

6 NCCR MANEP

Monday, 21.06.2010, Aula

Time	ID	MANEP I: CORRELATED ELECTRON SYSTEMS <i>Chair: T. Giamarchi, Uni Genève</i>
13:30	601	<p style="text-align: center;">The light that Resonant Inelastic X-ray Scattering sheds on High T_c Cuprates</p> <p style="text-align: center;"><i>Jeroen van den Brink, Institute for Theoretical Solid State Physics, IFW Dresden</i></p> <p>Resonant Inelastic X-ray Scattering (RIXS) provides direct access to elementary charge, spin and orbital excitations in complex oxides. As a technique it has made tremendous progress with the advent high-brilliance synchrotron X-ray sources. The fundamental question that arises is to precisely which low-energy correlation functions RIXS is sensitive. I will show that depending on the experimental RIXS setup, the measured charge dynamics can include charge-transfer, d-d and orbital excitations [1,2]. RIXS also allows probing spin dynamics, in particular magnons and bi-magnons dispersions [3,4]. Based on these observations, I will discuss the novelties that RIXS reveals on the spin dynamics of High T_c cuprates [5].</p> <p>[1] Van den Brink and Van Veenendaal, EPL 73, 121 (2006). [2] Forte et al., PRL 101, 106406 (2008). [3] Braicovich et al., PRL 102, 167401 (2009). [4] Ament et al., PRL 103, 117003 (2009). [5] Braicovich et al., PRL 104, 077002 (2010).</p>
14:00	602	<p style="text-align: center;">Is the ground-state of copper oxide really a collinear antiferromagnetic? X-rays tell a more complicated story...</p> <p style="text-align: center;"><i>V. Scagnoli ¹, U. Staub ¹, R. de Sousa ¹, Y. Bodenthin ¹, M. Garganourakis ¹, A. T. Boothroyd ², S. W. Lovesey ^{3,4}</i></p> <p style="text-align: center;">¹ Paul Scherrer Institut, 5232 Villigen PSI</p> <p style="text-align: center;">² Clarendon Laboratory, Dep. of Physics, Oxford University, UK-Oxford OX1 3PU</p> <p style="text-align: center;">³ ISIS Facility, Harwell Science and Innovation Campus, UK-Oxfordshire OX11 0QX</p> <p style="text-align: center;">⁴ Diamond Light Source Ltd., UK-Oxfordshire OX11 0DE</p> <p>Copper oxide has recently attracted much interest as a magnetically driven multiferroic with the highest T_c (230K). In this material a non-collinear spiral magnetic order ($215K \leq T \leq 230K$) breaks crystal inversion symmetry, inducing ferroelectricity. We use resonant x-ray diffraction at the Cu L edges to probe the subtle changes in the Cu electronic structure occurring at the appearance of multiferroicity and test the magnetic ground-state, expected to be a collinear antiferromagnet. In both phases we have found a strong dependence of the diffracted intensity on the polarization of the incident light. Such dependence is totally unexpected in a simple collinear antiferromagnetic phase proposed by neutron diffraction. In this model the Cu magnetic moment are aligned (antiferromagnetically) along the b-axis. This dependence could reflect and be a direct measurement of the atomic electronic polarization of the Cu 3d states.</p>

14:15	603	<p style="text-align: center;">The duality of charge carriers in LaAlO₃/SrTiO₃ superlattices revealed by resonant inelastic x-ray scattering</p> <p style="text-align: center;"><i>Kejin Zhou¹, Milan Radovic², Justine Schlappa¹, Vladimir Strocov¹, Joël Mesot³, Luc Patthey¹, Thorsten Schmitt¹</i></p> <p style="text-align: center;">¹ Paul Scherrer Institut, Swiss Light Source, 5232 Villigen PSI ² Laboratory for synchrotron and neutron spectroscopy, EPFL, CH-1015 Lausanne ³ ETHZ & EPFL & PSI</p> <p>The interface between the band insulators, LaAlO₃ and SrTiO₃, has been attracting great attention due to its fascinating two-dimensional conductive, magnetic and superconducting properties. Resonant inelastic x-ray scattering at Ti L-edges is particularly suitable to investigate the electronic structure of its interface since the signature of conducting Ti³⁺ states clearly displays a strong dd excitation while Ti⁴⁺ states exhibit no excitations up to 4 eV. Our studies on (LaO)_m/(STO)₁₀ superlattices prepared by Pulsed Laser Deposition reveal two types of carriers giving rise to localized and delocalized Ti 3d bands, respectively. The dual character of these carriers is even preserved after annealing under O₂ atmosphere and high temperature. Varying the number of LAO unit cells m showed that oxygen vacancies contributed carriers increase for larger m but saturate at a certain value. Increasing m, the electron transfer conduction mechanism begins to set in compensating the electric potential.</p>
14:30	604	<p style="text-align: center;">Spin ladders: Model systems and real materials</p> <p style="text-align: center;"><i>Christian Rüegg, London Centre for Nanotechnology and Department of Physics and Astronomy, University College London</i></p> <p>Quasi-one-dimensional arrays of pairs of transition metal ions, so-called ladders, serve as model systems for many theoretical studies of the electronic and magnetic ground state properties of low-dimensional systems. Recent results are presented on a number of new inorganic and metal-organic compounds, which enabled considerable experimental progress in the field. Measurements by neutron spectroscopy, diffraction, calorimetry and magnetometry at low temperatures and up to high magnetic fields are used to explore the full phase diagrams, spin dynamics, and critical behaviour of doped and undoped quantum spin ladders. The data allow stringent, parameter free tests of theoretical models and methods and inspire new directions for future studies in close connection with current research on ultra-cold gases of atoms, many-body theory and materials science.</p>
15:00	605	<p style="text-align: center;">NMR study of doping effects in a single-crystal 2-leg Heisenberg spin ladder</p> <p style="text-align: center;"><i>Francesco Casola^{1,2}, T. Shiroka^{1,2}, S. Wang^{3,4}, K. Conder³, E. Pomjakushina³, J. Mesot^{1,2}, H.-R. Ott¹</i></p> <p style="text-align: center;">¹ Laboratorium für Festkörperphysik, ETH Hönggerberg, CH-8093 Zürich ² Paul Scherrer Institut, CH-5232 Villigen PSI ³ Lab. for Developments and Methods, Paul Scherrer Institut, CH-5232 Villigen PSI ⁴ Laboratory for Quantum Magnetism, EPFL, CH-1015 Lausanne</p> <p>Nuclear magnetic resonance and magnetization measurements were used to probe the magnetic features of single-crystalline Bi(Cu_{1-x}Zn_x)₂PO₆ with 0 < x < 0.05 at temperatures between 2.6 and 300 K. The simple lineshape of the ³¹P NMR signals of the pristine compound, to a fair approximation Lorentzian-like, changes considerably for x = 0.01 providing clear evidence for a temperature dependent variation of the local magnetization close to the Zn sites. The generic nature of this</p>

		feature is indicated by results of model calculations on spin systems of limited size. Spin-lattice relaxation data, obtained by probing a crystal with $x = 0.05$, reveal a freezing of the impurity-induced local magnetization at temperatures below 4 K. Unlike previous studies on powdered samples, our results show unambiguously that non-magnetic impurities can give rise to a disordered magnetism and that frustration due to next-nearest-neighbour interactions along the leg is essential for correctly describing this spin-ladder system.
15:15	606	<p>Occurrence of superconductivity when the metal-insulator transition is inhibited in 1T-TaS₂</p> <p><i>Peng Xu, J. O. Piatek, P.-H. Lin, B. Sipos, H. Berger, L. Forró, H. M. Rønnow, M. Grioni</i> <i>Institut de Physique de la Matière Condensée, EPFL, CH-1015 Lausanne</i></p> <p>When a Mott metal-insulator transition is inhibited by a small amount of disorder in the layered dichalcogenide 1T-TaS₂, superconductivity coexists (below T=2.1 K) with a nearly-commensurate charge-density-wave. By angle-resolved photoelectron spectroscopy (ARPES) we show that it emerges from a bad metal normal state with strongly damped quasiparticles. The superconducting state is fragile: larger amounts of substitutional disorder in the Ta planes suppress the Mott phase but yield localization and insulating behavior.</p>
15:30		Coffee Break
		<p>MANEP II: SUPERCONDUCTIVITY <i>Chair: M. Sigrist, ETH Zürich</i></p>
16:00	611	<p>Some remarkable physical features of quasi one dimensional organic superconductors</p> <p><i>Denis Jérôme, UMR 8502, Université Paris-Sud, Orsay, France</i></p> <p>The wealth of work shows that the Bechgaard series, TMTSF₂X, X = PF₆, ClO₄ found to be superconducting 30 years ago provides simple model systems for low dimensional condensed matter physics. The recent study of the transport properties of the metallic phase TMTSF₂X, X = PF₆, ClO₄ part of the generic TM₂X phase diagram shows that the non-conventional linear in temperature law of the resistivity, and antiferromagnetic fluctuations are closely linked to the existence of superconductivity. Transport suggests the occurrence of a pseudo gap at low temperature in the charge sector related to the stability of the superconducting ground state. Strong interchain AF fluctuations in the metallic phase boost a singlet d-wave superconducting coupling. A Pauli limitation of the superconducting critical field and FFLO states are observed for selected orientations of the magnetic field. TMTSF₂X has become a model system for the study of other correlated compounds departing from the cuprate <i>doxia</i>.</p>
16:30	612	<p>Evidence for exciton condensation in layered TiSe₂: A photoemission study</p> <p><i>Philipp Aebi, Département de Physique, Université de Fribourg</i></p> <p>There is a longstanding open question about the existence of a condensate of electron-hole pairs (excitons) in a way as it is well-known for pairs of electrons, Cooper-pairs, in superconductivity. TiSe₂ exhibits an unusual temperature dependence in transport experiments and a specific band configuration that has been related to the possible formation of excitons. Here we present a temperature</p>

		<p>dependent, high-resolution angle-resolved photoemission study of 1T-TiSe₂. The material undergoes a phase transition from its room-temperature, normal phase to a low-temperature, charge-density wave phase. At low temperature the photoemission spectra are strongly modified, with large band renormalisations at high-symmetry points of the Brillouin zone and a very large transfer of spectral weight to backfolded bands. A calculation of the theoretical spectral function for an exciton phase using a BCS-like formalism reproduces the experimental features with very good agreement. This gives strong evidence in favour of the exciton phase in 1T-TiSe₂.</p>
17:00	613	<p style="text-align: center;">First direct observation of the Van Hove singularity in the tunneling spectra of cuprates</p> <p style="text-align: center;"><i>Alexandre Piriou, Nathan Jenkins, Christophe Berthod, Ivan Maggio-Aprile, Enrico Giannini, Øystein Fischer</i> <i>DPMC - University of Geneva, 24 quai Ernest Ansermet, CH-1211 Genève</i></p> <p>In quasi-two dimensional compounds such as Bi-based cuprates, the normal state band structure displays a van-Hove singularity (VHS). In 1961, Harrison claimed that this should not been seen in a planar tunnel junction [1]. More recently, a great debate has occurred over the longstanding question of whether it is possible to see this singularity in tunneling spectra. We have performed a detailed scanning tunneling spectroscopy study of the pure Bi₂Sr₂CuO_{6+δ} (Bi-2201) compound. We unambiguously observe the VHS with no sign of the superconducting gap. As one moves to lower doping levels and enters the superconducting dome, the VHS gradually moves to negative energies, while a superconducting gap opens. We show how this behavior can be understood and its relation with what has been observed in other Bi-based cuprates.</p> <p>* This work was supported by the NCCR MaNEP and the Swiss National Science Foundation. [1] W. A. Harrison, Phys. Rev. B. 123 (1961) 85.</p>
17:15	614	<p style="text-align: center;">Anisotropic superconducting properties of single-crystalline FeSe_{0.5}Te_{0.5}</p> <p style="text-align: center;"><i>Markus Bendele^{1,2}, S. Weyeneth¹, R. Puzniak³, A. Maisuradze², E. Pomjakushina⁴, K. Conder⁴, V. Pomjakushin⁵, H. Luetkens², S. Katrych⁶, A. Wisniewski³, R. Khasanov², H. Keller¹</i></p> <p>¹ <i>Physik-Institut der Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich</i> ² <i>Lab. for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI</i> ³ <i>Inst. of Physics, Polish Academy of Sciences, Aleja Lotników 32/46, PL-02-668 Warsaw</i> ⁴ <i>Lab. for Developments and Methods, Paul Scherrer Institute, CH-5232 Villigen PSI</i> ⁵ <i>Lab. for Neutron Scattering, ETHZ & PSI, CH-5232 Villigen PSI</i> ⁶ <i>Lab. for Solid State Physics, ETH Zürich, CH-8093 Zürich</i></p> <p>The structural and anisotropic superconducting properties of FeSe_{0.5}Te_{0.5} single crystals were investigated by means of single crystal X-ray and neutron powder diffraction, SQUID and torque magnetometry, and muon-spin rotation. Room temperature neutron powder diffraction reveals that the crystal mainly contains the PbO type tetragonal phase with a refined stoichiometry of Fe_{1.045}Se_{0.406}Te_{0.594}. The magnetic penetration depth λ at zero temperature was found to be $\lambda_{ab} = 491(8)$ nm in the ab-plane and $\lambda_c = 1320(14)$ nm along the c-axis. The temperature dependences of both λ_{ab} and λ_c are best described by a two-gap s+s-wave model with gap values of $\Delta_s(T=0) = 0.51(3)$ meV and $\Delta_L(T=0) = 2.61(9)$ meV for the small and the large gap, respectively. The magnetic penetration depth anisotropy</p>

		parameter $\gamma_\lambda(T) = \lambda_{ab}/\lambda_c$ as determined by muon-spin rotation and first critical field H_{c1} measurements increases with decreasing temperature, in agreement with the behavior of γ_λ observed in the iron-pnictide superconductors.
17:30	615	<p style="text-align: center;">Nature of stripes in the generalized t-J model applied to Cuprate superconductors</p> <p style="text-align: center;"><i>Kai-Yu Yang^{1,2}, Wei-Qiang Chen², T. M. Rice¹, M. Sigrist¹, Fu-Chun Zhang²</i> ¹ <i>Institut für Theoretische Physik, ETH Zürich, CH-8093 Zürich</i> ² <i>Center for Theoretical and Computational Physics and Department of Physics, The University of Hong Kong, Hong Kong SAR, China</i></p> <p>Recent transport properties on the stripe phase in LBCO found 2-dimensional superconductivity over a wide temperature range including a BKT transition at a temperature $T=16K$, with 3D superconducting ordering only at $T=4K$. These results contradict the long standing belief that the onset of superconductivity is suppressed by stripe ordering and suggest coexistence of stripe and SC phases. The lack of 3-D superconducting order above $T=4K$ requires an antiphase ordering in the SC state to suppress the interlayer Josephson coupling as proposed by Berg. Here we use a RMFT for t-J model to examine the energetics of the spin and charge stripe ordered SC states including antiphase domains in the SC order. We find that the energies of these modulated states are very close to each other and the anisotropy present in the low temperature tetragonal crystal structure favors stripe resonating valence bond states. The stripe antiphase SC states are found to have energies very close, but always above, the ground state energy which suggests additional physical effects are responsible for their stability.</p>
17:45	616	<p style="text-align: center;">Spin rotational symmetry breaking by orbital current patterns in two-leg ladders</p> <p style="text-align: center;"><i>Piotr Chudzinski¹, M. Gabay², T. Giamarchi¹</i> ¹ <i>DPMC-MaNEP, University of Geneva</i> ² <i>Laboratoire de Physique des Solides, Bat. 510, Université Paris-Sud</i></p> <p>In the weak-coupling limit, we study, as a function of doping, two-leg ladders with a unit cell containing both Cu and O atoms. For purely repulsive interactions, using bosonization and a novel RG scheme, we find that in a broad region of the phase diagram, the ground state consists of a pattern of orbital currents (OCP) defined on the top of an incommensurate density wave. We focus on this OCP and look for measurable signals of its existence: we compute magnetic fields induced within the ladder and check what kind of changes in the phase diagram one may expect due to SU(2) spin-rotational symmetry breaking. We investigate a single impurity problem (incl. OCP) which enables us to show the influence of SU(2) symmetry breaking on conductivity. We estimate the value of gap opened due to the OCP and discuss magnetic properties of a new phase.</p>

18:00	617	<p style="text-align: center;">Evidence for magnetically driven superconducting Q phase of CeCoIn₅</p> <p style="text-align: center;"><i>Simon Gerber¹, Nikola Egetenmeyer¹, Jorge L. Gavilano¹, Thierry Strässle¹, Andrea D. Bianchi², Eric Ressouche³, Roman Movshovich⁴, Eric D. Bauer⁴, John L. Sarrao⁴, Joe D. Thompson⁴, Michel Kenzelmann⁵</i></p> <p>¹ Lab. for Neutron Scattering, ETH Zürich & Paul Scherrer Institute, CH-5232 Villigen ² Département de Physique and Regroupement Québécois sur les Matériaux de Pointe, Université de Montréal, Montréal, Quebec H3C 3J7, Canada ³ CEA/Grenoble, INAC/SPSMS-MDN, 17 rue des Martyrs, 38054 Grenoble Cedex 9 ⁴ Condensed Matter and Thermal Physics, Los Alamos National Laboratory, Los Alamos, NM 87545, USA ⁵ Lab. for Developments and Methods, Paul Scherrer Institute, CH-5232 Villigen</p> <p>CeCoIn₅ is a Pauli-limited heavy-fermion superconductor that serves as a model material to study the interplay of superconductivity and magnetism in unconventional superconductors. We investigated the magnetic order inside the superconducting phase of CeCoIn₅ for external fields along the [1 0 0] crystallographic direction using neutron diffraction. We find a multicomponent ground state that simultaneously carries cooperating magnetic and superconducting orders. Magnetic order is established in form of a spin-density wave (SDW) with an incommensurate modulation $\mathbf{Q} = (q, q, 1/2)$ and $q = 0.45(1)$, which within experimental uncertainty is indistinguishable from the SDW found for fields applied along [1 -1 0]. The SDW is thus modulated along the lines of nodes of the $d_{x^2-y^2}$ superconducting order parameter, suggesting that it is driven by electron nesting along the line nodes. We postulate that the onset of magnetic order leads to reconstruction of the superconducting gap function and a magnetically-induced pair density wave.</p>
18:15	618	<p style="text-align: center;">Crystal Chemistry, Superconductivity and Magnetism of Iron Chalcogenides</p> <p style="text-align: center;"><i>Enrico Giannini¹, R. Viennois¹, D. van der Marel¹, R. Cerny²</i> ¹ DPMC, Université de Genève ² Laboratoire de Cristallographie, Université de Genève</p> <p>The structural simplicity of FeCh (Ch =S,Se,Te), in which the conducting layers are not separated by any third-atom layers, offers the best tool for investigating the nature of superconductivity and magnetism in Fe-based compounds. Either the pressure or the chemical composition distort the FeCh₄ tetrahedron and tune the electronic properties. When partially substituting Se for Te in the antiferromagnetic Fe_{1+x}Te, the excess of Fe is reduced and superconductivity appears over a wide range of compositions. Both the excess Fe and the Se substitution affect the structure and must be kept under control for tuning the structure deformation and the electronic properties. As a consequence of stretching the FeTe₄ tetrahedron, the excess Fe is proved to enhance spin and charge localization. Below a critical Fe-Te distance, the antiferromagnetism is weakened and superconductivity occurs, mediated by spin fluctuations as in the similar families of Fe-based oxy-pnictides.</p>
18:30	22	<p style="text-align: center;">Winner of the SPS Award for Condensed Matter Physics, sponsored by IBM</p>
18:45		<p style="text-align: center;">Postersession, Apéro, Barbecue</p>

Tuesday, 22.06.2010, Aula

Time	ID	<p align="center">MANEP III: NOVEL MATERIALS FOR NANOELECTRONICS <i>Chair: J.-M. Triscone, Uni Genève</i></p>
13:15	621	<p align="center">Topological origin of sub-gap conduction in insulating bi-layer graphene</p> <p align="center"><i>Ivar Martin ², Jian Li ¹, A. Morpurgo ¹, M. Büttiker ¹</i> ¹ <i>University of Geneva</i> ² <i>Los Alamos National Laboratory, USA</i></p> <p>The edges of graphene layers possess unusual electronic properties, originating from the pseudo-spinorial character of the electron wave-functions in these systems. These properties may lead to the many striking phenomena. In most cases, however, these phenomena are not expected to survive the influence of the strong structural and chemical disorder unavoidably present at the edges of real graphene devices. Here, we present a theoretical study of the low-energy states at the edges of electrostatically gapped bilayer graphene, which originate from the topological properties of the material band structure. We show that the contribution of these edge modes to the conductance of realistic devices remains sizable even when very strong disorder at the edges is present, and can dominate over bulk conduction if the electrostatically induced gap is sufficiently large. Our results are directly relevant for the interpretation of recent transport and optical spectroscopy experiments.</p>
13:45	622	<p align="center">Strong localization in graphene nanoribbon devices</p> <p align="center"><i>Jeroen B. Oostinga ^{1,2}, Benjamin Sacépé ¹, Monica F. Craciun ², Alberto F. Morpurgo ¹</i> ¹ <i>Department of Condensed Matter Physics and Group of Applied Physics, University of Geneva, quai Ernest-Ansermet 24, CH-1205 Geneva</i> ² <i>Kavli Institute of Nanoscience, Delft University of Technology, Lorentzweg 1, NL-2628 CJ Delft</i></p> <p>The high carrier mobility values measured in graphene (up to $10^4 - 10^5$ cm² /Vs at room temperature) make this new material a promising candidate for future high-speed electronic devices. However, since graphene is a zero-gap semiconductor, electrical conduction cannot be easily switched off in graphene-based field-effect transistors. Interestingly, in graphene nanoribbon devices, it has been shown that a transport gap appears at low charge densities. The origin of this gap is still under debate and remains to be understood. We have studied the conductance in the transport gap as a function of temperature and magnetic field, and found that this gap originates from strong localization of electronic states. Our experimental results provide a better understanding of the nature of the transport gap in graphene nanoribbons.</p>

