Physics, Budapest University of Technology and Economics, Hungary* In ballistic graphene, electrons behave in many ways similar to photons. In high-mobility suspended monolayer graphene we mimicked devices known from optics. Recently we demonstrated that a ballistic p-n junction can be formed representing a Fabry-Pérot etalon [1]. Striking features appear under the influence of a perpendicular magnetic field that can be traced to the formation of “snake states” along the p-n interface [2]. Beyond that we demonstrated that electrons in ballistic graphene can be guided by gate potentials the same way as photons in an optical fiber and we showed that we can fill the electrostatic guiding channel mode by mode. [1] P. Rickhaus, R. Maurand, Ming-Hao Liu et al., Nature Comm. 4, 2342 (2013) [2] P. Rickhaus, P. Makk, Ming-Hao Liu et al., Nature Comm. 6, 6470 (2015)
17:00	**132**	**Generation of Massively Twisted Electron Vortex Beams in a TEM** *Thomas Schachinger [1], Andreas Steiger-Thirsfeld [2], Michael Stöger-Pollach [2], Peter Schattschneider [1]* *[1] Institute of Solid State Physics, TU Vienna, Wiedner Hauptstraße 8, AT-1040 Wien* *[2] University Service Centre for Electron Microscopy, TU Vienna, Wiedner Hauptstr. 8, AT-1040 Wien* By placing holographic masks with a fork dislocation in their center in the condenser system of a TEM it is possible to twist the electrons’ wavefront such that it carries orbital angular momentum (OAM) quantized in units of $\hbar$, as well as magnetic moment [1]. OAM values of 100 to 200 $\hbar$ have been reported [2,3]. Using advanced focused ion beam milling strategies it is possible to reach OAM values of 250 $\hbar$ in the first diffraction order, going up to 1250 $\hbar$ in the 5th diffraction order, carrying a huge magnetic moment of 1250 Bohr magnetons.

[1] J. Verbeeck, H. Tian and P. Schattschneider, 2010. Nature 467, 301. [2] B. J. McMorran, A. Agrawal, I. M. Anderson et al., 2011. Science 331, 192-195. [3] V. Grillo, G. C. Gazzadi, E. Mafakheri et al., 2014. PRL 114, 034801.
TS and PS acknowledge financial support by the Austrian Science Fund (FWF) under grant number I543-N20.

17:15 **133**

Band inversion, topological phase transition and surface Dirac gap formation in the topological crystalline insulator (Pb,Sn)Se

Bastian M. Wojek [1], Magnus H. Berntsen [1], Andrzej Szczerbakow [2], Piotr Dziawa [2], Bogdan J. Kowalski [2], Tomasz Story [2], Oscar Tjernberg [1]
[1] ICT MNF Materials Physics, KTH Royal Institute of Technology, Electrum 229, SE-16440 Kista
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The study of topological properties of solids and corresponding phase transitions has received tremendous attention in the recent years. A particularly interesting class of materials are 3D topological crystalline insulators (TCIs) where degeneracies in the surface electronic band structure are protected by point-group symmetries of the crystals. The IV-VI narrow-gap semiconductors hosting such a TCI phase show an extraordinary tunability of their electronic structure. Employing angle-resolved photoelectron spectroscopy we investigate the details of the bulk band inversion and the topological transition in (Pb,Sn)Se as well as the selective gapping of Dirac surface states by means of a structural distortion at the (001) surface.

17:30 **134**

Simulation of the dynamics of Dirac fermions on topological insulator surfaces

Walter Poetz, Physics, University of Graz, Universitätsplatz 5, AT-8010 Graz

We present a finite difference scheme which allows the simulation of Dirac fermions on a lattice without fermion doubling. This approach is used to simulate electro-magnetic manipulation of topological-insulator (TI) surface states and the consequences on the pure- and mixed-state dynamics of Dirac fermions out of equilibrium. In this presentation we concentrate on static magnetic textures, such as solitonic domain-walls and vortices, and investigate the signatures of momentum-spin locking.

