

8 NCCR Nano

Wednesday, 26.03.2008, Room 0060 (Ground floor)

Time	ID	NANO 1: SELF ASSEMBLY, MOLECULAR ELECTRONICS I <i>Chair: M. Stöhr, Uni Basel</i>
09:00	811	<p>Adsorption of truxene derivatives on insulators investigated by nc-AFM</p> <p><i>Bartosz Such, Thilo Glatzel, Lars Zimmerli, Ernst Meyer, Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel</i></p> <p>Growth of organic adlayers on insulators is of utmost importance, however, available data are quite scarce compared to metal or semiconductor based systems. For study of insulating substrates STM has to be abandoned in favour of other methods, such as AFM, and additionally specially tailored molecules often has to be used. In the presentation we would like to present formation of adlayers by such molecules - tris(meta-CN)truxenes on KBr(001) surface. The molecules are formed by aromatic core with attached three benzonitrile groups aimed at anchoring the molecule to ionic surface. UHV nc-AFM with capability of performing Kelvin probe microscopy was used in experiments. Sub-molecular resolution observed in the images allowed for identification of adsorption geometry of molecular layer. At monolayer coverage the flat-lying molecules were found to form a hexagonal lattice with one of the lattice vectors oriented along either $\langle 100 \rangle$ or $\langle 010 \rangle$ directions of the substrate. However, due to the fact that benzonitrile groups have quite a large freedom of movement many various molecule configurations could be observed.</p>
09:15	812	<p>Supramolecular Synthons on Surfaces: Controlling Dimensionality and Periodicity of Tetraarylporphyrin Assemblies by the Interplay of Cyano and Alkoxy Substituents</p> <p><i>Nikolai Wintjes¹, Jorge Lobo-Checa¹, Meike Stöhr¹, Tomas Samuely¹, Jens Hornung², Tobias Voigt², François Diederich², Carlo Thilgen², Thomas Jung³</i></p> <p>¹ Department of Physics, University of Basel, Klingelbergstr. 82, 4056 Basel ² Laboratorium für Organische Chemie, ETH-Zürich, Hönggerberg, 8093 Zürich ³ Laboratory for Micro- and Nanotechnology, PSI, 5232 Villigen PSI</p> <p>It is generally believed that complex molecular layers on surfaces with engineered architectures and properties will play a major role in the development of addressable devices at the nanoscale. Particularly interesting self-assemblies, in view of future applications, are (i) molecular chains because of their potential to act as organic wires and (ii) porous networks due to their capability to recognize and host molecular guests.</p> <p>The self-assembly of three porphyrin derivatives was studied in detail on a Cu(111) substrate by means of Scanning Tunneling Microscopy (STM). All derivatives bear two 4-cyanophenyl substituents in diagonally opposed meso-positions of the porphyrin core but differ in the nature of the other two meso-alkoxyphenyl substituents. At coverages below 0.8 monolayers, two</p>

		<p>derivatives form molecular chains, which evolve into nanoporous networks at higher coverages. The third derivative self-assembles directly into a nanoporous network without showing a one-dimensional phase. The pore-to-pore distances for the three networks depend on the size and shape of the alkoxy substituents. All observed effects are explained by (i) different steric demands of the alkoxy residues, (ii) apolar (mainly dispersion) interactions between the alkoxy chains, (iii) polar bonding involving both cyanophenyl and alkoxyphenyl substituents, and (iv) the entropy/enthalpy balance of the network formation.</p>
09:30	813	<p style="text-align: center;">Fe and Co single atoms on metallic and insulating substrates studied by STM</p> <p style="text-align: center;"><i>Anne Lehnert¹, Stefano Rusponi¹, Geraud Moulas¹, Markus Etzkorn¹, Harald Brune¹, Sebastian Stepanow², Pietro Gambardella², Andreas Heinrich³, Cyrus Hirjibehedin³</i></p> <p style="text-align: center;">¹ Institut de Physique des Nanostructures (IPN), EPFL, Station 3, 1015 Lausanne ² ICN, Campus Universitat Autònoma de Barcelona, Edifici CM7, 08193 Bellaterra, Spain ³ IBM Almaden Research Center, 650 Harry Road, 94309 San Jose, United States</p> <p>The spin and orbital moment of free atoms can be determined using Hund's rules. In bulk, however, magnetism persists only for a few d-elements namely iron, cobalt, and nickel. Single atoms deposited on different substrates have different magnetic properties (magnetic moment, magnetic anisotropy energy, easy magnetization axis) due to a varying intermixing of the d orbitals and the electronic states of the substrate. We will compare the magnetism of Co and Fe atoms deposited on a partially insulating substrate namely CuN/Cu(001) and on a highly polarizable metallic substrate such as Rh(111) and Pt(111). We find the easy axis of Co/Rh(111) in plane whereas Co/Pt(111) is out of plane [1]. Co/Rh(111) has an equally large orbital moment ($L/S=0.50$) as Co/Pt(111) ($L/S=0.61$), but a magnetic anisotropy being one order of magnitude smaller compared to Co/Pt(111). Fe/Rh(111) is isotropic and the orbital moment substantially smaller ($L/S=0.12$) than for Co. The study of Fe and Co/Rh(111) is completed with an investigation of one monolayer of Fe and Co/Rh(111). Studying Co/CuN/Cu(001) is motivated by the finding of a large magnetic anisotropy of Fe on CuN[2]. Compared to monomers on a metallic surface the x-ray magnetic circular dichroism (XMCD) spectra of Co/CuN/Cu(001) indicate an atomic-like state of Co (3d8) suggesting that the CuN layer decouples the Co atoms from the Cu(001) electronic states. We find magnetic anisotropy energy for Co similar to what observed for Fe on CuN. However, Fe has an in plane easy axis while Co has an out of plane easy axis.</p> <p>[1] P. Gambardella et al., Science 300,1130 (2003) [2] C.F. Hirjibehedin et al., Science 317, 1195 (2007)</p>

