

1 KOND

**Postersession during lunch breaks on
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ID	KOND POSTER
101	<p data-bbox="318 323 871 352" style="text-align: center;">Al_xGa_{1-x}N crystals growth under high N₂ pressure</p> <p data-bbox="165 376 1023 427" style="text-align: center;"><i>Andrey Belousov, Sergiy Katrych, Peter Wägli, Janusz Karpinski, Jan Jun, Bertram Batlogg Laboratory for Solid State Physics, ETH-Hönggerberg, 8093 Zürich</i></p> <p data-bbox="165 456 1023 655">The group III-Nitrides are of significance for semiconductor devices, especially in optoelectronics (light-emitting diodes, UV-emitting lasers etc.) in the green/blue/ultraviolet range of the spectrum. They form continuous solid solutions (In_xGa_{1-x}N, In_xAl_{1-x}N and Al_xGa_{1-x}N). These compounds have a hexagonal wurtzite structure and a direct optical band gap ranging from 3.4 eV for GaN to 6.3 eV for AlN. Substrate crystals would be of great interest for homo-epitaxial thin film growth, yet growing them is a severe challenge because of the high melting temperature, the high decomposition nitrogen pressure and the low solubility in Ga or Al melt.</p> <p data-bbox="165 660 1023 991">We synthesized first Al_xGa_{1-x}N bulk single crystals up to 0.8 mm² in size and with aluminium content up to 85 at% from the solution in Ga melt under high pressure (up to 10 kbar) and high temperature using the high nitrogen gas pressure system. Typical experiments were carried out for 5-6 days at about 7 kbar and at 1800°C, using a constant thermal gradient of about 20K/cm. The polycrystalline (AlGa)N pellets with about 51% of Al served as a precursor for crystal growth. X-Ray diffraction confirms the growth of the Al_xGa_{1-x}N phase. LAICP Mass Spectrometry was performed for chemical analysis and homogeneity assessment, using an ArF excimer laser (193nm) for ablation the Al_xGa_{1-x}N crystals in a He flow and it showed the constant distribution of Al content of about 86 at% in volume, in agreement with X-ray diffraction measurements. Several growth experiments have been also performed at 5, 6 and 7 kbar nitrogen pressure. We present the crystal growth of Al_xGa_{1-x}N bulk crystals as well as some aspects of thermodynamic equilibrium in the Al-Ga-N system.</p>
102	<p data-bbox="165 1010 1023 1038" style="text-align: center;">Enhanced Uniaxial Magnetic Anisotropy in Fe₃₁Co₆₉ thin films on GaAs(001)</p> <p data-bbox="258 1062 930 1091" style="text-align: center;"><i>François Bianco¹, Patrick Bouchon², Gian Salis¹, Santos F. Alvarado¹</i></p> <p data-bbox="232 1091 956 1114" style="text-align: center;">¹ IBM Research, Zürich Research Laboratory, Säumerstr. 4, 8803 Rüschlikon</p> <p data-bbox="202 1114 986 1139" style="text-align: center;">² Ecole Polytechnique, 78 boulevard des Maréchaux Appt2026, F-91120 Palaiseau</p> <p data-bbox="165 1166 1023 1445">We report on the effect of post-growth annealing on the in-plane magnetic anisotropy properties of Fe₃₁Co₆₉ thin films, 10 to 50 monolayers (ML) thick, grown on GaAs(001) substrates, cooled to approx. 260 K under ultrahigh vacuum conditions. Hysteresis curves obtained by means of magneto-optical Kerr effect show that the films exhibit a uniaxial magnetic anisotropy with easy axis typically along the [110] substrate direction. The uniaxial magnetic anisotropy constant, K_u, exhibits a steep, quasi-linear increase with temperature. Thus by heating a 13 ML thick film to 520K, K_u increases from an as-grown value of 9·10³ J/m³ to 8.5·10⁴ J/m³. The slope of the K_u vs. T curve is higher for the thinner films, indicating a strong interface interaction between the substrate and the metal film. The strong increase of K_u induced by annealing can be accounted for by a thermally induced structural modification occurring at the ferromagnet/semiconductor interface.</p>

