6 Solid State Physics

Wednesday, 2. Sept. 2009, Room C

Time	ID	Solid State Physics I: X-Rays and Neutrons *Chair: D. Pescia, ETH Zürich*
09:00		***PLENARY SESSION***
12:40		***Postersession, Lunchbuffet***
13:00		***NESY Fachausschußsitzung***
14:00	601	**Nanomaterials in the new light: position-resolved and in-situ experiments with synchrotron radiation** *Oskar Paris* *Institute of Physics, University of Leoben, Franz-Josef-Strasse 18, 8700 Leoben, Austria* Nanoscale materials exhibit particular structural features at intermediate scales between the atomic/molecular world and macroscopic dimensions. Such systems may show novel properties and functions which result directly from the size of the compartments and/or the interactions between the individual structural units. Our research is directed towards the structural characterization and the understanding of structure-function relationships of hierarchical biological and synthetic nanoscale composites. Our experimental approaches are largely based on scattering techniques using synchrotron radiation. We apply sophisticated in-situ methods to "watch materials at work", and we develop microbeam scanning techniques to map the local nanostructure in hierarchically organized materials. In some cases, even a combination of in-situ approaches with scanning techniques is possible. In this lecture we give an overview about recent work on mineralised biological tissues and on the behaviour of fluids in confined geometry. In particular, we discuss the thermal stability of amorphous minerals in lobster cuticle [1], and the origin of the self sharpening mechanism in sea urchin teeth [2]. We further present recent results on in-situ fluid adsorption in ordered mesoporous silica, with particular emphasis on the deformation of the solid pore walls upon capillary condensation of the fluids [3]. [1] A. Al-Sawalmih, C. Li, S. Siegel, P. Fratzl, O. Paris, Adv. Mater. (2009) in press. [2] Y. R. Ma, B. Aichmayer, O. Paris, P. Fratzl, A. Meibom, R. A. Metzler, Y. Politi, L. Addadi, P. Gilbert, S. Weiner, Proc. Natl. Acad. Sci. USA 106 (2009) 6048-6053. [3] G. Guenther, J. Prass, O. Paris, M. Schoen, Phys. Rev. Lett. 101 (2008) 086104.

14:30	**602**	**Skutterudites and clathrates: are they phonon glasses and electron crystals ?** *Romain Viennois [1], Marek Koza [2], Hannu Mutka [2], Mark Johnson [2], Luc Girard [3], Didier Ravot [3], Pierre Toulemonde [4], Alfonso San Miguel [4]* *[1] DPMC, Université de Genève, 24 quai Ernest Ansermet, 1211 Genève, Switzerland* *[2] Institut Laue Langevin , 6 rue Jules Horowitz, 38042 Grenoble, France* *[3] Institut Gerhardt, place Eugène Bataillon, 34095 Montpellier, France* *[4] LPMCN, Université Claude Bernard - Lyon 1, Bat. Léon Brillouin, 69622 Villeurbanne, France* Nanocage compounds such as skutterudites and clathrates have strong potential for thermoelectric applications due to their low thermal conductivity. It is believed that these compounds behave as "phonon glass- electron crystals" [1] and that the low thermal conductivity is due to resonant scattering of heat-carrying phonons by localized vibrational rattling modes induced by the large thermal displacement of the atoms intercalated inside the nanocages. Using high resolution inelastic neutron scattering experiment and ab-initio calculations [2], we show that this picture requires to be reexamined because the vibrational modes associated with the intercalated atoms are harmonic, display a dispersive behavior and show phase correlations with other vibration modes. Hence, the widely applied picture of "phonon glass" and the mechanism of low thermal conductivity in these compounds have to be revised. [1] BC Sales et al., Phys. Rev. B 56, 15081 (1997) [2] M. Koza et al., Nature Mater. 7, 805 (2008)
14:45	**603**	**The Metal-Insulator-Transition in VO_2 investigated by Resonant Inelastic X-ray Scattering** *Kejin Zhou, Thorsten Schmitt, Francois Vernay, Justine Schlappa, Vladimir Strocov, Bernard Delley, Luc Patthey* *Paul Scherrer Institut, 5232 Villigen PSI, Switzerland* Vanadium dioxide VO_2 undergoes a metal-to-insulator transition (MIT) from a paramagnetic metal with tetragonal rutile structure to a nonmagnetic semiconductor with monoclinic structure below 340K, characterized by a sudden conductivity drop of several orders of magnitude [1]. Despite decades of studies the nature of this MIT is still not fully understood. The crucial question in the ongoing debate is, if the band gap opening is dominated by the crystallographic distortion (Peierls-transition) [2] or electron correlation effects (Mott-transition) [3]. We investigate changes of the electronic structure across the MIT in VO_2 by temperature dependent Resonant Inelastic X-Ray Scattering (RIXS) at the ADRESS beamline of the Swiss Light Source. RIXS is a unique photon-in / photon-out spectroscopic probe for determining the energy and symmetry of charge neutral excitations (e.g. crystal field or spin excitations) in strongly correlated materials. Our high-resolution RIXS study at the V L_3-edge reveals clear changes in the crystal field originating from the crystallographic distortion accompanying the MIT, especially a remarkable electronic excitation at -0.45 eV broadens and nearly merges with the elastic peak when going from the insulating to the metallic phase. Furthermore, we investigated the temperature dependent hysteresis of this excitation [4]. Differences between experiment and simulation within multiplet theory are discussed in relation to screening and charge fluctuation effects.

[1] M. Imada, A. Fujimori, and Y. Tokura, Rev. Mod. Phys. 70, 1039 (1998); D. B. McWhan et al., Phys. Rev. B 10, 490 (1994); A. Zylbersztejn and N. F. Mott, Phys. Rev. B 11, 4383 (1975)
[2] M. Gupta et al., Phys. Rev. B 16, 3338 (1977); R. M. Wentzcovitch et al., 72, 3339 (1994)
[3] S. Shin et al., Phys.Rev. B 41, 4993 (1990); S. Biermann et al., Phys. Rev. Lett. 94, 026404 (2005)
[4] T. C. Koethe et al., Phys. Rev. Lett. 97, 116402 (2006)

15:00 **604**

Collective spin-excitations in a quantum spin ladder probed by high-resolution Resonant Inelastic X-ray Scattering

Justine Schlappa [1], Thorsten Schmitt [1], Francois Vernay [1], Vladimir N. Strocov [1], Vita Ilakovac [2], Beni Thielemann [3], Henry M. Rønnow [4], Vanishri Salingrama [5], Andrea Piazzalunga [6], Xiaoqiang Wang [4], Lucio Braicovich [6], Giacomo Ghiringhelli [6], Christophe Marin [5], Joel Mésot [3], Bernard Delley [1], Luc Patthey [1]

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Resonant Inelastic X-ray Scattering (RIXS) is a powerful bulk-sensitive probe of the microscopic electronic properties of matter. In the soft x-ray range the excitation energy can be tuned such that the photon scattering cross section with the partially occupied electron states is greatly enhanced, becoming sensitive to their charge, orbital and spin degrees of freedom [1]. Here we present high-resolution Cu L3-RIXS study of the magnetic excitations in the low-dimensional spin-ladder compound $Sr_{14}Cu_{24}O_{41}$ [2]. Our findings demonstrate that RIXS couples to the two-triplon collective excitations in the system. In contrast to Inelastic Neutron Scattering, the RIXS cross-section changes only moderately over the entire Brillouin Zone, revealing excellent sensitivity also at small momentum transfers and allowing a direct determination of the two-triplon energy gap [3].

[1] A. Kotani and S. Shin, Rev.Mod.Phys. 73, 203 (2001).
[2] T. Vuletic et al., Physics Reports 428, 169-258 (2006).
[3] J. Schlappa et al., arXiv:0901.1331v2 [cond-mat.str-el].

15:15 **605**

Spin-lattice coupling in $CuCrS_2$ probed by inelastic neutron scattering

Martin Böhm [1], Julia Rasch [1], Jürg Schefer [2], Hannu Mutka [1], Clemens Ritter [1], Galina Abramova [3], Inga Vasilyeva [4]

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The triangular lattice Heisenberg antiferromagnet $CuCrS_2$ (S=3/2) with a quasi two-dimensional layered structure shows a complex three-dimensional magnetic long range order at T_N=37 K. The onset of the magnetic ordering is directly coupled

		to a lattice distortion from R3m to monoclinic Cm as seen from high resolution neutron powder diffraction data on D1A (ILL). Inelastic neutron powder time-of-flight experiments on IN4 (ILL) revealed below T_N a strong non-dispersive mode localized in Q at about $\hbar\omega$ = 12 meV which is characteristic for magnetic clusters. An enhanced scattering intensity at the spin wave-phonon crossing point at $\hbar\omega$ = 8 meV is additionally observed. We assume that the monoclinic lattice distortion in $CuCrS_2$ plays a key role in relieving geometrical frustration and is analog to a Spin-Peierls transition in one dimension. Below T_N the nearest neighbor Cr distances change irregular which makes the formation of a valence bond solid [1] favorable and accounts well for the non-dispersive mode at 12 meV. [1] C. Jia and J. H. Han, Phys. Rev. B 73, 172411 (2006)
15:30	**606**	**Condensed Matter Science with Spallation Neutrons and Synchrotron Radiation X-Rays at PSI** *Bruce Patterson, Paul Scherrer Institut, WSLA 116, 5232 Villigen, Switzerland* The Paul Scherrer Institut, in Villigen, Switzerland, operates large research facilities for Swiss and international user groups from universities and industry. Prominent among these facilites are the SINQ neutron source and the SLS synchrotron radiation source. This talk will highlight prominent experimental investigations of condensed matter performed with these sources, and a brief outlook will be given on the next large facility to be realized at PSI: the X-ray laser.
16:00		***Coffee Break***
		Chair: G. Krexner, Uni Wien
16:30	**607** **cancelled**	~~**Gravity tests on the micrometre scale with ultra-cold neutrons**~~ ~~*Hartmut Abele, Atominstitut, TU Wien, Stadionallee 2, 1020 Wien, Austria*~~ ~~The dynamics of a quantum mechanical wave packet bouncing off a hard surface in the gravitational field of the earth combines quantum theory with aspects of Newtonian mechanics. We present a realization of such a quantum bouncing ball with ultra-cold neutrons in a system, where the lowest stationary quantum states in the earth's gravitational field have been observed.~~ ~~The quantum bouncer searches for hypothetical short range gravity-like forces. Such new forces can be mediated from gauge bosons propagating in a higher dimensional space and this experiment can therefore test speculations on large extra dimensions of submillimetre size of space-time or the origin of the cosmological constant in the universe. Small effects are predicted and might give a signal in at a length scale of one micrometre. The experiment is sensitive to such forces by studying the dynamics of quantum mechanical wave packets, because Newtonian gravity and hypothetical fifth forces evolve with different phase information.~~