09:45	814	<p style="text-align: center;">Interactive webbased 3D Visualization of nano structures</p> <p style="text-align: center;"><i>Martin Guggisberg, Departement Informatik, Klingelbergstrasse 50, 4056 Basel Florian Müller, Imaging and Media Lab, Bernoullistrasse 32, 4056 Basel</i></p> <p>The tool Nano3d supports the 3D visualization of a three-dimensional relief representation from graphic data. The computation is interactive and required neither expert knowledge nor special software. Users can upload their 2d images from raster probe microscopes to nano3D. The intuitive Web interface lets the users choose individual color representation and perspective.</p> <p>http://image3d.epistemis.com/image3d</p>
10:00		<p>Coffee Break</p>
		<p>NANO 2: SELF ASSEMBLY, MOLECULAR ELECTRONICS II <i>Chair: E. Gneco, Uni Basel</i></p>
10:30	821	<p style="text-align: center;">Reactions on surfaces for the creation of supramolecular polymers</p> <p style="text-align: center;"><i>Meike Stöhr¹, Manfred Matena¹, Markus Wahl¹, Thomas A. Jung², Till Riehm³, Lutz H. Gade³</i></p> <p style="text-align: center;">¹ <i>Departement Physik, Universität Basel, Klingelbergstr. 82, 4056 Basel</i> ² <i>Paul-Scherrer-Institut, 5232 Villigen</i> ³ <i>Institut für Anorganische Chemie, University of Heidelberg, Im Neuenheimer Feld 270, DE-69120 Heidelberg</i></p> <p>By utilizing the concepts of supramolecular chemistry, impressive results for well-ordered 2D surface patterns have been presented. Mostly, non-covalent interactions like metal coordination, hydrogen bonding or dipolar coupling are exploited to create such supramolecular patterns in variable dimensions. However, the formation of such thermodynamically controlled aggregated structures is reversible in most cases and the interaction between the molecular components is frequently weak.</p> <p>In our work, the formation of stable well-defined structures from two different perylene derivatives by making use of thermally-activated reactions is shown. For the first molecule, called DPDI, three different assemblies on Cu(111) depending on the initial coverage were found if the sample is post-annealed at 300°C [1]. This annealing procedure leads to a surface-assisted dehydrogenation: each DPDI molecule releases two H atoms and can then act as H-bond donor and acceptor. One of the created patterns, a honeycomb network which exhibits an extraordinary stability, could be used for the construction of hierarchic structures by subsequently depositing further molecules of different kind whereas one of the trapped molecules displays a thermally activated hindered rotation [2]. The second molecule, called TAPP, assembles on Cu(111) in a close-packed structure while annealing at 150°C results in the formation of a metal-coordinated rectangular network which is commensurate to the Cu substrate. Annealing at temperatures >240°C induces a tautomerization of the molecules which enables the formation of covalently bonded TAPP chains [3].</p> <p>[1] M. Stöhr et al., <i>Angew. Chem. Int. Ed.</i> 44 (2005) 7394 [2] M. Wahl et al., <i>Chem. Commun.</i> (2007) 1349 [3] M. Matena et al., submitted</p>

11:00	822	<p style="text-align: center;">From simple conjugated molecules to coordination induced single molecule switches</p> <p style="text-align: center;"><i>Roman Huber¹, Christian Schönenberger¹, Sergio Grunder², Maria Teresa González¹, Michel Calame¹, Songmei Wu¹, Viviana Horhoiu², Marcel Mayor², Martin Bryce³</i></p> <p style="text-align: center;">¹ <i>Department of Physics, University Basel, Klingelbergstr. 82, 4056 Basel</i> ² <i>Department of Chemistry, University Basel, St.Johannsring 19, 4056 Basel</i> ³ <i>Department of Chemistry, University Durham, South Road, Durham, United Kingdom</i></p> <p>We determine and compare, at the single molecule level and under identical environmental conditions, the electrical conductance of four conjugated phenylene oligomers. These oligomers comprise terminal sulfur anchor groups with simple structural and conjugation variations. The measurements are performed via mechanically controllable break junctions. The comparison shows that the conductance of oligo(phenylene vinylene) (OPV) is slightly higher than that of oligo(phenylene ethynylene) (OPE). We find that solubilizing side groups do neither prevent the molecules from being anchored within a break junction nor noticeably influence the conductance value.[1] In the perspective of active building blocks, we further show preliminary electrical conductance investigations of a newly synthesized cruciform structure molecule, having the potential of a molecular switch.[2]</p> <p>[1]. Electrical conductance of conjugated oligomers at the single molecule level. R. Huber, M.T. Gonzalez, S. Wu, M. Langer, S. Grunder, V. Horhoiu, M. Mayor, M. Bryce, C. Schönenberger and M. Calame, to appear in JACS. [2]. New Cruciform Structures: Toward Coordination Induced Single Molecule Switches. Sergio Grunder, Roman Huber, Viviana Horhoiu, Maria Teresa González, Christian Schönenberger, Michel Calame and Marcel Mayor. JOC, 72, 8337 (2007).</p>
11:15	823	<p style="text-align: center;">Protection group controlled surface chemistry - Organization and heat induced coupling of biphenyl derivatives on metal surfaces.</p> <p style="text-align: center;"><i>Serpil Boz¹, Umut Soydaner², Meike Stöhr¹, Marcel Mayor²</i></p> <p style="text-align: center;">¹ <i>University of Basel, Department of Physics, Klingelbergstr. 82, 4056 Basel</i> ² <i>University of Basel, Department of Chemistry, St. Johannsring 19, 4056 Basel</i></p> <p>The development of scanning probe methods enabled the investigation of molecules on surfaces with impressive resolutions. The arrangement of the molecules in ordered patterns occurs because of a delicate balance between molecule - substrate and intermolecular interactions such as van der Waals interactions, H-bonding or dipolar coupling. A very appealing concept is to profit from the order of these pre-organized structures and to interlink the molecular building blocks to macromolecules. A prominent example for this is diacetylenes which have been polymerized on surfaces. Here we would like to present our new concept to control both, the molecular self-assembly and the subsequent intermolecular coupling reactivity by protection group chemistry. We described the formation of covalently linked individual polymeric structures on single crystal Cu (111) substrate. A herringbone network at room temperature forms a second phase after annealed at 469 K and covalently bond dimers are formed. As a result of further annealing cross-like macromolecules are obtained.</p>

11:30	824	<p style="text-align: center;">Lateral aromatic interactions: A novel design feature for two dimensional supramolecular architectures</p> <p style="text-align: center;"><i>Matthias Treier, Pascal Ruffieux, EMPA, Feuerwerkerstrasse 39, 3602 Thun</i> <i>Roman Fasel, EMPA, Überlandstrasse 129, 8600 Dübendorf</i></p> <p>Aromatic interactions are a very versatile class of noncovalent bonds in chemistry and biology, being relevant to supramolecular architectures and the folding of biological molecules such as DNA and peptides. Stacking of aromatic units is also relevant to molecular electronics since overlap between neighboring π-electron systems is used to create conduction pathways. We show - by a scanning tunneling microscopy study of the self-assembly behavior of the nonplanar polycyclic hydrocarbon hexa-cata-hexabenzocorone on Cu(111) - how a coupling motif based on self-complementary helical aromatic units is able to drive the formation of a chiral porous supramolecular network and chains based on lateral aromatic interactions in two dimensions. The usability of such binding motifs in tailored supramolecular structures is discussed.</p>
11:45	825	<p style="text-align: center;">Kelvin Probe Force Microscopy Study on Porphyrin Based Molecules on Alkali Halide Films</p> <p style="text-align: center;"><i>Thilo Glatzel, Lars Zimmerli, Ernst Meyer</i> <i>Department of Physics, University of Basel, Klingelbergstr. 82, 4056 Basel</i></p> <p>We conducted a comprehensive Kelvin probe force microscopy (KPFM) analysis of porphyrin based molecules evaporated on alkali halide covered Cu(111) surfaces. The KPFM method yields simultaneous information of topography and local work function at nanometer scale. We identified distinct differences in the local work function in dependence on the alkali halide film thickness. Furthermore, we were able to distinguish molecular structures from the surrounding down to the single molecular state by means of KPFM.</p> <p>From previous studies we know that the porphyrin molecules can be stabilized on bulk alkali halides due to the strong dipole character of the molecules. On KBr and NaCl thin films on Cu(111) we observe a comparable situation; the molecules arrange in pi-pi-stacks along the straight step edges of the islands while in between the islands molecular assemblies can be found. The KPFM method not only allows to enhance the stability of the measurements it also gives detailed information about the arrangement of the molecules.</p>
12:00		Postersession, Lunch
12:45	SPS GENERAL ASSEMBLY	