<p>103</p>	<p align="center">Spatial evolution of oxygen vacancies in Cr-doped SrTiO₃ during the insulator-to-metal transition in electric fields</p> <p align="center"><i>Pererik Andreasson, Markus Janousch, Urs Staub Swiss Light Source, Paul Scherrer Institut, 5232 Villigen</i></p> <p>Spatially resolved X-ray fluorescence maps are presented that show the introduction and the evolution of oxygen vacancies in chromium doped strontium titanate (Cr:SrTiO₃) during the electric field induced insulator-to-metal transition. Before the transition, the crystal is oxidized at the anode, changing the chromium from trivalent to tetravalent. Because of this possible electrochemical process, and the later shown spatial distribution of the oxygen vacancies, it is proposed that the vacancies are introduced at the anode, contributing to local conduction. These vacancies diffuse through the crystal towards the cathode creating a conducting network of oxygen defects. The spatial distribution of vacancies is explained by a model describing general electrical breakdown as a process percolating with fractal growth. After the transition the vacancy network seems to rearrange inside the crystal, possibly due to a more energetically favorable position of the network. The resistance after the transition shows a bistable state with highly reproducible resistance switching. [1, 2]</p> <p>[1] M. Janousch, G. I. Meijer, U. Staub, B. Delley, S. F. Karg, and B. P. Andreasson, <i>Adv. Mater.</i> 19, 2232 (2007). [2] G. I. Meijer, U. Staub, M. Janousch, S. L. Johnson, B. Delley, and T. Neisius, <i>Phys. Rev. B</i> 72, 155102 (2005).</p>
<p>104</p>	<p align="center">Correlation of conductivity and electronic structure of LaSrFe-oxides as a function of temperature (300 K < T < 800 K) and heterovalent B-site substitution</p> <p align="center"><i>Artur Braun ¹, Peter Holtappels ¹, Thomas Graule ¹, Ulrich Vogt ¹, Ludwig J. Gauckler ², Ashley S. Harvey ², Bongjin Simon Mun ³</i></p> <p align="center">¹ EMPA, Überlandstrasse 129, 8600 Dübendorf ² ETH Zürich, Department of Non-Metallic Materials, Hönggerberg, 8093 Zürich ³ Lawrence Berkeley National Laboratory, Advanced Light Source, and Ansan University, and Hanyang Univ., Ansan, Rep. of Korea, One Cyclotron Road, 94720 Berkeley</p> <p>We present here experimental studies on the electronic transport in lanthanum strontium ferric oxides and its structural changes upon cation hole doping and upon increasing temperatures, particularly as high as 500 degree Celsius. The conductivity follows a typical semiconductor-metal-like characteristics with a conductivity maximum at 700 K. Minute changes in the conductivity as a function of temperature, such as discontinuities or changes in the activation energy, are quantitatively reflected in the valence band spectra, as recorded using synchrotron radiation, and by high temperature x-ray diffraction. Heterovalent substitution with Ta and Ti can decrease the conductivity by up to three orders of magnitude. Interestingly, the relative electron hole concentration as well as the spectral intensity ratio of the unoccupied states near the Fermi level, as accessed by oxygen x-ray absorption spectroscopy, show both an exponential correlation with the conductivity, suggesting that disorder or percolation mechanisms at least partially control the transport in this material. By such quantitative analysis of the spectra, the iron eg bands are identified as electric switches, promoting electronic transport, whereas the t2g bands depress conductivity by means of ferromagnetic double exchange.</p>

