O 1: Plenary Talk Wilson Ho

Time: Monday 8:30–9:15 Location: H 0105

The Interior of Single Molecules

O 2: Invited Talk John Pendry

Time: Monday 9:30–10:15 Location: HE 101

Invited Talk O 2.1 Mon 9:30 HE 101

The Perfect Lens: Resolution Beyond the Limits of Wavelength — •John Pendry — Imperial College London

The lens is one of the most basic tools of optics but the resolution achieved is limited, as if the wavelength of light defined the width of a pencil used to draw the images. This limit intrudes in all kinds of ways. For example it defines the storage capacity of DVDs where the laser can only *see* details of the order of the wavelength.

Two types of light are associated with a luminous object: the near field and the far field. True to its name the far field escapes from the object and is easily captured and manipulated by a lens, but high resolution details are hidden in the near field and remain localised near the source and cannot be captured by a conventional lens. The near field is familiar to surface scientists in the form of surface plasmons, for example. To control the near field we have developed a new class of materials with properties not found in nature. These new materials derive their properties not from the atomic and molecular constituents of the solid, but from microstructure which can be designed to give a wide range of novel electromagnetic properties.

The lecture will describe the new materials and the principles behind them and show how they may be used to control and manipulate the near field. Finally a prescription will be given for a lens whose resolution is unlimited by wavelength provided that the ideal prescription for the constituent materials is met.

O 3: Invited Talk Klaus Ensslin

Time: Monday 10:15–11:00 Location: HE 101

Invited Talk O 3.1 Mon 10:15 HE 101

Graphene Single Electron Transistors — Christoph Stampfer, Francoise Molitor, Johannes Güttinger, Thomas Ihn, and •Klaus Ensslin — Solid State Physics Lab, ETH Zurich, Switzerland

Graphene flakes are patterned into nanostructures using electron beam lithography and dry etching. A mesoscopic Hall bar is investigated by low-temperature magnetotransport experiments. The potential inside the Hall bar is tuned by graphene side gates. We demonstrate that the carrier density can be tuned over typical lateral distances of 90 nm. This way a tunable graphene single electron transistor is realized. Clear conductance resonances and Coulomb diamonds are resolved at a temperature of T=2 K. We present data for several graphene single electron transistors and discuss the tunability of the tunnel barriers as well as the overall electronic configuration of the device.

O 4: Nanostructures at Surfaces

Time: Monday 11:15–12:30 Location: MA 042

O 4.1 Mon 11:15 MA 042

Dynamic processes in metalorganic networks based on oligopyridines and copper — •Achim Breitruck[1], Harry E. Hoster[1], Christoph Meier[2], Ulrich Ziener[2], and R. Jürgen Behm[1] — [1]Institute of Surface Chemistry and Catalysis, Ulm University, D-89069 Ulm — [2]Institute of Organic Chemistry III, Ulm University, D-89069 Ulm

We report on the dynamics of chiral metalorganic networks on the basis of Bis-terpyridines (BTP) and copper which were studied by time-resolved scanning tunneling microscopy (STM). Using highly oriented pyrolytic graphite (HOPG) as substrate, the samples were prepared by vapor deposition of oligopyridines to form a quadratic 2D molecular network[1] and post-deposition of copper under ultra high vacuum (UHV) conditions. At Cu coverages below phase saturation, we observed the formation of an Cu-organic network, consisting of copper-free and copper-containing BTP trimers. At room temperature, this allows the migration of Cu atoms within the network via a hopping mechanism from Cu-containing to Cu-free trimers on a timescale of seconds. The mechanism is accompanied by a local rearrangement of the BTP molecules. Despite the high adlayer dynamics, we find very large enantiopure domains with sizes $> 10^4$ nm^2.

[1] H.E. Hoster et al., Langmuir 23, 11570-11579, (2007)

[2] A. Breitruck et al., Surf. Sci. 601, 4200-4205, (2007)

O 4.2 Mon 11:30 MA 042

Mid infrared microspectroscopy: Characterization od diamond-like (DL) and polymer-like (PL) single nanoparticle — •Jean-Sébastien Samson[1], Raphaella Weiss[2], Erik Bründermann[1], Jörg Winter[2], and Martina Havenith[1] — [1]Physical Chemistry 2, Ruhr-University Bochum, Bochum, Germany — [2]Experimental Physics 1, Ruhr-University Bochum, Bochum, Germany

We report on the infrared spectroscopic characterization of plasma nanoparticles formed in a dusty plasma by scanning near-field infrared microscopy (SNIM). We use high power OPO-lasers with up to 2,7 W output power as radiation source [1] which emit in the so-called fingerprint region (2,5-4 um). We were able to use the characteristic N-H absorption band around 3300 cm-1 to spectrally resolve a shift of the band between the diamond-like and the polymer-like phase. The measurement were carried out on a sample containing 100 nm diamond-like and 400 nm polymer-like plasma nanoparticles. Our results demonstrate the high sensitivity of SNIM for characterization of nanoparticles found in plasma. [1]J.-S. Samson et al. PCCP, (2006), 8, 753-758

O 4.3 Mon 11:45 MA 042

Nanostructuring of the HOPG surface — •Artur Böttcher[1], Markus Cudaj[1], Daniel Löffler[1], Sharali Malik[2], Manfred Kappes[1,2], Patrice Brenner[3], and Dagmar Gerthsen[3] — [1]Institut für Physikalische Chemie, Universität Karlsruhe, Karlsruhe, Germany — [2]Institut für Nanotechnologie, Forschungszentrum Karlsruhe, Germany — [3]Laboratorium für Elektronenmikroskopie, Universität Karlsruhe, Germany