Time	ID	<p style="text-align: center;">NANO 3: NANOBIOLOGY <i>Chair: P. Frederix, Uni Basel</i></p>
13:45	831	<p style="text-align: center;">Novel Biological Sensors</p> <p style="text-align: center;"><i>Hans Peter Lang, Christoph Gerber, National Competence Center in Research (NCCR) for Nanoscale Science, Institute of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel</i></p> <p>We have established a new type of biological sensor based on microfabricated silicon cantilevers arrays. They are miniaturized, ultrasensitive and fast-responding sensors for application in chemistry, physics, biochemistry and medicine and respond by bending due to absorption of molecules or by shift in resonance frequency. They can be operated in different environments such as gaseous environment or liquids. When operated in liquid, microcantilever sensors are able to detect biochemical reactions. Each cantilever is functionalized with a specific biochemical probe receptor, sensitive for detection of the corresponding target molecule. Applications lie in the fields of label- and amplification-free detection of DNA hybridization, detection of proteins as well as antigen-antibody reactions and detection of larger entities, such as bacteria and fungi.</p> <p>Key publications:</p> <ul style="list-style-type: none"> - J. Zhang et al., "Rapid and label-free nanomechanical detection of biomarker transcripts in human RNA", <i>Nature Nanotechnology</i> 1, 214-220 (2006). - N. Backmann et al., "A label-free immunosensor array using single-chain antibody fragments", <i>Proc. Nat. Acad. Sci. USA</i> 102, 14587-14592 (2005). - R. McKendry et al., "Multiple label-free biodetection and quantitative DNA-binding assays on a nanomechanical cantilever array", <i>Proc. Nat. Acad. Sci. USA</i> 99, 9783-9787 (2002). - J. Fritz et al., "Translating Biomolecular Recognition into Nanomechanics", <i>Science</i> 288, 316-318 (2000).
14:15	832	<p style="text-align: center;">Polarization sensitive two-photon microscopy of nanometric Fe(IO₃)₃ crystals</p> <p style="text-align: center;"><i>Jerome Extermann ¹, Luigi Bonacina ¹, François Courvoisier ¹, Yannick Mugnier ², Ronan Le Dantec ², Véronique Boutou ³, Jean-Pierre Wolf ¹</i></p> <p style="text-align: center;">¹ <i>GAP/Université de Genève, 20 rue de l'Ecole de Médecine, 1211 Genève</i> ² <i>Polytech'Savoie, BP 80439, F-79440 Annecy</i> ³ <i>LASIM, 43 bd du 11 novembre 1918, F-69622 Villeurbanne Cedex</i></p> <p>The nonlinear optical properties of nanosized grains of Fe(IO₃)₃ have been studied using a Ti:Sapphire femtosecond oscillator coupled to an inverse microscope modified to detect the polarization dependence of the signal. We show that Fe(IO₃)₃ crystals (20-70 nm) can be efficiently employed as local probes for second-harmonic generation (SHG) microscopy, owing to their high non-linear coefficients. Contrary to fluorescent dye molecules, which need resonant excitation, Fe(IO₃)₃ crystals double the frequency of incident light in a large spectral range, they do not undergo photo-bleaching, and they possess a permanent dipole moment that bears information about the orientation of each nanocrystal. In this respect, we are currently investigating their possible use as sensors of local electric field in biological samples.</p>

14:30	833	<p style="text-align: center;">Recent developments in waveguide spectroscopy allowing quantitative real-time study of supported lipid membrane formation kinetics and structural changes in supported membranes triggered by compositional and environmental changes</p> <p style="text-align: center;"><i>Erik Reimhult ¹, Alireza Mashaghi ¹, Marcus Swann ², Marcus Textor ¹</i> ¹ <i>Laboratory for Surface Science and Technology, ETH Zürich, Wolfgang-Pauli-Strasse 10, 8093 Zürich</i> ² <i>Farfield Scientific Ltd., Farfield House, Southmere Court, Electra Way, Crewe Business Park, 1611 Crewe, United Kingdom</i></p> <p>A major obstacle to studying the many biological processes occurring in or at membranes is the lack of suitable techniques to study kinetics of membrane interactions and in particular to discriminate between interactions occurring at the membrane surface, in its interior or through reorganization of membrane constituents. We demonstrate advances in waveguide spectroscopy which - for the first time using an evanescent optical technique - allow for characterization of the formation kinetics of supported lipid bilayers, but also to in real time distinguish differences in structure for membranes of different composition and under various environmental conditions. By explicitly treating the adsorbed film as optically anisotropic we show not only that traditional isotropic analysis of evanescent biosensor responses yields the wrong film properties, but also that by taking anisotropy into account the correct mass uptake can be calculated and new detailed mechanistic insights for the liposome to supported lipid bilayer transition obtained.</p>
14:45	834	<p style="text-align: center;">The use of scanning probe microscopes in the life sciences: opening new vistas for diagnosis, prevention, intervention and therapy</p> <p style="text-align: center;"><i>Ueli Aebi, Roderick Lim, Laurent Kreplak, Ningping Huang*, Martin Stolz M. E. Müller Institute for Structural Biology, Biozentrum, University of Basel</i> <i>*present address: State Key Laboratory of Bioelectronics, Southeast University, Nanjing, 210096, P.R. China</i></p> <p>Visualizing the structure and dynamics of proteins, supramolecular assemblies and cell components is key to our understanding of biological function. Also, many diseases start at the single-molecule or single-cell level, and they are confined to particular cells, tissues or body parts. In this context, let us discuss the major tools currently available to image, measure, and manipulate biological matter at all levels, i.e. from the millimeter to the nanometer scale. A variety of experimental methods have been developed to provide three-dimensional (3-D) structural insight at various resolutions. Data acquisition is achieved by multiple imaging modalities including light, electron and atomic force microscopy (LM, EM and AFM). To visualize 3-D data sets, and to animate their dynamic properties in real-time, powerful graphics computers are employed. Here we focus on the AFM - a member of the family of scanning probe microscopes (SPMs) - as this instrument has opened completely new vistas for analyzing the surface topography of biological matter in its physiological buffer environment at a resolution comparable to that achieved by EM. Most exciting, while providing us with the 'eyes' for imaging biological matter from the mm to the µm and, ultimately, the nm scale, the AFM also gives us the 'fingers' to measure and</p>