17:00	**608**	**Discovery of strange atomic multipoles (parity and time odd) in magneto-electric $GaFeO_3$** *Urs Staub [1], Y. Bodenthin [1], C. Piamonteze [1], M. García-Fernández [1], R. De Souza [1], V. Scagnoli [2], M. Garganourakis [1], S. Koohpayeh [3], D. Fort [3], S. W. Lovesey [4]* *[1] Paul Scherrer Institut, Swiss Light Source, 5232 Villigen PSI, Switzerland* *[2] European Synchrotron Radiation Facility (ESRF), BP 220, 38043 Grenoble, France* *[3] University of Birmingham, Department of Metallurgy and Materials, Birmingham, UK* *[4] Diamond Light Source, Oxfordshire OX11 0DE, Harwell, UK* We present resonant soft x-ray diffraction data on the space group forbidden (010) reflection at the Fe L2,3 edges of magneto-electric $GaFeO_3$. These data give direct evidence for time and parity odd (magneto-electric) moments, in particular the magneto-electric quadrupole and show that the magneto-electric monopole would be accessible too. The discovery of magneto-electric multipoles in the open 3d shell is a direct measure of coupling between magnetic and electric properties and at base for the magneto-electric interaction. It reflects a direct measure of the multiferroic order parameter and its description of fundamental importance for a microscopic understanding of magnetically induced multiferroics.
17:15	**609**	**Extensive study on crystallographic and electronic structure LSF-Ni oxides** *Selma Erat [1], Artur Braun [1], Alejandro Ovalle [1], Nikolaos Karageorgakis [1], Cinthia Piamonteze [2], Zhi Liu [3], Ludwig J. Gauckler [4], Thomas Graule [1]* *[1] EMPA-Swiss Federal Laboratories for Materials Testing & Research, Überlandstrasse 129, 8600 Dübendorf, Switzerland* *[2] Swiss Light Source, Paul Scherrer Institut, 5232 Villigen, Switzerland* *[3] Advanced Light Source, Lawrence Berkeley National Laboratory, 1 Cyclotron Road, 94720 Berkeley, United States* *[4] ETH-Zürich, Department for Nonmetallic Inorganic Materials, Wolfgang-Pauli-Str. 10, 8093 Zürich, Switzerland* The electrical conductivity of LSF-Ni oxides which show semiconducting behavior at elevated temperatures and metallic like behavior at high temperatures explained in terms of changes in crystallographic structure monitored by temperature dependent neutron diffraction, in microstructure and in electronic structure, as well. In order to investigate the electronic structure, we record X-ray absorption spectra and make the theoretical calculation depending on Atomic Multiplet Theory. We get very good agreement between experimental results and theoretically calculated results. For example, $La_{0.5}Sr_{0.5}Fe_{0.75}Ni_{0.25}O_3$ which has higher conductivity has 50% Fe^{3+} and 50% Fe^{4+}, both in high spin state and which is denser comparing to other samples and grains are very well connected. In addition to that, the hybridization between Fe/Ni 3d and oxygen 2p orbitals is stronger than $La_{1-x}Sr_xFe$-oxides which make the Ni containing sample more conducting. The transition from rhombohedral to cubic phase is observed at around 500°C for this sample.

17:30	**610**	**X-Ray Diffraction Study on the Composition and Strain Fields in Ordered Arrays of SiGe Islands** *Nina Hrauda [1], JianJun Zhang [1], Julian Stangl [1], Günther Bauer [1], Vaclav Holy [2], Eugen Wintersberger [1], Dominik Kriegner [1], Rainer Lechner [1], Matthieu Stoffel [3], Oliver G. Schmidt [4], Mario Keplinger [1]* *[1] Institute for Semiconductor Physics, JKU Linz, Altenbergerstrasse 69, 4040 Linz, Austria* *[2] Faculty of Mathematics and Physics, Charles University Prague, Ke Karlovu 5, 12116 Prague, Czech Republic* *[3] Max Planck Institute Stuttgart, Heisenbergstrasse 1, 70569 Stuttgart, Germany* *[4] IWF Dresden, Heimholtzstrasse 20, 01069 Dresden, Germany* Silicon-Germanium islands are a model system for the investigation of Stranski-Krastanow growth. Such structures are of interest for the realization of field effect transistors utilising strained Si channels. During Ge deposition interdiffusion and segregation processes change the composition and thus the strain state of the islands. The properties of the Si capping layers are determined by the size, shape and composition of the buried islands. We have performed systematic studies of strain and composition of uncapped and capped SiGe islands grown by molecular beam epitaxy using high resolution X-ray diffraction and atomic force microscopy. 3D finite element method simulations of dome- and barn shaped islands were set up to serve as input for X-ray simulations. Special attention was given to the non-uniform distribution of germanium within the island. During this work it turned out, that in the Si capping layer tensile strains up to 1% are achievable without introducing defects.
17:45	**611**	**Studying multiferroics $RMnO_3$ by resonant x-ray diffraction** *M. Garganourakis [1], U. Staub [1], Y. Bodenthin [1], R. A. De Souza [1], M. García-Fernández [1], M. Kenzelmann [2], V. Y. Pomjakushin [2], C. Schneider [3], A. Dönni [4], M. Tachibana [4]* *[1] Swiss Light Source, Paul Scherrer Institut, Synchrotronstrasse 1, 5232 Villigen, Switzerland* *[2] Laboratory for Developments and Methods, Paul Scherrer Institut, Synchrotronstrasse 1, 5232 Villigen, Switzerland* *[3] General Energy Research Department, Paul Scherrer Institut, Oststrasse 2, 5232 Villigen, Switzerland* *[4] National Institute for Materials Science (NIMS), Tsukuba, Ibaraki, Japan* Multiferroic materials attract great interest due to the coexistence of ferroelectric and magnetic order, giving raise to fundamental questions about which effect can cause such interaction. Recently, high electric polarization *P* values were predicted in orthorhombic (o)$RMnO_3$ perhaps suitable for application in technology. In this study we present results of resonant soft x-ray powder diffraction of (o)$RMnO_3$ materials (R=Tm, Lu) as complementary results of those collected by neutrons [1]. Energy dependence of (1/2 0 1) reflection at the Tm M_5 edge revealed four different features, reflecting the multiple structure of resonance. The difference observed in the integrated scattered intensity with σ and π incident polarization indicates the magnetic origin of those energy features probing directly the order of Tm^{3+} magnetic moments. Further temperature dependence scans of each one of the four features verified the order of Tm^{3+} magnetic moments below T_c, where a spontaneous electric polarization occurs. The (1/2 0 0) reflection in the vicinity of

		the Mn $L_{2,3}$ edges, was also studied as a function of energy. Energy dependence scans revealed features in the respective energies for both $TmMnO_3$ and $LuMnO_3$ materials. These results will be discussed in relation to the occurrence of the ferroelectric polarization as well as in respect to the neutron results presented in Ref. [1]. Complementary measurements of $TmMnO_3$ thin films have been performed in order to reveal the dielectric properties as well as the magnetic phase transitions occurring in the epitaxial films. [1] V. Y. Pomjakushin et al, ''Evidence for large electric polarization from collinear magnetism in $TmMnO_3$", New J. Phys. **11**, (2009) 043019
18:00	**612**	**Bosons, Condensation, Chirality and Glass in quantum spin ladders** *Andrey Zheludev* *Laboratory for Neutron Scattering, ETHZ & PSI, 5232 Villigen, Switzerland* Excitations in certain quantum magnetic materials can be mapped onto a gas of interacting bosons. Static and dynamic correlations in such systems can be directly probed by neutron scattering techniques. This opens up a whole new approach to studying bosonic physics. For example, the application of an external magnetic field will take quantum-disordered magnets through a sequence of quantum phase transitions between "Mott-insulator" and "superconducting" phases. The latter can be viewed as Bose-Einstein condensates of "magnons". Unlike in conventional superfluids, neutrons enable direct measurements of the wave function of the condensate: both phase and amplitude. Geometrically frustrated interactions will produce unique periodically modulated and chiral condensates. The introduction of quenched disorder will stabilizes a novel phase of bosonic matter, namely the Bose Glass state. Interactions between magnons may give rise to peculiar instabilities similar to the roton spectrum termination in superfluid 4He, or even a total collapse of quasiparticle states. In the talk I will review recent neutron scattering studies of these remarkable phenomena in novel quantum spin ladder materials.
18:30		***END***