17:45 **135**

Solving a quantum many-body problem by experiment

Thomas Schweigler [1], Valentin Kasper [2], Sebastian Erne [1], Bernhard Rauer [1], Tim Langen [1], Thomas Gasenzer [3], Jürgen Berges [2], Jörg Schmiedmayer [1]
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[3] Kirchhoff-Inst. für Physik, Universität Heidelberg, Im Neuenheimer Feld 227, DE-69120 Heidelberg

We experimentally study a pair of tunnel-coupled one-dimensional atomic superfluids, which realize the quantum sine-Gordon/massive Thirring models relevant for a wide variety of disciplines from particle to condensed-matter physics. From measured interference patterns we extract phase correlation functions and analyze if, and under which conditions, the higher-order correlation functions factorize into lower ones. This allows us to characterize the essential features of the model solely from our experimental measurements, detecting the relevant quasiparticles, their interactions and the topologically distinct vacua. Our method provides comprehensive insights into a non-trivial quantum field theory and establishes a general method to analyze quantum many-body systems through experiments.

18:00 **136**

Photon pairs from microcavity polaritons

Mathias Sassermann, Patrick Mai, Zoltán Vörös, Gregor Weihs, Wolfgang Langbein
Institut für Experimentalphysik, Universität Innsbruck, Technikerstrasse 25d, AT-6020 Innsbruck

Interacting photons can be created by dressing them with material excitations. This interaction can be the basis for producing non-classical photon correlations, such as squeezed or entangled light. In our case, the dressed states, called polaritons, are created by enclosing a quantum well in a λ cavity. In this contribution, we discuss our work on photon scattering in a polariton sample with ultralow photonic and excitonic disorder. We demonstrate, how the photon statistics depends on a number of experimental parameters, e.g., excitation density, polarisation, and temporal filtering, and identify a parameter range, where quantum correlations can be observed.

18:15	137	**Spin sensitive interactions in the spin polarized 2D electron gas** *Dominik Kreil, Helga Böhm, Raphael Hobbiger, Jürgen Drachta* *Theoretical Physics, JKU Linz, Altenbergerstr. 69, AT-4040 Linz* In the two dimensional electron system (realized, e.g., in semiconductor quantum wells), correlations are more pronounced than in the three dimensional bulk. Therefore, the well known and good understood random phase approximation (RPA) is not sufficient to describe these systems satisfactorily. We are working on techniques to go beyond RPA and study physical properties in this regime. Our main interest lies in the occurrence of collective excitations or the Wigner crystallization, which only occurs in very dilute systems. Therefore, it is crucial to understand spin polarization in dilute electron gases.
18:30	138	**Thermal conductivity of rattling triggered heavy phonons** *Matthias Ikeda, Xinlin Yan, Andrey Prokofiev, Lukas Prochaska, Robert Svagera, Monika Waas, Silke Bühler-Paschen* *Insitute of Solid State Physics, TU Wien, Wiedner Haupstraße 8-10, AT-1040 Wien* Low phonon thermal conductivity can be considered as key requirement for efficient thermoelctric materials. Recently an increasing number of crystal structures is being discovered that sustain low-energy incoherent “rattling” motions of isolated atoms with type-I clathrates being prototypal model systems. The hybridization of these essentially non-dispersing low-energy “Einstein” modes with the acoustic phonon branches leads to a severe flattening of the latter at finite wave vectors and thus to a decrease of the phonon group velocity, which translates into an enhanced phonon quasiparticle mass. Here we show that this effect is at the origin of the ultra-low phonon thermal conductivit of type-I clathrates.
18:45	139	**Calculating forces in the random phase approximation (RPA)** *Benjamin Ramberger, Georg Kresse* *Computational Materials Physics, University of Vienna, Sensengasse 8/12, AT-1090 Vienna* Recently there has been a lot of progress in the development of computer simulations employing the Random Phase Approximation (RPA) so that RPA-correlation energies became accessible for large systems. However, there is not yet an efficient way to calculate forces in the RPA within the current framework. Since the calculation of forces is crucial for the simulation of elastic and vibrational properties as well as for structure relaxations, this is a promising area for further investigation. In this work, analytical expressions that might allow an efficient numerical calculation of forces within the RPA are established. This was done using the Green’s function formalism and finally the results were also translated into Feynman diagrams.
19:00	140	**Connection between high energy spin excitations and degree of electron correlations in $Ba(Fe_{1-x}Co_x)_2As_2$ superconductors** *Jonathan Pelliciari [1], Yaobo Huang [1], Valentina Bisogni [2], Paul Olalde-Velasco [1], Zhiping Yin [3], Kejin Zhou [4], Marcus Dantz [1], Genfu Chen [5], Vladimir Strocov [1], Gabriel Kotliar [3], Hong Ding [5], Thorsten Schmitt [1]* *[1] Swiss Light Source, Paul Scherrer Institute, CH-5232 Villigen PSI* *[2] National Synchrotron Light Source II, Brookhaven National Lab., Upton, NY 11973-5000, USA* *[3] Department of Physics and Astronomy, Rutgers University, New Jersey 08854-8019, USA* *[4] Diamond Light Source, Harwell Science & Innovation Campus, Didcot, Oxfordshire OX11 0DE, UK* *[5] Institute of Physics, Chinese Academy of Sciences, P.O.Box 603, CN-100190 Beijing* We probed the high-energy spin-excitations(HESEs) in under, nearly-optimal and over electron-doped $BaFe_{2-x}Co_xAs_2$ with Fe-L_3 edge RIXS. Our result show well-defined spin-excitations dispersing up to 200 meV persisting into the superconducting phase, similar as found in hole-doped superconductor $Ba_{0.6}K_{0.4}Fe_2As_2$ (BKFA) [K. J. Zhou, et.al., Nat.Commun 4 1470] thereby demonstrating the existence of an universal correlated spin state in these materials. HESEs in $BaFe_{2-x}Co_xAs_2$ are nearly independent of electron-doping, in contrast to BKFA that softened relative to parent $BaFe_2As_2$. This result is consistent with our DMFT calculations, which show a lower degree of electron correlations for the electron-doped iron-pnictides.
19:15		***Transfer to Dinner***
20:00		***Conference Dinner***