		manipulate biological matter at the level of single molecules, organelles and cells. Evidently, the prospects of this unique nano-sensor and -actuator in fundamental research and for practical applications in biology and medicine are only limited by our imagination. The biomedical potential of such nano-sensors and -actuators will be illustrated by examples that include a molecular transport machine, cytoskeletal filament and single cell biomechanics, and an arthroscopic AFM.
15:15	835	<p style="text-align: center;">Self-assembling copolymer architectures induce different coordination ways for metals</p> <p style="text-align: center;"><i>Cornelia Palivan, Alessandro Napoli, Wolfgang Meier, Department of Chemistry, University of Basel, Klingelbergstrasse 80, 4056 Basel</i></p> <p>The presence of metals in self-assembling copolymer systems changes dramatically the physical and chemical properties leading to composite materials with new behavior and therefore larger technological applications. In this study we were interested to establish if the metal coordination in self-assembling copolymer systems is depending on the resulting morphologies and how far this is related to the molecular parameters and environment, such as block lengths, hydrophilic/hydrophobic ratio, or solvents. Using Electron paramagnetic resonance (EPR) and UV-Vis spectroscopy we investigated the coordination sites for Cu(II) in PEG/PPS block copolymers, which form either micelles or nanovesicles, when diluted in polar solvents. When PEG/PPS copolymer system form nanovesicles, the EPR analysis indicates that the metal is directly coordinating PEG, while PPS is not accessible at all. When the copolymer auto-assembles in spherical micelles the EPR spectrum indicates a different coordination for the metal where the preferred coordination points belongs to PEG, while those related to PPS represent only a minor component. Contrary, the PEG/PPS diblock once present as free polymeric chains offer as major coordination sites the sulfur atoms of PPS and only as minor ones those related to PEG.</p>
15:30		Coffee Break
		<p>NANO 4: MICROMECHANICS AND NANOMECHANICS</p> <p><i>Chair: H. P. Lang, Uni Basel</i></p>
16:00	841	<p style="text-align: center;">An Atomic Force Microscope on its way to Mars</p> <p style="text-align: center;"><i>Sebastian Gautsch, IMT, Uni Neuchâtel, Jaquet-Droz 1, 2000 Neuchâtel</i></p> <p>The Atomic Force Microscope (AFM) has revealed itself as a reliable tool for characterizing surface topography with nanometer resolution. In principle, a sharp tip mounted on a cantilever is brought into close proximity of the sample surface. The forces acting between the sample and the tip slightly deflect the cantilever. Scanning across the surface while recording this deflection provides a topographic image of the sample. At the first glance, high sensitivity and required interaction between the instrument and the operator render the AFM unsuitable for planetary missions. However, micro-fabrication technology combined with innovative design ideas allowed a Swiss consortium (University of Basel, University of Neuchâtel and Nanosurf AG) to build an error tolerant system with functionality for addressing the above mentioned challenges. The instrument is part of the Phoenix mission</p>

		<p>to Mars will land on the red planet in May 2008. The primary goal of the AFM is to characterize Martian dust and soil samples.</p> <p>The instrument consists of a micro-fabricated AFM chip mounted on an electromagnetic scanner for controlling X, Y and Z motion. Specially designed electronics drive the scanner and read the topographic information detected by the AFM chip.</p>
16:30	842	<p>Quantitative AFM-SECM analysis with conductive cantilevers</p> <p><i>Patrick Frederix¹, Patrick Bosshart¹, Mohamed Chami¹, Terunobu Akiyama², Nico De Rooij², Urs Staufer³, Andreas Engel¹</i></p> <p>¹ M. E. Müller Institute, Biozentrum, University of Basel, Klingelbergstr 70, 4056 Basel</p> <p>² Institute of Microtechnology, University of Neuchâtel, Rue Jaquet-Droz 1, 2007 Neuchâtel</p> <p>³ Precision Manufacturing & Assembly, Mechanical, Maritime & Materials Engineering, Delft University of Technology, Mekelweg 2, NL-2628 CD Delft</p> <p>Atomic force microscopy (AFM) has become a widely used technique to study surface structures in vacuum, air and liquid. The capability to measure in liquid is important to study dynamic processes in biology and chemistry. On the other hand, scanning electrochemical microscopy (SECM) allows study of the local electrochemical properties of a sample immersed in liquid, using a small electrode that is approached to or scanned closely above a surface.</p> <p>To combine these techniques we use conductive cantilevers that are merely insulated except for a small part near or at the tip [1-3], enabling correlation of topographical and functional features. In this presentation quantitative analysis of the SECM signals are presented for measurement on conductive supports as well as membrane proteins.</p> <p>[1] Akiyama, et al. 2004; Jap. J. Appl. Phys. 43: 3865 [2] Frederix, et al. 2005; Nanotechnology 16: 997 [3] Gullo, et al. 2006; Anal. Chem. 78: 5436</p>
16:45	843	<p>Combination of Scanning Force Microscopy with Nanofluidic Channels Driven by an Evaporation Pump</p> <p><i>Friedjof Heuck¹, Terunobu Akiyama¹, Nico F. de Rooij¹, Andre Meister², Harry Heinzlmann², Patrick L. T. M. Frederix³, Andreas Engel³, Urs Staufer⁴</i></p> <p>¹ Institute of Microtechnology, Jaquet-Droz 1, 2002 Neuchâtel</p> <p>² CSEM SA, Rue Jaquet-Droz 1, 2002 Neuchâtel</p> <p>³ M. E. Müller Institute, Klingelbergstr. 70, 4056 Basel</p> <p>⁴ Delft University of Technology, Mekelweg 2, 2628 Delft, Netherlands</p> <p>We report the integration of an evaporation based micro pump into a scanning force microscope sensor chip for supplying its hollow cantilever and tip with liquids. This approach is part of the work towards a pipette for applications in cell biology, where we aim at administering minute amounts of ions or ligands to functional membrane proteins.</p> <p>We will present the fabrication of the device, a model for determining its pump rate and its experimental evaluation. More over, we will demonstrate operational integrity of the probe by means of scanning force microscope imaging of an E-coli bacterium.</p>

17:00

844

Residual friction and dissipation in atomic-scale contacts subject to periodic loading

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The transition from atomic-scale stick-slip to continuous sliding with ultralow friction predicted by the Prandtl-Tomlinson model has been observed upon decreasing the load on a sharp Atomic Force Microscope tip slowly scanned in contact with a cleaved ionic crystal in UHV [1]. The extracted low contact stiffness suggests that atomic-scale stick-slip mainly involves elastic energy stored and released by atoms near the tip apex (nanotip or nanocontact), as also argued by the Leiden University group [2]. A related transition has been observed with increasing excitation of flexural modes of a high-Q AFM cantilever [3]. In contrast to the previously observed or predicted reduction of friction in the presence of perpendicular oscillations [4], the effect appears not to be associated with a time-average increase of the tip-sample distance. The observed dependence of the friction force on the excitation amplitude could be explained in terms of an oscillating corrugation potential experienced by the nanotip. Indeed, if the actuation frequency is much smaller than the natural frequency and damping rate of the nanotip, but much larger than the scanning frequency (velocity/lattice spacing), the computed friction values nearly collapse on a universal curve when plotted against a single parameter extracted from quasistatic friction measurements.