<p>105</p>	<p style="text-align: center;">Correlation of electronic structure and electrical conductivity of $\text{La}_{1-x}\text{Sr}_x\text{Fe}_{1-y}\text{Ni}_y\text{O}_{3-\delta}$</p> <p style="text-align: center;"><i>Selma Erat ¹, Artur Braun ¹, Peter Holtappels ¹, Zhi Liu ², Thomas Graule ¹, Ludwig Gauckler ³</i></p> <p style="text-align: center;">¹ <i>EMPA, Überlandstrasse 129, 8600 Dübendorf</i></p> <p style="text-align: center;">² <i>ALS, Advanced Light Source, Lawrence Berkeley National Laboratory, One Cyclotron Road, 92720 Berkeley, United States</i></p> <p style="text-align: center;">³ <i>ETHZ, Wolfgang-Pauli-Str. 10, 8093 Zürich</i></p> <p>We provide an exhaustive parameter study of the LSF-Ni perovskites in terms of transport properties and electronic structure. The well known hole doping mechanism on the A-site cation is monitored by changes in the p-projected density of states as evidenced by oxygen (1s) x-ray absorption spectroscopy. We extend this study to B-site cation substitution, i.e. iron by nickel, and correlate the electronic structure with the ambient temperature transport. A rigorous discussion of the evolution of spectral characteristics across A-site and B-site substitution is provided. The Fe 2p spectra of the compounds for low Sr concentrations remain essentially unchanged, but for higher Sr contents a second component appears in the spectra. The electrical conductivity strongly depends on the stoichiometry. The focus is to determine the correlation between the electrical conductivity and the electronic structure of the compounds.</p>
<p>106</p>	<p style="text-align: center;">Anisotropic conductivity of disordered 2DEGs due to spin-orbit interactions</p> <p style="text-align: center;"><i>Oleg Shalaev, Daniel Loss, Department of Physics and Astronomy, University of Basel, Klingelbergstrasse 82, 4056 Basel</i></p> <p>We show that the conductivity tensor of a disordered two-dimensional electron gas becomes anisotropic in the presence of both Rashba and Dresselhaus spin-orbit interactions (SOI). This anisotropy is a mesoscopic effect and vanishes with vanishing charge dephasing time. Using a diagrammatic approach including zero, one, and two-loop diagrams, we show that a consistent calculation needs to go beyond a Boltzmann equation approach. In the absence of charge dephasing and for zero frequency, a finite anisotropy $\sigma_{xy} \sim e^2/p_F l_{\text{tr}}$ arises even for infinitesimal SOI, where p_F is the Fermi momentum and l is the mean free path of an electron.</p>
<p>107</p>	<p style="text-align: center;">Low energy muon studies of magnetic semiconductors</p> <p style="text-align: center;"><i>Dmitry Eshchenko ¹, Vyacheslav Storchak ², Elvezio Morenzoni ³, Thomas Prokscha ³, Andreas Suter ³, Xinyu Liu ⁴, Jacek Furdyna ⁴</i></p> <p style="text-align: center;">¹ <i>Physik-Institut der Universität Zürich, Winterthurerstrasse 190, 8057 Zürich</i></p> <p style="text-align: center;">² <i>Russian Research Centre "Kurchatov Institute", Kurchatov Sq. 1, 123182 Moscow, Russian Federation</i></p> <p style="text-align: center;">³ <i>SMU, Paul Scherrer Institute, 5232 Villigen PSI</i></p> <p style="text-align: center;">⁴ <i>Department of Physic, University of Notre Dame, 225 Nieuwland Science Hall Notre Dame, 46556 Indiana, United States</i></p> <p>The spin of the carriers has so far played a minor role in semiconductor devices mainly because the semiconductors used for industrial applications, such as Si and GaAs, are nonmagnetic. On the other hand, the enhanced spin-related phenomena have been realized in diluted magnetic semiconductors (DMS) to offer applications known as spintronics. Discovery of ferromagnetism (FM) in the canonical DMS - GaMnAs films which have the benefit of being compatible with GaAs technology - has led to intense studies</p>