Time	ID	**KOND V** *Chair: Oskar Paris, Uni Leoben*
17:00	**141**	**Small Angle Scattering from free metal clusters in a supersonic molecular beams** *Heinz Amenitsch [1], Michele Devetta [2], Paolo Piseri [2]* *[1] Institute of Inorganic Chemistry, TU Graz, Stremayergasse 9/IV, AT-8010 Graz* *[2] Dipartimento di Fisica & CiMaINa, Universita delgi Studi di Milano, via Celoria 6, IT-20133 Milano* The study of isolated nanoparticles produced in the gas phase is a key issue for understanding how the properties of matter evolve from atomic and molecular level to bulk materials. Access to information on free nanoparticle morphology, such as aggregate structure and fractal dimension in molecular cluster beams, is thus of major importance to understand e.g. cluster beam deposition. Here we characterized a cluster beam from Pulsed Microplasma Cluster Source with time resolved small angle scattering with 9 ms time resolution. The structures showed sizes changing from 2 nm from to top to about 5 nm at the tails of the cluster beam.
17:30	**142**	**Early Stage Protein/Nanoparticles Interaction Studied by SAXS and a Free Jet Micromixer** *Benedetta Marmiroli [1], Barbara Sartori [1], Jens Meissner [2], Gianluca Grenci [3], Matthias Girod [4], Gerhard H Findenegg [2], Heinz Amenitsch [1]* *[1] Institute of Inorganic Chemistry, Graz University of Technology, Stremayrgasse 9/IV, AT-8010 Graz* *[2] Institut für Chemie, Technische Universität Berlin, Strasse des 17. Juni 124, DE-10623 Berlin* *[3] Mechanobiology Institute, National University of Singapore, SG-117411 Singapore* *[4] Elettra-Sincrotrone Trieste, SS 14 km 163.5, Basovizza, IT-34149 Trieste* Recently we have designed, fabricated and tested a microfluidic device based on hydrodynamic focusing and a free-jet optimized for synchrotron small angle X-ray scattering time resolved measurements. We have employed the micromixer at the Austrian SAXS beamline at Elettra-Sincrotrone Trieste synchrotron radiation source to investigate the interaction of silica nanoparticles with lysozyme in the sub-millisecond/millisecond time range. In this communication we will describe the measurement issues like the alignment and the determination of the jet behaviour. We will then present the first results that demonstrate the appropriateness of the technique to measure such systems.
17:45	**143**	**Dynamics of the self-assembled supermolecular structure of perylene bisimide and oxygenic polyoxometalates** *Max Burian [1], Aurelio Bonasera [2], Zois Syrgiannis [2], Francesco Rigodanza [2], Marcella Bonchio [3], Maurizio Prato [2], Heinz Amenitsch [1]* *[1] Graz University of Technology, Stremayergasse 9/V, AT-8010 Graz* *[2] University of Trieste, via L. Giorgieri 1, IT-34127 Trieste* *[3] University of Padova, via F. Marzolo 1, IT-35131 Padova* Upon addition of perylene bisimide (PBI2+) to ruthenium polyoxometalate (RuPOM) in aqueous solution a spontaneous self-assembly into a nano-scaffold occurs. In both TEM and SEM images of the hybrid material various morphologies were observed from which no detailed information on the intermolecular structure could be gained. Solution SAXS measurements reveal the formation of plate-like superstructures in the nanometer regime, suggesting a disordered lateral arrangement of the molecules. Subsequent SAXS and UV/VIS stop-flow experiments give rise to the self-assembly kinetics of the two compounds whereas the obtaiend results will be discussed in more detail.