More recent simulations [5] reveal that deviations from adiabatic following cause a residual viscous-like friction which is independent of damping, and a concomitant energy loss in the range where friction suppression was predicted earlier [2]. In the same range, thermal activation can introduce strong fluctuations in the lateral force, but has little effect on the average residual friction. Remarkably, the total loss, including the contribution from the periodic actuation, can be smaller than in the absence of the latter. Simple physically motivated approximations can explain these a priori surprising results. Because the actuation contribution, hence the minimum energy loss, increase with the damping, it is important to estimate the latter. The nanotip damping can in principle be determined from two independent measurements, which remain to be performed in a systematic fashion.

[1] A. Socoliuc, R. Bennewitz, E. Gnecco, E. Meyer, Phys. Rev. Lett. 92, 134401 (2004)

[2] S. Yu. Krylov, J. A. Dijksman, W. A. van Loo, J. W. M. Frenken, Phys. Rev. Lett. 97, 166103(2006)

[3] A. Socoliuc, E. Gnecco, S. Maier, O. Pfeiffer, A. Baratoff, R. Bennewitz, E. Meyer, Science 313, 307 (2006)

[4] M. Urbakh, J. Klafter, D. Gourdon, J. Israelachvili, Nature 430, 525 (2004)

[5] S. Maier, PhD Thesis, University of Basel (2007); S. Maier, A. Socoliuc, A. Baratoff, E. Meyer (unpublished)

<p>17:30</p>	<p>845</p>	<p style="text-align: center;">New Trends in Nanotribology: From Scanning Probe Scattering to Superlubric Imaging</p> <p style="text-align: center;"><i>Enrico Gnecco ¹, Akshata Rao ¹, Sabine Maier ², Anisoara Socoliuc ³, Thilo Glatzel ¹, Ernst Meyer ¹</i></p> <p>¹ <i>Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel</i> ² <i>Lawrence Berkeley National Laboratory, 1 Cyclotron Road, 94720 Berkeley, CA, United States</i> ³ <i>Nanonis GmbH, Technoparkstrasse 1, 8005 Zürich</i></p> <p>Our present knowledge of friction mechanisms on the nanometer scale is applied to develop new techniques in scanning probe microscopy (SPM). In the first part of the contribution, SPM manipulation experiments of gold nanoparticles will be presented and interpreted with classical scattering theory. The angle of deflection of the nanoparticles, pushed by the probing tip, is related to the spacing between consecutive scan lines, which replaces here the impact parameter of scattering theory. Comparing analytical and numerical results with the experiments allow us to estimate the friction force between particles and surface. In the second part, I will show how our recent observations of superlubricity [1, 2] can be used as a powerful imaging technique. Time-modulated experiments on alkali halides, graphite and mica surfaces will be shown, as well as space-modulated measurements on thin KBr films heteroepitaxially grown on NaCl. "Superlubric imaging" allows to distinguish between surface and buried interfaces properties, and opens the path to unprecedented resolution in contact SPM.</p> <p>[1] A.Socoliuc, R.Bennewitz, E.Gnecco, and E.Meyer, Phys. Rev. Lett. 92 (2004) 134301 [2] A. Socoliuc, E. Gnecco, S. Maier, O. Pfeiffer, A. Baratoff, R. Bennewitz, Science 313 (2006) 207</p>
<p>17:45</p>	<p>846</p>	<p style="text-align: center;">Scanning probe scattering of gold particles on nanopatterned surfaces</p> <p style="text-align: center;"><i>Akshata Rao ¹, Enrico Gnecco ¹, Diego Marchetto ², Karine Mougín ³, Monica Schönenberger ¹, Sergio Valeri ², Ernst Meyer ¹</i></p> <p>¹ <i>Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel</i> ² <i>Department of Physics, University of Modena and Reggio Emilia, Via Campi 213/A, IT-41100 Modena</i> ³ <i>Inst. de chimie des surfaces et interfaces I.C.S.I. - C.N.R.S. - UPR 9069, 15, Rue Jean Starky, F-68057 Mulhouse Cedex</i></p> <p>A new approach to the problem of nanoparticle manipulation is proposed. Rather than focusing on the motion of a single particle [1, 2] we consider ensembles of particles, and study their collective displacement under the strong perturbation created by an AFM tip. An analytical formula derived from the scattering theory is compared to the experimental results where gold nanoparticles were manipulated on a silicon surface with different patterns (grooves and pits) produced by focused ion beam. An extension of the formula allows to extract friction between particles and surfaces from the angles of scattering.</p> <p>[1] C. Baur, A. Bugacov, B. E. Koel, A. Madhukar, N. Montoya, T. R. Ramachandran, A. A. G. Requicha, R. Resch, and P. Will, Nanotechn. 9, 360 (1998). [2] R. Resch, C. Baur, A. Bugacov, B. E. Koel, A. Madhukar, A. A. G. Requicha, and P. Will, Langmuir 14, 6613 (1998).</p>

18:00		END
18:15		Conference Dinner

Thursday, 27.03.2008, Room 0060 (Ground floor)

Time	ID	PLENARY SESSION AND SPS AWARD CEREMONY
08:30		Plenary Session
09:15	801	NANO Plenary Talk: see page 32
10:00		Coffee Break
10:30		Plenary Session continued
11:15		SPS AWARD CEREMONY
11:45		Plenary Session continued
12:30		Postersession, Lunchbuffet
		NANO 5: QUANTUM COMPUTATION, NANOWIRES, NANOMAGNETISM <i>Chair: A. Baratoff, Uni Basel</i>
14:45	851	<p>Modulation of Andreev reflections and supercurrent by the Kondo effect in single-walled carbon nanotube quantum dots</p> <p><i>Alexander Eichler, Markus Weiss, Stefan Oberholzer, Christian Schönenberger, Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel</i></p> <p>We use single-walled carbon nanotubes (SWCNT) contacted to superconducting leads to study experimentally the interaction of superconductivity and Kondo physics in a quantum dot. A variety of interesting features arises when the Kondo temperature T_k is of the same order as the critical temperature T_c. Amongst other effects, an alternation of Andreev reflections between states with even and odd occupation numbers has been observed in several samples, in one case in combination with a backgate dependent supercurrent through the SWCNT due to the Josephson effect.</p>
15:00	852	<p>Electrolyte Gated Silicon Nanowire FETs</p> <p><i>Dino Keller, Oren Knopfmacher, Björn Nisen, Michel Calame, Christian Schönenberger, Department of Physics; University of Basel, Klingelbergstrasse 82, 4056 Basel</i></p> <p>Silicon Nanowire (Si NWs) FETs have shown to be very sensitive to charged molecules adsorbed on their surface. Therefore they are ideal candidates for basic sensing units in integrated bio- or chemical sensors. Hence a top down approach for CMOS compatible fabrication of Si NW FETs has been developed. Semi-conducting leads connecting the nanowire to macroscopic metal contacts enable both, p- and n- conducting regions.</p>