14:00	623	<p style="text-align: center;">Magneto-optical studies of monolayer graphene on SiC</p> <p style="text-align: center;"><i>Iris Crassee¹, A. B. Kuzmenko¹, J. Levallois¹, J. L. M. van Mechelen¹, D. van der Marel¹, Th. Seyller²</i></p> <p style="text-align: center;">¹ University of Geneva ; ² University of Erlangen</p> <p>A promising method to produce graphene on a large scale is graphitization of SiC. Recently the anomalous (half-integer) DC quantum Hall effect was found in epitaxial graphene on SiC[1,2]. We perform magneto-optical spectroscopy in the THz and FIR range to elucidate the frequency dependent electronic properties of epitaxial monolayer graphene. The diagonal and off-diagonal (Hall) optical conductivity are obtained for magnetic fields up to 7 T by measuring optical absorption and Faraday rotation. The observed rotation angle is of the order of the fine structure constant. The optical Hall conductivity is highly sensitive to the doping level. We observe at least two electronic components, one with a finite and one with a vanishing band gap.</p> <p>[1] J. Jobst et al., arXiv:0908.1900 (2009). [2] X. Wu et al., Appl. Phys. Lett. 95, 223108 (2009).</p>
14:15	624	<p style="text-align: center;">Electron Spin Resonance study of Graphene</p> <p style="text-align: center;"><i>Luka Ciric, A. Sienkiewicz, B. Nafradi, A. Magrez, L. Forró</i> <i>EPFL, Institute of Physics of Condensed Matter, Station 3, CH-1015 Lausanne</i></p> <p>Electron spin resonance (ESR) is an efficient technique to study the density of states (as a function of temperature and doping) of graphene, and to detect magnetic interaction of localized spins at the edges of graphene flakes and ribbons. We have performed ESR measurements in the 4-300 K temperature range on graphene samples derived from: 1) chemical reduction of graphene oxide sheets, 2) liquid phase exfoliation of graphite (LPEG), 3) and mechanical exfoliation. The ESR signal depends very much on the method of preparation of graphene. The amount of localized spins and the Pauli component of the spin susceptibility vary from sample to sample. In some cases ferromagnetism is observed below 20 K.</p>
14:30	625	<p style="text-align: center;">Multifunctionality at the nanoscale: looking closely at ferroic domain walls</p> <p style="text-align: center;"><i>Patrycja Paruch, DPMC, University of Geneva</i></p> <p>Intrinsically nanoscale and multifunctional, domain walls in ferroic materials are a fascinating system for fundamental studies and potential applications. As elastic interfaces in disordered media, they present characteristic roughness and complex dynamics. In addition, these intrinsically nanoscale interfaces often show properties beyond those of their parent material.</p> <p>In the context of recent work on ferroic domain walls in perovskite oxides, I will present results of our nanoscale studies of the thermal and environmental effects on the behavior of domain walls in epitaxially grown thin films of $\text{Pb}(\text{Zr}_{0.2}\text{Ti}_{0.8})\text{O}_3$, and discuss the observation of a domain-wall-specific shear displacement (forbidden by symmetry in the bulk), potentially useful for surface acoustic wave devices. I will also show how this same response can be more generally observed in materials such as BiFeO_3, and present our studies of the switching mechanisms in this latter material.</p>

15:00	626	<p style="text-align: center;">Tunable spin-orbit interaction at oxide interfaces</p> <p style="text-align: center;"><i>Andrea D. Caviglia¹, M. Gabay², S. Gariglio¹, N. Reyren¹, A. Fête¹, C. Cancellieri¹, J.-M. Triscone¹</i></p> <p style="text-align: center;">¹ DPMC University of Geneva, 24 Quai Ernest-Ansermet, 1211 Geneva ² Laboratoire de Physique des Solides, Bat. 510, Université Paris-Sud 11, Centre d'Orsay, FR-91405 Orsay Cedex</p> <p>The quasi-two-dimensional electron gas found at the LaAlO₃/SrTiO₃ interface offers exciting new functionalities, such as tunable superconductivity, and has been proposed as a new nanoelectronics fabrication platform. In this contribution we lay out a new example of an electronic property arising from the interfacial breaking of inversion symmetry, namely a large Rashba spin-orbit interaction, whose magnitude can be modulated by the application of an external electric field. By means of magnetotransport experiments we explore the evolution of the spin-orbit coupling across the phase diagram of the system. We uncover a steep rise in Rashba interaction occurring around the doping level where a quantum critical point separates the insulating and superconducting ground states of the system.</p>
15:15	627	<p style="text-align: center;">Novel Si-in-Si one dimensional template for atomic chains</p> <p style="text-align: center;"><i>François Bianco¹, Sigrun A. Köster¹, James H. G. Owen¹, Daniel Mazur¹, David R. Bowler², Christoph Renner¹</i></p> <p style="text-align: center;">¹ Département de Physique de la Matière Condensée, NCCR MaNEP, Université de Genève, 24 Quai Ernest-Ansermet, 1211 Genève 4, ² London Center for Nanotechnology (LCN) and University College London (UCL), 17-19 Gordon Street, WC1H 0AH, London</p> <p>Low dimensional structures, like atomic nanowires, provide an interesting platform to explore fundamental laws of quantum mechanics and could become key components in future electronic devices. We present a novel one-dimensional Si-in-Si structure self-assembled on flat Si(001) terraces, whose length is only limited by substrate defects and step edges.</p> <p>This so-called Haiku stripe forms during the growth of Bi nanolines. Subsequent hydrogenation of the nanolines during which the bismuth is stripped off, leaves the Haiku core intact. It is precisely 4 Si dimers wide (1.54 nm), defect free and composed of 5- and 7-fold rings of Si extending 5 layers deep into the bulk. Haiku stripes are stable up to 400°C in UHV and, terminated by hydrogen, are likely to be inert in air. They provide a promising alternative to vicinal surfaces and step edges to self-assemble isolated surface and sub-surface single atom chains on a technologically relevant substrate.</p>
15:30	628	<p style="text-align: center;">Nano-structured SmFeAs(O,F) single crystals: Nearly isotropic transport up to 65 T</p> <p style="text-align: center;"><i>Philip J. W. Moll¹, Roman Puzniak², Fedor Balakirev³, Janusz Karpinski¹, Nikolai D. Zhigadlo¹, Bertram Batlogg¹</i></p> <p style="text-align: center;">¹ Laboratory for Solid State Physics, ETH Zürich ² Institute of Physics, Polish Academy of Sciences Warsaw, Poland ³ Los Alamos National Laboratory LANL, Los Alamos, USA</p> <p>Electric 4-probe transport measurements were performed on Focused Ion Beam (FIB) cut single crystals with sub-μm^2 cross-section, with current along and perpendicular to the crystallographic c-axis. The 4-probe geometry was defined accurately, resulting in large signals and excellent signal-to-noise ratio. Our study of the transport properties of SmFeAs(O,F) ($T_c \sim 52$ K) single crystals reveals a</p>

	promising combination of high ($> 2 \cdot 10^6$ A/cm ²) and nearly isotropic critical current densities, which agree well with magnetization measurements. We find the onset of resistivity in pulsed fields up to 65T for currents along the c-axis (j c) very close to those for currents in the ab-plane. This favorable intragrain current transport in SmFeAs(O,F) is a crucial requirement for possible applications.
15:45	Coffee Break ; END

ID MANEP POSTER	
6001	<p style="text-align: center;">Fe_{1+y}Se_xTe_{1-x} superconductors: phase diagram, crystal growth, structural and magnetic properties</p> <p style="text-align: center;"><i>Ekaterina Pomjakushina¹, Kazimierz Conder¹, Vladimir Pomjakushin², Markus Bendele^{3,4}, Rustem Khasanov⁴</i></p> <p style="text-align: center;">¹ <i>Laboratory for Developments and Methods, PSI, Villigen</i> ² <i>Laboratory for Neutron Scattering ETHZ and PSI, Villigen</i> ³ <i>Physik-Institut der Universität Zürich</i> ⁴ <i>Laboratory for Muon Spin Spectroscopy, PSI, Villigen</i></p> <p>We report on a comparative study of the crystal structure and the magnetic properties of FeSe_{1-x} (x = 0:0 - 0:15) superconducting samples by neutron powder diffraction and magnetization measurements. The effect of a starting (nominal) stoichiometry on the phase purity of the obtained samples, the superconducting transition temperature T_c, as well as the chemical stability of FeSe_{1-x} at ambient conditions were investigated. We also report on Fe_{1+y}Se_xTe_{1-x} single crystal growth and study of their structural and magnetic properties.</p>
6002	<p style="text-align: center;">Evidence for large electric polarization from collinear commensurate magnetism in multiferroic TmMnO₃</p> <p style="text-align: center;"><i>Vladimir Y. Pomjakushin¹, M. Kenzelmann², A. Dönni³, A. B. Harris⁴, T. Nakajima⁵, S. Mitsuda⁵, M. Tachibana³, L. Keller¹, J. Mesot¹, H. Kitazawa³, E. Takayama-Muromachi³</i></p> <p style="text-align: center;">¹ <i>Laboratory for Neutron Scattering, ETHZ and PSI, Villigen</i> ² <i>Laboratory for Developments and Methods, PSI, Villigen</i> ³ <i>National Institute for Materials Science, Tsukuba, Japan</i> ⁴ <i>Department of Physics and Astronomy, University of Pennsylvania, USA</i> ⁵ <i>Department of Physics, Faculty of Science, Tokyo University of Science, Japan</i></p> <p>There has been research activity in the field of magneto-electric multiferroics after Kimura <i>et al</i> (2003) showed that antiferromagnetic and ferroelectric orders coexist in orthorhombically distorted perovskite TbMnO₃ and are strongly coupled. One remaining key question is whether magnetic order can induce ferroelectric polarization that is as large as that of technologically useful materials. We show that ferroelectricity in TmMnO₃ is induced by collinear magnetic order, and that the lower limit for its electric polarization is larger than in previously investigated orthorhombic heavy rare-earth manganites. The temperature dependence of the lattice constants provides further evidence of large spinlattice coupling effects. Our experiments suggest that the ferroelectric polarization in the orthorhombic perovskites with commensurate magnetic ground states could pass the 1 μC cm⁻² threshold, as predicted by theory. (Sergienko <i>et al</i> 2006; Picozzi <i>et al</i> 2007)</p>

6003	<p style="text-align: center;">Optical Investigation of the Charge Dynamics in $\text{Ba}(\text{Co}_x\text{Fe}_{1-x})_2\text{As}_2$</p> <p style="text-align: center;"><i>Andrea Lucarelli¹, F. Pfuner¹, J. G. Analytis², J.-H. Chu², I. R. Fisher², L. Degiorgi¹</i> ¹ <i>Laboratorium für Festkörperphysik, ETH Zürich, CH-8093 Zürich</i> ² <i>Geballe Laboratory for Advanced Materials and Department of Applied Physics, Stanford University, Stanford, California 94305-4045, U.S.A.</i></p> <p>We report on a thorough optical investigation of Co-doped BaFe_2As_2 over a broad spectral range (from the far infrared up to the ultraviolet) and as a function of temperature. An optical experiment measures the dynamical response of the electron and facilitates monitoring of many-body effects experienced by the electron in the material. For $x=0$ we observe a depletion in the far infrared energy interval of the optical conductivity below the spin-density-wave (SDW) phase transition at $T_{\text{SDW}}=135$ K, ascribed to the formation of a pseudogap-like feature. This is accompanied by the narrowing of the Drude term. We will also present novel optical data for various Co-dopings in the spectral ranges of relevance for the pseudogap excitation as well as the superconducting gap. We will address their evolution when mapping the phase diagram of $\text{Ba}(\text{Co}_x\text{Fe}_{1-x})_2\text{As}_2$ and discuss the optical fingerprints due to the interplay between structural/magnetic and superconducting phase transitions.</p>
6004	<p style="text-align: center;">Morphology, Elasticity and Slow Dynamics of Superconducting Vortex Lattices Investigated with Time Resolved Stroboscopic Neutron Scattering.</p> <p style="text-align: center;"><i>Sebastian Mühlbauer^{1,2}, Christian Pfeleiderer², Peter Böni², Andrey Zheludev¹, E. M. Forgan³, Albrecht Wiedenmann⁴</i> ¹ <i>Laboratorium für Festkörperphysik HPF, ETH Zürich</i> ² <i>Technische Universität München, Physik Department E21, Garching, Germany</i> ³ <i>School of Physics and Astronomy, University of Birmingham, Birmingham, UK</i> ⁴ <i>Institut Laue Langevin ILL, Grenoble, France</i></p> <p>Vortex lattices (VL), glasses and liquids attract great interest not only as source of microscopic information on superconductivity but also as model systems of crystallization. The elastic matrix of a VL describes the energy associated with a distortion due to thermal fluctuations, gradients of magnetic field, pinning and in the presence of transport currents. We report direct microscopic measurements of the VL tilt modulus in bulk Nb using time-resolved neutron scattering in combination with a tailored magnetic field setup. The observed relaxation process shows increasing VL stiffness with increasing \mathbf{H} and reduced damping with increasing \mathbf{T} and agrees well with a VL diffusion model. Moreover, we observe a dramatic changeover of the relaxation process associated with the complicated VL morphology in the intermediate mixed state. Our study represents a show-case how to access directly VL melting, the formation of vortex glass states and slow vortex dynamics.</p>
6005	<p style="text-align: center;">Influence of doping on the strong rail spin ladder compound $(2,3\text{-dmpyH})_2\text{CuBr}_4$</p> <p style="text-align: center;"><i>Sebastian Mühlbauer¹, A. Zheludev¹, D. Hüvonen¹, V. Glazkov², T. Yankova³</i> ¹ <i>Neutron Scattering and Magnetism Group, Lab. für Festkörperphysik, ETH Zürich</i> ² <i>Kapitza Institute, Moscow,</i> ³ <i>Moscow State University, Moscow</i></p> <p>The compound $(2,3\text{-dmpyH})_2\text{CuBr}_4$ crystallizes in the triclinic space group $P2(1)/n$. At low temperature, $(2,3\text{-dmpyH})_2\text{CuBr}_4$ represents a rare example of a strong rail spin $S = 1/2$ ladder, characterized by a $J_{\text{rung}} = -3.1\text{cm}^{-1}$ and a $J_{\text{rail}} = -6.02^{-1}$ [1]. Measurements of susceptibility indicate that a gap of approximately 2 K opens up, corresponding to an accessible critical field of approximately 2.5 T [1].</p> <p>We present a systematic study of the doping dependence of the low temperature magnetic properties of $(2,3\text{-dmpyH})_2\text{CuBr}_4$ by substitution of Br atoms with Cl atoms. Measurements</p>

	<p>of magnetization and susceptibility indicate that the gap closes at surprisingly small Cl dopant concentrations around 2 percent.</p> <p>[1] A. Shapiro et al. J. Am. Chem. Soc. 129, 952-959 (2007)</p>
6006	<p style="text-align: center;">Electron paramagnetic resonance investigation of $\text{EuFe}_{2-x}\text{Co}_x\text{As}_2$ ($x=0, 0.1, 0.2$) single crystals</p> <p style="text-align: center;"><i>Zurab Guguchia¹, A. Shengelaya², F. Muranyi¹, Z. Bukowski³, J. Karpinski³, H. Keller¹</i></p> <p style="text-align: center;">¹ <i>Physik-Institut der Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich</i> ² <i>Department of Physics, Tbilisi State University, Chavchavadze 3, GE-0128 Tbilisi</i> ³ <i>Laboratory for Solid State Physics, ETH Zürich, CH-8093 Zürich</i></p> <p>Electron Paramagnetic Resonance (EPR) studies were carried out in $\text{EuFe}_{2-x}\text{Co}_x\text{As}_2$ ($x=0, 0.1, 0.2$) single crystals, revealing an EPR spectrum of Dysonian lineshape. The signal is ascribed to the Eu^{2+} ions with spin $S=7/2$. Our study reveals that in all the samples the linewidth ΔH and g factor strongly depend on the temperature for both prominent orientations $H \parallel ab$ and $H \parallel c$ of the single crystals. Above the spin-density wave transition temperature T_{SDW} the linewidth shows Korringa behaviour, as it increases linearly with temperature with a slope of approximately 8 G/K, indicating an exchange coupling between the conduction electrons and the localized Eu^{2+} ions. Below T_{SDW} the slope of the linewidth changes and the Korringa relaxation disappears. This may be explained by the opening of the energy gap at Fermi surface below the SDW transition.</p>
6007	<p style="text-align: center;">Muon spin rotation study of the CaC_6 superconductor at low temperatures</p> <p style="text-align: center;"><i>Ferenc Muranyi¹, R. Khasanov², S. Weyeneth¹, M. Bendele^{1,2}, C. Baines², H. Keller¹</i></p> <p style="text-align: center;">¹ <i>Physik-Institut der Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich</i> ² <i>Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institut, CH-5232 Villigen PSI</i></p> <p>A recent ARPES study [1] indicated the existence of a second superconducting gap ($\Delta(0) \sim 0.2$ meV) in intercalated graphite CaC_6. It motivated us to conduct muon spin rotation (μSR) experiments at low temperatures down to 20 mK to search for a second gap. However, low temperature μSR shows no evidence within experimental precision for the existence of a second gap. The observed temperature dependence of the in-plane magnetic penetration depth in the μSR measurements is well described by a single s-wave superconducting order parameter. Further experimental work is required to clarify the two-gap issue.</p> <p>[1] K. Sugawara et al., Nature Physics 5, 40-43 (2009).</p>
6008	<p style="text-align: center;">Metallic-like temperature dependence of the mobility in n-type organic single-crystal field effect transistors</p> <p style="text-align: center;"><i>Nikolas Minder¹, Shimpei Ono^{1,2}, Alberto Morpurgo¹</i></p> <p style="text-align: center;">¹ <i>DPMC and GAP, Université de Genève, 24 Quai Ernest Ansermet, CH 1211 Geneva</i> ² <i>Central Research Institute of Electric Power Industry, Tokyo 201-8511, Japan</i></p> <p>Semiconductor devices based on organic molecules are highly promising for large area electronics due to their low processing costs and potentially low power consumption. Yet, for organic logic circuits to reach sufficiently high performance, n-type and p-type materials are indispensable to implement CMOS architectures. Here we discuss our recent measurements on PDIF-CN₂ single crystals which exhibit the highest electron mobilities reported (around 5 cm²/Vs at RT) and show an increase of the mobility with decreasing temperature, exceeding 6 cm²/Vs at 220 K. This is the first observation of metallic-like temperature-dependence of the mobility in n-type organic field effect transistors, demonstrating that band-like transport is achievable not only for p-type materials where it had been observed in the past. On air-gap transistors, the threshold voltage at RT is nearly zero, and the devices are highly air-stable, making PDIF-CN₂ promising candidate for applications.</p>

6009	<p style="text-align: center;">Equilibrium and out of equilibrium studies of ultracold fermions in an optical lattice</p> <p style="text-align: center;"><i>Thomas Uehlinger, Daniel Greif, Robert Jördens, Niels Strohmaier, Leticia Tarruell, Henning Moritz, Tilman Esslinger</i> <i>Institute for Quantum Electronics, ETH Zürich, 8093 Zürich</i></p> <p>We use a two-component ultracold Fermi gas of ^{40}K atoms in a 3D optical lattice to realize the Fermi-Hubbard model. This approach of simulating solid-state systems offers the advantage of posing well-defined questions and accessing clean probes. Tuning the interaction we investigate the crossover from a metallic to a Mott insulating state. This is signaled by a drastic reduction of double occupancy and the appearance of a gapped mode. The resolution in double occupancy allows for precise comparison with both DMFT calculations and high-temperature series expansions. If the lattice modulation is sufficiently weak, the increase of doublons with time is well captured by linear response theory. In this regime the buildup rate is a measure for equilibrium properties such as the local spin ordering. For long modulation times the system is driven into a far from equilibrium state. We show that the dominant decay mechanism is a high-order scattering process.</p>
6010	<p style="text-align: center;">MuSR studies of the heavy fermion CeRhSi_3</p> <p style="text-align: center;"><i>Nikola Egetenmeyer¹, S. Gerber¹, J. Gavilano¹, M. Kenzelmann², G. Seyfarth³, A. Maisuradze⁴, R. Khasanov⁴, Ch. Baines⁴, A. Desilets-Benoit⁵, A. Bianchi⁵, D. Andreica⁶, D. MacLaughlin⁷</i></p> <p style="text-align: center;">¹ <i>Laboratory for Neutron Scattering, ETH Zürich and PSI</i> ² <i>Laboratory for Developments and Methods, PSI</i> ³ <i>Département de physique de la matière condensée, Université de Genève</i> ⁴ <i>Laboratory for Muon-Spin Spectroscopy, PSI</i> ⁵ <i>Département de Physique, Université de Montréal, Canada</i> ⁶ <i>Faculty of Physics, Babes-Bolyai University, Romania</i> ⁷ <i>Department of Physics and Astronomy, University of California Riverside, U.S.A.</i></p> <p>CeRhSi_3 is a noncentrosymmetric heavy-fermion antiferromagnet with a Néel temperature of $T_N = 1.6$ K. The magnetically ordered state is incommensurate with small ordered Ce moments of about $0.1 \mu_B$. At external pressures of the order of 12 kbar and low temperatures, deep inside of the antiferromagnetic state, a superconducting phase develops and may coexist with the incommensurate magnetic order. MuSR measurements were conducted at PSI on co-aligned single crystals of CeRhSi_3. At ambient pressure and $T < T_N$ three muon precession frequencies were observed. The application of pressures up to 12.5 kbar revealed appreciable pressure-induced changes in the Néel temperature and a drastic suppression of the internal fields. The pressure dependence of the Néel temperature displays a broad maximum around 6 kbar. On the other hand the internal fields decrease monotonically with increasing pressure. This suggests an unusual antiferromagnetic phase.</p>