18:00	**144**	**Core-Shell Nanoparticles – Insights in Their Growth and Dynamic Behaviour by Small-Angle X-Ray Scattering** *Tilman A. Grünewald [1], Andrea Lassenberger [2], Iris Vonderhaid [2], Harald Rennhofer [1], Ronald Zirbs [2], Heinz Amenitsch [3], Barbara Capone [4], Peter D. J. van Oostrum [2], Erik Reimhult [2], Helga C. Lichtenegger [1]* *[1] Institute of Physics and Materials Science, BOKU Vienna, Peter Jordan Straße 82, AT-1190 Vienna* *[2] Department of Nanobiotechnology, BOKU Vienna, Muthgasse11/II, AT-1190 Vienna* *[3] Institute of Inorganic Chemistry, TU Graz, Stremayrgasse 9/V, AT-8010 Graz* *[4] Faculty of Physics, Uni Vienna, Sensengasse 8/10, AT-1090 Vienna* Functional nanoparticles for which an inorganic, e.g. superparamagnetic, core can be used to localize or actuate the responsive (spherical) brush polymer shell of the nanoparticle are receiving immense interest as building blocks for biomedical and smart materials applications. The shell density profile and its change in solvation upon external stimuli determine the functionality for the diverse biotechnological applications. In this study the, ability to characterize core-shell NPs in response to varying solvent conditions by SAXS as well as the ability to follow the growth of iron oxide cores during synthesis.
18:15	**145**	**Chemical and crystalline Structure of spherical and non-spherical CdSe-CdS nanocrystalls** *Lukas Ludescher [1], Dmitry Dirin [2], Gerhard Fritz-Popovski [1], Maksym Kovalenko [2], Oskar Paris [1], Rainer Lechner [1]* *[1] Institute of Physics, Montanuniversität Leoben, Franz Josef-Straße 18, AT-8700 Leoben* *[2] Dep. of Chemistry and Applied Biosciences, ETH Zürich, Vladimir Prelog Weg 1, CH-8093 Zürich* A pronounced improvement in chemical stability and optical properties for core-shell semiconducting nanocrystals has been achieved using wet-chemical synthesis methods [1,2]. In a current study performed at the synchotron ESRF, we have investigated CdSe nanocrystals with an epitaxially grown CdS shell by small and wide angle x-ray scattering (SAXS/WAXS). We revealed the chemical and crystalline core-shell structure of spherical and non-spherical CdSe-CdS nanocrystals. The non-spherical symmetry can be related to facet formation on the particle surface and depends on the nanocrystal diameter. [1] R.T. Lechner, et al., Chem. Mater., 2014; [2] M.G. Bawendi, Nat. Mater., 2013
18:30	**146**	**Role of spin-orbit coupling in osmates probed by oxygen K edge resonant x ray scattering and x ray absorption** *Xingye Lu, Thorsten Schmitt, Yaobo Huang, Marcus Dantz, Jonathan Pelliciari* *Paul Scherrer Institut, CH-5232 Villigen PSI* We use oxygen K edge resonant inelastic x ray scattering (RIXS) and x ray absorption to reveal the effect of spin-orbit coupling on the electronic structure and elementary excitations of pyrochlore osmate $Cd_2Os_2O_7$. In stark contrast to pyrochlore iridates $Eu_2Ir_2O_7$ and $Pr_2Ir_2O_7$ where spin-orbit exciton are clearly identified, the incident energy dependent RIXS of $Cd_2Os_2O_7$ does not reveal clear Raman mode, implying spin-orbit coupling may not play a role in osmate. Similar results have also been observed in pyrochlore Cd_2ReO_7 and perovskite $NaOsO_3$. These results suggest that iridates may be a unique 5d system hosting the novel Mott physics.
18:45	**147**	*cancelled*
19:00		***Vollversammlung Fachausschuß NESY***
19:30		***END***
19:45		***Public Lecture***