	<p>of the FM in these materials for spintronics applications. Although there is an emerging consensus that the FM in DMS originates from the interaction between itinerant carriers and localized magnetic moments, the microscopic theory of FM in these materials is the subject of considerable debate.</p> <p>Low energy muon (LEM) spin relaxation measurements offer the unique possibility to study magnetic properties of magnetic semiconductor films in the microscopic scale. In the particular case of GaMnAs film - the internal magnetic field is determined to amount 0.2T.</p>
<p>108</p>	<p style="text-align: center;">Spin orbit splitting of quantum well states in ultrathin Pb layers</p> <p style="text-align: center;"><i>Hugo Dil ^{1,2}, Fabian Meier ¹, Jürg Osterwalder ¹, Jorge Lobo-Checa ³, Luc Patthey ²</i> ¹ <i>Physik-Institut, Universität Zürich, Winterthurerstrasse 190, 8057 Zürich</i> ² <i>Swiss Light Source, Paul Scherrer Institute, 5232 Villigen-PSI</i> ³ <i>Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel</i></p> <p>When the thickness of a thin metal layer approaches the electron coherence length, quantum well states (QWS) can form between the metal-substrate interface and the surface. Comparable to surface states, the space inversion symmetry is broken for QWS. This can lift the spin degeneracy of the valence band electrons, which is generally referred to as the Rashba effect.</p> <p>Here we present recent spin and angle resolved photoemission results obtained with the COPHEE spectrometer at the SIS beamline at the SLS on QWS in ultrathin (6-22 ML) Pb films grown on Si(111)$\sqrt{3}\times\sqrt{3}$:Pb. A spin splitting of the states as expected from the Rashba effect is clearly observed. However, the magnitude of the splitting of about 15 meV is too small to be detected by spin integrated photoemission. This illustrates the need for spin and angle resolved photoemission spectroscopy to access such subtle effects.</p>
<p>109</p>	<p style="text-align: center;">Quantitative vectorial spin analysis in spin and angle resolved photoemission: Bi/Ag(111) and Pb/Ag(111)</p> <p style="text-align: center;"><i>Fabian Meier ^{1,2}, Hugo Dil ^{1,2}, Jürg Osterwalder ¹, Jorge Lobo-Checa ³, Thomas Greber ¹</i> ¹ <i>Universität Zürich, Winterthurerstrasse 190, 8057 Zürich</i> ² <i>PSI, 5232 Villigen</i> ³ <i>Universität Basel, Klingelbergstrasse 82, 4056 Basel</i></p> <p>We present a novel quantitative vectorial spin analysis procedure that allows the determination of the spin polarization vector of individual bands. It will be shown that the combination of the COPHEE spectrometer together with the novel data analysis is a very powerful tool for the investigation of a broad range of systems. This will be illustrated by recent results on the surface alloys Bi/Ag(111) and Pb/Ag(111) obtained with COPHEE at the SIS beamline of the SLS at PSI. We confirm recent experimental and theoretical investigations considering the giant Rashba splitting and we find that the spin polarization vector is rotated out of the surface plane. Both the giant spin splitting and the out of plane spin polarization component are a consequence of the altered surface symmetry caused by the $\sqrt{3}\times\sqrt{3}$R30° reconstruction and the corresponding in plane potential gradients and provides a new mechanism to tailor the spin structure of new materials.</p>