Time	ID	Solid State Physics II: Spins, Magnetism *Chair: R. Grössinger, TU Wien*
09:00		***PLENARY SESSION***
12:40		***Postersession, Lunchbuffet***
14:00	621	**Universality and scaling in a regime of inverse symmetry breaking: quantum physics meets classical physics.** *Danilo Pescia, N. Saratz, A. Lichtenberger, O. Portmann, U. Ramsperger, A. Vindigni* *Laboratory for Solid State Physics, ETH Zürich, 8093 Zürich, Switzerland* Inverse symmetry breaking (ISB) is a phenomenon in which the symmetry is restored upon cooling, and it is very rare in nature. The phase diagram of modulated phases describing pattern evolution in many different systems is expected to be generally SB. We have discovered multiple ISB topological transitions in a two-dimensional pattern forming spin system that directly contradict this expectation and relate pattern evolution in modulated systems to their dimensionality and the power law exponent of the underlying long-range interaction. In this regime of multiple ISB the spin system displays universality and scaling aspects which are usually observed within SB-processes. These results show that physical properties of systems ruled by the competition between quantum and classical interactions can be radically different from common wisdom.
14:30	622	**Heusler Alloy Films on Semiconductor Templates** *Reinhold Koch, Tanveer Ashraf, Christian Gusenbauer, Shibo Wang* *Institute of Semiconductor and Solid State Physics, University of Linz, Altenbergerstrasse 69, 4040 Linz, Austria* Epitaxial growth and magnetic properties of Heusler alloy films on the semiconducting substrate GaAs(001) are investigated with the ultimate goal of realizing magnetic tunnel junctions with a high tunneling magnetoresistance ratio as well as highly spin-polarized magnetic electrodes for application in spin- and magnetoelectronics. Using an ultra high vacuum cantilever beam magnetometer provides quantitative information on magnetization, magnetostriction and intrinisc stress of the Heusler films. In situ structural investigations are performed with a scanning tunneling microscope. First results on the Heusler alloy Fe_3Si will be presented.
14:45	623	**Electric Current Induced Spin Excitation due to Rashba Field** *Wolfgang Jantsch [1], Marek Havlicek [1], Wladek Ungier [2], Zbyszek Wilamowski [2]* *[1] Institut für Halbleiter- und Festkörperphysik, Altenbergerstr. 69, 4040 Linz, Austria* *[2] Institute of Physics, PAS, Al. Lotnikow 32/46, 02668 Warsaw, Poland* We review evidence for the electric current induced spin excitation in asymmetric Si quantum wells. Evidence is based on the anisotropy of the spin resonance signal due to the two dimensional carriers: apart from the anisotropy of the

		linewidth and the g-factor, which can be fully described in terms of the Rashba field, the signal shape changes from absorptive to dispersive, depending on the tilt angle with respect to the magnetic field and the type of cavity used. We explain the rich dependence in terms of two contributions: the transfer of microwave energy to (i) the magnetic energy and (ii) to Joule heating. The latter shows a resonant effect due to the spin dependent carrier velocity.
15:00	**624**	**Magnetic structure of Almandine: electronic structure calculations** *Danylo Zherebetskyy, Georg Amthauer, Michael Grodzicki* *University of Salzburg, Hellbrunnerstraße 34, 5020 Salzburg, Austria* The magnetic structure of almandine has been investigated by cluster molecular orbital calculations in local spin density approximation in order to arrive at a more detailed understanding of the magnetic structure and the exchange pathways. The calculated hyperfine parameters and spin-allowed d-d transitions for the iron ions are in quantitative agreement with the respective experimental values obtained by Mössbauer and NIR spectroscopy demonstrating the reliability of the calculations. Based on the experimentally determined crystal structures, the coupling constants for the various magnetic interactions are calculated. From these values, the spin structure is derived and the possible exchange pathways are discussed. The competing superexchange pathways exist via oxygen bridges between directly neighboured iron ions and via edges of silicon tetrahedra and aluminium octahedra connecting more distant iron dodecahedra. This research was founded by the Austrian Science Foundation (FWF), grant number P18805-P.
15:15	**625**	**Competition between magnetism and superconductivity in iron chalcogenides** *Romain Viennois [1], Enrico Giannini [1], Jason Hancock [1], Carmine Senatore [1], Florence Levy [1], Dirk van der Marel [1], Radovan Cerny [2], Manfred Womes [3], Jean-Claude Jumas [3]* *[1] DPMC, Université de Genève, 24 quai Ernest Ansermet, 1211 Genève, Switzerland* *[2] Laboratoire de cristallographie, Université de Genève, 24 quai Ernest Ansermet, 1211 Genève, Switzerland* *[3] Institut Gerhardt, place Eugène Bataillon, 34095 Montpellier, France* In $Fe_{1+x}Te_{1+y}Se_y$ compounds, that are isostructural to the iron-based pnictide superconductors, both magnetic and superconducting transitions occur. We have succeeded in growing pure and Se-doped single-crystals of $Fe_{1+x}Te$ and studied their physical properties and their magnetic phase diagrams by means of various techniques: transport, magnetization, spectroscopy (optics, Mössbauer, X-rays). The various experimental probes show that increasing Se content y and/or decreasing the Fe excess x favor the occurrence of superconductivity below 12 K. Experimental evidence is found that correspondingly the strength of the Coulomb interaction is reduced in these compounds. Our present results suggest that weakening the electron correlations is favorable to superconductivity in these compounds. Structure refinement form single-crystal X-ray diffraction data has confirmed the excess of Fe and the occupancy of an additional Fe-site. A large occupancy ($x > 0.02$) of this additional highly coordinated site favors the magnetic coupling, preventing the superconducting pairing.

15:30	**626**	**Building blocks of an artificial kagome ice system** *Elena Mengotti [1], Laura Heyderman [1], Arantxa Fraile Rodriguez [1], André Bisig [1], Frithjof Nolting [1], Loic Le Guyader [1], Hans Beni Braun [2]* *[1] Paul Scherrer Institut, 5232 Villigen PSI, Switzerland* *[2] School of Physics, UCD, Belfield, National University of Ireland, Dublin 4, Ireland* We observed with photoemission electron microscopy the magnetic states in the three basic building blocks of the kagome ice system, a fascinating frustrated system where local dipolar interactions can not all be satisfied. The building blocks, consisting of one, two and three rings of single domain dipolar coupled ferromagnetic islands, are created with electron beam lithography. Employing dipolar energy calculations, we are able to make a full characterization of these finite structures and identify the lowest energy states. Following demagnetization, consisting of rotation of the sample in a magnetic field, we observe the interesting result that at each three-island vertex the 'ice rule' (two moments pointing in/one pointing out or vice versa) is always obeyed. In addition, we find that as the number of rings is increased there is a clear decrease in the ability to achieve the low energy states. This implies that the ground state will never be achieved in the infinite system via such a demagnetization method.
15:45	**627**	**Electric transport properties of high-temperature superconducting thin films under high current densities and electric fields** *Ionut Puica [1], Wolfgang Lang [1], Marius Aurel Bodea [2], Khurram Siraj [2], Johannes Pedarnig [2], John Durrell [3]* *[1] University of Vienna, Faculty of Physics, Electronic Properties of Materials, Boltzmanngasse 5, 1090 Wien, Austria* *[2] Johannes-Kepler-University Linz, Institute of Applied Physics, Altenberger Straße 69, 4040 Linz, Austria* *[3] University of Cambridge, Department of Materials Science and Metallurgy, Pembroke Street CB2 3QZ, Cambridge, United Kingdom* Many of the puzzling properties of the cuprate high-temperature superconductors are still not understood and novel experimental conditions might provide additional insights. We report such measurements performed with a fast pulsed-current technique on optimally doped and underdoped very thin YBCO films. It provides significant reduction of the self-heating at high dissipation levels and allows current densities of the order of 10 MA/cm^2 even in the normal state and electric fields reaching 1 kV/cm. This technique was applied to directly probe the depairing current, as well as the non-Ohmic behavior of paraconductivity, magneto-resistivity and Hall effect due to the superconducting fluctuation suppression in high electric fields. Films grown on vicinal substrates were used to investigate vortex motion at very high velocities in various arrangements of the copper-oxide layers and the magnetic field. At high vortex velocities the intrinsic anisotropy of forces relevant for vortex motion is significantly larger than previously observed.
16:00		***Coffee Break***

Time	ID	Solid State Physics III: Nano & Photonics I *Chair: K. Unterrainer, TU Wien*
16:30	631	**Circuit-based quantum cascade lasers** *J. Faist, C. Walther, G. Scalari, M. Fischer, M. Beck* *Institute for Quantum Electronics, ETH Zürich, 8093 Zürich, Switzerland* The quantum cascade laser (QCL) is a semiconductor laser based on intersubband transitions in quantum wells. It presently covers a wide spectral window ranging from 4.9 THz to 1.2 THz [1,2]: possible applications in imaging and astronomy push the extension of the frequency range towards longer wavelengths. A control over the in-plane degree of freedom of the electron may be an essential element to obtain population inversion and optical gain at very low THz frequencies, where the broadening of the states becomes very close to the photon energy (< 5 meV). In this work we present results obtained on low frequency THz QCL immersed in strong magnetic field. The devices, based on a intra-well transition, exhibit extremely low threshold currents (1 A/cm^2 and below) due to the reduction of the non-radiative scattering processes obtained via the magnetic field confinement [2]. A new structure relying on magnetically enhanced population inversion displays laser action at about 1 THz ($\lambda \approx 300$ μm). The structure, grown in the $Al_{0.1}Ga_{0.9}As$/GaAs material system, is based on an intra-well excited state optical transition in a very wide (76.5 nm) quantum well. A double-metal ridge waveguide structure displays laser action starting from an applied magnetic field of 8.2 T. The transport at constant applied bias shows extremely pronounced features attributable to magneto-intersubband resonances [3], also present in light emission. An other structure operated down to a frequency of 760 GHz. Taking advantage of the tight confinement provided by the metal-metal waveguide, we also have explored microcavities as well as photonic crystal quantum cascade lasers based on very low frequency material. These cavities enable us to explore the coupling between transport and photon emission in the regime of very subwavelength emitters as the ratio of volume over lambda cube is much below unity. Particularly interesting are cavities presenting strong analogy with LC circuits where the Purcell factor can be much larger than unity. [1] C. Walther et al, Appl. Phys. Lett., 89, 231121 (2006) [2] C. Walther, et al., Appl. Phys. Lett. 91 (13), 131122 (2007). [3] G. Scalari et al., Phys. Rev. Lett., 93, 237403 (2004)
17:00	632	**Narrow photoluminescence emission of Ge islands grown on pit-patterned Si(001) substrates at various temperatures** *Florian Hackl, Martyna Grydlik, Moritz Brehm, Thomas Fromherz, Günther Bauer,* *Insitut für Halbleiter und Festkörperphysik, Johannes Kepler Universität Linz,* *Altenbergerstrasse 69, 4040 Linz, Austria* The advantages of Ge islands grown on pre-patterned Si(001) substrates as compared to randomly nucleated ones are the control over the nucleation sites as well as the island's comparatively narrow size distribution. We demonstrate that this narrow size distribution significantly reduces the spectral width of the island photoluminescence (PL). Ge islands were grown by molecular beam epitaxy at different temperatures (650°C, 690°C, 725°C and 760°C) on substrates pit-patterned by e-beam lithography with various periods from 300 nm to 900 nm. Low Si capping temperature (300°C) was used to preserve the island shape, size and Ge composition. We determine clear correlation between the deposited