6011	<p style="text-align: center;">Graphene based devices on top of single crystal SrTiO₃ substrates</p> <p style="text-align: center;"><i>Nuno J. G. Couto, Benjamin Sacépé, Alberto.F. Morpurgo</i> <i>Département de Physique de la Matière Condensée (DPMC) and Group of Applied Physics (GAP), Université de Genève</i></p> <p>Recent studies on suspended graphene have shown clearly that the substrate plays an important role in determining the electronic and structural properties of graphene. Nevertheless it is important from the physics perspective to investigate graphene devices supported by substrates with different properties. An interesting candidate is single crystal strontium titanate (SrTiO₃ STO), which has a dielectric constant of 300 at room temperature and 20000 at 4K. The STO surface can also be chosen to be atomically flat and with different controlled chemical terminations, which can provide more information on different factors affecting the properties of graphene. In this poster we show the first transport measurements of exfoliated graphene on top of single crystal STO. The exfoliated graphene was detected through an optical microscope by analyzing its relative contrast. We also successfully developed nanofabrication techniques to engineer graphene devices with enough quality to exhibit Quantum Hall Effect.</p>
6012	<p style="text-align: center;">Dissipation-driven phase transitions in superconducting wires</p> <p style="text-align: center;"><i>Alejandro M. Lobos¹, Anibal Iucci², Markus Müller³, Thierry Giamarchi¹</i> ¹ DPMC-MaNEP, University of Geneva ² Universidad Nacional de La Plata and CONICET, Argentina ³ The Abdus Salam International Centre for Theoretical Physics, Trieste, Italy</p> <p>Narrow one-dimensional (1D) superconducting wires with diameter $d \ll \xi_0$ (with ξ_0 the bulk-coherence length) are systems in which order-parameter fluctuations destroy long-range order (LRO), only allowing for the existence of quasi-LRO. While ideally isolated wires have been thoroughly studied before, the complete understanding of 1D systems subject to environment-induced dissipation is at present under intensive research. In this work, we show that a weak coupling t_{\perp} to a diffusive metallic film reinforces superconductivity in the wire through the quench of fluctuations. We obtain the critical points and phases of the system at $T = 0$, and predict a quantum phase transition towards a superconducting phase with LRO as a function of the wire's superconducting stiffness and t_{\perp}. We also analyze dissipative effects introduced by the electromagnetic environment, and finally discuss implications for the dc-resistivity and optical conductivity.</p>
6013	<p style="text-align: center;">Dynamical correlation functions in spin-1/2 ladders under a magnetic field</p> <p style="text-align: center;"><i>Pierre Bouillot¹, Corinna Kollath², Andreas Läuchli³, Mikhail Zvonarev⁴, Thierry Giamarchi¹</i> ¹ DPMC-MaNEP, University of Geneva ² CNRS, Ecole Polytechnique, France ³ Max Planck Institut, Germany ⁴ CNRS, LPTMS, Université Paris-Sud, France</p> <p>Our work is dedicated to magnetic properties of spin-1/2 ladders. These systems have recently generated a great interest due to the new experimental realization of (Hpip)₂CuBr₄. During the last few years, this compound has been the focus of numerous measurements like specific heat, magnetostriction, NMR and neutron scattering. We theoretically investigate these systems and determine the zero temperature dynamical correlations using time-dependent density matrix renormalization group. This numerical approach allows us to fully explore their spectrum for a broad range of magnetic fields. We are able to compute the high energy components that are not accessible by analytical methods. The calculated correlations are directly related to the neutron scattering cross section that we can predict with very good precision.</p>

6014	<p>Anisotropic properties of superconducting single crystals of $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$</p> <p><i>Saskia Bosma, S. Weyeneth, H. Keller</i> <i>Physik-Institut der Universität Zürich, Winterthurerstrasse 190, CH-8057 Zürich</i></p> <p>The anisotropic properties of layered high temperature superconductors such as MgB_2 and $\text{SmFeAsO}_{1-x}\text{F}_x$ were investigated, and interpreted in terms of multi-gap superconductivity. Since multi-gap behavior was also observed in cuprates, a careful investigation of representative cuprate systems is desirable. Here we report a study of the anisotropic magnetic properties of underdoped $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ ($x = 0.086$) single crystals by means of magnetic torque and SQUID magnetometry. Using highly sensitive piezo-resistive torque sensors, torque magnetometry allows to investigate very small single crystals of high quality. A shaking technique is applied to enhance the vortex-lattice relaxation, even in the pinned state. This reduces irreversibility effects, thus allowing extended angle-dependent torque measurements in a wide range of temperature and field.</p>
6015	<p>Ferromagnetic spin resonance in EuTiO_3 probed by time-domain THz ellipsometry</p> <p><i>J. L. M. van Mechelen¹, I. Crassee¹, T. Kolodiazhnyi², D. van der Marel¹</i> ¹ <i>Département de Physique de la Matière Condensée, Université de Genève</i> ² <i>New Materials Group, National Institute for Materials Science, Tsukuba, Japan</i></p> <p>A time-domain study in the THz range on insulating EuTiO_3 has revealed the existence of a strong magnetic circular dichroism which manifests itself as a gigantic Faraday rotation of THz light up to $340 \text{ deg mm}^{-1}\text{T}^{-1}$. We have performed ellipsometric transmission measurements at 4.5 K in a magnetic field up to 1.6 T, from which we deduced the dielectric permittivity and the magnetic permeability for right and left handed circularly polarized light. Due to the spin-only character of EuTiO_3 the dichroism is present for <i>purely</i> magnetic dipole transitions inside the Zeeman split Eu 4f levels and shows up as a ferromagnetic spin resonance absorption for only one chirality. We present a spectral weight analysis for the spin resonance using a newly derived optical spin sum rule based on the Landau-Lifshitz-Gilbert theory.</p>
6016	<p>Evidence for extended magnetic interactions in the cuprates from the magnon dispersion of $\text{Sr}_2\text{CuO}_2\text{Cl}_2$</p> <p><i>Marco Guarise, M. Moretti Sala, Giacomo Ghiringhelli, L. Braicovich, H. M. Rønnow, B. Dalla Piazza, H. Berger, J. Hancock, D. van der Marel, T. Schmitt, V. Strocov, P.-H. Lin, P. Xu, M. Grioni</i> <i>Institut de Physique de la Matière Condensée, EPFL, CH-1015 Lausanne</i></p> <p>$\text{Sr}_2\text{CuO}_2\text{Cl}_2$ (SCOC) is an insulating parent compound of the high-T_c cuprates, and an almost ideal realization of a spin-1/2 2D antiferromagnetic Heisenberg insulator. We exploited high-resolution resonant inelastic x-ray scattering (RIXS) at the Cu L_3 edge ($2p \rightarrow 3d$; 930 eV) to map for the first time the dispersion of magnetic excitations over the whole magnetic Brillouin zone. We find a large (~ 60 meV) difference between the magnon energies at the $(p,0)$ and $(p/2,p/2)$ points. This observation is incompatible with magnetic interactions involving only nearest-neighbor Cu spins. The data are on the other hand well reproduced by an extended t-t'-t''-U single-band Hubbard model, which generates various 2- and 4-spin interactions. Together with neutron data on La_2CuO_4 (LCO; R. Coldea et al. Phys. Rev. Lett. 86, 5377 (2001)) our RIXS results suggest that extended magnetic interactions are a general feature of the insulating cuprates, and set new constraints on theoretical models of these materials.</p>

6017	<p style="text-align: center;">Low energy muon spin rotation study of the Meissner effect in $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ heterostructures</p> <p style="text-align: center;"><i>Bastian M. Wojek^{1,2}, E. Morenzoni¹, A. Suter¹, T. Prokscha¹, Z. Salman¹, G. Logvenov³, A. Gozar³, I. Bozovic³, H. Keller²</i></p> <p style="text-align: center;">¹ <i>Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, 5232 Villigen PSI</i> ² <i>Physik-Institut, Universität Zürich, 8057 Zürich</i> ³ <i>Brookhaven National Laboratory, Upton, New York 11973-5000, USA</i></p> <p>Also years after the discovery of high temperature superconductivity in hole-doped cuprates, the origin of the pseudo-gap state in the underdoped region of the phase diagram is still controversially discussed. It remains unclear if superconducting fluctuations above T_c form a precursor state of superconductivity which only lacks phase coherence or if there is a competing order responsible for breaking Cooper-pairs [Adv. Phys. 54, 715-733 (2005)]. Here we report on low energy muon spin rotation studies on $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ thin film heterostructures consisting of optimally doped “electrodes” and underdoped barrier layers. The experiments show super-currents flowing throughout the whole film resulting in a Meissner effect even for temperatures much higher than T_c of the ~ 50 nanometers thick barrier. These findings indicate a long-ranged proximity effect inducing a non-zero superfluid density in a nominally non-superconducting material in the pseudo-gap state.</p>
6018	<p style="text-align: center;">Spectroscopy of cold bosonic atoms by periodically phase-modulation of optical lattice potential</p> <p style="text-align: center;"><i>Akiyuki Tokuno, T. Giamarchi DPMC-MaNEP, University of Geneva</i></p> <p>Cold atoms in optical lattices are vigorously studied experimentally and theoretically as one of the candidates for a quantum simulator. At the same time, further development of probes to microscopic structure of systems is needed. We propose a novel spectroscopy in cold atom experiments by a measurement of energy absorption rate (EAR) of systems thermalized by periodic phase-modulation of optical lattice potentials, i.e., shaking lattices. Within the linear response theory, the EAR is formulated. Interestingly it is given by the imaginary part of the retarded current-current correlation function. In other word, it corresponds to an optical conductivity in electric systems. In addition to the formulation, the comparison with another EAR spectroscopy in periodically amplitude-modulated lattice potentials, which is one of the standard spectroscopy in experiments, is also discussed in several systems.</p>
6019	<p style="text-align: center;">Semimetal to semiconductor phase transition in 1T-TiS_2 induced by Nb doping studied by angle resolved photoemission spectroscopy</p> <p style="text-align: center;"><i>Miguel A. Valbuena, Peng Xu, Ping-Hui Lin, Balázs Sipoş, Helmuth Berger, László Forró, Marco Grioni, Institut of Condensed Matter Physics ICMP, EPFL</i></p> <p>Layered transition metal dichalcogenides, and their related doped or intercalated compounds, have been subject of intense research during the past decades, mainly because their reduce dimensionality provides an exceptional playground to test and study the different interactions in two dimensional systems. This family of compounds exhibits plenty of interesting phenomena. Interaction such electron-phonon coupling, which is rather strong in some of these materials, is responsible of periodic lattice distortion leading to charge density waves instabilities and/or superconductivity. Angle resolved photoemission spectroscopy (ARPES) has been carried out to study the electronic properties of niobium doped compounds $1\text{T-Nb}_x\text{Ti}_{1-x}\text{S}_2$ ($x = 0$ to 0.3). The effects of Nb doping on the electronic properties of TiS_2 have been analyzed. The undoped sample is a narrow band gap degenerated semiconductor that shows semi-metallic behavior. With Nb doping, a pseudogap at the Fermi level is developed indicating a metal-to-semiconductor phase transition.</p>

6020	<p style="text-align: center;">Threshold Voltage and Space Charge in Organic Transistors</p> <p style="text-align: center;"><i>Ignacio Gutiérrez Lezama, Alberto F. Morpurgo, DPMC and GAP, Université de Genève</i></p> <p>The high quality of rubrene single-crystal field-effect transistors enables the study of the electronic properties of organic semiconductors and their interfaces. Here, we use these devices to study microscopic processes determining the threshold voltage V_T. We observe that V_T shifts to positive values with decreasing channel length and increasing source-drain bias, as a consequence of the transfer of charge from the contacts. We model the effect using Poissons equation, under the assumption that the density of states in rubrene is that of a conventional semiconductor, and find excellent quantitative agreement without any free fitting parameter. This finding demonstrates the consistency, at a quantitative level, of different recent experiments performed on rubrene crystals, and illustrates how field-effect measurements can be used to determine microscopic parameters, such as the effective mass of charge carriers.</p>
6021	<p style="text-align: center;">Pseudogap and anisotropic far-infrared optical conductivity of URu₂Si₂</p> <p style="text-align: center;"><i>Julien Levallois¹, F. Lévy¹, J. A. Mydosh², Y.-K. Huang³, D. van der Marel¹</i> ¹ DPMC, Université de Genève, CH-1211 Genève 4 ² Kamerlingh Onnes Laboratory, Leiden University, NL-2300RA Leiden, ³ Van der Waals-Zeeman Institute, University of Amsterdam, NL-1018XE Amsterdam</p> <p>Since more than to decades, the origin of the enigmatic hidden-order state in URu₂Si₂ is still a mystery. At $T_{HO} = 17.5$ K, all the thermodynamical and transport measurements exhibit a clear anomaly and suggest a Fermi surface reconstruction. We performed far-infrared optical conductivity for an electric- field applied both along the a-axis and the c-axis of URu₂Si₂'s tetragonal structure as a function of temperature. The optical conductivity, which presents a pronounced anisotropy, shows a clear evidence of a sharp crossover at 25 K, corresponding to a partial suppression of the optical conductivity for both axis. This is accompanied by a significant renormalization of the plasma frequency and the scattering rate. Those observations strongly suggest that electronic bands located at few meV from the Fermi level start to slide when the temperature goes below 25 K, which in turn causes the thermodynamic phase transition at T_{HO}.</p>
6022	<p style="text-align: center;">Giant spin orbit splitting from band topology: Experiment and tight-binding approach to the Bi/Si(111) bandstructure</p> <p style="text-align: center;"><i>Emmanouil Frantzeskakis¹, Stéphane Pons^{1,2}, Marco Gioni¹</i> ¹ Laboratoire de Spectroscopie Electronique, ICPM, EPFL, Station 3, CH-1015 Lausanne ² Département Physique de la Matière et des Matériaux, Institut Jean Lamour, CNRS, Nancy Université, FR-54506 Vandoeuvre-les-Nancy</p> <p>The degeneracy of electronic states of opposite spins is lifted at surfaces or interfaces due to the lack of inversion symmetry and to the out-of-plane gradient of the crystal potential. The splitting can be further enhanced by a strong in-plane potential gradient in a surface alloy [1]. The Si(111)-Bi trimer phase has been recently reported to combine a giant Rashba-type spin-splitting with a semiconducting substrate [2,3]. We present ARPES data revealing new features of the electronic structure. The complex band dispersion can be interpreted in terms of an empirical tight-binding model. This simple approximation in combination with our novel experimental results sheds new light into the complex bandstructure. Most notably, it predicts that the giant spin splitting is intimately connected to the peculiar band topology and the trimerization.</p> <p>[1] C.R. Ast et al, Phys. Rev. Lett. 98, 186807 (2007). [2] I. Gierz et al, Phys. Rev. Lett. 103, 046803 (2009). [3] K. Sakamoto et al., Phys. Rev. Lett., 103, 156801 (2009).</p>

6023	<p style="text-align: center;">High Field ESR Study of (EDT-TTF-CONH)₆Re₆Se₈(CN)₆ Under Pressure</p> <p style="text-align: center;"><i>Dejan Djokic¹, Areta Olariu¹, Patrick Batail², László Forró¹</i> ¹ <i>Institute of Physics of Condensed Matter, EPFL, Lausanne</i> ² <i>Laboratoire de Chimie, Ingénierie Moléculaire et Matériaux d'Angers, CNRS-Université d'Angers, Angers, France</i></p> <p>210 GHz temperature dependent ESR measurements under hydrostatic pressure were done on a (EDT-TTF-CONH)₆Re₆Se₈(CN)₆ charge transfer. One line was found with nearly free electron g-factor. The ESR spectra were recorded from 300 down to 2 K at various pressures up to 1.5 GPa. This solid has proven exceptional for probing the highly 2D Kagomé geometry with two possible scenarios, 1/2 and/or 2/3 band filling. The high temperature rhombohedral phase of the compound is accompanied by a lightly conducting state (evidenced by transport measurements) having S = 1/2 Kagomé topology, unprecedentedly emerged in the chemistry of TTF family. The related line-width temperature dependence was found to follow Elliott-Yafet relaxation mechanism. The structural phase transition towards the low temperature triclinic phase, occurring around 180 K at a.p., drives the system into a Mott insulating state nearly at the same temperature. This state can be modelled by 1D Heisenberg S = 1/2 chain with AF coupling of ~ 65 K. Cooling considerable decreases the line-width (250 G → 50 G), owing to exchange narrowing and localisation.</p>
6024	<p style="text-align: center;">Pseudogap Phase of High-Temperature Superconductors Studied by ARPES</p> <p style="text-align: center;"><i>Elia Razzoli^{1,2}, M. Shi², J. Mesot³</i> ¹ <i>Laboratory for synchrotron and neutron spectroscopy, EPF Lausanne</i> ² <i>Swiss Light Source, Paul Scherrer Institute, CH-5232 Villigen PSI</i> ³ <i>Paul Scherrer Institute, ETH Zürich and EPF Lausanne, 5232 Villigen PSI</i></p> <p>One of the most striking features of High-Temperature Superconducting cuprates is that, over a wide region of the phase diagram, the spectroscopic signature of a gap remains long after the signatures for phase coherence have vanished. So far, it is still unclear whether this pseudogap regime is a phase precursor to superconductivity or it is a distinct phase that competes with superconductivity. In this contribution we will present angle-resolved photoemission results on La_{2-x}Sr_xCuO₄ over a wide doping range. We will show how the underlying Fermi surface, the superconducting and pseudogaps evolve from a highly underdoped insulator (x = 0.03) to an overdoped superconductor (x = 0.17). We will show the dichotomy of the dispersion observed in the gaped and the gapless regions of the Brillouin zone in the pseudogap phase of the underdoped cuprates. The implication of the dichotomy of the dispersion in the pseudogap phase will be discussed.</p>
6025	<p style="text-align: center;">When Superconductivity meets Magnetism: Angle Resolved Photoemission Spectroscopy and Polarized Neutron Reflectometry studies on YBa₂Cu₃O_{7-x}/La_{0.7}Sr_{0.3}MnO₃ Bilayers</p> <p style="text-align: center;"><i>Milan Radovic^{1,2}, Elia Razzoli^{1,2}, Ming Shi², Jochen Stahn³, Yasmine Sassa³, Martin Månsson^{1,2}, Xiaoyu Cui², Luc Patthey², Joël Mesot^{1,3}</i> ¹ <i>Laboratory for Synchrotron and Neutron Spectroscopy, EPFL, CH-1015 Lausanne</i> ² <i>Swiss Light Source, Paul Scherrer Institut, CH-5232 Villigen PSI</i> ³ <i>ETH Zürich and Paul Scherrer Institut, CH-5232 Villigen PSI</i></p> <p>The relationship between High-temperature superconductivity (HTSC) and magnetic order is an essentially important phenomenon for both fundamental and applicative research (spintronics). Many studies showed an intimate connection between magnetic order and HTSC, but it is still under debate if the magnetic interactions could act as an attractive force</p>

	<p>between electrons or if they compete with each other. We started investigation on coexistence of HTC superconductivity and magnetism on a series of $n(\text{YBa}_2\text{Cu}_3\text{O}_{7-x})/m(\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3)$ bilayers (n, m-numbers of unit cells). By fine tuning of the YBCO layer thickness and by using ARPES we were able to study the influence of magnetism on HTSC. Consequently, we performed a investigation of structural and magnetic properties of the YBCO/LSMO bilayers using Polarized Neutron Reflectometry (PNR). We believe that by combining the data obtained by ARPES and PNR, it will be able to better understand the connection between magnetic order and HTSC.</p>
6026	<p style="text-align: center;">Magnetically-driven electric polarization in a magneto-electric organo-metallic magnet</p> <p style="text-align: center;"><i>M. Kenzelmann ¹, V. S. Zapf ², F. W. Fabris ², F. Balakirev ², S. Francoual ², Y. Chen ³</i> ¹ <i>Laboratory for Developments and Methods, Paul Scherrer Institute, CH-5232 Villigen</i> ² <i>National High Magnetic Field Lab, M/S E536, Los Alamos National Lab, Los Alamos, NM 87545</i> ³ <i>Department of Physics and Astronomy, Johns Hopkins University, Baltimore, Maryland 21218, USA</i></p> <p>Magnetically-induced ferroelectricity has been under intense investigation in a wide range transition metal oxides, but it has proven difficult to find non-oxide based materials in which electric polarization arises from magnetic order. Here we present a study of copper dimethyl sulfoxide dichloride (CDC), a magneto-electric organo-metallic quantum magnet containing $\text{Cu S} = 1/2$ spins, in which switchable electric polarization arises from field-tuned magnetic order and the electric state can be switched in an unusual hysteretic fashion by applied magnetic field pulses. Our study shows that magneto-electric interactions can exist in this important class of organo-metallic materials, opening the road to designing magnetoelectrics and multiferroics using large molecules as building blocks. Further, we demonstrate that CDC undergoes a magneto-electric quantum phase transition where both ferroelectric and magnetic order emerge simultaneously as a function of magnetic field at very low temperatures.</p>
6027	<p style="text-align: center;">Manganese silicide nanowires on the Si(001) surface induced by Bi nanolines</p> <p style="text-align: center;"><i>James H. G. Owen ¹, H. Liu ², K. Miki ², Christoph Renner ¹</i> ¹ <i>DPMC, NCCR MaNEP, Université de Genève, 24 Quai Ernest-Ansermet, 1211 Genève 4</i> ² <i>Nano-Architecture Group, National Institute for Materials Science, 1-1 Namiki, Tsukuba, Ibaraki 305-0044, Japan</i></p> <p>Deposition of sub-monolayer quantities of Mn onto a Si(001) surface with a high density of Bi nanolines results in the formation of Mn nanowires, 5-10 nm wide, 3 nm high, and up to 600 nm long. The nanowires are never formed in the absence of the Bi nanolines; instead large islands form. The Haiku core of the Bi nanoline is known to induce short-range stress in the surrounding silicon surface, straining neighbouring dimers and repelling step edges[1]. We propose that in addition to these effects, the Bi nanolines alter the overall stress tensor of the surface, and thus promote the 1D growth of the Mn silicide into these highly-oriented nanowires.</p> <p>[1] J. H. G. Owen, K. Miki, and D. R. Bowler J. Mat. Sci. 41 4568 (2006)</p>

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Pauli paramagnetic effects on the flux line lattice in CeCoIn₅

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We report small-angle neutron scattering studies of the flux line lattice (FLL) in the heavy-fermion superconductor CeCoIn₅ ($T_c = 2.3$ K), with field parallel to the crystal c-axis. Our measurements of the field- and temperature-dependence of the FLL form factor (FF) show that field-induced flux line core paramagnetism, which causes the field-enhancement of the FF previously reported at 50 mK [1], persists to temperatures up to 1250 mK ($> T_c / 2$) [2]. At all temperatures, and for fields just below H_{c2} , the FF falls from a peak value. We discuss the physical reasons for this fall, and suggest that it arises due to field-induced paramagnetic depairing effects within the flux line cores, which causes them to expand at the highest fields.