<p>110</p>	<p align="center">Ultrafast Structural changes accompanying Low Spin to High Spin conversion of [FeII(bpy)₃]²⁺</p> <p align="center"><i>Amal el Nahhas¹, Wojciech Gawelda², Christopher Milne¹, Van Thai Pham¹, Renske van der Veen¹, Maik Kaiser³, Maurizio Benfatto⁴, Daniel Grolimund³, Steven Johnson³, Rafael Abela³, Andreas Hauser⁵, Christian Bressler¹, Majed Chergui¹</i></p> <p align="center">¹ EPFL-ISIC-LSU, 1015 Lausanne ² Instituto de Óptica, Calle Serrano 121, 28006 Madrid, Spain ³ Paul Scherrer Institut, 5232 Villigen PSI ⁴ INFN, Frascati, 1044 Frascati, Italy ⁵ Departement of Physical Chemistry, 1211 Genève</p> <p>Photo- induced spin cross over is an ultrafast process, which dramatically changes the geometric structure of the compound next to its total spin. Femtosecond optical spectroscopies revealed a rapid and complex relaxation pathway, from the initially excited singlet metal-to-ligand charge transfer 1MLCT over its triplet metal-to-ligand charge transfer 3MLCT (intersystem crossing <20fs), then back transfer of the electron to metal-centered (MC) states, until it stabilizes in the high spin (HS) 5T state (with a long lifetime of 665 ps). Since the entire spin crossover process is completed within only 1ps, we are interested to understand more about the detailed intermediate steps. After having measured for the first time the HS structure of aqueous [FeII(bpy)₃]²⁺ via picosecond x-ray absorption fine structure (XAFS), we have recently succeeded to record the initial process exploiting femtosecond x-ray pulses at the MicroXAS beamline of the Swiss Light Source (SLS). With a time resolution of ca. 160fs, we have monitored the XAFS changes, which indicate that the structural changes are complete within less than 500 fs. The current status of the structural analysis will be discussed.</p>
<p>111</p>	<p align="center">Nascent Iodine Radicals Studied by Ultrafast Laser and X-ray Absorption Spectroscopies</p> <p align="center"><i>Van-Thai Pham¹, Wojciech Gawelda², Chris Milne^{1,3}, Amal El Nahhas¹, Renske van der Veen^{1,3}, Frederico Alves Lima^{1,3}, Daniel Grolimund³, Steven Johnson³, Rafael Abela³, Christian Bressler¹, Majed Chergui¹</i></p> <p align="center">¹ LSU-ISIC-SB-EPFL, 1015 Lausanne ² Instituto de Óptica "Daza de Valdés", CSIC/ Serrano 121, 28006 Madrid, Spain ³ Swiss Light Source, Paul-Scherrer-Institut, 5232 Villigen PSI</p> <p>Aqueous iodide is a prototype model for solvation dynamics studies due to its ionic simplicity. We investigated solvation dynamics of aqueous iodide using both time-resolved X-ray and laser spectroscopies. A rearrangement of the water molecules around the iodine atom following two-photon ionization of iodide was traced by X-ray absorption spectra around the iodine L1 and L3 edges. The appearance of the 2s_p absorption right below the L1 edge after 50 ps serves as the fingerprint of nascent iodine atoms. Optical pump-probe spectroscopy is applied to quantify the initial fractional population of nascent iodine atoms, which are used as input to interpret the time-resolved XAFS. These indicate a (fractional) electron back transfer from the solvent to the iodine atom, as predicted by excited state DFT simulations. On the nanosecond time scale we observe new products, I₂⁻ and I₃⁻, whose population evolution we also follow via time-resolved XAFS. An outlook towards planned femtosecond XAFS experiments at the microXAS beamline of the Swiss Light Source will be given.</p>

112**Gate Stack for GaAs inversion-mode devices**

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For an effective "inversion"-mode GaAs n-MOSFET it is essential to fabricate the interface between the GaAs and the gate dielectric such that the Fermi level is unpinned. Therefore substrate preparation and surface states passivation are fundamental approaches and can be well controlled by Molecular Beam Epitaxy (MBE).

We utilized a three chamber MBE cluster for HfO₂/Si/GaAs gate stack deposition and determined the influence of different surface cleaning procedures on the electrical characteristics of these capacitors. Variations in surface stoichiometry and -reconstruction are taken into account as well as the minimum Si interlayer thickness for a successful surface state passivation. CV measurements under dark and illuminated conditions are indicating whether an inversion of the Si/GaAs interface emerges and an unpinned Fermi level is realized.

113**Monte Carlo study of the three-dimensional Coulomb glass**

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The memory and hysteresis effects found in strongly-disordered electron systems can be explained by the existence of a glassy phase, the Coulomb glass. Efros and Shklovskii have predicted the emergence of a soft Coulomb gap, resulting from the long-range interactions between the localized electrons. However, the relationship between the soft Coulomb gap in the density of states and the electron's glassy behavior has been a long-standing unresolved question. Only recently has it been surmised within the framework of a mean field theory that the disordered electron system undergoes a replica symmetry breaking transition at a finite temperature, similar to the Sherrington-Kirkpatrick model of spin glasses. Because it is not clear, however, whether the transition persists beyond the mean-field approximation, we study in detail the critical behavior and the shape of the Coulomb gap in three space dimensions using Monte Carlo methods and support our Monte-Carlo results by a T=0 simulation using extremal optimization. Furthermore, we compare our results for the (random-energy) Coulomb glass model to previous results on a random lattice version of the model. Since these models possess different symmetries, the equivalence of the phase diagrams is far from obvious, contrary to previous claims.