		<p>The nanowire like Si structure - which should act as sensor for charged molecules in a later state - is situated on top of a SiO₂ layer. The gate voltage is applied via the Si substrate below. In this geometry liquids can be brought in contact with the NW and an additional gate voltage can be applied via an electrolyte electrode. The effect of the back gate and electrolyte gate are compared showing that a reliable control over both potentials, the electrolyte potential and the substrate potential, is mandatory for any well defined sensing experiment.</p>
15:15	853	<p align="center">Metal Catalyst in CVD Growth of Carbon Nanotubes: Role of Chemical Composition</p> <p align="center"><i>Oleg Yazyev, Alfredo Pasquarello EPFL-ITP and IRRMA, Station 13, 1015 Lausanne</i></p> <p>Carbon nanotubes (CNTs) are expected to become an important constituent of many technologies including future generation electronics. The inability of performing growth of CNTs with predetermined chirality indices and thus electronic properties is the major obstacle on the way to incorporating CNTs into electronic devices. The chemical vapor deposition (CVD) growth of CNTs catalyzed by metallic nanoparticles is believed to be the most promising approach for reaching this goal. As shown in recent observations, nanoparticles of a variety of metals, including the chemically inert coinage metals, can serve as catalysts in CVD growth of CNTs.</p> <p>We model the crucial steps of CVD growth of CNTs from first principles by considering various metal catalysts. Binding and diffusion of small carbon fragments as well as the binding energies of armchair and zigzag edges of CNT fragments have been studied. Our results indicate that coinage metal catalysts, in particular Cu, favor CVD growth of CNTs at low temperatures and with narrow chirality distributions.</p>
15:30		Coffee Break
16:00	854	<p align="center">The role of uncompensated spins in exchange biasing</p> <p align="center"><i>Hans J. Hug, I. Schmid, S. Romer, P. Kappenberger, M. Marioni, M. Parlinska, EMPA Dübendorf</i></p> <p>The origin of the exchange bias (EB) effect has been traced back to the existence of pinned uncompensated spins (UCS) in the antiferromagnet (AFM) or at its interface. However, the understanding of the underlying mechanism is still clouded by contradictory reports: For example, both a parallel as well as an antiparallel orientation of the UCS relative to the magnetization direction of the ferromagnet (FM) were reported for similar FM/AFM systems. Here different magnetization histories in magnetometry and high resolution magnetic force microscopy measurements are used advantageously to demonstrate the co-existence of pinned UCS that are parallel and antiparallel to the cooling field in metallic (IrMn) and oxidic (CoO) EB systems. We further conclude that the EB effect is mainly a result of pinned interfacial UCS, which are antiparallel to the FM spins [1]. In further experiments, the distribution of density of the UCS were imaged on the length scales of single grains. A surprisingly strong fluctuation of the local UCS density (UCSD) was observed. A correlation between the UCSD and the local exchange field was performed. Clearly, a high UCSD results in a high local exchange bias field. Regions with an anti-biasing effect were found. Using grain-boundary engineering, exchange-biased materials without such</p>

		<p>regions could be fabricated that showed a substantially increased exchange bias effect.</p> <p>[1] Schmid et al. EPL, 81 (2008) 17001</p>
16:30	855	<p>Electron-mediated decay of quantum dot nuclear spin polarization</p> <p><i>Patrick Maletinsky, Atac Imamoglu, Institute of Quantum Electronics, ETH Hönggerberg, HPT G10, 8093 Zürich</i></p> <p>Electron spins trapped in solid-state systems exhibit strong hyperfine interactions with a nuclear spin reservoir, which is normally fluctuating and randomly oriented. To suppress this fundamental decoherence mechanism for the electron spin, several theoretical scenarios for optically active semiconductor quantum dots (QDs) have been proposed [1]. Implementing these proposals requires a deeper understanding of the properties of the mesoscopic QD nuclear spin ensemble and of the possibilities of manipulating the nuclear spins.</p> <p>We use optical preparation and detection of the spin and energy of QD electrons to manipulate and measure the average nuclear spin polarization (NSP) in a single, self-assembled QD [2]. I will discuss recent time resolved studies of NSP which show that a QD electron can be very efficient in destroying an established QD NSP [3]. Moreover, due to the nonlinear behavior of the coupled electron-nuclear spin system, this nuclear spin decay can have interesting non-exponential characteristics in the presence of external magnetic fields. Ultimately, further understanding of the dynamics of the nuclear spin system and its subtle interactions could enable us to improve the decoherence time of the electron spin.</p> <p>[1] A. Imamoglu et al., PRL 91, 17402 (2003). [2] C. W. Lai et al., PRL 96, 167403 (2006). [3] P. Maletinsky et al., PRL 99, 056804 (2007).</p>
16:45	856	<p>Magnetic Ordering of Nuclear Spins in an Interacting 2D Electron Gas</p> <p><i>Daniel Loss Dept. of Physics, Uni Basel</i></p> <p>I report on our recent investigation of the magnetic behavior of nuclear spins embedded in a 2D interacting electron gas using a Kondo lattice model description [1]. We derive an effective magnetic Hamiltonian for the nuclear spins which is of the RKKY type and where the interactions between the nuclear spins are strongly modified by the electron-electron interactions. We show that the nuclear magnetic ordering at finite temperature relies on the (anomalous) behavior of the 2D static electron spin susceptibility, and thus provides a connection between low-dimensional magnetism and non-analyticities in interacting 2D electron systems. Using various perturbative and non-perturbative approximation schemes in order to establish the general shape of the electron spin susceptibility as function of its wave vector, we show that the nuclear spins locally order ferromagnetically, and that this ordering can become global in certain regimes of interest. We demonstrate that the associated Curie temperature for the nuclear system increases with the electron-electron interactions up to the millikelvin range.</p> <p>[1] P. Simon, B. Braunecker, and D. Loss, Phys. Rev. B 77, 045108 (2008).</p>
17:15		END

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Towards heterodyne four wave mixing in single pyramidal GaAs/AlGaAs quantum dots

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We have built up a highly sensitive heterodyne four-wave-mixing detection system which enables us to measure fully degenerate four wave mixing emission resolved both in phase and amplitude. Our goal is to measure the transient third order polarization emitted from single pyramidal GaAs/AlGaAs quantum dot states. These quantum dots are from particular interest due to their specific features, such as high oscillator strength, controlled shape and barrier, coupling to other quantum structures (quantum wells, quantum wires).