[1] A.D. Bianchi et al., Science 319 177 (2008)

[2] J.S. White et al., New J. Phys. 10, 023026 (2010)

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Anisotropic properties and multi-gap superconductivity in SmFeAsO_{1-x}F_y

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The recent discovery of superconductivity in iron-pnictide superconductors stimulated extensive experimental and theoretical work to explore the fundamental mechanisms of high-temperature superconductivity. Since anisotropic properties are a common feature among high-temperature superconductors, a careful investigation of these characteristics is needed in order to clarify their role for the appearance of superconductivity. The anisotropic properties of iron-pnictides were studied on SmFeAsO_{1-x}F_y single crystals by combining torque magnetometry, SQUID magnetometry, and muon-spin rotation. In the superconducting state the magnetic penetration depth anisotropy parameter was found to increase with decreasing temperature, in contrast to the steadily decreasing upper critical field anisotropy parameter. The in-plane magnetic penetration depth λ_{ab} shows a pronounced decrease of the superfluid density $\rho_S \propto \lambda_{ab}^{-2}$ as the field is increased to 1.4 T. The results are interpreted in terms of a two-gap model and compared to those of various layered high-temperature superconductors such as MgB₂ cuprates.

6030	<p style="text-align: center;">Proximal detection of magnetism near the surface of YBCO films using β-NMR</p> <p><i>Hassan Saadaoui</i>^{1,*}, <i>G. D. Morris</i>², <i>Z. Salman</i>^{3,*}, <i>Q. Song</i>¹, <i>K. H. Chow</i>⁴, <i>M. D. Hossain</i>¹, <i>C. D. P. Levy</i>², <i>T. J. Parolin</i>⁵, <i>M. R. Pearson</i>², <i>L. H. Greene</i>⁶, <i>P. J. Hentges</i>⁶, <i>M. Smadella</i>¹, <i>D. Wang</i>¹, <i>R. F. Kiefl</i>^{1,2,7}, <i>W. A. MacFarlane</i>⁵</p> <p>¹ <i>Dep. of Physics and Astronomy, University of British Columbia, CA-Vancouver V6T 1Z1</i> ² <i>TRIUMF, 4004 Wesbrook Mall, CA-Vancouver, British Columbia V6T 2A3</i> ³ <i>Clarendon Lab., Dep. of Physics, Oxford University, Parks Road, Oxford OX1 3PU, UK.</i> ⁴ <i>Department of Physics, University of Alberta, CA-Edmonton, T6G 2G7</i> ⁵ <i>Chemistry Department, University of British Columbia, CA-Vancouver, V6T 1Z1</i> ⁶ <i>Dep. of Physics, University of Illinois at Urbana-Champaign, Urbana, Illinois 61801, USA</i> ⁷ <i>Canadian Institute for Advanced Research, 180 Dundas Street West, CA-Toronto M5G 1Z8</i> <i>* Present affiliation: PSI, Laboratory for Muon Spin Spectroscopy, 5232 Villigen PSI</i></p> <p>Beta-detected NMR (β-NMR) of highly spin polarized ^8Li, implanted within 15nm of Ag on (110) and (001)-oriented $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$, was carried out to search for spontaneous magnetism near the surface of YBCO. The spin precession is monitored by measuring the asymmetry of the emitted electrons after ^8Li decays, which is directly proportional to the local magnetic field distribution, i.e. the resonance. The measurements, taken in the Meissner state, showed extra broadening of the resonance in both Ag/YBCO(110) and Ag/YBCO(001) films below the T_c of YBCO. This indicates, perhaps, the appearance of very small spontaneous disordered magnetic fields (0.2 G) which break time reversal symmetry, or the presence of magnetic field inhomogeneities due to vortices near the surface of the YBCO films.</p>
6031	<p style="text-align: center;">The phase diagram of precursor superconductivity as obtained from the infrared c-axis conductivity of $\text{RBa}_2\text{Cu}_3\text{O}_{7-\delta}$</p> <p><i>Adam Dubroka</i>¹, <i>D. Munzar</i>², <i>Li Yu</i>¹, <i>M. Rössle</i>¹, <i>K. W. Kim</i>¹, <i>T. Wolf</i>³, <i>C. T. Lin</i>⁴, <i>A. Schafgans</i>⁵, <i>S. J. Moon</i>⁵, <i>D. Basov</i>⁵, <i>J. L. Tallon</i>⁶, <i>J. Storey</i>⁶, <i>C. Bernhard</i>¹</p> <p>¹ <i>Univ. of Fribourg, Dep. of Physics and FRIMAT, Chemin du Musée 3, CH-1700 Fribourg</i> ² <i>UFKL, Masaryk University, Kotlářská 2, Brno, Czech Republic</i> ³ <i>Forschungszentrum Karlsruhe, IFF, DE-76021 Karlsruhe</i> ⁴ <i>Max-Planck-Institute for Solid State Research, Heisenbergstrasse 1, DE-70569 Stuttgart</i> ⁵ <i>Department of Physics, University of California, San Diego, USA</i> ⁶ <i>MacDiarmid Institute for Advanced Materials & Nanotechnology, Gracefield Road, Lower Hutt, New Zealand</i></p> <p>We present a multilayer analysis of the infrared c-axis conductivity of $\text{RBa}_2\text{Cu}_3\text{O}_{7-\delta}$ single crystals which reveals important differences in the electronic conductivities between the pairs of closely and widely spaced CuO_2 planes, corresponding to the intra- and inter-bilayer regions. The intra-bilayer conductivity is weakly coherent and in the normal state, below a certain temperature, T^{on}, exhibits an increase of low frequency spectral weight with lowering temperature. The inter-bilayer response is dominated by an opposite trend, i.e., a gap-like suppression of the low energy electronic states below a temperature T^* that gives rise to an insulator-like behaviour and likely competes with superconductivity. We track the doping dependence of T^{on} and T^* from the spin glass phase to the optimal doping. We discuss our results in terms of a precursor superconducting state. Our infrared reflectivity measurements at magnetic field up to 8 T bring additional support for this interpretation.</p>

6032	<p style="text-align: center;">Heat propagation velocities in coated conductors for fault current limiter applications.</p> <p style="text-align: center;"><i>Louis Antognazza¹, M. Decroux¹, M. Therasse¹, M. Abplanalp²</i></p> <p style="text-align: center;">¹ University of Geneva, DPMC, 24 Quai Ernest Ansermet, 1211 Geneva 4 ² ABB Corporate Research Centre in Switzerland, 5405 Baden-Dättwil</p> <p>The superconducting fault current limiters (SFCL) are mainly based on coated conductors (CC) in spite of the low electric fields the CC can sustain due the very low propagation velocities of the normal zone. The SFCL demonstrators are made of coil but another way of building them is to use plates with a meandered line. In a meander the heat generated by a local dissipative zone diffuses also laterally and switches the adjacent lines, increasing the apparent propagation velocity of the normal zone. There is also a possibility to increase the lateral propagation velocity of the heat by adding onto the Hastelloy substrate a thermal short circuit between the lines. We will discuss the benefit of this approach as compared to the standard coil geometry.</p>
6033	<p style="text-align: center;">Magnetic and superconducting properties of electron doped La_{2-x}Ce_xCuO₄ epitaxial thin films</p> <p style="text-align: center;"><i>Hubertus Luetkens¹, A. Suter¹, E. Morenzoni¹, T. Prokscha¹, A. Winkler², Y. Krockenberger², L. Alff², A. Tsukada³, M. Naito³, G. Pascua¹, H.-H. Klaus⁴</i></p> <p style="text-align: center;">¹ Laboratory for Muon-Spin Spectroscopy, PSI ² Institute for Material Science, TU Darmstadt ³ NTT Basic Research Laboratory, Atsugi 243-01 ⁴ Institute for Solid State Physics, TU Dresden</p> <p>The magnetic and superconducting phase diagram of high quality electron-doped T'-La_{2-x}Ce_xCuO₄ epitaxial films on SrTiO₃ has been determined by means of low energy muon spin rotation (LE-μSR) as a function of depth below the surface. The electronic phase diagram of La_{2-x}Ce_xCuO₄ films, if investigated near the surface of the films, resembles the phase diagrams of the bulk electron-doped cuprates Nd_{2-x}Ce_xCuO₄ and Pr_{2-x}Ce_xCuO₄ where the magnetic phase exists to a relatively large doping level of $x = 0.1$. In contrast, if the magnetic and superconducting properties are investigated in the center of the typically 250 nm thick films, the phase diagram shows a remarkable similarity to the phase diagram of its hole-doped counterpart La_{2-x}Sr_xCuO₄ with a narrow magnetic doping region and a broad superconducting region between $0.05 < x < 0.25$.</p>
6034	<p style="text-align: center;">Effect of a staggered spin-orbit coupling on the occurrence of a nematic phase in Sr₃Ru₂O₇</p> <p style="text-align: center;"><i>Mark H. Fischer, Manfred Sigrist, Institute for Theoretical Physics, ETH Zürich, 8093 Zürich</i></p> <p>Clean single crystals of Sr₃Ru₂O₇ undergo a metamagnetic transition at low temperatures. This transition shows a strong anisotropy in the applied field direction with critical fields H_c ranging from 5.1T for the case of $H \perp c$ to almost 8T for $H \parallel c$. In addition, studies on ultra-pure samples revealed a bifurcation of the metamagnetic line for fields in c-direction and it is argued that a nematic phase emerges between the magnetization jumps. The aim of this study is to explain the field anisotropy of these phenomena. We introduce the metamagnetic transition by means of a van Hove singularity scenario and show that a rotation of the O-octahedra around the c-axis introduces a staggered Rashba-like spin-orbit coupling within the planes, naturally leading to an anisotropy of the magnetic response. The spin-orbit coupling shows an influence on both, the critical field H_c and the occurrence of the nematic phase.</p>

6035	<p>Collective Mode Energy Measured by Scanning Tunneling Spectroscopy Does Not Follow T_c in $\text{Bi}_2\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_{10+\delta}$</p> <p><i>Nathan Jenkins¹, A. Piriou¹, C. Berthod¹, Y. Fasano², I. Maggio-Aprile¹, E. Giannini¹, Ø. Fischer¹</i></p> <p>¹ DPMC-MaNEP, University of Geneva, 24 Quai Ernest-Ansermet, 1211 Geneva 4 ² Instituto Balseiro and Centro Atómico Bariloche, San Carlos de Bariloche, Argentina</p> <p>We report on a scanning tunneling microscopy (STM) study of the three-layer compound $\text{Bi}_2\text{Sr}_2\text{Ca}_2\text{Cu}_3\text{O}_{10+\delta}$ (Bi-2223). A realistic model including the (π, π) spin resonance mode seen by neutrons has previously been used [1] to give remarkably good fits to spectra in Bi-2223. We further showed that for a nearly-optimally doped sample, Ω and Δ are anticorrelated, that is Ω decreases as Δ increases [2]. We now have furthered these results by performing a doping dependence study of Ω. Three separate samples were looked at with three different dopings (underdoped, optimally doped, and overdoped). For the underdoped and optimally doped samples, results qualitatively followed the doping dependence found by neutron experiments. However, in the overdoped sample there is almost no dependence at all for $\Delta < 45$ meV. Thus Ω does not follow T_c. This finding necessitates further neutron experiments on overdoped samples to properly characterize the doping dependence of the (π, π) spin resonance.</p> <p>[1] Giorgio Levy de Castro, Christophe Berthod, Alexandre Piriou, Enrico Giannini, Øystein Fischer, Phys. Rev. Lett. 101, 267004 (2008). [2] Jenkins, N., Fasano, Y., Berthod, C., Maggio-Aprile, I., Piriou, A., Giannini, E., Hoogenboom, B. W., Hess, C., Cren, T., Fischer, Ø., Phys. Rev. Lett. 103, 227001 (2009).</p>
6036	<p>Structural Studies of the Interfaces Between Insulating Metal Oxides</p> <p><i>Stephan A. Pauli¹, C.M. Schlepütz¹, D. Martoccia¹, M. Björck¹, C. W. Schneider¹, S. Thiel², J. Mannhart², P. R. Willmott¹</i></p> <p>¹ Paul Scherrer Institut, CH-5232 Villigen PSI ² Experimentalphysik VI, Institut für Physik, Universität Augsburg, DE-86135 Augsburg</p> <p>The physics responsible for the formation of a highly mobile, two-dimensional, electron gas at the interface between the insulators LaAlO_3 and SrTiO_3 has been the subject of considerable research and controversy. The formation of conductance at the interface only occurs for LaAlO_3 films with thicknesses above three monolayers. It is well known that in strongly correlated electron systems even subtle changes in the structure, i.e., in the atomic positions or in the chemical composition, can lead to profound differences in the physical properties. Hence, a structural model of the $\text{LaAlO}_3 / \text{SrTiO}_3$ interface structure with sub-Ångstrom resolution is essential in order to understand these phenomena. Surface X-Ray Diffraction is uniquely capable of providing this required accuracy. The evolution of the atomic structure of the interface between LaAlO_3 and SrTiO_3 as a function of monolayer thickness will be described. The structures were extracted using phase-retrieval algorithms followed by conventional structural refinement.</p>

6037	<p>Ultrafast laser-induced spin-reorientation in the heterostructure Co/SmFeO₃</p> <p><i>Loïc Le Guyader</i>¹, <i>L. Joly</i>², <i>A. Kleibert</i>¹, <i>F. Nolting</i>¹, <i>R. Pisarev</i>³, <i>A. Kirilyuk</i>⁴, <i>Th. Rasing</i>⁴, <i>A. Kimel</i>⁴</p> <p>¹ SLS, Paul Scherrer Institut, Villigen; ² IPCMS, Strasbourg, France ³ Ioffe Physical Technical Institute, St Petersburg, Russia ⁴ IMM, Radboud University Nijmegen, The Netherlands</p> <p>The magnetization direction of ferromagnetic (FM) films can be pinned by coupling them to an antiferromagnet (AFM). It has been demonstrated recently that a subpicosecond laser-excitation of an antiferromagnetic orthoferrites RFeO₃ (R is a rare-earth ion) may result in ultrafast modification of the magnetic anisotropy followed by a reorientation of the antiferromagnetic spins over 90-degrees within a few picoseconds (i.e. much faster than a typical period of spin precession in a ferromagnetic material ≈ 1 ns). What would be the response of an FM-layer if such a spin-reorientation in the AFM takes place in a coupled AFM-FM structure? How fast would the FM-layer reorient? Here we report on our investigations of the laser-induced dynamics of Co and Fe spins in a Co/SmFeO₃ heterostructure with the help of X-ray magnetic circular dichroism (XMCD) and time-resolved Photoemission electron microscopy. Reorientation of Co-spins faster than 100 ps is observed and the trajectory of the reorientation is investigated.</p>
6038	<p>High oxygen pressure single crystal growth of spin ladder superconductor Sr_{14-x}Ca_xCu₂₄O₄₁ by optical floating zone technique</p> <p><i>Guochu Deng Kazimierz Conder, Ekaterina Pomjakushina, Solid State Chemistry, Laboratory for Developments and Methods, Paul Scherrer Institut, 5232 Villigen PSI</i></p> <p>Highly Ca-doped Sr_{14-x}Ca_xCu₂₄O₄₁ (x≥10) is the only copper spin ladder compound showing superconductivity (T_c ~9K) at elevated pressure (~4.5GPa). As the origin of superconductivity is still not understood, this compounds family still attracts research interest. Further progress is, however, to a great extent dependent on availability of large-size, good quality single crystals. For samples with x>12, high oxygen pressure, which can no be applied in commercial optical floating zone furnaces, is necessary for crystal growth. We have modified our optical floating zone furnace for a high pressure work. By applying 15 bar of oxygen, large size Sr_{1.8}Ca_{12.2}Cu₂₄O₄₁ single crystal (6x7x55 mm) has already been successfully grown.</p>
6039	<p>The spin-mediated pairing interaction of high T_c superconductors: clues from scanning tunneling spectroscopy on YBa₂Cu₃O_{7-δ} single crystals</p> <p><i>Ivan Maggio-Aprile</i>¹, <i>Y. Treboux</i>¹, <i>Y. Fasano</i>², <i>N. Jenkins</i>¹, <i>A. Piriou</i>¹, <i>C. Berthod</i>¹, <i>Ø. Fischer</i>¹</p> <p>¹ DPMC, University of Geneva ² Instituto Balseiro and Centro Atmico Bariloche, Bariloche, Argentina</p> <p>After two decades, the exact origin of the pairing interaction in cuprate superconductors remains a mystery. Scanning tunnelling spectroscopy is a perfect tool to investigate this question. While it is well established that conventional superconductors reveal the existence of phononic excitations in the tunneling spectra, the identification of the "dip-hump feature" in the tunnel conductance with bosonic excitations in high T_c superconductors is relatively recent and limited to Bi-based cuprates. We present here recent tunnelling spectroscopy measurements performed on YBa₂Cu₃O_{7-δ} single crystals and the first analysis of the systematic signature of these bosonic modes in this compound. We show through numerical modelling that the dip-hump feature in YBCO can also be associated with the (π, π) spin resonance detected in neutron scattering experiments, and that the local doping dependence of the energy of this mode follows the same trend as for Bi-based cuprates. All evidence support that spin-mediated pairing plays an important role in high-T_c superconductivity.</p>