ID	KOND Poster
161	**Probing the resistivity and doping concentration of semiconductors at the nanoscale using Scanning Microwave Microscopy** *Enrico Brinciotti [1], Georg Gramse [2], Thomas Schweinböck [3], Andreas Altes [3], Matthias Fenner [4], Jürgen Smoliner [5], Manuel Kasper [1], Giorgio Badino [1], Silviu-Sorin Tuca [1], Ferry Kienberger [1]* *[1] Keysight Technologies Austria GmbH, Keysight Labs, Gruberstrasse 40, AT-4020 Linz* *[2] Johannes Kepler University, Biophysics Institute, Gruberstrasse 40, AT-4020 Linz* *[3] Infineon Technologies, Am Campeon 1-12, DE-85579 Neubieberg* *[4] Keysight Technologies Deutschland GmbH, Lyoner Strasse 20, DE-60528 Frankfurt* *[5] TU-Wien, Inst für Festkörperelektronik, Floragasse 7, AT-1040 Wien* We present a new method to extract, with nanoscale lateral resolution, resistivity and doping concentration of semiconductor materials from Scanning Microwave Microscopy (SMM) S11 reflection measurements. The method does not require a dedicated calibration sample. Using a three error parameters de-embedding workflow, the S11 raw data are first converted into a calibrated resistance image. An analytical model of the SMM tip/sample system that includes tip radius, skin depth, resistivity, and doping concentration has been developed and applied to fit the measured calibrated resistance. The method has been successfully tested on two doped Si staircase samples with known doping concentration and resistivity.
162	**Diffusion modelling of language shift in Carinthia, Austria** *Katharina Prochazka, Gero Vogl* *Faculty of Physics, University of Vienna, Boltzmanngasse 5, AT-1090 Vienna* Language shift occurs when speakers give up the use of one language for another. An Austrian example is Carinthia where the use of Slovenian has been steadily declining. To understand this decline, which reduces cultural diversity, language shift needs to be monitored. One way to accomplish large-scale monitoring are models of physical diffusion which can be used to study language shift. In this work, we present an agent-based model to simulate language shift in Carinthia over time and space. The model is calibrated using empirical data from the Austrian census. In addition, we discuss limitations in applying physical models to linguistic problems.
163	**Formation of p-n junctions in GaAs/InGaAs nanowires** *Suzanne Lancaster, Hermann Detz, Martin Kriz, Gottfried Strasser* *Institute for Solid State Electronics, Vienna University of Technology, Floragasse 7, AT-1040 Vienna* Semiconductor nanowires are promising with regards to the down-scaling of optoelectronic devices as well as the integration of heterogeneous materials. Difficulties in dopant incorporation and activation complicate the fabrication of functional devices. We will present a detailed study on the formation of p-n junctions via in-situ doping during growth, compared to those created via metallic diffusion during contact processing. Doped GaAs/InGaAs nanowires grown by MBE are dispersed on SiO_2, contacted with Au/Zn/Au or Ge/Au/Ni/Au for p- and n-type contacts respectively, and characterized electrically and optically in order to optimize the p-n junction quality.
164	**Oxide diffusion barriers on GaAs(001)** *Anirban Sarkar, Reinhold Koch, Shibo Wang, JKU Linz, Altenbergerstr. 69, AT-4040 Linz* Thin oxide layers functioning as tunnel contacts and/or diffusion barriers between a ferromagnetic electrode and a semiconductor template are expected to improve the spin injection efficiency by reducing the loss of the electrons' spin polarization at the interface. We present our recent results on the growth and properties of thin films of two transition metal oxides, MgO and MoO_3, on GaAs(001) substrates, with emphasis on their structure, morphology, stress, strain relaxation, and electrical properties. Furthermore, as an exemplary diffusing element in GaAs(001) we investigated the interdiffusion across the oxide barrier by means of Fe/(MgO,MoO_3)/GaAs(001) heterostructures.