		amount of Ge and the pattern period on the size distribution of the islands. Additionally, we have to stress that already a low density of dislocated superdomes reduces the PL intensity dramatically. These findings emphasize the importance of accurate control of heteroepitaxial island growth on pre-defined positions.
17:15	**633**	**Observation of Novel Vortical Entities in an Exciton-Polariton Condensate** *Konstantinos Lagoudakis [1], Tomas Ostatnicky [2], Alexey Kavokin [2], Yuri Rubo [3], Regis André [4], Daniel Le Si Dang [4], Benoit Deveaud-Plédran [1]* *1 EPFL-SB-IPEQ-LOEQ, Batiment PH, Station 3, 1015 Lausanne, Switzerland* *2 Theory of Light Matter Coupling in Nanostructures, School of Physics and Astronomy, University of Southampton, Southampton SO17 1BJ, United Kingdom* *3 Centro de Investigación en Energia, Universidad Nacional Autónoma de México, Temixco, 62580 Morelos, Mexico* *4 Institut Néel, CNRS, 25 Avenue des Martyrs , 38042 Grenoble, France* Spinor superfluids are known for their exotic vorticity properties. Some non standard vortical entities that carry fractional vorticity, are the commonly known half quantum vortices which are characterised by a π rotation of the fluid phase and a π rotation of the fluid spin when circumventing the vortex core. In the dilute atomic gas BEC community, spinor condensates are by now established in several laboratories. They constitute the ideal systems to create half quantum vortices but the required complexity to excite and observe them, has not allowed for their observation and thus, no experimental evidence is given for the existence of half vortices in spinor superfluids so far. Linearly polarised exciton polariton condensates in the solid state are alternative systems in which the observation of half vortices is favoured. In this experimental work, condensation of exciton polaritons, occurs in the same CdTe microcavity sample used as in our previous work. Owing to the strong coupling between intracavity and extracavity fields, all polariton properties are directly imprinted in the emitted photons and thus access to the phase, density and polarisation of the condensate are gained by standard optical measurements. The observation of half vortices requires near field polarisation resolved interferometry: If the fractional rotation of the linear polarisation and the fluid phase of half vortices is projected on a circular polarisation basis, then one gets a full phase rotation in one polarisation and zero phase rotation in the other. Using the right excitation and detection scheme, we have achieved to go beyond standard vortices and to give evidence of the first experimental observation of half quantum vortices in a spinor condensate.
17:30	**634**	**Control of the quantum well subband relaxation time by an applied electric field** *T. Fromherz [1], P. Rauter [1], N. Q. Vinh [2], B. N. Murdin [3], G. Mussler [4], D. Grützmacher [4], G. Bauer [1]* *[1] Institut für Halbleiter und Festkörperphysik, Universität Linz, Altenbergerstr. 69, 4040 Linz, Austria* *[2] FOM Institute for Plasma Physics, Rijnhuizen, 3430 Nieuwegein, Netherlands* *[3] Advanced Technologie Institute, University of Surrey, Guildford, United Kingdom* *[4] Forschungszenrum Jülich, 52425 Jülich, Germany* Crosspolarized photocurrent autocorrelation experiment on SiGe valence band multi-quantum-well (QW) structures were performed in order to directly monitor

		the light (LH) to heavy hole (HH) subband relaxation time and its dependence on an externally applied electric field. LH states of adjacent QWs are tunnel-coupled via an electric field. We show, that this coupling results in spatial indirect QW transitions and a consequent enhancement of the LH-HH relaxation time by a factor 2. The relaxation time was directly measured by establishing a non-equilibrium occupation of the LH ground state in the central well by a free electron (FEL) laser puls tuned to the HH-LH transition energy. With a delayed FEL pulse, the non-equilibrium occupation of LH state was directly monitored by measuring the additional PC excited from the non-equilibrium LH population into the continuum.
17:45	**635**	**Optical Tomography of Confined Microcavity Polariton Probability Densities** *Gaël Nardin, Taofiq Paraïso, Roland Cerna, Barbara Pietka, Yoan Léger, Ounsi El Daif, Francois Morier-Genoud, Benoît Deveaud-Plédran* *EPFL-LOEQ, Station 3, 1015 Lausanne, Switzerland* We present optical tomography measurements of the probability density of microcavity polaritons, confined in three dimensions by traps of various sizes and shapes. The traps are made of local extensions of the cavity spacer length, providing a confinement potential for the cavity mode. Strong coupling between the confined photonic modes and quantum well excitons gives rise to fully confined polariton modes. Collecting the photoluminescence emitted by the polariton modes under continuous nonresonant laser excitation, we reconstruct a three dimensional mapping of the photoluminescence, from which we can extract the spatial distribution of the confined states at any energy. We discuss the impact of various confinement geometries on the wavefunction patterns and give an intuitive understanding in terms of a light-matter quasiparticle confined in a box. To our knowledge, this work constitutes the first high resolution probability density imaging of confined quasiparticles in a semiconductor heterostructure. Indeed, the fact that, due to their small De Broglie wavelength, the wavefunction of charge carriers generally cannot be imaged by far-field optical apparatus, is overcome in our case by taking advantage of the strong coupling with light. This probability density tomography could provide crucial information on the physics of polariton devices.
18:00	**636**	**Formation of gold nanowires in superfluid helium** *Peter Moroshkin [1], Victor Lebedev [1], Bernard Grobety [2], Eugene Gordon [3], Peter Tönnies [4], Antoine Weis [1]* *[1] Department of Physics, University of Fribourg, Chemin du Musée 3, 1700 Fribourg, Switzerland* *[2] Department of Geosciences, University of Fribourg, Chemin du Musée 6, 1700 Fribourg, Switzerland* *[3] Institute of problems of Chemical Physics RAS, Semenov av. 1, 142432 Chernogolovka, Russian Federation* *[4] Max-Planck-Institut für Dynamik und Selbstorganisation, Bunsenstrasse 10, 37073 Göttingen, Germany* We report on an experimental study of filament formation by metallic particles created during laser ablation of gold in liquid He. Filament fragments removed from the cryostat, after warm-up were examined by optical and electron microscopy.

		The observed macroscopic filaments are in fact ropes composed of a large number of very thin wires. Each individual wire has a thickness of several nanometers and an aspect ratio larger than 100. The length of a rope made of such nanowires can reach several cm. We interpret the filament formation to result from the coalescence of impurity particles (gold atoms, clusters) on quantized vortex lines in superfluid He. The particles aggregate along the vortex core, thereby forming quasi one-dimensional strings. The systematic control of this novel method for producing metal nanowires may have important applications in nanoscience. Work funded by the Swiss National Science Foundation, # 200020-119786
18:15	**637**	**Statistical properties of nonequilibrium transport quantities in integer quantum Hall systems** *Christoph Uiberacker [1], Rudolf Römer [2], Josef Oswald [1]* *[1] Institut für Physik, Montanuniversität Leoben, Franz-Josef-Strasse 18, 8700 Leoben, Austria* *[2] Center for Scientific Computing, University of Warwick, Coventry CV4 7AL, UK* We use the Nonequilibrium Network Model (NNM) [1,2] to calculate resistances in 2D electron systems under strong magnetic fields. The random potential, caused by impurities, is treated with a regular model potential and transport is assumed to occur by tunneling through saddle points. The energies of the Landau levels are calculated by a self-consistent Thomas-Fermi model. We assume fields to be linear across saddle points, which enables us to use scattering probabilities calculated for equilibrium. This directly implies a transfer function for chemical potentials by assuming all states connected to a saddle point to be in local equilibrium, that is, a purely off-diagonal conductivity tensor with $G_{xy}=e^2/h$ per level. In this way we investigate scaling of resistances and their fluctuations and derive critical exponents. It appears that a single Landau level calculated with the NNM belongs to the universality class of classical 2D percolation, in contrast to findings of Chalker and Coddington [3]. From successful simulations of transport experiments with the NNM [4] we pose the question: Is phase-coherence important in nonequilibrium or is it destroyed? [1] J. Oswald, Physica E 3, 30 (1998). [2] J. Oswald and M. Oswald, J. Phys.: Condens. Matter 18, R101 (2006). [3] J. T. Chalker and P. D. Coddington, J. Phys. C 21, 2665 (1988). [4] J. Oswald, Int. J. Mod. Phys. B 21, 1424 (2007); M. Oswald, J. Oswald and R. Mani, Phys.Rev. B 72, 035334 (2005); C. Sohrmann, J. Oswald, and R. A. Römer, Quantum Percolation in the Quantum Hall Regime, Lecture Notes in Physics, Vol. 762, 163 (2009)
18:30		***END***
19:30		***Conference Dinner***