6040	<p>Study of magnetoelectric effects (parity and time odd) by resonant x-ray diffraction techniques in GaFeO₃</p> <p><i>Urs Staub</i>¹, <i>Y. Bodenthin</i>¹, <i>C. Piamonteze</i>¹, <i>M. García-Fernandez</i>¹, <i>R. De Souza</i>¹, <i>V. Scagnoli</i>¹, <i>M. Garganourakis</i>¹, <i>S. Koohpayeh</i>², <i>D. Fort</i>², <i>S. W. Lovesey</i>^{3,4}</p> <p>¹ <i>Swiss Light Source, Paul Scherrer Institut, CH 5232 Villigen PSI</i> ² <i>Dep. of Metallurgy and Materials, University of Birmingham, Birmingham B15 2TT, UK</i> ³ <i>ISIS Facility, Harwell Science and Innovation Campus, Oxfordshire OX11 0QX, UK</i> ⁴ <i>Diamond Light Source Ltd., Oxfordshire OX11 0DE, UK</i></p> <p>We present resonant soft and hard x-ray diffraction data on the space group forbidden (0k0) reflection at the Fe L_{2,3} and K edges of magneto-electric GaFeO₃. These data give direct evidence for time and parity odd (magneto-electric) moments. Whereas the soft x-ray diffraction results can be interpreted in terms of crossed electric-magnetic dipole transitions, the hard resonant x-ray diffraction data occurring at the pre-edge of the Fe K, is based on the crossed electric dipole-quadrupole transition, both of parity odd character. Both experiments access magnetoelectric multipoles in the open Fe 3d shell, which are a direct measure of coupling between magnetic and electric properties and at base for the magnetoelectric interaction. They reflect a direct measure of the overlap of oxygen 2p and Fe 3d orbitals responsible for the large magnetoelectric effects, which is of fundamental importance for a microscopic understanding of magnetically induced multiferroics.</p>
6041	<p>Strong-coupling signatures in the tunneling spectra of metals and superconductors: the role of dimensionality</p> <p><i>Christophe Berthod, DPMC-MaNEP, University of Geneva</i></p> <p>The signatures of electron-phonon coupling in the tunneling spectra of conventional superconductors have been thoroughly investigated theoretically following their first observation by Giaever et al. in lead. These signatures are generically weak - a few percent - and are completely absent in the normal state. In recent years a similar feature in the STM tunneling spectra of high-T_c cuprate superconductors, the so-called dip feature, has been attributed to the interaction of electrons with a (π, π) collective spin excitation. In contrast to the electron-phonon signatures in lead, the dip feature is generically strong in cuprates, reaching ~ 20% in Bi-2223. We show that this difference in the strength of the strong-coupling signatures is due to the dimensionality rather than to a difference in the strength of the coupling. We also suggest that strong-coupling signatures should be observable in the normal-state spectra of nearly two-dimensional high-T_c superconductors.</p>
6042	<p>Structural and magnetic properties of the parent compound T'-La₂CuO₄ of electron-doped cuprates</p> <p><i>Gwendolyne Pascua</i>¹, <i>H. Luetkens</i>¹, <i>A. Suter</i>¹, <i>R. Hord</i>², <i>A. Buckow</i>³, <i>H. Maeter</i>⁴, <i>H.-H. Klauss</i>⁴, <i>J. Kurian</i>³, <i>Y. Krockenberger</i>⁵, <i>K. Hofmann</i>², <i>B. Albert</i>², <i>L. Alff</i>³</p> <p>¹ <i>Laboratory for Muon-Spin Spectroscopy, Paul-Scherrer-Institut (PSI), 5232 Villigen PSI</i> ² <i>Eduard-Zintl-Institute of Inorganic and Physical Chemistry, Technische Universität Darmstadt, Petersenstr. 18, DE-64287 Darmstadt</i> ³ <i>Institute of Materials Science, Technische Universität Darmstadt, Petersenstr. 23, DE-64287 Darmstadt</i> ⁴ <i>Institut für Festkörperphysik, TU Dresden, DE-01069 Dresden</i> ⁵ <i>Cross-Correlate Materials Research Group (CMRG), Advanced Science Institute (ASI), RIKEN, 2-1 Hirosawa, Wako, Saitama 351-0198, Japan</i></p> <p>Bulk material of crystalline T'-La₂CuO₄ has been produced at moderate temperatures using a novel synthesis route. Structural properties were determined via highly-resolved X-ray</p>

	<p>powder diffraction. The data were refined based on a structure model derived from the Nd_2CuO_4 - type (I4/mmm, no. 139). The new La compound possesses the largest a and c lattice constants within the T' - Re_2CuO_4 (Re= Rare earth ion) series. Muon spin rotation reveals a gradual slowing down of magnetic fluctuations below $T_{N1} \approx 200$ K and static magnetic order below $T_{N2} = 115$ K in contrast to T- La_2CuO_4 where $T_{N2} \approx 300$ K is more than twice as much. Within the T' - Re_2CuO_4 series, the Néel temperature of the La compound is also drastically reduced. This can be traced back to an increased 2-dimensionality possibly due to the absence of a polarizable Re ion in the structure.</p>
6043	<p>Electronic Structure of Superconducting iron-chalcogenide studied by angle-resolved photoemission spectroscopy</p> <p><i>Ping-Hui Lin¹, M. A. Valbuena¹, R. Viennois², K. W. Yeh³, M. Grioni¹</i> ¹ <i>Laboratoire de Spectroscopie Electronique, ICPM, EPFL</i> ² <i>Department of Condensed Matter Physics, University of Geneva</i> ³ <i>Institute of Physics, Academia Sinica, Taiwan</i></p> <p>Iron-chalcogenides has generated interest due to the similarity in electron structure with superconducting iron-pnictides and the simplicity of the crystal structure. We report the electronic structure around Γ point of series of iron-chalcogenide superconducting samples, $\text{Fe}_{1+x}(\text{Te}_{1-y}\text{Se}_y)$, measured with angle-resolved photoemission spectroscopy. From a preliminary analysis, the measured bands qualitatively agree with the DFT calculations. At Γ point, the bands in the vicinity of the Fermi Energy shift up as the Se doping level increases, as a consequence of the larger hole density produced by Se substitution. In addition, we observe that the shape of Fermi surface topology of $\text{Fe}_{1+x}(\text{Te}_{1-y}\text{Se}_y)$ around Γ point is altered by Se doping from a circle to an asymmetric dumbbells shape.</p>
6044	<p>Controlled growth and placement of carbon nanotubes for device applications</p> <p><i>Yuliya Lisunova, C. Blaser, P. Paruch, DPMC, University of Geneva</i></p> <p>The outstanding mechanical and electronic properties of carbon nanotubes (CNT) make them promising for applications as nanoscale sensors or wires, junctions, and transistors. An important aspect of device fabrication is the controlled growth and placement of CNT on target surfaces.</p> <p>Here, we present the optimisation of single-walled CNT growth by chemical vapour deposition for two device configurations. Using an iron and molybdenum salt based catalyst, supported on alumina nanoparticles, we grow 50 - 150 μm long CNT suspended across trenches in prepatterned Si-based substrates, for transfer to ferroelectric films following [1]. Separately, we are investigating CNT growth on atomic force microscopy tips, following [2], as a way to increase tip resolution and aspect ratio. Such hybrid tips could allow the switching of very small ferroelectric domains [3].</p> <p>[1] X.M.H. Huang et al., NL 5, 1515 (2005) [2] J.H. Hafner et al., JPCB 105, 743 (2001) [3] P. Paruch et al., Proc CIMTEC D, 675 (2002)</p>
6045	<p>Polarization switching and ferroelectric field effect in devices combining carbon nanotubes with epitaxial $\text{Pb}(\text{Zr}_{0.2}\text{Ti}_{0.8})\text{O}_3$ thin films</p> <p><i>Cedric Blaser¹, Y. Lisunova¹, F. Guy², S. Gariglio^{1,2}, P. Paruch¹</i> ¹ <i>DPMC, University of Geneva;</i> ² <i>hepia, Geneva</i></p> <p>The exceptional electronic properties of carbon nanotubes (CNTs) have been extensively investigated using field effect, with SiO_2 as the gate dielectric. An alternative, potentially multifunctional system can be obtained by combining CNTs with ferroelectrics [1,2]. In such</p>

	<p>a device, the switchable remnant ferroelectric polarization can be used to locally modulate the electronic properties of the CNT, while the CNT can act as a local electric field source for nanoscale polarization switching.</p> <p>We fabricated CNT-ferroelectric devices by depositing single-walled CNT from aqueous suspension onto patterned epitaxial $\text{Pb}(\text{Zr}_{0.2}\text{Ti}_{0.8})\text{O}_3$ thin films. Such devices show a repeated, reversible polarization switching with voltage application via the CNT, as well as clockwise hysteresis in transconductance measurements, characteristic of a ferroelectric field effect.</p> <p>[1] P. Paruch et al., APL 93, 132901 (2008) [2] T. Sakurai et al., JJAP 45, L1036 (2006)</p>
6046	<p style="text-align: center;">Crystal structure and superconductivity above 50 K in Th-substituted SmFeAsO</p> <p style="text-align: center;"><i>Nikolai D. Zhigadlo ¹, S. Katrych ¹, S. Weyeneth ², R. Puzniak ^{2,3}, P. Moll ¹, Z. Bukowski ¹, J. Karpinski ¹, H. Keller ², B. Batlogg ¹</i></p> <p style="text-align: center;">¹ <i>Laboratory for Solid State Physics, ETH Zürich</i> ² <i>Physik-Institut der Universität Zürich</i> ³ <i>Institute of Physics, Polish Academy of Sciences, Warsaw, Poland</i></p> <p>Superconducting poly- and single-crystalline samples of the $\text{Sm}_{1-x}\text{Th}_x\text{FeAsO}$ were successfully synthesized and grown under high pressure. We present detailed crystallographic and magnetic investigations, for polycrystalline samples with nominal Th content of $x = 0.3$ and T_c of 51.5 K and for single crystals with $T_c = 49.5$ K and refined doping level of $x = 0.11$. $\text{Sm}_{1-x}\text{Th}_x\text{FeAsO}$ samples are characterized by a high intergrain critical current density of 10^3 A/cm² for polycrystalline samples, and by an intragrain critical current density of the order of 10^6 A/cm² for single crystals at 2 K in 7 T. The magnetic penetration depth anisotropy γ_λ exhibits a pronounced increase with decreasing temperature, in good agreement with the behavior observed for single crystals of $\text{SmFeAsO}_{1-x}\text{F}_x$. By comparing our experimental data for $\text{Sm}_{1-x}\text{Th}_x\text{FeAsO}$, $\text{SmFeAsO}_{1-x}\text{F}_x$ and $\text{SmFeAs}_{1-x}\text{PxO}$ systems with various others Fe-based pnictides we find that the critical temperature is very sensitive to the height of the pnictogene from the Fe plane.</p>
6047	<p style="text-align: center;">Fine tuning strain through composition: $\text{Pb}_x\text{Sr}_{1-x}\text{TiO}_3$ on DyScO_3</p> <p style="text-align: center;"><i>Gijsbert Rispens [*], J. Heuver, O. Nesterov, B. Noheda</i> <i>Zernike institute for advanced materials, University of Groningen, The Netherlands</i> [*] <i>Currently at: DPMC, University of Geneva</i></p> <p>It is widely known that epitaxial strain can tune the properties of ferroelectrics. However, the small number of suitable substrates limits the possibilities of such strain tuning. Substituting Sr for Pb in the ferroelectric PbTiO_3 changes the lattice parameters, allowing continuous strain tuning. In $\text{Pb}_x\text{Sr}_{1-x}\text{TiO}_3$ grown on (110) DyScO_3, tensile strain changes the polarization direction from out-of-plane to in-plane at $x = 0.83$. Synchrotron GID experiments reveal a periodic domain structure with domain walls along the $\langle 110 \rangle$ directions for the in-plane-polarized phase, in good agreement with theoretical predictions for PbTiO_3 under tensile strain. Unlike in pure materials, the phase boundary between the in-plane and out-of-plane ferroelectric phases, for which high dielectric and piezoelectric responses are expected, is accessible. This shows the potential of combining strain and composition for engineering of functional properties.</p>

6048	<p>Single crystal growth and superconducting properties of doped LnFeAsO (Ln=La, Pr, Nd, Sm, Gd) and AFe₂As₂ (A=Ba, Ca, Rb, Eu)</p> <p><i>Janusz Karpinski¹, N. D. Zhigadlo¹, S. Katrych¹, Z. Bukowski¹, R. Puzniak¹, K. Rogacki¹, P. Moll¹, B. Batlogg¹, S. Weyeneth², H. Keller², M. Tortello³, R. Gonnelli³, F. Balakirev⁴</i></p> <p>¹ Laboratory for Solid State Physics, ETH Zürich, 8093 Zürich ² Physik-Institut der Universität Zürich, 8057 Zürich ³ Dipartimento di Fisica, Politecnico di Torino, 10129 Torino, Italy ⁴ High Magnet. Field Lab. Los Alamos, USA</p> <p>Growth, structure, and superconducting properties of doped LnFeAsO (Ln=La, Pr, Nd, Sm, Gd) and AFe₂As₂ (A=Rb, Ba, Ca, Eu) single crystals are presented. LnFeAsO single crystals were grown from flux at high-pressure of 30 kbar. Superconductivity in LnFeAsO has been induced by partial substitution of O by F, Ln by Th or As by P. Crystals of Ba_{1-x}Rb_xFe₂As₂, CaFe_{2-x}Co_xAs₂ and EuFe_{2-x}Co_xAs₂ were grown in quartz ampoules from flux at low pressure. Resistivity measurements on SmFeAs(O,F) were performed with in- and out-of-plane current flow in magnetic field up to 65 T. The critical current density at low temperature was almost independent on field and current direction and exceeds 10⁶ A/cm². The penetration depth anisotropy γ_{λ} and the upper critical field anisotropy γ_{H_c} are different and temperature dependent, what indicates multigap superconductivity. For the SmFeAsO_{1-x}F_x crystals, Point-Contact Andreev-Reflection spectroscopy studies show the existence of two gaps, which energy varies with doping level.</p>
6049	<p>The apparent influence of elastic scattering on binding energies and the mean free path in x-ray photoemission</p> <p><i>Eike F. Schwier, Claude Monney, Zuzana Vydrova, Nicolas Mariotti, Clement Didiot, Miryam Garcia-Fernandez, M. Gunnar Garnier, Philipp Aebi</i> <i>Université de Fribourg, Department de Physique</i></p> <p>If x-ray photoemission spectroscopy (XPS) is employed to determine the properties at surfaces and interfaces there are two main types of measurements that are commonly performed. One is the determination of the valence state of atoms and the chemical analysis inside the sample, and the other is the so called depth profiling, where the photoemission lines are measured as a function of polar emission angle. Here we explore the influence of elastic scattering of photoelectrons during the photoemission process and focus on the creation of apparent shifts in the binding energies in core-levels and the impact on the angular and element dependence of the mean free path.</p>
6050	<p>Shear effects in lateral piezoresponse force microscopy at 180° ferroelectric domain walls</p> <p><i>Jill Guyonnet¹, H. Béa^{1,2}, F. Guy³, S. Gariglio^{1,3}, S. Fusil⁴, K. Bouzehouane⁴, J.-M. Triscone¹, P. Paruch¹</i></p> <p>¹ DPMC, University of Geneva, ² now at SPINTEC, CEA Grenoble, France ³ hepia, Geneva, ⁴ CNRS/Thales, Palaiseau, France</p> <p>Piezoresponse force microscopy (PFM) is the primary tool for nanoscale ferroelectric studies, with vertical and lateral response components linked to out-of-plane and in-plane polarization. For tetragonal ferroelectrics in out-of-plane electric fields a purely vertical response is expected. The lateral response sometimes observed at 180° domain walls has generally been attributed to topographical or electrostatic artefacts.</p> <p>We report on PFM studies of lateral response at domain walls in PbZr_{0.2}Ti_{0.8}O₃ thin films. Comparing these observations with electric force microscopy studies and simulations, we analyze different possible mechanisms, and conclude that domain wall shear is</p>

	<p>responsible [1], in agreement with theoretical predictions [2]. This response is also observed in other types of domain walls, and in other materials [3].</p> <p>[1] J. Guyonnet et al., APL 95, 132902 (2009) [2] A. N. Morozovska et al., PRB 75, 174109 (2007) [3] J. Guyonnet et al., accepted JAP</p>
<p>6051</p>	<p style="text-align: center;">Pulsed laser deposition of TbMnO₃ thin films</p> <p style="text-align: center;"><i>Yi Hu¹, Matthias Bator¹, Jonathan White², Michel Kenzelmann³, Thomas Lippert¹, Christof Niedermayer², Christof W. Schneider¹</i></p> <p style="text-align: center;">¹ Paul Scherrer Institut, General Energy Research Department, 5232 Villigen-PSI ² Paul Scherrer Institut, Laboratory for Neutron Scattering, 5232 Villigen-PSI ³ Paul Scherrer Institut, Laboratory for Developments and Methods, 5232 Villigen-PSI</p> <p>Epitaxial films of orthorhombic multiferroic TbMnO₃ have been successfully grown on different substrates by pulsed laser deposition from a sintered TbMnO₃ target. Due to the low mismatch between film and substrate lattice parameters, SrTiO₃, YAlO₃ and NdGaO₃ single crystalline substrates have been used. Structural characterization by x-ray diffraction show that single phased, strained TbMnO₃ thin films have been grown with a thickness ranging from 40 to 200 nm. On (100)-oriented SrTiO₃, TbMnO₃ growth pseudocubic with a (001) orientation. TbMnO₃ thin films with (110) and (010) orientations are obtained when grown on (110)-oriented YAlO₃ or NdGaO₃ and (010)-oriented NdGaO₃ substrates. The x-ray measurements indicate a very good crystallinity for the different orientations prepared so far, with a FWHM for the rocking curves smaller than 0.1.</p>
<p>6052</p>	<p style="text-align: center;">Identification of the Fermi and non-Fermi liquid phase in transport properties of MnSi</p> <p style="text-align: center;"><i>Stevan Arsenijevic¹, A. Akrap², C. Petrovic², C. Vaju¹, R. Gaal¹, L. Forro¹</i></p> <p style="text-align: center;">¹ Institute of Condensed Matter Physics, EPFL, CH-1015 Lausanne ² Condensed Matter Physics and Materials Science Department, Brookhaven National Laboratory, Upton, New York 11973, USA</p> <p>MnSi is an itinerant magnet which at low temperatures develops a long-range helical order. Recent studies show that under pressure it undergoes a transition from Fermi liquid to non-Fermi liquid (NFL) phase. We have investigated this crossover with simultaneous measurements of the electrical resistivity and thermoelectric power under hydrostatic pressure up to 25 kbar. The resistivity measurements which confirmed earlier results were used to determine the phase diagram by comparing the coefficients derived from the low-temperature power-law behavior. An abrupt decrease of the power-law exponent n from 2 to 1.5 is determined to be at the critical pressure $p_c = 14.6$ kbar indicating a pronounced change in electronic configuration. We have extended previous works by investigating the thermoelectric power under pressure. While at the onset of the FL regime thermopower has a sharp decrease, an almost linear decrease below 10 K signals the NFL behavior.</p>
<p>6053</p>	<p style="text-align: center;">Anomalous LaAlO₃ c-axis contraction in the LaAlO₃ / SrTiO₃ system</p> <p style="text-align: center;"><i>Claudia Cancellieri, N. Reyren, A. D. Caviglia, A. Fête, S. Gariglio, J.-M. Triscone DPMC, Université de Genève, 24 Quai E.-Ansermet, 1211 Genève 4</i></p> <p>The structural properties of LaAlO₃ films grown on (001) SrTiO₃ substrates by pulsed laser deposition are investigated using x-ray diffraction. Films thinner than ~ 20 unit cells are found to be fully strained with the in-plane lattice parameter equal to the one of the substrate. No signature of dislocations could be found in rocking curves analyses. An anomalous shrinking of the c-axis is measured for films thinner than ~ 15 unit cells that cannot be explained with a simple elastic model. An additional electrostatic force, due to the polar nature of LaAlO₃, allows our data to be explained. We show that the evolution of the LaAlO₃ dielectric constant as a function of the LaAlO₃ thickness allows the c-axis evolution to be understood.</p>

6054	<p style="text-align: center;">CeCu₂Si₂: new insights from magneto-transport measurements</p> <p style="text-align: center;"><i>Gabriel Seyfarth, K. Sengupta, A.-S. Rüetschi, D. Jaccard, DPMC, University of Geneva</i></p> <p>We report on recent multiprobe measurements (Hall and Nernst effect, electric resistivity, thermoelectric power and ac specific heat) on a high purity CeCu₂Si₂ single crystal at ambient and under pressure. At p=0, the low T (0.2 - 4 K) Nernst signal exhibits uncommon features, i.e. (1) an overall small magnitude compared to other heavy fermions, and (2) a prominent maximum followed by a sign change below 1K, the field dependence of which does not match the H_{c2}(T). Indeed, the dominant contribution to the Nernst signal seems to be coupled to the antiferromagnetic phase, rather than the vortex motion. With increasing pressure (so far up to 2.6 GPa), we have observed a drastic: the Nernst voltage increases by about one order of magnitude compared to p=0, and there is no more sign change nor extremum. Further measurements up to 7GPa are already underway, potentially monitoring the valence instability.</p>
6055	<p style="text-align: center;">Self-organization and electronic properties of Ag/Si(111) - 7x7</p> <p style="text-align: center;"><i>Nicolas Mariotti¹, C. Didiot¹, E. F. Schwier¹, C. Monney³, Z. Vydrova¹, L. Perret-Aebi², C. Battaglia², M. Garcia-Fernandez¹, M. G. Garnier¹, P. Aebi¹</i> ¹ University of Fribourg, Chemin du Musee 3, 1700 Fribourg ² EPFL - IMT, Rue A.-L. Breguet 2, 2000 Neuchâtel ³ Paul Scherrer Institute, 5232 Villigen PSI</p> <p>Our work is situated at the junction of two fields. The first is self-organization at surfaces, which offers promising fundamental and application-oriented opportunities to guide the growth of nanostructures. The second is the study of formation of metal-semiconductor contacts at the nanometric scale. We studied the growth of silver nanoclusters on the Si(111)-7x7 surface. Due to its high potential barrier for adatom hopping, the 7x7 reconstruction is a good candidate for metal adsorbate self-organization. Below 500 K, Ag is nonreactive with the Si(111) substrate, making the formation of cluster arrays possible at room temperature. We optimized the kinetic parameters of Ag growth to increase size and structure homogeneity of nanostructures. We show this in STM images, displaying the formation of small arrays of similar clusters. A study using scanning tunneling spectroscopy was then done on these well defined Ag nanoclusters.</p>
6056	<p style="text-align: center;">Field-effect studies of rare-earth nickelate thin films</p> <p style="text-align: center;"><i>Raoul Scherwitzl, P. Zubko, C. Lichtensteiger, J.-M. Triscone, University of Geneva</i></p> <p>A fascinating family of compounds are the rare-earth perovskite nickelates RNiO₃, which display a sharp temperature-driven metal-insulator M-I transition with resistance changes of up to four orders of magnitude [1]. We present field-effect studies on two members of this family, LaNiO₃ and NdNiO₃. Bulk LaNiO₃ is metallic at all temperatures. However it has been shown that, as the thickness is reduced below 8 unit cells (u.c.), a M-I transition appears at a characteristic temperature which was found to be tunable by up to 24 K using an electric field [2]. NdNiO₃ already displays an intrinsic M-I transition and its behaviour in ultrathin films under applied electric field will also be discussed.</p> <p>[1] M. Medarde, J. Phys: Condens. Matter 9, 1679 (1997) [2] R. Scherwitzl et al., Applied Physics Letters 95, 222114 (2009)</p>