165	**Confocal Brillouin Microscopy Imaging** *Augustinus Asenbaum [1], Christian Pruner [1], Emmerich Wilhelm [2], Alfons Schulte [3], Erwin Eisenegger [4], Filippo Scarponi [4], John R. Sandercock [4]* *[1] Dep. for Materials Research and Physics, University of Salzburg, Hellbrunnerstr. 34, AT-5020 Salzburg* *[2] Institute for Physical Chemistry, University of Vienna, Währingerstr. 42, AT-1090 Vienna* *[3] Department of Physics, University of Central Florida, 4111 Libra Drive, 32816 Orlando, USA* *[4] JRS Scientific Instruments, Im Grindel 6, CH-8932 Mettmenstetten* A plane-parallel Fabry-Perot interferometer has a low free spectral range and also a low contrast which does not allow measurements of Brillouin spectra of opaque samples, because the very high-intensity elastic peak has to be separated from the rather low intensity Brillouin peaks. Using corner-cube prisms Sandercock introduced a multi pass Fabry-Perot thereby attaining a contrast of more than eleven orders of ten. By attaching a confocal microscope the recording of Brillouin back-scattering spectra with about 1 µm spatial resolution was achieved. With the aid of a computer controlled x-y table, Brillouin spectra imaging of solid samples is also possible. The software for controlling the x-y table is included in the software.
166	**Calorimetry of a Bose-Einstein condensed photon gas** *Qi Liang, Atominstitut, TU-Wien, Stadionallee 2, AT-1020 Vienna* Bose-Einstein condensation has been achieved with cold atoms, quasiparticles in solid state materials as polaritions, and more recently also with photons. In the latter experiment, a trapped two-dimensional photon gas in a dye filled optical microcavity is investigated. By multiple absorption and re-emission cycles with dye molecules, number conserving thermalisation is achieved. Bose-Einstein condensation above a critical photon number here leads to a macroscopic population at the position of the cavity low-frequency cutoff. We here report the study of calorimetry properties of trapped photon gas, as a measurement the heat capacity of the optical quantum gas.
167	**Solvation structure around the Li ion in a mixed cyclic/linear carbonate solution unveiled by the Raman noncoincidence effect** *Maurizio Musso [1], Maria Grazia Giorgini [2], Stefano Cerini [2], Kazuma Futamatagawa [3], Hajime Torii [3]* *[1] Department of Materials Research and Physics, University of Salzburg, Hellbrunnerstr. 34, AT-5020 Salzburg* *[2] Dep. of Industrial Chemistry 'Toso Montanari', Univ. of Bologna, Viale del Risorgimento 4, IT-40136 Bologna* *[3] Department of Chemistry, School of Education, Shizuoka University, 836 Ohya, JP-422-8529 Shizuoka* The solvation structure around the Li ion in a mixed cyclic/linear carbonate solution, an important factor for the performance of lithium-based rechargeable batteries, is examined by measuring and analyzing the Raman spectroscopic noncoincidence effect observed for the C=O stretching Raman band in this solution. This technique has the advantage of perceiving relative distances and orientations of solvent molecules clustering around an ion in the first solvation shell. The Li ion is preferably solvated by PC molecules, and is totally protected from direct interaction (contact ion paring) with the perchlorate ion.
168	**Superheating and Structural Changes of Lithium and Sodium in Nanoporous Glasses** *Gerhard Krexner [1], Abdul Ghaffar [2], Ivo Zizak [3], Sigrid Bernstorff [4], Heinz Amenitsch [4]* *[1] Faculty of Physics, University of Vienna, Boltzmanngasse 5, AT-1090 Vienna* *[2] Department of Physics, GC University, Katchery Road, PK-54000 Lahore* *[3] HZB für Materialien und Energie, Synchrotron BESSY II, DE-12489 Berlin* *[4] Austrian SAXS-Beamline, ELETTRA – Sincrotrone, IT-34149 Basovizza, Trieste* The effects of confinement on Lithium and Sodium in nanoporous glasses such as Vycor and Gelsil with pore sizes 5-20 nm are studied with synchrotron radiation at room temperature and during in situ heating and cooling experiments. Instead of their BCC bulk structures both metals adopt a mixture of close-packed phases. On heating, confined Lithium remains stable above the bulk melting point (454 K) up to about 1000 K indicating that superheating of the solid phase is possible up to $T/T_m = 2.2$ while for confined Sodium superheating was observed at least up to $T/T_m = 1.5$.