Time	ID	Solid State Physics IV: Nano & Photonics II *Chair: J. Faist, ETH Zürich*
09:00		***PLENARY SESSION***
12:40		***Postersession, Lunchbuffet***
14:00	**641**	**In situ synchrotron radiation studies on the nucleation and growth of SiGe nanostructures** *Tobias Schülli [1], Marie-Ingrid Richard [2], Gilles Renaud [1], Günther Bauer [3], Vaclav Holy [4]* *[1] Institut Nanosciences et Cryogenie/SP2M/NRS, 17 rue des Martyrs, 38054 Grenoble, France* *[2] IM2NP, UMR CNRS, Faculté des Sciences de St Jérôme, 13397 Marseille, France* *[3] Institut für Halbleiterphysik, Johannes Kepler Universität Linz, Altenberger Strasse 69, 4040 Linz, Austria* *[4] Charles University, Faculty of Mathematics and Physics, Ke Karlovu 5, 12116 Prague, Czech Republic* The growth of Ge on Si(001) has been extensively studied over the last years. Being a promising candidate for applications of semiconductor heterostructures, the SiGe system serves as well as a model for Stranski Krastanov growth. We have investigated different aspects of the growth kinetics, using in situ x-ray scattering methods. The different stages of the growth as 2D-3D transition and the different shape transformations can be clearly distinct. Our results can quantify parameters as material transport and eventual ripening effects during the different stages of the growth, tracing an image of the size and shape evolution of the islands. Furthermore, the method seems to be particularly suited to correlate these parameters with the internal structure of the islands as interdiffusion and the appearance of defects during growth.
14:30 **moves to 18:30 on 3.9.**	**642**	**Al-free Material System for InP-based Intersubband Devices** *Aaron Maxwell Andrews, Hermann Detz, Michele Nobile, Pavel Klang, Elvis Mujagic, Werner Schrenk, Gottfried Strasser* *Institute for Solid-State Electronics and Center for Micro- and Nanostructures, Vienna University of Technology, Floragasse 7, 1040 Wien, Austria* Optical intersubband (ISB) devices, like quantum well infrared photodetectors (QWIP) and quantum-cascade lasers (QCL), have reached a high level of maturity, but are often limited by the material system used. In most QWIPs and all published QCLs, the well barrier material is Al-based which leads to a high barrier effective mass, growth defects, interface roughness, filament currents, and difficult post-processing. We develop the growth, characterization, and realization of ISB devices in the Al-free InP-based InGaAs/GaAsSb material system. The InGaAs well and GaAsSb barrier room temperature conduction band offset (360meV) and effective mass (0.045me) were determined by multiple quantum well (4.5 to 12 nm) ISB absorption samples. We report the first InGaAs/GaAsSb QWIPs with peak detectivity at 7.6 µm and the first Al-free QCLs lasing at 11.2 µm. We acknowledge the support of the Austrian Nano Initiative RPC PLATON.

14:30	**643**	**4.5 µm VECSEL (vertical external cavity surface emitting laser) at room temperature** *Hans Zogg, Rahim Mohamed, Amir Khiar, Matthias Fill, Ferdinand Felder* *Thin Film Physics Group, LSSP, ETH Zürich, Technoparkstr 1, 8005 Zürich, Switzerland* We report the first VECSEL for the mid-infrared range operating up to above RT. The active part is a single 850 nm thick epitaxial PbSe layer, followed by a 2.5 pair PbEuTe/PbTe Bragg mirror. No microstructural processing is needed. Excitation is optical with 1.55 or 2.2 µm wavelength lasers. The devices operate up to 65°C in the active layer with 100 ns pulses, and 6 mWp output power at 27°C heat sink temperature. CW (Continous Wave) is feasible employing a diamond heat spreader; such a spreader will restrict the temperature rise to below 35°C under typical operation conditions. In contrast to III-V quantum cascade or type W mid-IR lasers which are edge-emitters, VECSELs emit in a narrow cone (~1°). Extension to lower and higher wavelength is easily possible employing PbEuSe or PbSnSe active layers. (More: www.tfp.ethz.ch)
14:45	**644**	**Optomechanical resonators with minimal acoustic dissipation** *Garrett D. Cole [1,2], Ignacio Wilson-Rae [3], Michael R. Vanner [1,4], Simon Gröblacher [1,4], Markus Aspelmeyer [1]* *[1] Institute for Quantum Optics and Quantum Information, Austrian Academy of Sciences, Boltzmanngasse 3, 1090 Vienna, Austria* *[2] Center for Micro and Nano Structures, Vienna University of Technology, Floragasse 7, 1040 Vienna, Austria* *[3] Technical University München, 85748 Garching, Germany* *[4] Faculty of Physics, University of Vienna, 1090 Vienna, Austria* Micromechanical resonators are a promising means to observe quantum phenomena in macroscopic objects. Within this emerging field of quantum optomechanics, the overarching goal is to combine the concepts of cavity quantum optics with radiation-pressure coupling in order to generate and detect quantum states of optomechanical systems. In this regime, resonators of exceptional acoustic and optical quality are required; specifically, these devices must combine both high reflectivity and low mechanical dissipation (high Q) for the vibrational mode of interest. A major challenge in this endeavor is the coupling of the micromechanics with the external environment. Here, we present both experimental and theoretical results for novel megahertz resonators based on freestanding epitaxial $Al_xGa_{1-x}As$ Bragg reflectors in which the anchoring to the supports has been engineered to minimize acoustic losses. Compared with dielectric reflectors, the use of monocrystalline heterostructures gives rise to significant improvements in the achievable Q while simultaneously exhibiting near unity reflectivity.

15:00	**645**	**Silicon Photonic Microcavities as Candidates for Switching** *Sophie Schönenberger [1], Thilo Stöferle [1], Rainer F. Mahrt [1], Nikolaj Moll [1], Bert J. Offrein [1], Thorsten Wahlbrink [2], Jens Bolten [2]* *[1] IBM Research GmbH, Säumerstrasse 4, 8803 Rüschlikon, Switzerland* *[2] Advanced Microelectronic Center Aachen (AMICA), Otto-Blumenthal-Strasse 25, 5207 Aachen, Germany* We report on two specific types of integrated microcavities based on silicon-on-insulator (SOI) technology, namely circular grating resonators (CGRs) and 1D photonic crystal cavities. They open up the feasibility of highly integrated ultrafast electro-optical modulators due to their small active optical volume of less than 1 μm^3 and very small device area. The structures are designed by optimizing the quality factor Q of the isolated cavities using 3D finite-difference time-domain (FDTD) methods, where theoretical Q-values up to 10^6 are reached for the isolated cavities. By adding in- and out-coupling waveguides the Q-factor will reduce to a few thousands, corresponding to photon lifetimes and therefore optical switching times in the range of a few picoseconds. The linear optical properties of such cavities are investigated by transmission spectroscopy. High speed all-optical switching is demonstrated by optical excitation of charge carriers within the cavity.
15:15	**646**	**Measurement of the Raman Tensor of Stibnite (Sb_2S_3)** *Paolo Sereni [1], Maurizio Musso [1], Peter Knoll [2], Roland Resel [3], Markus Koini [3], Peter Blaha [4], Karlheinz Schwarz [4], Günther Schmidt [4]* *[1] University of Salzburg, Department of Materials Engineering and Physics, Hellbrunnerstrasse 34, 5020 Salzburg, Austria* *[2] University of Graz, Department of Experimental Physics, Institute of Physics, Universitätsplatz 5, 8010 Graz, Austria* *[3] Graz University of Technology, Institute of Solid State Physics, Petersgasse 16/II, 8010 Graz, Austria* *[4] Wien University of Technology, Institute of Materials Chemistry, Gumpendorfer Str. 1a, 1060 Wien, Austria* Since sulfide minerals are potentially attractive materials for thermoelectric and photovoltaic applications, our group is performing a research programme aimed at measuring the Raman tensor of Stibnite, Sb_2S_3, a naturally occurring sulfosalt semiconducting mineral with a band gap of approximately 1.4-1.7 eV. X-ray diffraction pole figure technique was used to determine the structural properties of the single crystalline sample. Polarization-dependent Raman spectroscopic measurements have been performed for various sample orientations using an infrared laser excitation line (1064 nm). The polarization-dependent analysis yields 10 Ag, 5 B1g, 10 B2g and 5 B3g Raman active modes from the five non-equivalent sites. The corresponding phonon frequencies have been calculated using the PHONON/WIEN2k codes. The obtained measurement results are here presented and compared with the values predicted by the calculations.

15:30	**647**	**Terahertz Si:B blocked-impurity-band detectors by ion implantation** *Patrick Rauter [1], Thomas Fromherz [1], Stefan Winnerl [2], Michael Zier [2], Andreas Kolitsch [2], Manfred Helm [2], Günther Bauer [1]* *[1] Institute of Semiconductor and Solid State Physics, University of Linz, Altenberger Str. 69, 4040 Linz, Austria* *[2] Institute of Ion-Beam Physics and Materials Research, Forschungszentrum Dresden-Rossendorf, Postfach 510119, 01314 Dresden, Germany* One means of realizing terahertz detectors is constituted by blocked impurity band detectors (BIBs).Conventionally, BIBs are fabricated by epitaxially growing an ultra-pure Si layer, which prevents the generation of high dark-current, on top of a highly doped impurity layer, which serves as the optically active region of the device. In this work, we report the fabrication of vertical Si:B BIBs by completely non-epitaxial methods, namely by the ion implantation of a sharply modulated doping profile into a high-ohmic SOI wafer. Our samples exhibit highly competitive responsivities of 10 A/W for photon energies of 50 meV. Within a high-gain region our devices feature avalanche gain values of 100, which is of the order required for single photon detection. The demonstration of an ion-implanted vertical Si:B BIB opens a highly promising road to technologically simple and cheap BIB array fabrication with implantation substituting the delicate MBE growth of ultra-clean blocking layers.
15:45		
16:00		***Coffee Break***
		Solid State Physics V: Awards & Fachausschusssitzung FKP *Chair: U. Staub, PSI Villigen & W. Jantsch, Uni Linz*
16:15	**32**	***Winner of the ÖPG "Karlheinz Seeger" Award***
16:45	**33**	***Winner of the ÖPG "AT&S" Award***
17:00	**42**	***Winner of the SPS Award for Condensed Matter Physics, sponsored by IBM***
17:30		***FKP Fachausschußsitzung***
18:00		***END***
19:30	**21**	***Public Lecture***

651 Ultra-small-angle scattering of polarized neutrons on amorphous soft-magnetic ribbons

Gerald Badurek [1], Roland Grössinger [2], Reiko Sato-Turtelli [2], Erwin Jericha [1]
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Amorphous soft-magnetic materials represent an attractive source material for highly efficient magnetic shielding. Fabricated as ribbons under various heat treatment and applied stress conditions these materials may exhibit anisotropic orientation of the magnetic domains with respect to the ribbon axis. We have studied amorphous ribbons based on various Fe-B-Co compositions which exhibit domain sizes in the micrometer range in the non-magnetized state, and much larger homogeneous magnetic regions with an external magnetic field applied. We have studied both magnetized and non-magnetized amorphous magnetic ribbons whose axes were orientated along and perpendicular to the direction of high angular resolution of a novel ultra-small angle scattering instrument with polarized neutrons (USANSPOL). Quantities of investigation were the sizes and possible form anisotropy of the domains in the non-magnetized samples and the extent of magnetically homogeneous regions in the magnetized samples.