6057	<p>High Curie temperature in epitaxial $\text{Pb}(\text{Zr}_{20}\text{Ti}_{80}\text{O}_3)$ thin films grown on silicon</p> <p><i>Alessia Sambri¹, S. Gariglio¹, J.-M. Triscone¹, F. Guy², J. Reiner³, C. H. Ahn³</i> ¹ DPMC, University of Geneva, ² TIN, HEPIA, Geneva ³ Department of Applied Physics, Yale University</p> <p>Epitaxial growth of perovskite thin films on silicon is a challenging process which requires the control of the silicon/oxide interface at the atomic level. Although complex, the epitaxial approach offers the possibility of tuning, and eventually improving, the properties of the deposited materials, through, for instance, strain engineering. For ferroelectrics, it has been demonstrated theoretically and experimentally that the strain induced by the in-plane lattice mismatch between film and substrate can lead to a modification of the paraelectric-ferroelectric phase transition temperature [1, 2, 3, 4]. In $\text{Pb}(\text{Zr}_{20}\text{Ti}_{80}\text{O}_3)$, an increase of the transition temperature from 460° C (bulk) to about 680° C for films grown on Nb:SrTiO₃ has been observed [5]. In this study, we use x-ray diffraction to determine the structural properties and Curie temperature of epitaxial $\text{Pb}(\text{Zr}_{20}\text{Ti}_{80}\text{O}_3)$ thin films grown on metallic SrRuO₃ layer on SrTiO₃-buffered silicon wafers. A significant increase of the transition temperature, as compared to the bulk, is observed.</p> <p>[1] N. A. Pertsev et al., Phys. Rev. Lett. 80, 1988 (1998) [2] N. A. Pertsev et al., Phys. Rev. B 67, 054107 (2003) [3] Warusawithana et al., Science 324, 5925 (2009) [4] Choi et al., Science 306, 5698, (2004) [5] S. Gariglio et al., Appl. Phys. Lett. 90, 202905 (2007).</p>
6058	<p>Static roughness of a one-dimensional interface at finite temperature</p> <p><i>Elisabeth Agoritsas, T. Giamarchi, DPMC-University of Geneva - MaNEP</i></p> <p>We compute analytically the static roughness of an elastic line in a 2D random-bond potential. This disordered elastic system could describe e.g. ferromagnetic domain walls in thin films, subjected to a quenched uncorrelated disorder. Defined as the mean variance of relative displacements of an interface at a given lengthscale r, the roughness $B(r)$ is expected to behave in a power-law $B(r) \sim r^{2\zeta}$. It is here computed in a variational approach, with a full replica-symmetry-breaking Ansatz, which accounts for metastability in the system. This variational approach gives direct - though approximate - expressions for the roughness and its crossover lengthscales.</p> <p>We find in particular that the two expected thermal and random-manifold regimes for ζ, respectively at small and large lengthscales, smoothly connect at small temperatures via an intermediate regime ending at a temperature-independent lengthscale r_0 (the Larkin length), and which disappears at higher temperatures with $r_0 \sim T^5$.</p>
6059	<p>Novel Method to Probe Ion Diffusion in Battery-materials by μ^+SR</p> <p><i>Martin Månsson¹, Kazuhiko Mukai², Yutaka Ikedo², Hiroshi Nozaki², Isao Watanabe³, Jun Sugiyama²</i> ¹ LNS/PSI Villigen & LSNS/EPF Lausanne ² Toyota Central Research and Development Labs., Japan ³ Muon Science Laboratory, RIKEN, Japan</p> <p>One of the main obstacles for the maturity of electric cars is the development of a high-capacity, cheap and safe rechargeable battery. One of the most important and fundamental properties of Li-ion batteries is the diffusion coefficient for the lithium ions. In spite of a long research history for battery materials, e.g. Li_xCoO_2, this intrinsic physical property has been out of reach for experimental probes due to interference from the magnetic atoms in these compounds. We have recently presented a novel method [J. Sugiyama et. al, PRL 103, 147601 (2009)] using the muon-spin relaxation (μ^+SR) technique, which makes it possible to</p>

	<p>determine the diffusion coefficient in these materials with very high reliability, giving results that are well in line with theoretical predictions. Consequently, μ^+SR could prove to be a crucial tool for the evolution of Li-ion batteries, and in particular for the future fabrication of all-solid-state batteries.</p>
<p>6060</p>	<p>Spin Density Wave Order in the Quasi-1D Metallic Antiferromagnet NaV_2O_4</p> <p><i>Martin Månsson</i>^{1,2}, <i>Hiroshi Nozaki</i>³, <i>Jun Sugiyama</i>³, <i>Yutaka Ikedo</i>³, <i>Masashi Harada</i>³, <i>Vladimir Pomjakushin</i>², <i>Vadim Sikolenko</i>², <i>Antonio Cervellino</i>⁴, <i>Tatsuo Goko</i>⁵, <i>Jess H. Brewer</i>⁵, <i>Yasmine Sassa</i>², <i>Nikola Egetenmeyer</i>², <i>Oscar Tjernberg</i>⁶, <i>Hiroya Sakurai</i>⁷, <i>Bertrand Roessli</i>²</p> <p>¹ LSNS, EPF Lausanne, ² LNS, ETHZ and PSI Villigen ³ Toyota Central Research and Development Labs., Japan, ⁴ SLS, PSI Villigen ⁵ TRIUMF, UBC Vancouver, Canada ⁶ Materials Physics, Royal Institute of Technology, KTH, Sweden ⁷ National Institute for Materials Science, Japan</p> <p>NaV_2O_4 is a rare quasi-one-dimensional (Q1D) compound where a coexistence of antiferromagnetic (AF) order below $T_N = 140$ K and metallic conductivity down to 40 mK is found. From our positive muon-spin spectroscopy (μ^+SR) investigation [J. Sugiyama et al. PRB 78, 224406 (2008)] we find a clear static AF order below $T_N = 140$ K. Further, neutron diffraction experiments using a powder sample down to 20 K display a series of magnetic Bragg peaks below $T_N = 140$ K. Analysis demonstrates the formation of an incommensurate spin density wave order (IC-SDW) [H. Nozaki et al., accepted manuscript (2010)] with $\mathbf{k} = (0, 0.191, 0)$ and the ordered moment estimated as $(0, 0, 0.77\mu_B)$ at 20 K. Finally very recent angle-resolved photoelectron spectroscopy (ARPES) data from single crystal samples will be presented [M. Månsson et al., manuscript (2010)].</p>
<p>6061</p>	<p>Soft X-ray ARPES Investigation of High-temperature Superconductors</p> <p><i>Martin Månsson</i>^{1,2}, <i>T. Claesson</i>³, <i>A. Önsten</i>³, <i>M. Shi</i>⁴, <i>Y. Sassa</i>², <i>S. Pailhès</i>⁵, <i>J. Chang</i>⁶, <i>L. Patthey</i>⁴, <i>J. Mesot</i>^{1,2}, <i>T. Muro</i>⁷, <i>T. Nakamura</i>⁷, <i>N. Momono</i>⁸, <i>M. Oda</i>⁸, <i>M. Ido</i>⁸, <i>O. Tjernberg</i>³</p> <p>¹ LSNS, EPF Lausanne, ² LNS, ETHZ & PSI Villigen ³ Materials Physics, Royal Institute of Technology, Sweden, ⁴ SLS, PSI Villigen ⁵ CEA, CNRS, CE Saclay, Laboratoire Léon Brillouin, France ⁶ University of Sherbrooke, Canada ⁷ Japan Synchrotron Radiation Research Institute, SPring-8, Japan ⁸ Department of Physics, Hokkaido University, Japan</p> <p>Performing angle-resolved photoelectron spectroscopy (ARPES) in the soft x-ray (SX) region has many advantages compared to lower photon-energies ($h\nu$). For instance, SX-ARPES is more bulk sensitive, it has a better perpendicular k-resolution and the photoemitted electrons can be assumed to have a free-electron final-state [M. Månsson, et al. PRL 101, 226404 (2008)]. Consequently, SX-ARPES is the ideal tool to investigate 3D electronic structures in a straightforward manner [A. Önsten, M. Månsson, et al. PRB, 76, 115127 (2007)]. Here we present ARPES data from the cuprate superconductor $\text{La}_{1.48}\text{Nd}_{0.4}\text{Sr}_{0.12}\text{CuO}_4$ [T. Claesson, M. Månsson et al. PRB 80, 094503 (2009)] acquired at both $h\nu = 55$ and 500 eV. The two Fermi surfaces show significant differences, which is attributed to either the change in probing depth suggesting dissimilarity of the intrinsic electronic structure between surface and bulk regions, or a considerable c-axis dispersion signaling an interlayer coupling.</p>

6062	<p style="text-align: center;">Dispersion of two-spinon and collective orbital excitations in Sr_2CuO_3 investigated by Resonant Inelastic Soft X-Ray Scattering</p> <p style="text-align: center;"><i>Thorsten Schmitt¹, J. Schlappa¹, K. J. Zhou¹, H. M. Rønnow², V. N. Strocov¹, S. Singh³, J.-S. Caux⁴, J. van den Brink⁵, J. Mesot⁶, L. Patthey¹</i></p> <p style="text-align: center;">¹ SLS, Paul Scherrer Institut, ² EPFL, ³ Univ. Paris Sud, ⁴ Univ. Amsterdam, ⁵ IFW Dresden, ⁶ EPFL, ETH-Z and PSI</p> <p>Understanding complex quantum systems showing phenomena from strong electron-electron correlations and quantum fluctuations is of pivotal importance in condensed matter physics. Resonant Inelastic X-ray Scattering (RIXS), an experimental technique of the ADDRESS beamline of the Swiss Light Source, is a powerful probe of excitations from the electronic ground state. We present high-resolution RIXS measurements of magnetic and electronic excitations in the quasi one-dimensional corner-sharing single-chain compound Sr_2CuO_3 possessing nearly ideal properties of the one-dimensional antiferromagnetic Heisenberg spin-1/2 model. Momentum transfer dispersion of the Cu L_3-RIXS signal along the chains probes the dynamical spin structure factor of the two-spinon continuum complementary to Inelastic Neutron Scattering. Two kinds of collective modes occur within the orbital excitation energy range, one with the same periodicity as the two-spinon spectrum and one of opposite periodicity. These results are discussed in the context of spin-charge separation, a prominent characteristic of one-dimensional spin-1/2 Heisenberg chains.</p>
6063	<p style="text-align: center;">Microscopic Study of the Superconducting State of the Iron Pnictide RbFe_2As_2</p> <p style="text-align: center;"><i>Zurab Shermadini^{1,2}, J. Kanter³, C. Baines¹, Z. Bukowski³, R. Khasanov¹, H.-H. Klaus², H. Luetkens¹, H. Maeter², G. Pascua¹, B. Batlogg³, A. Amato¹</i></p> <p style="text-align: center;">¹ Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI ² Institute for Solid State Physics, TU Dresden, DE-01069 Dresden ³ Laboratory for Solid State Physics, ETH Zürich, CH-8093 Zürich</p> <p>The parent (undoped) iron-arsenide compounds, AFe_2As_2 ($\text{A}=\text{Ba}, \text{Sr}, \text{Ca}$), were found to exhibit a coupled, structural/antiferromagnetic phase transition, all with the transition temperatures above 100 K. Surprisingly, the bulk superconductivity with relatively low transition temperatures T_c's was reported recently for the undoped compounds with $\text{A}=\text{K}, \text{Cs}$ and Rb. In this work we report on the studies of the temperature and the magnetic field dependence of the magnetic penetration depth λ of RbFe_2As_2 ($T_c = 2.52$ K) by means of muon-spin rotation. The zero-temperature values of λ and the upper critical field B_{c2} are $\lambda(0) = 270(5)$ nm and $B_{c2}(0) = 2.7(2)$ T. The temperature dependence of λ^{-2} is discussed within the framework of the two-gap ($s + s$ wave) and the pair breaking scenario.</p>
6064	<p style="text-align: center;">Non-Fermi-Liquid-like Charge Transport of Overdoped Cuprates</p> <p style="text-align: center;"><i>Jonathan Buhmann, Matthias Ossadnik, T. M. Rice, Manfred Sigrist</i> <i>Institute for Theoretical Physics, ETH Zürich</i></p> <p>We investigate the breakdown of the Landau Fermi liquid picture of the normal state of heavily overdoped high-temperature superconducting cuprates. We analyze the effect of strongly anisotropic quasiparticle scattering on charge transport properties within a semiclassical approach based on the Boltzmann equation beyond single relaxation time approximation. This study is motivated by the correlation between charge transport and superconductivity for $\text{Tl}_2\text{Ba}_2\text{CuO}_{6+x}$ reported by Abdel-Jawad et al. [1] and the non-perturbative linear temperature dependence of the anisotropic part of the quasiparticle scattering amplitudes found within a functional renormalization group study [2].</p> <p>[1] M. Abdel-Jawad et al.; Nature Physics 2, 821 (2006) [2] M. Ossadnik et al.; Phys. Rev. Lett. 101 256405, (2008)</p>

<p>6065</p>	<p>Superfluid Density and Energy Gap-Function of Superconducting PrPt₄Ge₁₂</p> <p><i>Alexander Maisuradze¹, M. Nicklas², R. Gumeniuk², C. Baines¹, W. Schnelle², H. Rosner², A. Leithe-Jasper², Yu. Grin², R. Khasanov¹</i></p> <p>¹ Paul Scherrer Institut, CH-5232 Villigen PSI ² Max-Planck-Inst. für Chemische Physik fester Stoffe, Nöthnitzer Str. 40, DE-01187 Dresden</p> <p>The filled skutterudite superconductor PrOs₄Sb₁₂ attracted much attention, since it exhibits heavy fermion superconductivity below 1.85 K with a complex phase diagram [1,2]. Despite of numerous studies the symmetry of the superconducting order parameter and even the existence of nodes in the gap function is still discussed controversial [2]. Recently, a new Pr-containing skutterudite superconductor, PrPt₄Ge₁₂ was discovered [3], which is isostructural to PrOs₄Sb₁₂. PrPt₄Ge₁₂ was studied in muon-spin rotation (μSR), specific heat, and electrical resistivity experiments. The continuous increase of the superfluid density with decreasing temperature and the dependence of the magnetic penetration depth λ on the magnetic field obtained by means of μSR, as well as the observation of a T³ dependence of the electronic specific heat indicate to the presence of point-like nodes in the superconducting energy gap. The gap and the specific heat are found to be well described by two models with point nodes, similar to results obtained for the unconventional heavy fermion skutterudite superconductor PrOs₄Sb₁₂.</p> <p>[1] E. D. Bauer et al., Phys. Rev. B 65, 100506 (2002). [2] M. B. Maple et al., J. Supercond. Novel Magn. 19, 299 (2006). [3] R. Gumeniuk et al., Phys. Rev. Lett. 100, 017002 (2008).</p>
<p>6066</p>	<p>Magneto-transport properties of LaAlO₃ /SrTiO₃ interfaces</p> <p><i>Alexandre Fête¹, A. Caviglia¹, C. Cancellieri¹, N. Reyren¹, S. Gariglio¹, M. Gabay², J.-M. Triscone¹</i></p> <p>¹ DPMC, Université de Genève, 24 quai E.-Ansermet, CH-1211 Genève 4 ² LPS, Bat 510, Université Paris-Sud 11, Centre d'Orsay, FR-91405 Orsay Cedex</p> <p>The quasi-two-dimensional electron gas found at the LaAlO₃ / SrTiO₃ interface offers exciting new functionalities, such as electric field tunable superconductivity [1]. By means of transport experiments in field effect devices, we explore the evolution of the magneto-conductance across the phase diagram for different magnetic field geometries. For doping values close to the metal-superconductor transition, we have shown that a strong Rashba spin orbit coupling develops as the doping level increases [2]. In recent experiments, we have measured the magneto-resistance applying the magnetic field out of plane, in plane and varying its direction with respect to the current. These measurements allow the different contributions (orbital, electron-electron interaction, Zeeman) to the magneto-conductance to be revealed. A strong sensitivity of the electron gas properties to the strength and orientation of the magnetic field, temperature and doping is observed.</p> <p>[1] Caviglia et al., Nature 456, 624-627 (2008) [2] Caviglia et al., Cond-mat (0912.3731v1)</p>

6067	<p style="text-align: center;">Interaction between the magnetic and superconducting order parameters in a $\text{La}_{1.94}\text{Sr}_{0.06}\text{CuO}_4$ wire</p> <p style="text-align: center;"><i>Elvezio Morenzoni², Meni Shay¹, Amit Keren¹, Gad Koren¹, Amit Kanigel¹, Oren Shafir¹, Lital Marcipar¹, Moshe Dubman², Gerard Nieuwenhuys², Andreas Suter², Thomas Prokscha², Daniel Podolsky³</i></p> <p style="text-align: center;">¹ <i>Department of Physics, Technion-Israel Institute of Technology, Haifa 32000, Israel</i> ² <i>Laboratory for Muon Spin Spectroscopy, Paul Scherrer Institute, CH 5232 Villigen PSI</i> ³ <i>Department of Physics, University of Toronto, Toronto, Ontario, Canada M5S 1A7</i></p> <p>We investigate the coupling between the magnetic and superconducting order parameters in an 8-m-long meander line wire made of a $\text{La}_{1.94}\text{Sr}_{0.06}\text{CuO}_4$ film with a cross section of $0.5\text{-}100\ \mu\text{m}^2$. The magnetic order parameter is determined using the low-energy muon spin relaxation technique. The superconducting order parameter is characterized by transport measurements and modified by high current density. We find that when the superconducting order parameter is suppressed by the current, the magnetic transition temperature, T_m, increases. The extracted sign and magnitude of the Ginzburg-Landau coupling constant indicate that the two orders are repulsive, and that our system is located close to the border between first- and second-order phase transition.</p>
6068	<p style="text-align: center;">Magnetolectric multipoles in GaFeO_3</p> <p style="text-align: center;"><i>Cynthia Piamonteze¹, Y. Bodenthin¹, M. Garcia-Fernandez¹, S. Lovesey^{2,3}, U. Staub¹</i></p> <p style="text-align: center;">¹ <i>Swiss Light Source, Paul Scherrer Institut, CH-5232 Villigen PSI</i> ² <i>ISIS Facility, Harwell I Science and Innovation Campus, UK-Oxfordshire OX11 0QX</i> ³ <i>Diamond Light Source Ltd., UK-Oxfordshire OX11 0DE</i></p> <p>GaFeO_3 is a multiferroic system, which is ferroelectric above room temperature and orders ferrimagnetically below $T_c = 200\text{K}$. The magnetic moment is along c, which is perpendicular to the electric polarization along b. Essential to understanding the coupling between magnetic and electric polarization in multiferroics is the magnetolectric order parameter, a toroidal or anapole atomic multipole. Several experimental and theoretical works have been published in the interpretation and measurement of the anapole moment, many of those in GaFeO_3. In particular, soft x-ray Bragg diffraction experiment at the Fe $L_{3,2}$ edges, have provided solid evidence for the magnetolectric quadrupole in multiferroic GaFeO_3 [1]. In this work we will present x-ray absorption dichroic signals at the Fe $L_{3,2}$ edges of GaFeO_3 which are proportional to magnetic, polar and magnetolectric multipoles, including the anapole moment.</p> <p>[1] U. Staub et al., Phys. Rev. B 80, 140410 (R) (2009)</p>
6069	<p style="text-align: center;">Influence of the domain walls on the Josephson effect in Sr_2RuO_4</p> <p style="text-align: center;"><i>Adrien Bouhon, Manfred Sigrist, Institute for Theoretical Physics, ETH Zürich, 8093 Zürich</i></p> <p>A detailed theoretical interpretation of the Josephson interference experiment between Sr_2RuO_4 and Pb reported by Kidwingira et al is given [F. Kidwingira, J. D. Strand, D. J. Van Harlingen and Y. Maeno, Science 314 (2006), 1267]. Assuming chiral p-wave pairing symmetry a Ginzburg-Landau theory is derived in order to investigate the structure of domain walls between chiral domains. It turns out that anisotropy effects of the Fermi surface and the orientation of the domain walls are essential for their internal structure. Introducing a simple model for a Josephson junction the effect of domain walls intersecting the interface between Sr_2RuO_4 and Pb is discussed. It is shown that characteristic deviations of the Fraunhofer interference pattern for the critical Josephson current as a function of the magnetic field occurs in qualitative agreement with the experimental finding. Moreover the model is able also to account for peculiar hysteresis effects observed in the experiment.</p>