In order to demonstrate the ability of our set-up we measured the third order polarization emitted from GaAs/AlGaAs quantum well hetero-structures, which consists of 25 independent quantum wells. The inhomogeneous broadened emission of the quantum wells leads to the formation of a photon echo. Thanks to the phase resolution, we were able to observe it in real time.

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Nuclear spin dynamics in quantum dots

Daniel Klauser, William Anthony Coish, Daniel Loss
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The hyperfine interaction between the electron spin and the nuclear spins within a quantum dot has been established as the main source of decoherence for the electron spin. The decay of transverse and longitudinal spin components show rich dynamics including exponential, gaussian and power-law decay. Further, a universal phase-shift for driven single spin oscillations has been predicted and experimentally observed recently [1]. In this context of hyperfine induced electron spin decoherence also the dynamics of the nuclear spin system (Overhauser field dynamics) have come into focus. We discuss the dynamics of the nuclear spin system and how measurements of the Overhauser field [2] may alter this dynamics.

[1] F. H. L. Koppens, D. Klauser, W. A. Coish, K. C. Nowack, L. P. Kouwenhoven, D. Loss and L. M. K. Vandersypen, Phys. Rev. Lett. 99, 106803, (2007).

[2] D. Klauser, W. A. Coish and Daniel Loss, Phys. Rev. B 73, 205302, (2006).

863

Non-local measurements on normal metal-superconductor hybrid structures: the quest for crossed Andreev reflection

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Lateral multiterminal Al/Al₂O₃/Ti/Au-hybrid structures with electrode distances bigger than the superconducting coherence length have been prepared to study the contribution of charge imbalance (CI) to the measured non-local voltage U_{nl}. Superconducting tunneling spectroscopy was used to characterize each tunneling barrier. Temperature-dependent U_{nl} of injector-detector pairs of differing barrier transparency were measured with lock-in technique. For energies higher than the superconducting energy gap we find that all of the

	<p>injector-detector configurations show a negative non-local U_{ac}-signal which can only be due to CI. Interestingly, one injector-detector pair with low barrier transparency shows a positive U_{nl} within the gap decreasing with increasing temperature. This result is unexpected since CI is supposed to be more prominent in the high-transparency regime. In order to be able to measure coherent transport processes like crossed Andreev reflection and elastic cotunneling, samples with electrode distances of the order of the superconducting coherence length were prepared. First results will be presented here.</p>
<p>864</p>	<p style="text-align: center;">Spin dynamics in InAs-nanowire quantum-dots coupled to a transmission line</p> <p style="text-align: center;"><i>Mircea Trif¹, Daniel Loss¹, Vitaly N. Golovach²</i></p> <p style="text-align: center;">¹ <i>Departement für Physik, Universität Basel, Klingelbergstrasse 82, 4056 Basel</i> ² <i>Arnold Sommerfeld Center for Theoretical Physics and Center for Nanoscience, Department of Physics, Theresienstr. 37, DE-80333 München</i></p> <p>We study theoretically electron spins in nanowire quantum dots placed inside a transmission line resonator. Because of the spin-orbit interaction, the spins couple to the electric component of the resonator electromagnetic field and enable coherent manipulation, storage, and read-out of quantum information in an all-electrical fashion. Coupling between distant quantum-dot spins, in one and the same or different nanowires, can be efficiently performed via the resonator mode either in real time or through virtual processes. For the latter case we derive an effective spin-entangling interaction and suggest means to turn it on and off. We consider both transverse and longitudinal types of nanowire quantum-dots and compare their manipulation timescales against the spin relaxation times. For this, we evaluate the rates for spin relaxation induced by the nanowire vibrations (phonons) and show that, as a result of phonon confinement in the nanowire, this rate is a strongly varying function of the spin operation frequency and thus can be drastically reduced compared to lateral quantum dots in GaAs. Our scheme is a step forward to the formation of hybrid structures where qubits of different nature can be integrated in a single device.</p>
<p>865</p>	<p style="text-align: center;">The effect of surface transfer doping on pentacene thin film transistor performance</p> <p style="text-align: center;"><i>Niklaus Baumann, Claudio Vanoni, Soichiro Tsujino, Thomas Jung, Paul Scherrer Institut, Laboratoty for Micro- and Nanotechnology, 5232 Villigen PSI</i></p> <p>The performance of organic thin-film transistors (TFTs) is strongly influenced by doping. It has been shown previously that p-type doping of few monolayer pentacene TFTs by coevaporation of tetrafluorotetracyanoquinodimethane (F4TCNQ) reduces the contact resistance by more than a factor of 20. In ultra thin film pentacene TFTs, sub-monolayer detection of guest molecules such as F4TCNQ and tetraphenylporphyrin manganese (III) chloride (MnTPP-Cl) by surface-doping has been demonstrated. Here we investigate the relation between the pentacene layer thickness and the doping efficiency and the impact of surface doping on the contact resistance by the transmission line method. The influence of the energy difference of the HOMO/LUMO levels between host (pentacene) and guest molecules will be discussed.</p>