652 Magnetic and electronic structure of multiferroic RMn_2O_5

Y. Bodenthin [1], U. Staub [1], M. García-Fernández [1], R. A. De Souza [1], M. Garganourakis [1], M. Janoschek [2, 3], J. Schlappa [1], E. I. Golovenchits [4], V. A. Sanina [4], S. G. Lushnikov [4]
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[2] Laboratory for Neutron Scattering, ETH Zürich and Paul Scherrer Institut, 5232 Villigen PSI, Switzerland
[3] Physik Department E21, TU München, 85748 Garching, Germany
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Materials presenting a coupling between magnetism and ferroelctricity are usually called multiferroics. The interest in these materials lies in the possibility of control of electric (magnetic) properties by the application of a magnetic (electric) field, which would be of great use in spintronic devices.
In the orthorhombic family RMn_2O_5 series (R= Y, Er, Ho, Tb) the magnetoelectric couplings are gigantic, and the magnetic phases involved are complicated. Cooling from the paramagnetic phase one first enters an incommensurate magnetic phase (2D-ICM), with a wave vector $q = (q_x, 0, q_z)$, where both q_x and q_z are incommensurate. On further cooling, the system moves into a commensurate phase (CM), with an intermediate incommensurate phase (1D-ICM) depending on the rare earth. In the CM phase the systems present a ferroelectric (FE) polarization, although the onset of ferroelectricity seems to be associated with the 2D-ICM transition. We used resonant soft x-ray scattering (RSXS) to study the magnetic properties of RMn_2O_5 with and without applied electric field [1]. This technique, that probes directly the Mn 3d and R 4f states, has proved to be a powerful tool to study charge, orbital and magnetic ordering phenomena.
Using RSXS on the Mn $L_{2,3}$ and Er $M_{4,5}$ edges we studied the magnetic ordering of $ErMn_2O_5$. We demonstrate that ferroelectricity strongly couples with the commensurate magnetic structure and that the magnetic order can be deliberately modulated, excited and switched by applying a static electric field. The obtained magnetic structural and the electronic information are compared with those obtained by a recenty neutron study [2].

[1] Y. Bodenthin et al., Phys. Rev. Lett. 100, 027201 (2008).
[2] B. Roessli et al., J. Phys. : Condens. Matter 20, 485216 (2008).

653 Interface trap density measurements in high-k/Ge gate stacks and determination of the charge neutrality level

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The correct determination of the trap density distribution $D_{it}(E)$ at the oxide-semiconductor interface of future high mobility channel MOSFETs is essential for the optimization of their electrical performance. The conductance method, which was efficiently applied to Si, reaches its limit on alternative substrates like low band gap germanium (Ge), because of the strong influence of minority carrier processes. Recent investigations show that these restrictions are severe and might lead to incorrect conclusions. We discuss here the appearance of such processes, compare the conventional conductance method [1] to the full conductance method of Martens et al. [2], and propose an alternative where a reverse bias V_r is applied to source and drain with respect to the substrate. In this configuration, it becomes possible to separate, on the same device, the contribution of electron and hole trap distributions and by the same token to determine the position of the charge neutrality level (CNL) at the surface of the semiconductor. It is found to be located 0.14 eV above the valence band edge, in good agreement with published reports [3].

[1] E. H. Nicollian and J. R. Brews, MOS Physics and Technology (New York: Wiley, 1982)
[2] K. Martens, et al., IEEE Trans. Electron. Dev. 55, 547 (2008)
[3] A. Dimoulas et al., Appl. Phys. Lett. 89, 252110 (2006)

654 Structure, electrical conductivity and gas sensing behaviour of nano-particulate tungsten oxide films

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[2] Institute of Solid State Physics, Graz University of Technology, Austria, Petersgasse 16, 8010 Graz, Austria

Tungsten trioxide with a small, uniform grain size, as confirmed by XRD and TEM studies was synthesized using a microwave plasma process. Using ultrasonic dispersion and spin coating, homogenous nano-particulate films were deposited on glass substrates with interdigital Au electrodes. After pre-annealing at temperatures up to 500°C the sensor devices were installed in a gas testing chamber with integrated heating for measuring the electric resistance as a function of temperature and analyte gas composition. In dry, synthetic air the electric resistance showed a reproducible, pronounced maximum at temperatures in the range of 100°C. Gas sensing tests showed a reproducible detection of the O_2:N_2 ratio as well the addition of a few ppm of H_2S to air and an improvement of response time with increasing temperature in the range from 150 to 250°C. Pre-annealing at higher temperatures leads to a hexagonal WO_3 structure and better device stability, but reduced gas sensitivity.

655 Investigations of the antenna effect of photovoltaic solar modules

Markus Drapalik [1], Julian Schmid [1], Erika Kancsar [1], Viktor Schlosser [1], Gerhard Klinger [2]
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The ability of photovoltaic devices to receive electromagnetic radiation in the frequency range between 1 Hz and 1 GHz was compared with the performance of a monopole antenna. Spectra coming from natural sources as well as generated signals were simultaneously recorded with a digital storage oscilloscope. The antenna gain of the photovoltaic cell or module was determined relative to the gain of the reference monopole. We observed that for cells or modules with an area greater than 200 cm^2 their gain equals or is even somewhat greater than the one of the 83 cm long monopole in the whole frequency range. Photovoltaic modules based on amorphous silicon generally exhibit a larger gain than that one observed on crystalline silicon modules of equal size. The results of our investigations will be presented and potential consequences arising from electromagnetic compatibility regulations for large area photovoltaic power generators will be discussed.

656 Structural changes of alkali metals induced by geometrical confinement in nanopores

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Confinement effects in nanoporous systems are essentially due to i) host-guest interactions at the interface and/or ii) changes in the confined material following from geometrical constraints. The first case applies e.g. to fluids in nanoporous systems and has recently been studied in some detail. On the other hand, much less is known about the second case realized, e.g., in confined metals. In the present investigation we study the alkali metals Sodium and Lithium confined in porous Vycor glass with an average pore size of 9 nm using X-ray Scattering and Differential Scanning Calorimetry. Surprisingly, in the confined system close-packed structures dominate already at room temperature while the bulk structure of Na and Li is bcc at ambient conditions and transforms to close-packed phases only well below 100K. This indicates an upward shift of the phase transition temperature by more than 200K due to geometrical confinement.

657 Investigation of the interior surface of a silicon/metal nanocomposite

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A nanocomposite material, composed of a porosified silicon wafer and electrochemically deposited metal-nanostructures is investigated with respect to the interface between silicon and metal. The inner surface of the porous silicon matrix is covered by an oxide layer of about 5 nm, if the samples are aged in air before the deposition procedure. Metal-filling of as-etched specimens also show an oxide content which arises during the galvanic process. The kind of oxygen depends on the deposition process and also on the kind of deposited metal. Accurate structural analysis of individual particles shows oxidation of the metal which likely arises after the preparation of the membranes which are exposed to ambient air. Knowledge of the interface is not only necessary for the interpretation of the gained experimental results but also to figure out possible applications of the hybrid system.

658 Effect of rapid solidification on magnetostriction and microstructure in melt-spun Fe-Al ribbons

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Our previous study showed that the achievable magnetostriction in the melt-mould cast iron-rich $Fe_{100-x}Al_x$ (x=15,19,25) alloys depends significantly on the structural phases (A2,B2 or DO3) as well as on the degree of texture and disorder due to different heat treatments and quenching from high temperature. Our investigation demonstrates that the lattice constant, the grain size and the magnetostriction depend strongly on the quenching rates. The results indicate that the variation of the quenching rate induced different degree of internal stress, disorder and crystallographic texture, which can be observed in different behavior in magnetostriction.

659 A study of the low pass characteristics of photovoltaic solar cells

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The electrical equivalent circuit of a photovoltaic solar cell connected to an external consumer is formed by a light dependent current generator and several current dividers. Since the internal elements of a solar cell are voltage dependent complex conductors, described by a capacitor in parallel with an ohmic resistor, they act as a low pass filter to the external circuitry. Front contact grid of the cell and external wiring can add an additional inductor to the system. Since solar cells can generate electrical noise caused by a variety of internal and external sources (for instance thermal noise, shot noise, light fluctuations, vibrations, RF signal reception) the knowledge of the a.c. transfer function under operating conditions becomes important because low frequency noise will be transmitted from the solar array to the power converter/conditioner with only little attenuation. In the present work we have investigated the electrical characteristics of photovoltaic solar cells made from crystalline silicon under d.c. as well as under a.c. conditions. Experimental results were compared with simulations in order to verify the validity of the assumed circuit model. From the investigations we have made so far a cut off frequency in the range between 10kHz and 100kHz independent of the cell area was found.