6070	<p style="text-align: center;">High performance thermoelectric materials</p> <p style="text-align: center;"><i>Sascha Populoh ¹, A. Shkabko ¹, M. H. Aguirre ¹, P. Tomes ¹, A. Weidenkaff ¹, T. Jäger ², C. Mix ², G. Jakob ², C. Felser ²</i></p> <p style="text-align: center;">¹ <i>EMPA, Solid State Chemistry and Catalysis, Überlandstrasse 129, 8600 Dübendorf</i> ² <i>University of Mainz, Staudinger Weg 7, 55128 Mainz</i></p> <p>Thermoelectricity which can for example be used to convert waste heat into electricity is a promising technology to fight global warming. In order to do this effectively thermoelectric materials with a high performance are needed. Promising candidates are strongly correlated electron systems, where high Seebeck coefficients S can be found accompanied by a good electrical conductivity. Due to their electronic band structure are transition metal oxides and the half-Heusler compounds appropriate candidates. The former may undergo a metal to insulator transition, where a divergence of S is predicted. In the latter class thin films were investigated. A superlattice based on TiNiSn and $\text{Zr}_{0.5}\text{Hf}_{0.5}\text{NiSn}$ is supposed to decrease the thermal conductivity due to phonon scattering at the interfaces and thus increase the figure of merit. The generated symmetry due to the superlattice is analyzed by X-ray diffraction. Furthermore, the power factor is measured.</p>
6071	<p style="text-align: center;">On-demand electron entanglement in a normal-superconductor junction</p> <p style="text-align: center;"><i>Andrey V. Lebedev ¹, G. B. Lesovik ², G. Blatter ¹</i></p> <p style="text-align: center;">¹ <i>Institute for Theoretical Physics, ETH Zürich</i> ² <i>L. D. Landau Institute for Theoretical Physics, Moscow, Russia</i></p> <p>We analyse on-demand spin electron-hole entanglement creation scheme in a ballistic normal-superconductor junction. Applying a voltage pulse of the specific form to the NS junction one can create a singlet pair of holes excitations in the filled Fermi sea of the normal region propagating towards to the NS boundary. Due to the Andreev reflection process one of the holes can be scattered back as an electron that corresponds effectively to the emission of a Cooper pair out of the superconductor to the normal region. Electrons in this pair are entangled both in spin and energy degrees of freedom. Using proper energy filters this entangled electron-hole pair may be further splitted to the different leads leaving the spin-entangled component untouched. The remaining spin entanglement is then analysed by measuring the spin-current cross-correlators between the leads.</p>
6072	<p style="text-align: center;">Non-linear spin dynamics on the square-lattice - neutron scattering and theory</p> <p style="text-align: center;"><i>Martin Mourigal ^{1,2}, N. B. Christensen ³, G. Nilsen ¹, H. M. Rønnow ¹, M. Enderle ², P. Tregenna-Piggott ⁴, D. M. McMorrow ⁵</i></p> <p style="text-align: center;">¹ <i>LQM, EPFL</i>, ² <i>Institut Laue Langevin, France</i>, ³ <i>Risø DTU, Denmark</i>, ⁴ <i>LNS, PSI</i>, ⁵ <i>University College of London, UK</i></p> <p>The Heisenberg $S = 1/2$ square-lattice antiferromagnet describes a large variety of Mott insulating materials and has received tremendous attention in the last decades. Spin-wave theory (SWT) is a successful paradigm to describe its dynamics although quantum fluctuations may lead to a breakdown of the spin-wave picture and the emergence of new phenomena. Recently, theoretical efforts focused on the effect of an applied magnetic field, predicting spontaneous magnon decay of which experimental evidence is still missing. We will present recent inelastic neutron scattering results, in zero and finite field, on the model square-lattice compounds CFTD $[\text{Cu}(\text{DCOO})_2 \cdot 4\text{D}_2\text{O}]$ and CAPCC $[(2\text{-amino-5-chloropyridinium})\text{CuCl}_4]$ confirming the role of quantum effects already in non-frustrated materials. We will report the observation of 2- and 3-magnon continua at the zone boundary of CFTD and a study of CAPCC in the magnetic field regime proposed for magnons instability. Our results will be compared with SWT and recent QMC results.</p>

6073	<p style="text-align: center;">Functional Nanomaterials for Catalysis and Sensing Applications</p> <p style="text-align: center;"><i>Greta R. Patzke, Ying Zhou, Roman Kontic, Franziska Conrad, Min Sheng Inst. of Inorganic Chemistry, University of Zürich, Winterthurerstrasse 190, CH-8057 Zürich</i></p> <p>Nanostructured oxides are promising materials for catalysis and sensing applications so that they are a rewarding research field. Their targeted synthesis is still a challenging task which has to be addressed with numerous synthetic and analytical techniques [1]. Catalytic nanoparticles: We focus on Zn-Cu-Ga spinels that open up new ways to nanoscale Cu-catalysts in a flexible and stable oxide matrix. Bismuth vanadate nanoparticles with promising photocatalytic properties have also been hydrothermally synthesized [2]. Nanowire-based sensors: The ammonia sensitivity of W/Mo-oxide nanoparticles [1] could be improved using inorganic additives during the synthesis. Furthermore, we explored the humidity sensing properties of hydrothermally synthesized bismuth oxysulfate nanowires.</p> <p>[1] R. Kiebach, N. Pienack, W. Bensch, J.-D. Grunwaldt, A. Michailovski, A. Baiker, T. Fox, Y. Zhou, G. R. Patzke, Chem. Mater. 2008, 20, 3022. [2] Y. Zhou, K. Vuille, A. Heel, B. Probst, R. Kontic, G. R. Patzke, Appl. Catal. A 2010, 375, 140.</p>
6074	<p style="text-align: center;">Graphene - a corrugated and chiral structure</p> <p style="text-align: center;"><i>Philip Willmott¹, Domenico Martocchia¹, Matts Björck¹, Christian Schlepütz¹, Stephan Pauli¹, Thomas Brugger², Thomas Greber² ¹ Swiss Light Source, Paul Scherrer Institut, ² Physikinstitut, Universität Zürich</i></p> <p>Graphene/Ru(0001) was studied by surface x-ray diffraction. The data were fit using Fourier-series expanded displacement fields from an ideal bulk structure, plus the application of symmetry constraints. The shape of the observed superstructure rods proves a corrugated reconstruction of the substrate, induced by strong bonding of graphene to ruthenium. Both the graphene layer and the underlying substrate are corrugated, with peak-to-peak heights of $(0.82 \pm 0.15) \text{ \AA}$ and $(0.19 \pm 0.02) \text{ \AA}$ for the graphene and topmost Ru-atomic layer, respectively. The Ru-corrugation decays slowly over several monolayers into the bulk. Importantly, the system also exhibits chirality, whereby in-plane rotations of up to two degrees in those regions of the superstructure where the graphene is weakly bound are driven by elastic energy minimization. This and similar systems might be exploited to produce nanoarrays of chiral macromolecules, which may thereby provide a straightforward pathway for structural investigations of biomolecules which resist crystallization.</p>
6075	<p style="text-align: center;">Functional Nanomaterials for Catalysis and Sensing Applications</p> <p style="text-align: center;"><i>Ying Zhou, F. Conrad, R. Kontic, M. Sheng, G. R. Patzke Institute of Inorganic Chemistry, University of Zürich</i></p> <p>Nanostructured materials hold the promise of high efficiency for catalysis and sensing applications which makes them a rewarding research field.</p> <p>Zn/Cu-Spinels: We explore the excellent host facilities of this spinel material in the synthesis of nanostructured solid solutions. We focus on Zn-Cu-Ga oxide systems that display an interesting challenging coordinationstructural chemistry and open up new ways to nanoscale Cu-catalysts in a flexible and stable interesting oxide matrix.</p> <p>BiVO₄ Photocatalysis: The monoclinic modification of BiVO₄ with a band gap of 2.4 eV is one of the most promising visible-light-driven photocatalysts. The photocatalytic splitting of water into H₂ and O₂ (artificial photosynthesis) is a much sought-after goal of modern inorganic chemistry.</p> <p>Oxide-based Nanowire Sensors: To increase the sensitivity of oxide-based gas sensors we investigate the potential of nanostructured W/Mo-oxides and of novel bismuth oxysulfate nanowires. The NH₃ sensitivity of the W/Mo-oxide nanoparticles could be strongly improved using inorganic additives during the synthesis.</p>

6076	<p style="text-align: center;">Magneto-thermal Transport Study of the LaAlO₃/SrTiO₃ Interface at ambient and high Pressure</p> <p style="text-align: center;"><i>Anna-Sabina Rüetschi, G. Seyfarth, N. Reyren, C. Cancellieri, D. Jaccard DPMC, Université de Genève</i></p> <p>Electric and thermoelectric properties of the LaAlO₃/SrTiO₃ interface are presented. In a multiprobe set-up the resistivity, the Hall and Nernst effects and the thermopower are measured on the same sample at ambient and high pressure. At ambient pressure our study shows the first thermoelectric measurements of this interface at low temperatures. The thermopower at 4.2 K is about 100 $\mu\text{V}/\text{K}$, which is quite large for a simple metal with the same low carrier density. The Nernst coefficient in the superconducting state is of the order of several hundred $\mu\text{V}/\text{KT}$, which is two orders of magnitude larger than in the high temperature superconductors. The high pressure experiment revealed a strong pressure dependence of the superconducting critical temperature, which is suppressed at the lowest investigated pressure of 0.8 GPa. Efforts are underway to reproduce these results, to study them in more detail and to improve their resolution.</p>
6077	<p style="text-align: center;">Electron-phonon coupling in TiSe₂: A photoemission study</p> <p style="text-align: center;"><i>Zuzana Vydrova, C. Monney, E. F. Schwier, N. Mariotti, C. Didiot, M. G. Garnier, M. Garcia-Fernandez, H. Beck, P. Aebi Département de Physique, Université de Fribourg</i></p> <p>At the temperature of 200K, the quasi-two-dimensional system 1T-TiSe₂ undergoes a phase transition towards a charge density wave phase, which is accompanied by a periodic lattice distortion. Therefore, electron-phonon coupling should play an important role and should also be observable in angle-resolved photoemission. Here, we look for signatures in the experimental spectral function that could be connected to electron-phonon coupling. Indeed, photoemission spectra at the L-point of the Brillouin zone exhibit a surprising peak near the Fermi level at low temperatures. Modeling the electron-phonon self-energy (non-momentum-resolved) via the McMillan or Eliashberg function and using it to calculate the spectral function we are able to identify this as a signature of electron-phonon coupling. We further develop the theoretical approach to obtain momentum-resolved self energies.</p>
6078	<p style="text-align: center;">Magnetism of Ni and Co-doped ZnO Produced by Low Temperature Synthesis Process</p> <p style="text-align: center;"><i>Zlatko Mickovic¹, D. T. L. Alexander², A. Sienkiewicz¹, L. Forró¹, A. Magrez¹ ¹ Institute of Physics of Condensed Matter, EPFL ² Interdisciplinary Centre for Electronic Microscopy, EPFL</i></p> <p>It was found that the electron doping stabilizes the ferromagnetic state in Co and Ni doped ZnO, interesting for usage in spintronics. Advantageously, ZnO is natively n-doped. The origin of the high-temperature ferromagnetism is still highly contested, experimental ferromagnetic signatures often being traced down to the presence of secondary phases. Here, we show that the weak ferromagnetism of Ni doped ZnO stems from the NiO inclusions in the ZnO matrix. The ferromagnetic state exists below 100 K and exhibits a remanence of 0.05 emu/g and coercivity of 2000 Oe at 2 K. Co doped ZnO synthesized in reducing atmosphere results with metallic Co inclusions that induce high-temperature ferromagnetism with T_c in excess of 300 K. Synthesis in oxidizing atmosphere results with Co doped ZnO without precipitates of metallic Co and the absence of ferromagnetic signatures. The latter Co:ZnO was shown to exhibit Curie-Weiss behaviour with Curie-Weiss temperature of -60 K.</p>

6079	<p style="text-align: center;">Superconductivity and magnetic ordering in Co-substituted EuFe_2As_2 single crystals</p> <p style="text-align: center;"><i>Zbigniew Bukowski, P. Moll, N. D. Zhigadlo, S. Katrych, J. Karpinski, B. Batlogg Laboratory for Solid State Physics, ETH Zürich, 8093 Zürich</i></p> <p>EuFe₂As₂ is particularly interesting compound due to the presence of both spin-density waves of Fe and antiferromagnetic ordering of the localized Eu²⁺ moments. The Co-substitution for Fe suppresses the SDW ordering and induces superconductivity while antiferromagnetic ordering of Eu²⁺ moments remains unaffected. The single crystals of Co-substituted EuFe₂As₂ with a size up to few millimeters were grown using the Sn flux method. The obtained crystals were characterized using X-ray diffraction, WDX analysis, resistivity and magnetization measurements. The resistivity re-entrance and anomalous temperature dependence of the upper critical field are observed as the effect of Eu magnetic ordering on superconductivity. The compositional phase diagram is proposed.</p>
6080	<p style="text-align: center;">Nanoscale ferroelectric domain switching mechanisms in BiFeO₃</p> <p style="text-align: center;"><i>Benedikt Ziegler¹, H�el�ene B�ea^{1,2}, Manuel Bibes³, Agn�es Barth�el�emy³, Patrycja Paruch¹ ¹ DPMC University of Geneva, ² now at SPINTEC, CEA Grenoble, France ³ CNRS/Thales Palaiseau, France</i></p> <p>The coexisting ferroelectric and antiferromagnetic ordering in BiFeO₃ at room temperature has made this material one of the most studied multiferroics. Different intrinsic ferroelectric domain configurations can be observed in BiFeO₃ thin films grown under different conditions. In this work, the switching behavior of polydomain configuration films was studied with piezoresponse force microscopy. Using the local electric field applied by a scanning probe microscopy tip, the reversal of both out-of-plane and in-plane polarization components was observed, with the final domain state depending on the applied field polarity and the tip sweeping. The observed switching behavior can be correlated with the radial and vertical components of the highly inhomogeneous electric field applied by the tip, and possibly indicates a symmetry changed predicted for the material under high fields along the (001) direction.</p>
6081	<p style="text-align: center;">Pressure influence on $(\text{EDT-TTF-CONH})_6\text{Re}_6\text{Se}_8(\text{CN})_6$, a Metallic Kagom�-Type Organic-Inorganic Hybrid Compound</p> <p style="text-align: center;"><i>Jacim Jacimovic¹, C. V�aju¹, P. Batail², L. Forr�o¹ ¹ EPFL, School of Basic Sciences, Station 3, CH-1015 Lausanne ² UMR 6200, CNRS-Universit� dAngers</i></p> <p>In $(\text{EDT-TTF-CONH})_6\text{Re}_6\text{Se}_8(\text{CN})_6$ dimers of the organic molecule form a Kagom� topology, unique for an organic material. Metallic state of the material at ambient temperature and pressure has been hypothesized, however there has been no direct observation of this state. Here, we show the manifestation of metallic state in resistivity at ambient pressure between 180 K and 300 K, with a strong two-dimensional character, in coherence with the Kagom� lattice symmetry. Upon lowering the temperature, a transition from the metallic regime to an insulating state at 180 K is followed by a structural instability at the same temperature, leading to a localized, electrically insulating ground state. The interplay between the metal-like and the insulating state is examined through pressure study extending up to pressures of 1 GPa. We have found that pressure pushes the MI transition rapidly to ambient temperature. By thermopower measurements we show that hole-like charge carriers dominate the conduction.</p>

6082	<p style="text-align: center;">Absence of magnetic phase separation in MnSi under pressure</p> <p style="text-align: center;"><i>Alex Amato ¹, D. Andreica ¹, P. Dalmas de Rotier ², A. Yaouanc ², G. Lapertot ²</i> ¹ Lab. for Muon-Spin Spectroscopy, Paul Scherrer Institute, CH-5232 Villigen PSI ² CEA/DSM/Institut Nanosciences et Cryogénie, FR-38054 Grenoble</p> <p>We report muon spin spectroscopy data (μSR) obtained under hydrostatic pressure on a large single crystal of the itinerant helimagnet MnSi [see also Ref. 1]. The measurements were performed down to 0.235 K and up to 15.1 kbar. Up to the critical pressure $p_c = 14.9(2)$ kbar, where the magnetic order is suppressed, the μSR data unambiguously demonstrate that the ground state of the system is magnetic with no indication of any phase separation. These data contradict the previous observations reported by Uemura et al. [2]. It may be that the sample and pressure quality plays a role in the appearance of magnetic phase separation.</p> <p>[1] D. Andreica et al., Phys. Rev. B 81, 060412R (2010). [2] Y. J. Uemura et al., Nat. Phys. 3, 29 (2007).</p>
6083	<p style="text-align: center;">Proximity induced interfacial magnetism at nanometer scale in complex oxide superlattices</p> <p style="text-align: center;"><i>Dillip K. Satapathy ¹, J. Stahn ², I. Marozau ¹, V. K. Malik ¹, M. Rössle ¹, Ch. Niedermayer ², C. Bernhard ¹</i> ¹ Dep. of Physics and Fribourg Center for Nano Materials, Univ. of Fribourg, 1700 Fribourg ² Lab. for Neutron Scattering, ETH Zürich and Paul Scherrer Institut, 5232 Villigen PSI</p> <p>We report the proximity induced evolution of magnetic induction depth profiles in superlattices (SLs) consisting of the superconductor (SC) $\text{YBa}_2\text{Cu}_3\text{O}_7$ (YBCO), and the ferromagnet (FM) $\text{La}_{0.66}\text{Ca}_{0.33}\text{MnO}_3$ (LCMO), grown on NdGaO_3 (NGO) and $\text{La}_{0.3}\text{Sr}_{0.7}\text{Al}_{0.5}\text{Ta}_{0.35}\text{O}_3$ (LSAT) substrates. The depth-resolved magnetization profiles in these SLs are measured by using polarized neutron reflectometry (PNR). We observe changes in the spin-polarized neutron reflectivity profiles which indicate that the profile of the magnetization density in the SC-FM SLs undergo some sudden and drastic changes at a temperature below the SC transition temperature and under high-applied magnetic field at the sample. In addition to a sudden and significant broadening of the total reflection edge, we observe the occurrence of magnetic Yoneda wings. The origin of this broadening as well as the temperature and applied magnetic field dependence of the magnetic induction depth profile in these SLs will be presented in detail.</p>
6084	<p style="text-align: center;">Phenomenology of the saddle point regime of the two-dimensional Hubbard model</p> <p style="text-align: center;"><i>Matthias Ossadnik, T. M. Rice, M. Sigrist, ITP, ETH Zürich</i></p> <p>We present a phenomenological approach to the saddle-point regime found in renormalization group flows for the two-dimensional Hubbard model. We try to resolve difficulties arising from the presence of multiple divergences by exploiting the known insulating spin-liquid phenomenology of two-leg ladders.</p>

6085	<p style="text-align: center;">Revealing the Ortho II Band Folding in $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ Films</p> <p style="text-align: center;"><i>Yasmine Sassa¹, Milan Radovic^{2,3}, Martin Månsson^{1,2}, Xiaoyu Cui³, Stéphane Pailhès⁴, Elia Razzoli^{2,3}, Sebastian Guerrero⁵, Ming Shi³, Philip R. Willmott³, Fabio Miletto Granozio⁶, Joël Mesot^{1,2}, Luc Patthey³</i></p> <p style="text-align: center;">¹ LNS, PSI Villigen, ² LSNS, EPF Lausanne, ³ SLS, PSI Villigen ⁴ CEA, CNRS, CE Saclay, LLB, France, ⁵ Condensed Matter Theory Group, PSI Villigen ⁶ CNR-INFN Coherentia, Napoli, Italy</p> <p>One of the remaining unsolved puzzles in high-temperature superconductivity is the origin of the so-called pseudogap state. Recent quantum oscillations measurements on underdoped $\text{YBa}_2\text{Cu}_3\text{O}_{7-\delta}$ (Y123) under high magnetic fields indicate the existence of small Fermi surface pockets. So far, angle-resolved photoelectron spectroscopy (ARPES) data obtained from cleaved single crystals of Y123 seem to be inconsistent with the quantum oscillation experiments. Here, we present an ARPES study on Y123 films in situ grown by pulsed laser deposition (PLD). Through a careful control of the growth, we successfully produced underdoped surfaces with ordered oxygen vacancies within the CuO chains. The resulting Fermi surface displays a clear Ortho II band folding, emphasizing how order within the CuO chains strongly affects the electronic properties of the superconducting CuO_2 planes. Until now, the Ortho II band folding was not detected and consequently thought to be negligible in theoretical models.</p>
6086	<p style="text-align: center;">Growth and characterisation of high-T_c superconductor and colossal magnetoresistance superlattices</p> <p style="text-align: center;"><i>Vivek K. Malik¹, I. Marozau¹, B. Doggett¹, S. Das¹, D. K. Satapathy¹, M. Rössle¹, C. Marcelot², J. Stahn², C. Bernhard¹</i></p> <p style="text-align: center;">¹ Dep. of Physics & Fribourg Center for Nanomaterials, University of Fribourg, Chemin du Musée 3, CH-1700 Fribourg ² Lab. for Neutron Scattering, ETH Zürich & Paul Scherrer Institut, CH-5232 Villigen PSI</p> <p>High-T_c superconductor ($\text{YBa}_2\text{Cu}_3\text{O}_7$) and colossal magnetoresistance ($\text{La}_{0.67}\text{Ca}_{0.33}\text{MnO}_3$) superlattices have been grown on NdGaO_3 substrates using pulsed laser deposition. NdGaO_3 has better lattice mismatch to $\text{YBa}_2\text{Cu}_3\text{O}_7$ and $\text{La}_{0.67}\text{Ca}_{0.33}\text{MnO}_3$ and is stable from structural point of view below 100 K compared to SrTiO_3, $\text{YBa}_2\text{Cu}_3\text{O}_7$ and $\text{La}_{0.67}\text{Ca}_{0.33}\text{MnO}_3$ both are strongly correlated materials. We have grown these multilayers to study antagonistic phenomenon of superconductivity and magnetism in these complex oxide systems. Sharp interface quality has been maintained during growth using in-situ RHEED. Structural quality of interfaces and individual layers have been probed using x-ray/neutron reflectivity and x-ray diffraction. Significant effect on electrical properties has been observed after external annealing in O_2 environment.</p>
6087	<p style="text-align: center;">A ^{29}Si NMR study of the quasi 1-D $S = 1/2$ spin-chain compound $\text{BaCu}_2\text{Si}_2\text{O}_7$</p> <p style="text-align: center;"><i>Toni Shiroka^{1,2}, F. Casola^{1,2}, A. Zheludev³, J. Mesot², H.-R. Ott¹</i></p> <p style="text-align: center;">¹ Laboratorium für Festkörperphysik, ETH Zürich, ² Paul Scherrer Institut, Villigen PSI ³ Laboratory for Neutron Scattering, ETH Zürich and Paul Scherrer Institut, Villigen PSI</p> <p>The magnetic features of $\text{BaCu}_2\text{Si}_2\text{O}_7$, which orders magnetically at $T_N = 9.2$ K, have been investigated in the past via magnetic susceptibility and neutron scattering studies. Here we report on a ^{29}Si NMR investigation of this compound, whose resonance signals and spin-lattice relaxation times $T_1(T)$ were recorded at 7.07 T, at temperatures between 5 and 300 K. The transition at T_N is well reflected in a sudden and dramatic increase in the width of the resonance signal and a distinct peak in $T_1^{-1}(T)$, growing out of a temperature independent background and decreasing by an order of magnitude at 5 K. Between 14 and 150 K, $T_1^{-1}(T)$ follows surprisingly well an unexpected $a + bT^2$ behaviour. Above 150 K, the relaxation rate</p>