<p>866</p>	<p style="text-align: center;">The role of π-π stacking in molecular junction formation</p> <p style="text-align: center;"><i>Songmei Wu¹, Sergio Grunder², Roman Huber¹, Maria Teresa González¹, Christian Schönenberger¹, Marcel Mayor², Michel Calame¹</i></p> <p style="text-align: center;">¹ <i>Dep. of Physics and Swiss Nanoscience Institute, Klingelbergstrasse 82, 4056 Basel</i> ² <i>Department of Chemistry, St. Johannis-Ring 19, 4056 Basel</i></p> <p>Conjugated organic compounds are under close scrutiny in the emerging field of molecular electronics. Molecular junctions comprising only a few or even a single molecule are usually prepared by immobilizing thiol-terminated compounds between two atomic contacts [1]. We show in this work that conjugated OPE (oligo-phenylene ethynylene) with a single end-thiol acting as linker group can efficiently bridge Au atomic contacts prepared via mechanically controllable break junctions. We attribute this effect to the interaction between neighboring molecules in the junction (mainly π-π stacking). This remarkable property highlights the importance of intermolecular interaction in molecular junctions, an often overlooked aspect. We will compare these results with measurements of OPE molecules bearing thiol anchor groups at both ends.[2]</p> <p>[1]. Electrical conductance of molecular junctions by a robust statistical analysis, M. T. González, S. Wu, R. Huber, S. J. van der Molen, C. Schönenberger and M. Calame, Nano Letters 6, 2238 (2006) [2]. Electrical conductance of conjugated oligomers at the single molecule level , R. Huber, M. T. Gonzalez, S. Wu, M. Langer, S. Grunder, V. Horhoiu, M. Mayor, M. Bryce, C. Schönenberger, M. Calame, to appear in JACS (2007)</p>
<p>867</p>	<p style="text-align: center;">Stimuli responsive MEMS compatible surfaces</p> <p style="text-align: center;"><i>Ana Maria Popa¹, Raphael Pugin¹, Jerome Polesel Maris¹, Jeffrey Alan Hubbell²</i> ¹ <i>CSEM, Jaquet Droz 1, 2000 Neuchatel,</i> ² <i>EPFL, 1015 Lausanne</i></p> <p>Micro electro mechanical systems find applications ranging from accelerometers to biosensors. Although silicon structuring technologies have reached impressive lateral resolution, which allows now the production of the so-called NEMS (nano electro mechanical systems) in order to achieve functions such as manipulation on the nanoscale, smaller building blocks might be added to complement the structure and functions of such devices. One option would be the functionalisation with stimuli responsive molecules which reversibly change conformation in response to an external parameter, strength and thus acts as the smallest mechanical unit of the MEMS.</p> <p>In this context we will successively present a novel method for etching nanopores in silicon with aspect ratio higher than 1:10 and the subsequent functionalisation of the pore walls with poly-N isopropyl amide, a polymer which displays a lower critical solution temperature of 32°C. The responsiveness of the obtained system has been characterized using force spectroscopy and imaging AFM in liquid. Preliminary conclusions regarding possible applications will also be reported.</p>
<p>868</p>	<p style="text-align: center;">Deposition of porous carbon films by magnetron sputtering</p> <p style="text-align: center;"><i>Kasper Renggli¹, Natascha Kappeler¹, Lucas Casparis¹, Daniel Mathys², Teresa de los Arcos¹, Peter Oelhafen¹</i></p> <p style="text-align: center;">¹ <i>Department of Physics, University of Basel, Klingelbergstr. 82, 4056 Basel</i> ² <i>Microscopy Center, University of Basel, Klingelbergstr. 80, 4056 Basel</i></p> <p>In this work we explore the chemical composition, electronic structure, optical properties, and morphology of a porous form of graphitic-like carbon deposited by magnetron sputtering on hot silicon substrates. The influence of different metallic films deposited onto the Si substrates was investigated. The films were characterized by photoelectron spectroscopy and ellipsometry.</p>

<p>869</p>	<p align="center">Image3D, interaktives 3D Visualisierungswerkzeug</p> <p><i>Martin Guggisberg, Dep. Informatik, Universität Basel, Klingelbergstrasse 50, 4056 Basel</i></p> <p>Das Werkzeug Image3D ermöglicht Laien die Berechnung einer dreidimensionalen Reliefdarstellung aus Bilddaten. Image3D ist vollumfänglich auf die Benutzung über das Internet angelegt. Mittels eines Web-Interface kann der Benutzer seine Bilder an Image3D übertragen. Es lassen sich interaktive Darstellungen aus Daten von Rastersondenmikroskopen aus verschiedenen Perspektiven darstellen.</p>
<p>870</p>	<p align="center">Atomic-scale friction modulated by a buried interface</p> <p><i>Raphael Roth ¹, Sabine Maier ², Enrico Gnecco ¹, Pascal Steiner ¹, Alexis Baratoff ¹, Roland Bennewitz ³, Ernst Meyer ¹</i></p> <p><i>¹ Department of Physics, University of Basel, Klingelbergstrasse 82, 4056 Basel</i> <i>² Lawrence Berkeley National Laboratory, 1 Cyclotron Road, 94720 Berkeley (California), United States</i> <i>³ Department of Physics, McGill University, Montreal, rue University, 3600 Montreal, Canada</i></p> <p>Combined atomic and friction force microscopy reveals a significant modulation of atomic-scale friction related to the small periodic rumpling induced at the interface between a heteroepitaxial film of KBr on NaCl(100). Transitions from dissipative atomic scale stick-slip to smooth sliding with ultralow friction are observed within the 6 x 6 surface unit cell of the underlying superstructure. Scanning across atomic-scale defects confirms the high resolution capabilities of friction force microscopy close to the ultralow friction state. Strong variations of the tip-surface interaction energy across the superstructure demonstrate that subsurface chemical and size inhomogeneities dramatically change the frictional properties of the surface probed by the microscope tip.</p>
<p>871</p>	<p align="center">Dynamic superlubricity on insulating and conductive surfaces</p> <p><i>Pascal Steiner, Enrico Gnecco, Raphael Roth, Thilo Glatzel, Ernst Meyer</i> <i>Department of Physics, Klingelbergstr. 82, 4056 Basel</i></p> <p>Friction between a sharp silicon tip and various atomically flat surfaces (NaCl, KBr, graphite, mica) is minimised by piezo-induced oscillations at well-defined resonance frequencies. This procedure extends an electro-capacitive way to achieve the same effect, which was recently introduced by our group and tested on insulating alkali halide crystals in ultra-high vacuum. A controlled reduction of friction is observed now also on conductive surfaces like graphite, and in ambient conditions, which is quite promising for technological applications to micro-electromechanical devices. The theory previously used to interpret 'dynamic superlubricity' under general conditions is supported by new experimental observations showing that the contact between tip and sample is well maintained when the oscillations are applied.</p>

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Long-Range Ordering of Metallic Nanostructures using Block Copolymer Self-Assembly

Li Wang, CSEM SA, Jaquet Droz 1, 2002 Neuchâtel

Ability to fabricate, manipulate or arrange sub-100nm objects remains nowadays a key challenge in nanotechnology. In this context, the self-assembly properties of block copolymers (BC) offer a unique tool to access the heart of the nanoscale (typic.10-100nm) and to build nanostructures with controlled dimensions.

We recently demonstrated the use of responsive BC micelles (PS-b-P2VP) as etch mask for the design of functionalized nanostructured surfaces. We also showed ability of such micelles to act as nanoreactors for the controlled synthesis of large arrays of metallic nanoparticles with average diameter down to 30nm and their use as catalyst for the growth of carbon nanotubes. However, nanostructures obtained from BC often exhibit some structural "defects" and a lack of long range order and orientation, which are prejudicial for some applications, in particular in electronic and optic, where a high level of order is required.

As recently reported, the concept of "templated self-assembly" (TSA) can efficiently improve self-organization of objects at the nanoscale level. Our goal is thus to apply TSA to the production of ordered arrays of metallic nanostructures. As first results, we will report the synthesis of gold nano-structures on flat silicon surface by the direct loading of metal ions into acid stimulated PS-b-P2VP micelles. Depending on pH conditions, either gold nanoring or gold nanodot structures could be obtained. The possibility to simply tune the dimensions and morphology of these metallic nanostructures will also be presented.

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Selective shielding of an antioxidant enzyme by smart, polymeric nanovesicles. A new way of anti-inflammatory treatment.

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We have designed and tested a novel antioxidant nanoreactor based on encapsulation of superoxide dismutase in superoxide permeable nanovesicles. The polymeric membrane of the nanovesicles is both able to protect the encapsulated enzyme and to let superoxide ions penetrate to their inner space, were the enzyme is converting it. The advantage of this system, compared to the conventional encapsulation into liposomes is, that neither channels nor release from the nanocontainer is needed.