660 Coherence Properties of Microcavity Polaritons Investigated by Heterodyne Four-Wave-Mixing Experiments

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In the strong coupling regime of semiconductor microcavities, the eigenstates of the system are mixed exciton-photon quasiparticles called polaritons. Polaritons are composite bosons and show a high degree of coherence provided by their photonic content. Their excitonic content, on the other side, enables them to interact with each other. This last feature is in

	particular responsible for the appearance of different non-linear phenomena such as saturation, complex formation, blue-shift etc. The investigation of correlations between polariton states in microcavities is therefore a challenging many-body problem. We report here on the coherent dynamics of polaritons in a high quality III-V microcavity. We use Heterodyne spectral interferometry to filter the FWM signal from other emission components. A peculiar oscillation pattern of the FWM amplitude is observed in the time domain. It differs strongly from the normal mode oscillations arising from the lower- and upper-polariton-branch coherent emission. This behavior depends both on the excitation density and on the cavity detuning. We will discuss these results in the framework of polariton-polariton and polariton-photon interactions.
661	**Molecular orientations in the low-temperature phase of C_{60}** *Gerhard Krexner, Faculty of Physics, University of Vienna, Boltzmanngasse 5, 1090 Vienna, Austria* *Jürg Schefer, Paul Scherrer Institut, PSI, 5232 Villigen, Switzerland* Solid C_{60} undergoes a phase transition from a fcc high-temperature to a simple cubic low-temperature phase at about 260 K. While above T_c the molecules rotate more or less freely, the molecular orientational distribution below T_c is restricted to two discrete states. Previous studies aiming at the determination of these molecular orientational angles yielded relatively small, however, significant differences which were interpreted as a dominance of, alternatively, short- or long-range ordering tendencies in C_{60} molecular crystals. In order to better understand the origin these discrepancies we first performed a detailed numerical analysis of Bragg intensities allowing to single out those reflections which are particularly sensitive to the molecular orientational angles. Then, the temperature dependence of these reflections was studied in a neutron single crystal diffraction experiment on the instrument TriCS at the SINQ neutron source at PSI.
662	**Magnetic Characterisation of Industrial High Strength Steels** *Martin Kriegisch [1], Paul Fulmek [2], Nasir Mehboob [1], Peter Haumer [2], Roland Grössinger [1]* *[1] Institut für Festkörperphysik, TU Wien, Wiedner Hauptstraße 8-10/E138, 1040 Wien, Austria* *[2] Institut für Sensor und Aktuatorsysteme, TU Wien, Gußhausstraße 25-29, 1040 Wien, Austria* Two high strength cold rolled steels were investigated with respect to their magnetic properties at room temperature. For this purpose the magnetization curve was measured using a classical 25 cm-Epstein frame. After careful sample demagnetization, the measurements were performed at frequencies between 0.1 Hz and 50 Hz by applying a sinusodial induction function. In a cold rolled material a magnetic anisotropy parallel to the rolling direction can be expected. In order to make this visible we determined also the microstructure and performed magnetic measurements parallel and perpendicular to the rolling direction. The thus determined results will be analyzed using the Energetic Model.

663 Structural investigation of nanowires using x-ray diffraction

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Making semiconductor nanowires exploitable for applications, requires precise control of their structural properties. For this purpose, we used x-ray diffraction to investigate InAs/InP nanowires with respect to their epitaxial relationship to the substrate, their orientation distribution, their strain state, as well as the amount of wurtzite phases in the nanowires. While for bulk materials only the zincblende structure is stable, in nanowires wurtzite segments are easily introduced, with consequences on the band structure. In addition to a certain wurtzite content, we find an increased lattice constant in growth direction.
Due to defects such as stacking faults, the crystal lattice orientation may change in nanowires rather easily. This can be determined from pole figures, which have been recorded for several nanowire systems, among them branched Si/GaAs nanowires grown by a combination of MOVPE and MBE. The obtained structural data serve as feedback for wire growth, and as input for the calculation of optoelectronic properties.

664 Crystal Structures and Intermolecular Spin Interactions of La@C_{82} in Fullerene Matrices

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Mono-metallofullerenes (MFs) like La@C_{82} or nitride endohedral fullerenes N@C_{60} have appealing electron spin states and magnetic properties which have potential for solid-state quantum information processing and spintronics. We have investigated the ESR properties and crystal structures of solid-state La@C_{82} embedded in various types of empty fullerene matrices. The dipole-dipole interaction between La@C_{82} molecules can be controlled by changing the concentration of La@C_{82} in the empty fullerene matrices. The crystal structures of empty fullerenes with La@C_{82} represent the dispersion behavior of La@C_{82} molecules. The hexagonal crystal structure of a C_{82} matrix results in a narrow ESR hyperfine structure of La@C_{82}. Finally, a C_{60} matrix has low dispersion ability because of the large difference in cage size, and La@C_{82} molecules form dimer- or cluster-like structures in C_{60} matrix.

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665 Neutron holography using multidetectors

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Neutron holography is a novel technique providing information on local atomic arrangements in the bulk. The recording of holograms of satisfactory quality requires data taking with good statistics over a large range of sample orientations and/or detector positions leading to inconveniently long measuring times. The use of stable and well calibrated multidetectors, however, could reduce the necessary time by one or two orders of magnitude. The instrument TriCS at the SINQ neutron source at PSI disposes of one of the very few fully operational neutron multidetectors presently available in Europe and, therefore, offers the possibility to test this approach. We report on neutron holographical studies of palladium hydride and ammonium chloride performed using the multidetector at TriCS and discuss various technical problems arising specifically in the context of neutron holography experiments.

666 The effect of annealing temperature and Ni doping on structural, optical, and electrical properties of $La_{1/3}Sr_{2/3}Fe_{1-x}Ni_xO_{3-\delta}$ thin film and bulk

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We present the effect of annealing temperature and Ni doping on structural, optical, and electrical properties of $La_{1/3}Sr_{2/3}Fe_{1-x}Ni_xO_{3-\delta}$ pellets and sol gel thin films. Thin films have been synthesized and grown on sapphire using modified Pecchini method and spin-coating. The films are annealed at temperatures such as 600°C, 700°C and 800°C for 30 min, while the pellets are sintered at 1200 °C for 12 hours in order to get pure perovskite structure. Temperature dependent conductivity measurements have been performed by using four-point probe technique. All samples - thin films and pellets - showed semiconducting behavior over the temperature and obvious increase of conductivity by adding nickel. Films synthesized at 700°C have highest conductivity. For the pellets, the electrical conductivity increases by two orders of magnitude by adding 20 % of nickel to $La_{1/3}Sr_{2/3}FeO_3$ even at room temperature. The band gap of the films decreases with increasing annealing temperature possibly due to the crystallite size increasing.

667 A Ferromagnet with a new topology in azide-bridged Cobalt(II) complexes

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A new polynuclear azide-bridged cobalt(II) complex, catena-[HMTA-tetra-azido-aqua-dicobalt(II)], (HMTA = hexamethylenetetramine) has been synthesized and magnetically and structurally characterized. The monoclinic structure of the title complex crystallizes in the space group C2/m with Z = 4. It consists of a complex 3D system in which coexists end-on and end-to-end azido bridging ligands between the Co(II) centers. The HMTA ligand is also linking three different Co(II) atoms. The network analysis shows a three- and six-connected

network topology not yet previously reported. The magnetic properties of the title complex are also reported, and it was found that the magnetic interactions define another new three- and four-connected net assigned as a [6.8(2)][6(4).10(2)]-tfo-net. Magnetic ordering and spontaneous magnetization is achieved below T_c = 15.6 K.

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Magneto-structural investgations of benzene-tetracarboxylato complexes

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The design and characterization of Molecular Magnetic Materials based on coordination chemistry compounds is now an important topic in material science. We recently have reported the magneto-structural properties of a series of transition metal complexes of benzene-dicarboxylato (BDC), like terephthalato anion, as bridging ligands [1]. In progress of our work, we now report the synthesis, single crystal structure investigations as well as the magnetic susceptibility measurements of a series of di-, tri- and tetra-nuclear copper(II) amine complexes with benzene-tetracarboxylate (BTC) as bridging ligand.

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Molecular magnetic systems containing Cu(2n)-cluster units

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We report the synthesis and structural characterization of a series of new copper(II) cluster complexes obtained by the reaction of copper(II) salts with substituted N,O-bridging ligands, like bis(dimethylamino)-2-propanol (bdmap) or dipyridylketone (dpk), with substituted phosphonate bridging anions. In the present cluster systems the number of Cu(II) centers is 2, 4 or 6; and the central metal atoms have coordination numbers 4 (square planar) and 5 (square pyramidal). Temperature variable magnetic susceptibility measurements show strong antiferromagnetic to moderate ferromagnetic coupling between the paramagnetic Cu(II) centers. A detailed analyses of the magnetic coupling parameters as well as possible super-exchange pathways are discussed.

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Exploring the Potential for Application of the New Iron Pnictide Superconductors in High Magnetic Fields

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High upper critical fields, small electronic anisotropy and negligible dissipation by vortex motion are prerequisites for possible applications of superconductors, together with suitable metallurgical properties. To explore the new class of Fe-based superconductors, we have

studied the relevant electrical properties of $SmFeAs(O_{0.75},F_{0.2})$ in pulsed fields up to 65 Tesla, on Focused Ion Beam micro-cut single crystals oriented along the main crystal directions. Over large regions in temperature and field we find all the electronic properties, including substantial critical current densities (> 5 10^6 A/cm^2) and negligible losses due to dissipation (> 43 T @ 15K), to be promising for potential application.