	<p>tends to saturate at a constant value. The NMR line shape reflects the usual magnetization of a spin chain, with a decrease of the shift with increasing temperature (for $T > T_N$). Above 150 K the resonance maximum is observed at a practically constant frequency. For the interpretation of the experimental data we perform model calculations employing Quantum Monte Carlo techniques.</p>
6088	<p>Reversible switching of magnetic transitions in Na_xCoO_2 ($x \approx 0.83$) by altering the Coulomb potential background</p> <p><i>Jakob Kanter¹, Ch. Niedermayer², D. Sheptyakov², K. Mattenberger¹, B. Batlogg¹</i> ¹ <i>Laboratory for Solid State Physics, ETH Zürich, CH-8093 Zürich</i> ² <i>Laboratory for Neutron Scattering, Paul Scherrer Institut, CH-5232 Villigen PSI</i></p> <p>In sodium cobaltate the electrons in the CoO_2 layers are subject to a complex Coulomb potential landscape produced by the adjacent sodium ions which, due to their partial mobility, form various ordering patterns. In recent studies we could reversibly switch between distinct magnetic transitions with a T_c of 8 K and 16 K. This was accomplished by preparing different sodium configurations connected to a sodium reordering transition around 280 K. The distinct magnetic phases are investigated by means of muon spin rotation, resistivity, specific heat and magnetization measurements with a focus on the magnetic moment orientation and the dependence of the transition temperatures on the magnetic field strength and orientation. Resistivity measurements under high pressure allow for comparison of the shifts in the transition temperature to the relative change in lattice parameters along the different crystal directions.</p>
6089	<p>NMR Search for orbital-current Effects in under-doped YBCO</p> <p><i>Björn Graneli¹, S. Strässle¹, J. Roos¹, M. Mali¹, H. Keller¹, J. Karpinski²</i> ¹ <i>Physik-Institut der Universität Zürich,</i> ² <i>Laboratory for Solid State Physics, ETHZ</i></p> <p>Exotic electronic properties of cuprates are currently approached using the broken symmetry concept. Prominent models suggest the existence of d-density wave order and circulating currents in the pseudogap phase. The occurrence of OC in the CuO_2 planes would generate weak additional local magnetic fields, static and fluctuating, which possibly may be detected using Nuclear Magnetic Resonance (NMR). We present a ^{89}Y NMR study on oriented powder samples, focusing on the search for OC signatures [1]. The temperature dependence of the ^{89}Y line-width, and the spin-lattice relaxation rate were investigated in the pseudogap phase. We found no evidence for OC, but assessing our measurement uncertainties, we provide upper limits for a static OC field (< 0.15 mT) and a fluctuating OC field amplitude (< 0.7 mT), values which impose significant constraints on OC models.</p> <p>[1] S. Strässle, J. Roos, M. Mali, and H. Keller, Phys. Rev. Lett. 101, 237001 (2008).</p>
6090	<p>Solar Thermoelectric Cavity Converter</p> <p><i>Petr Tomes¹, C. Suter², M. Trottmann¹, D. Alfarug¹, L. Karvonen¹, O. Brunko¹, M. H. Aguirre¹, A. Shkabko¹, S. Populoh¹, A. Steinfeld^{2,3}, A. Weidenkaff¹</i> ¹ <i>Solid State Chemistry, EMPA, 8600 Dübendorf</i> ² <i>Department of Mechanical and Process Engineering, ETH Zürich, 8092 Zürich</i> ³ <i>Solar Technology Laboratory, Paul Scherrer Institute, 5232 Villigen PSI</i></p> <p>Four leg thermoelectric oxide modules consisting of two p-type ($\text{La}_{1.98}\text{Sr}_{0.02}\text{CuO}_4$) and two n-type ($\text{CaMn}_{0.98}\text{Nb}_{0.02}\text{O}_3$) thermoelectric legs were produced. The legs are connected electrically in series and sandwiched thermally between two Al_2O_3 plates, which serve as absorber and cooler. A solar cavity-receiver packed with an array of thermoelectric oxide modules is designed, fabricated and tested to convert concentrated solar radiation. The cavity design serves to capture efficiently concentrated solar radiation and to reduce re-</p>

	<p>radiation losses from top of the absorber plates. The thermoelectric oxide modules are tested at ETHs high-flux solar simulator. For different concentrated solar radiation inputs, the temperature distribution in the cavity, open-circuit voltage and power output for different external loads are measured. Further the experimental data will be used to validate a heat transfer model, which will be used to optimize geometrical parameters (e.g., dimensions of cavity, length/width of thermoelectric legs) for the maximal solar-to-electricity energy conversion efficiency.</p>
6091	<p style="text-align: center;">A Photon Josephson Junction (PJJ) using circuit QED</p> <p style="text-align: center;"><i>Sebastian Schmidt, H. Tureci, G. Blatter, ETH Zürich</i></p> <p>We propose a novel scheme to realize a Photon Josephson junction (PJJ) in a circuit QED environment by tunnel-coupling two microwave resonators, each containing a single superconducting qubit. The photon-qubit coupling introduces an anharmonicity in the spectrum of the coupled photon-qubit system, leading to the appearance of a dynamical phase transition. We theoretically investigate its critical properties and discuss how to measure it experimentally.</p>
6092	<p style="text-align: center;">Behaviour of Al/SrTiO_{3-x}Ny/Al as MEMRISTORS</p> <p style="text-align: center;"><i>Andrey Shkabko, Myriam H. Aguirre, Anke Weidenkaff EMPA, Solid State Chemistry and Catalysis, Überlandstrasse 129, 8600 Dübendorf</i></p> <p>The electroformation and resistance switching behaviour of Al/STON/Al is investigated for a possible application in memristors. The resistance of Al/STON/Al irreversibly increases when voltages higher than a certain threshold voltage are applied. A bistable resistance switching develops at one of the Al electrodes that serve as the anode, and the formation of stacking faults in STON during preparation by microwave plasma treatment is a prerequisite for the occurrence of reversible switching. Heating of the Al/STON/Al memristor is characterized during electroformation and switching of the resistances. The electrode with the higher voltage potential is heated to higher temperatures than the electrode with the lower potential, suggesting a reversible (nonstable) displacement of the anions in a low voltage region. The temperature during the switch increase up to T= 285°C at the anode interface which suggests an electrochemical redox reaction at such high temperature.</p>
6093	<p style="text-align: center;">Synthesis and thermoelectric properties of aluminum-doped zinc oxide</p> <p style="text-align: center;"><i>Myriam H. Aguirre, Nina Schaeuble, Andrey Shkabko, Anke Weidenkaff Solid State Chemistry and Catalysis, EMPA</i></p> <p>Zinc oxide is a promising thermoelectric (TE) material due to its high Seebeck coefficient and low-cost production. Pure zinc oxide exhibits low electrical conductivity (0.1 S/cm at RT, ca. 25 S/cm at 1000°C) and high thermal conductivity (ca. 50 W/mK at RT, ca. 5 W/mK at 1000°C). Doping zinc oxide with aluminium improves the thermoelectrical properties. However, the thermal conductivity is still a draw-back of either doped or undoped zinc oxide. The introduction of boundaries to increase the scattering of phonons could be highly beneficial to lower the lattice thermal conductivity. Then, nano-scaled materials were synthesised by different methods like soft chemistry and thin films by magnetron sputtering. The aim of this work is to analyse the effect of the introduction of new nanostructure on the thermoelectric properties of the material.</p>

6094	<p style="text-align: center;">Engineering Leg-Materials for All-Oxides Thermoelectric Module</p> <p style="text-align: center;"><i>Lassi Karvonen ^{1,2}, D. S. Alfarug ¹, M. Aguirre ¹, L. Bocher ¹, P. Hug ¹, P. Mandaliev ¹, S. Populoh ¹, P. Tomes ¹, A. Weidenkaff ¹</i></p> <p style="text-align: center;">¹ <i>Laboratory for Solid State Chemistry and Catalysis, EMPA, CH-8600 Dübendorf</i> ² <i>Laboratory of Inorganic Chemistry, Aalto University School of Science and Technology, FI-02015 Espoo</i></p> <p>Several oxides show potentiality as leg materials for thermoelectric energy conversion. $\text{CaMn}_{1-x}\text{Nb}_x\text{O}_{3-\delta}$, $\text{La}_{1.98}\text{Sr}_{0.02}\text{CuO}_4$ and $[\text{Ca}_2\text{CoO}_{3-\delta}]_{0.62}\text{CoO}_2$ were characterized for their oxygen contents, phases, microstructures and figures of merit (ZT). Nb^{5+} substitution for Mn^{4+} in $\text{CaMn}_{1-x}\text{Nb}_x\text{O}_{3-\delta}$ ($0.0 < x < 0.10$) dopes the system with n -type carriers. The so-far optimum trade-of between the Seebeck, resistivity and thermal conductivity is found at $x = 0.02$ with $\text{ZT}_{1060\text{K}} = 0.3$. $\text{La}_{1.98}\text{Sr}_{0.02}\text{CuO}_4$ is an easy-to-prepare p-type material. Therefore, despite its low ZT value of 0.02 ($T > 500 \text{ K}$), it is a work bench for studying the effects of synthesis conditions on the microstructure and density of the leg-material and subsequent consequences on thermoelectric properties. $[\text{Ca}_2\text{CoO}_{3-\delta}]_{0.62}\text{CoO}_2$ is a promising candidate for a p-type material. Growth of uniaxial agglomerates or even single-crystals with extended lateral dimensions is under optimization. Aim is to provide a precursor powder, possible to align by using simple low-pressure uniaxial pressing.</p>
6095	<p style="text-align: center;">Laser induced CDW melting in TiSe_2 studied by optical and x-ray time resolved spectroscopy</p> <p style="text-align: center;"><i>Ekaterina Vorobeva ¹, S. L. Johnson ¹, P. Beaud ¹, U. Staub ¹, R. A. De Souza ¹, C. J. Milne ^{1,2}, G. Ingold ¹, A. N. Titov ^{3,4}</i></p> <p style="text-align: center;">¹ <i>Swiss Light Source, Paul Scherrer Institut, 5232 Villigen PSI</i> ² <i>Laboratoire de Spectroscopie Ultrarapide, EPFL, 1015 Lausanne</i> ³ <i>Institute of Metal Physics UrDRAS, RU-620219 Ekaterinburg</i> ⁴ <i>Institute of Metallurgy UrDRAS, AmundsenSt. 101, RU-620016 Ekaterinburg</i></p> <p>1T-TiSe_2 is a layered material which undergoes a second order phase transition at temperatures below 200K with a formation of a commensurate charge density wave (CDW) phase associated with a $(2 \times 2 \times 2)$ superlattice. As a part of understanding of collective interactions happening in this material we study the dynamics of electronic and lattice subsystems with femtosecond time-resolved laser pump/x-ray probe and laser pump/probe spectroscopies. Our experimental x-ray data reveal an ultrafast laser-induced melting of a CDW state happening within the first 200 fs for laser fluences above $150 \mu\text{J}/\text{cm}^2$ at 172K. Complementary optical reflectivity measurements show the presence of an A_{1g} amplitude mode of the CDW that softens as the laser fluence increases and finally disappears. Implementation of time-resolved x-ray diffraction makes it possible to monitor directly a structural response during a photo-induced phase transition and to decouple the electron and lattice degrees of freedom.</p>
6096	<p style="text-align: center;">Spin waves in multiferroic LiCu_2O_2: far-infrared study in high magnetic fields</p> <p style="text-align: center;"><i>Dan Huvonen ¹, T. Rööm ¹, U. Nagel ¹, H. Engelkamp ², E. Kampert ², Y. J. Choi ³, C. L. Zhang ³, S. Park ³, S.-W. Cheong ³</i></p> <p style="text-align: center;">¹ <i>Natl Inst of Chem Phys and Biophys, Tallinn, Estonia</i> ² <i>HFML, Radboud University Nijmegen, Nijmegen, Netherlands</i> ³ <i>Rutgers Center for Emergent Materials Dep of Phys and Astr, Rutgers University, New Jersey 08854, USA</i></p> <p>LiCu_2O_2 is known to be the first copper-based multiferroic spin cycloidal material. LiCu_2O_2 is quasi-1D system with weak interaction between Cu^{2+} spin chains and transits to spin cycloidal state at 23K with emergence of electric polarization (P c). Polarization is flipped</p>

	<p>to a-axis direction by magnetic field above 2T in b-axis direction. Magnetic excitations in the spin spirals are gapless spin waves. However, anisotropic interactions create a finite gap at zero wave vector, $q = 0$. In magnets with a non-collinear spin ordering, such as a spin cycloid, both components of light, magnetic and electric, may induce optical transitions. The transitions have different selection rules and can be informative for determining the ground state properties. We study magnetic excitations and magneto-electric coupling by THz absorption spectroscopy between 3 to 200 cm^{-1} at temperatures from 1.6 to 30K and in magnetic fields up to 30 T.</p>
<p>6097</p>	<p align="center">Multiferroic Composites Probed with Soft X-ray Techniques</p> <p align="center"><i>Rajesh V. Chopdekar¹, A. Scholl², E. Arenholz², Y. Suzuki³, A. Fraile-Rodriguez¹, F. Nolting¹, L. J. Heyderman¹</i></p> <p align="center">¹ Paul Scherrer Institut, 5232 Villigen PSI</p> <p align="center">² Advanced Light Source, Lawrence Berkeley National Lab, Berkeley, CA 94720 USA</p> <p align="center">³ Materials Science and Engineering, University of California, Berkeley, CA, 94720 USA</p> <p>In a multiferroic material, there are simultaneously multiple order parameters such as ferromagnetism (FM) and ferroelectricity (FE). One route to obtain room-temperature multiferroic functionality is to construct a composite of strongly ferroelectric and ferromagnetic materials whose interface facilitates elastic coupling. We present a soft X-ray spectro-microscopy study of epitaxial layers of CoFe_2O_4 on BaTiO_3 substrates, which serve as model systems to understand multiferroic composite interfacial coupling. By tuning to the Fe or Ti elemental absorption edges and using circular or linear dichroism, FM and FE domains may be observed concurrently via X-ray photoemission electron microscopy. Linearly polarized x-rays show differential absorption along and perpendicular to an anisotropy axis such as the FE polarization axis in BaTiO_3, and circularly polarized x-rays yield differential absorption for ferromagnetic domains parallel versus anti-parallel to the x-ray propagation axis. Thus individual micron-scale FE and FM domains in multilayer composites can be measured simultaneously.</p>
<p>6098</p>	<p align="center">World Record High Field Magnet for Neutron Scattering</p> <p align="center"><i>Rolf Spreiter¹, D. Goldschmid¹, S. Schneider¹, U. Wagner¹, J. Hinderer¹, P. Mock¹, J. Hunziker¹, C. Beneduce¹, U. Meier¹, T. Wüthrich¹, P.-A. Bovier¹, D. Eckert¹, P. Allenspach²</i></p> <p align="center">¹ Bruker BioSpin AG, Fällanden, ² Paul Scherrer Institute, Villigen</p> <p>The world's highest field superconducting split pair magnet for neutron scattering, developed and produced by Bruker BioSpin AG, has reached its target field of 16 Tesla, more than 1 T higher than the previous highest field for such a magnet. It is the first high field split pair magnet to be equipped with active shielding technology. This novel magnet is a prerequisite for a new class of experiments using the scattering of polarized neutrons in high magnetic fields. In addition to the magnet, a new split pair cryostat with HTS current leads, VTI (Variable Temperature Insert) and power supply was developed. The VTI offers a wide temperature range from 2 K to 300 K and was designed in collaboration with the Institut Laue-Langevin (ILL) in Grenoble, France. The development program carried out at Bruker to achieve the goals of this pioneering and challenging project will be presented.</p>

6099	<p style="text-align: center;">Ultrafast Relaxation in a Low Density Electron Glass</p> <p style="text-align: center;"><i>Verner K. Thorsmølle¹, N. Peter Armitage²</i></p> <p style="text-align: center;">¹ <i>Département de Physique de la Matière Condensée, Université de Genève</i> ² <i>Department of Physics and Astronomy, The Johns Hopkins University</i></p> <p>We present a study of the photoexcited conductivity relaxation dynamics of the impurity states in the electronic glassy system, phosphorous-doped silicon, Si:P. Using optical pump-terahertz probe spectroscopy we find strongly temperature and fluence dependent non-exponential relaxation behavior occurring on a sub-ns timescale, which is in contrast to the much longer timescales in more common high density glassy systems. We investigate the role of various relaxation mechanisms including the possibility of multiple particle hopping.</p>
6100	<p>(Cancelled)</p>
6101	<p style="text-align: center;">Electron-phonon mass enhancement in graphene antidot lattices</p> <p style="text-align: center;"><i>Vladimir M. Stojanovic¹, Nenad Vukmirovic², Christoph Bruder¹</i></p> <p style="text-align: center;">¹ <i>Departement Physik, Universität Basel, Klingelbergstrasse 82, 4056 Basel</i> ² <i>Lawrence Berkeley National Laboratory, MS 50F-1650, USA-Berkeley 94720</i></p> <p>We explore the ramifications of the electron-phonon (e-ph) coupling in graphene antidot lattices, i.e., superlattices of voids (antidots) in a graphene sheet, displaying a direct band gap whose magnitude can be controlled via the antidot size and density. The relevant e-ph-coupling mechanism in these semiconducting counterparts of graphene is the modulation of electronic hopping integrals by the lattice vibrations (Peierls-type coupling). Based on accurate calculations of the band structures and the phonon spectra for a number of representative antidot lattices, we determine both the zero-momentum quasiparticle weight due to the e-ph coupling for an electron at the bottom of the conduction band - or, equivalently, the mass enhancement parameter - and the nonzero-momentum quasiparticle weight. Our principal finding - a significant e-ph mass enhancement, providing an indication of polaronic behavior - can be ascribed to the peculiar momentum dependence of the e-ph interaction in these low-dimensional, narrow-band systems. Our study yields direct predictions for future angle-resolved photoemission spectroscopy measurements in graphene antidot lattices.</p>

Strain-induced effects on the electronic structure of manganite thin films and their properties

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Hole-doped manganese oxides $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$ (LSMO) have attracted much attention because of their remarkable electronic and magnetic properties, such as colossal magnetoresistance, metal-insulator transition, and half-metallicity [1]. Extensive studies have demonstrated that the physical properties of these oxides can be controlled by epitaxial strain [2, 3]. However, very little is known about their electronic structure and the influence of the strain effects on the electronic structure.

In the last years, our in-situ angle-resolved photoemission spectroscopy (ARPES) studies of LSMO films grown under tensile stress on SrTiO_3 have provided first insights in the electronic structure of these materials: anomalously broad ARPES dispersing features and finite and k-dependent spectral weight at the Fermi level [4, 5]. More recently, we investigated LSMO with different transition temperatures (T_c) and showed that T_c is closely related to details of the electronic structure, particularly to the spectral weight at the k-point corresponding to the sharpest step at the Fermi level [6].

To better understand our experimental ARPES data in relation to the strain induced by the lattice mismatch, we are currently investigating the electronic structure and properties of LSMO films grown on different substrates, under tensile (SrTiO_3) and compressive (LaAlO_3) stress. Structural, transport and magnetic properties are discussed in relation with photoelectron spectroscopy data. Especially the information about strain-induced effects on the low-binding energy (3d) states, as probed by ARPES, is crucial because the electronic and magnetic properties of LSMO arise from the 3d electrons.

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