671 High Performance of Thermally Stable Enhancement-Mode HEMTs on InAlN/GaN Heterostructures

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We report on a novel device structure for enhancement-mode (E-mode) high electron mobility transistors (HEMTs) based on a lattice-matched InAlN/GaN heterostructure capped with highly doped GaN to reduce and stabilize the surface potential. The GaN cap above the thin barrier of 1 nm InAlN and 1 nm AlN was selectively etched at the gate leading to a record transconductance above 0.6 S/mm after thermal post-annealing at 400°C and 500°C. The maximum drain current measured on a 500 nm gate was 0.8 A/mm. Comparing the device to a non-recessed and Al_2O_3 capped MOSHEMT proved a low damage fabrication process and gives opportunities for normally-off and normally-on operation on the same substrate. Rf dispersion was reduced due to the free electrons in the cap layer.

672 Dynamics of Strongly Correlated Fermi Fluids

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A manifestly microscopic determination of the dynamics of fermionic quantum fluids still poses a number of open questions. Among those, the two most prominent problems are the role of exchange effects and the importance of multi–pair fluctuations. Here we demonstrate that, on the level of a generalized Random Phase Approximation (RPA), exchange effects lower the collective mode towards the particle-hole continuum. This is in agreement with recent experiments [1,2] on the phonon-roton mode in ^{3}He. Acounting for dynamic two–pair fluctuations also results in a lowering of the roton minimum. It is intuitive that such effects become increasingly relevant when the excitation wavelengths become comparable with the interparticle distance. In addition, (and in contrast to RPA type approaches), these processes give rise to a damping of the collective mode, and its reemergence at the high-energy side of the particle–hole band. Our formalism is based on variationally optimizing the time–dependent wave funcion. We derive energy dependent effective interactions for the direct as well as the exchange channel. State–of–the–art results for the static ground state structure are used as input. We present results for both ^{3}He and the electron liquid, in the bulk and in two–dimensional layers.

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673 Temperature dependent Hall study of InN layers made by nitridation of InAs substrate

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InN layers, obtained by nitridation of InAs substrates, are studied by temperature dependent Hall measurements (T-Hall). The InN layers are 100 nm thick, and were obtained by nitridation of InAs substrates, varying nitridation parameters: temperature, time and ammonia flux. The T-Hall measurements are done from 35 K to 373 K. The charge carrier density (n), mobility (μ) and resistivity (ρ) are calculated, using a double-channel model to account for the effect of the InAs substrates and reported as function of the nitridation parameters. The InN layers are always n-type and a maximum n value of 2×10^{20} cm^{-3} with a maximum μ of 2200 $cm^2V^{-1}s^{-1}$ are obtained for the sample prepared with the highest nitridation temperature (700°C) and the highest ammonia flux (500 sccm), for one hour.

674 Ohmic contacts of n-type $Ti_xCr_{2-x}O_3$ and its application to temperature dependent Hall measurements

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An ohmic contact is proposed for the semiconductor $Ti_xCr_{2-x}O_3$. It consists of 10 nm Ti and 50 nm Au, followed by thermal annealing at 1000°C for 20 min in N_2 atmosphere. Ohmic contacts are obtained on three samples with x=0.17, 0.41 and 1.07 in a van der Pauw geometry for temperature dependent Hall measurements (T-Hall). T-Hall measurements are done between 35 K and 373 K. All samples showed n-type nature, with a charge carrier density (n) on the order of 10^{20} cm^{-3}, decreasing as x increased. All samples showed a minimum on n around 150 K. Mobilities are almost constant at 11, 28 and 7 $cm^2V^{-1}s^{-1}$ for x=0.17, 0.41 and 1.07, respectively.

675 Magnetic relaxation in T-Al_3Mn(Pd,Fe) compounds

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T-Al_3Mn, a complex intermetallic Taylor phase, contains 156 atoms in the orthorhombic unit cell (space group Pnma). Some of the sites are either too close in space to be occupied simultaneously or show mixed Al/Mn occupancy, causing chemical and spatial disorder in the lattice, which is amplified by the Pd/Fe substitution for Mn. Magnetically it can be characterized as a spin glass. We report on both field dependence of the freezing temperature and the time dependence of the magnetization.

676 ^{57}Fe Mössbauer study on Fe-Sb compounds

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$FeSb_2$ is a narrow gap semiconductor for which a colossal Seebeck coefficient and interestig magnetic properties have been reported, which makes the samples an intersting canditate for thermoelectric applications. In this work we report on a magnetic and a high field ^{57}Fe Mössbauer investigation. A correlation between the locally determined hyperfine fields and the temperature dependence of the magnetization is obtained. The results are compared to those obtained for nearly 1:1 Fe-Nb compounds.

677 Self-assembled nanostructures within porous silicon

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The self-assembly process of porous silicon which is achieved by anodization of a silicon wafer is attempted to describe by a sort of Ostwald ripening which is well known regarding particle growth surfaces. This kind of self organization is due to the minimization of the free energy associated with the interface of two phases. The pore growth occurs in the manner that larger pores are formed on the expense of smaller ones resulting in a mesoporous structure with a quasi-regular pore-arrangement. Within these pores transition metals are deposited by a galvanic process. The precipitates are also self-arranged in a quasi-regular way leading to a 3-D array of metal-structures. These deposites can be tuned I size, shape and spatial distribution by the process parameters leading to samples with desired physical properties.

678 Crystal growth and composition-property relationship of $Ce_3Pd_{20}Si_6$

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Single crystals of the heavy fermion compound $Ce_3Pd_{20}Si_6$ were grown by various techniques - from the melt and from high temperature solution using fuxes of various compositions. The resulting stoichiometry of the crystals as well as their physical properties show sizable dependence on the different growth techniques. The Ce content (delta Ce) varies by more than 3% among all grown single crystals. We have revealed a systematic dependence of the lattice parameter, the residual resistance ratio and the lower phase transition temperature T(L) with delta Ce. This clarifies the sizable variation of T(L) in the literature, which we interpret in terms of Kondo lattice physics. We predict that a modest pressure can suppress T(L) to zero and thus induce a quantum critical point.

679 Investigation of Yb substitution in the clathrate phase $Eu_8Ga_{16}Ge_{30}$

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Attempts to introduce rare earth elements other than Eu as guest atoms into intermetallic clathrates have remained elusive to date. Besides fundamental interest, their motivation is to create “strongly correlated” clathrates with correlation-enhanced “giant” thermopower values in addition to the much discussed low thermal conductivities, and thus with enhanced thermoelectric figures of merit. In Eu clathrates no sizeable hybridization of the 4f electrons with the conduction electrons is observed. Here we present our attempts to incorporate Yb in $Eu_8Ga_{16}Ge_{30}$. Yb leads to strong correlation effects in many intermetallic compounds. Along with the standard melting and annealing procedure an alternative route, namely quick quenching of the melt by melt spinning, was tested. Samples obtained in both ways were investigated by XRD, SEM/EDX, and TEM/EDX techniques. No sizable substitution of Eu by Yb in the clathrate phase was found.

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Patent applications (US 12/231,183 and JP 135994/2008) and utility model applications (AT 295/2008 and DE 20 2008 006 946.7) filed.

680 Investigations of wind induced vibrations on the output current of photovoltaic solar modules

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Ideally solar to electric power conversion by photovoltaic devices produce a d.c. output. Several circumstances lead to additional transients, a.c. and noise currents which superimposes the d.c. current of a solar power generator which therefore can become a severe source of electromagnetic interferences. Due to the exposed location of photovoltaic modules and their large area wind forces easily introduce vibrations of the mounting construction. This can add a low frequency component to the solar generated current. Below 10 Hz the protection of the circuit by the use of low pass filters can be excluded for technical and economical reasons. Therefore the potential effect of wind induced vibrations and its electromagnetic compatibility is of high interest. In the present work we present results from laboratory experiments as well as outdoor investigations made with a small 10Wp module mounted at the roof top of our faculty. The results we have derived from our investigations will be discussed with respect to different applications, such as building integration of photovoltaic power generators.

681 Temperature dependent magnetic Raman scattering of NiO single crystal and nanoparticles

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NiO is an antiferromagnetic material with a Neel temperature of 523K. Nanoparticles of this material show entirely different properties as compared to bulk NiO. The behavior shown by these nanoparticles is still not well understood.
We have prepared nanoparticles of different sizes by mechanochemical method and by Sol-Gel method. Temperature dependent magnetic Raman measurements are performed both for NiO and its nanoparticles within temperature range of 35-300K. At room temperature 2-Magnon peak can be observed in raman spectra of NiO single crystal which changes its position with the change of temperature. Such peak is not observed in the spectra of nanoparticles at room temperature. Magnetic measurements are performed by SQUID magnetometer and are compared by results of magnetic Raman measurements.

682 Electron Spin Resonance in Pristine and Alkali-Doped Single-Walled Carbon Nanotubes

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In standard materials of single-walled carbon nanotubes (SWCNTs) the ESR signal is identified as a super-paramagnetic response of low impurity concentration. After doping a narrow ESR line appears which is assigned to the response from conduction electrons (CESR). To identify the CSER signal we critically assess whether it could come from residual graphitic carbon which can be clearly excluded. Accurate values for the signal intensities are presented together with the corresponding concentration of spins and g-factors. The CESR signal allows determining the density of states on the SWCNT assembly. In addition ESR studies on highly purified and metal-semiconductor separated SWCNTs are reported for the first time.

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Influence of Diffusion to magnetooptic spectra in Faraday and Voigt geometry

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The magnetooptic spectra are influenced by magnetic field and diffusion between dielectric layers. The diffusion occurs during the vaporization process and smoothes the transition between layers. A homogeneous magnetic field is applied in Faraday and Voigt configuration. Due to the diffusion process between layers additional structures occure in the spectra. The result is an octave (matlab) programm which calculates the transmission and reflection of dielectric layers as a function of magnetic field and parameters of diffusion. The structures in the magnetooptic spectra are discussed.