By combining the focused ion beam technique, 30keV-Ga^+-FIB, with high-temperature oxidation well defined periodic structures were fabricated on HOPG surfaces [1]. The method exploits the high reactivity of the amorphous surface areas towards the oxidation-induced gasification of undercoordinated carbon sites, C→CO, CO_2. Large surface areas covered by periodically arranged nanocavities, gratings and arrays of nm-sized squares have been fabricated routinely. The minimum width of the grooves written is limited by the interaction of the ion beam with the substrate and levels presently off at 80 nm. The mean depth of the grooves can be easily varied in the range up to 55 nm by applying different ionic doses. These parameters enable to fabricate large arrays of nanographene plates with desired size and shape. Two stages are clearly distinguishable in the kinetics of the etching process: within the early stage the amorphous carbon is removed and in the later stage the prism surfaces of the regular graphite are gradually gasified with lower efficiency. The integral removal probability depends on the surface temperature and ranges from 10^{-11} to 10^{-8} C/O_2. [1] A. Böttcher et al. Nanotechnology, 17(2006)

O 4.4 Mon 12:00 MA 042

Effect of HF concentration on physical and electronic properties of electrochemical formed nano-porous silicon — •Pushpendra Kumar[1], Manash Ghosh[1], Hongdan Yan[1], Frank Ludwig[2], Meinhard Schilling[2], and Peter Lemmens[1] — [1]IPKM, TU-Braunschweig — [2]EMG, TU-Braunschweig

We report on the preparation and functionalization of porous silicon (PS) using electrochemical etching in hydrofluoric (HF) acid based solutions. The properties of PS such as thickness of the porous layer, porosity and average pore diameter are precisely controlled and characterized using optical absorption, nitrogen sorption isotherms, field emission SEM, Raman and PL spectroscopy. Functionalization was performed by oxidizing and subsequent doping with different dyes and magnetic molecules.

O 4.5 Mon 12:15 MA 042

Preparation and functionalization of porous anodic aluminum oxide templates — •Hongdan Yan[1], Seth White[1], Pushpendra Kumar[1], Peter Lemmens[1], and Pengxiang Zhang[2] — [1]IPKM,TU-Braunschweig — [2]IAMPE, Kunming University of Science and Technology, Yunnan, China

We report on the preparation of porous anodic aluminum oxide templates (AAO) and their functionalization/modification. AAO with nanoporous morphology is a well controlled template material due to the high density and uniformity of nano pores. Free standing, transparent membranes have been prepared and doped with dyes, magnetic molecules. Ni and Fe nano-wires have been grown within the pores by electrodeposition.

O 5: Magnetic Nanostructures

Time: Monday 11:15–12:45 Location: MA 043

O 5.1 Mon 11:15 MA 043

Probing the surface states of single atoms on cobalt nanoislands — •Laurent Limot[1], Benjamin Heinrich[1], Mircea-Vasile Rastei[1], Cristian Iacovita[1], Pavel A. Ignatiev[2], Valeri S. Stepanyuk[2], Patrick Bruno[2], and Jean-Pierre Bucher[1] — [1]Institut de Physique et Chimie des Matériaux de Strasbourg, UMR 7504, Université Louis Pasteur, F-67034 Strasbourg, France — [2]Max-Planck-Institut für Mikrostrukturphysik, D-06120 Halle/Saale, Germany

With the remarkable downscaling of data-storage bits, both writing and reading processes become extremely challenging, since read sensors need to be comparable to the bit size, and at the same time, their sensitivity must be improved due to the loss in signal-to-noise ratio. Future progress strongly relies on our fundamental understanding of magnetic phenomena in reduced dimensions.

Atoms on magnetic nanoislands represent a model playground for investigating such phenomena. In this study, we focus on the electronic properties of single Ni, Cu and Co atoms adsorbed on cobalt nanoislands grown on the Cu(111) surface. By combining low-temperature scanning tunneling spectroscopy with *ab initio* calculations we reveal the existence of a common electronic resonance, resulting from the localization of the nanoisland surface states at the adsorption site of the atoms.

O 5.2 Mon 11:30 MA 043

Tailoring exchange interactions between magnetic adatoms in engeneered nanostructures: ab initio study — •Pavel A. Ignatiev, Valeri S. Stepanyuk, and Patrick Bruno — Max-Planck-Institut für Mikrostrukturphysik, Weinberg 2, D-06120 Halle, Germany

The controllable modification of quantum states in 1D nanostructures could permit one to manipulate their electronic and magnetic properties. An advanced experimental methods, such as the scanning tunneling microscope (STM), allows one to construct chains on surfaces in atom-by-atom fashion [1,2]. Our ab initio calculations unambiguously demonstrate that both sign and magnitude of the exchange interaction between magnetic impurities incorporated in nonmagnetic chains on metal surfaces can be tailored by an appropriate design of the chain length and composition [3]. Such engineered 1D systems are experimentally feasible [4], and the above effects should be detectable with modern technology, for instance, by probing the Kondo resonance [5].

[1] S. Folsch, P. Hyldgaard, R. Koch, and K. H. Ploog Phys. Rev. Lett. 92, 056803 (2004).

[2] N. Nilius T. M. Wallis, and W. Ho, Science 297, 1853 (2002).

[3] P. A. Ignatiev, V. S. Stepanyuk and P. Bruno, submitted to PRL

[4] J. Lagoute, C. Nacci, and S. Folsch Phys. Rev. Lett. 98, 146804 (2007).

[5] P. Wahl, P. Simon, L. Diekhoner, V. S. Stepanyuk, P. Bruno, M. A. Schneider, and K. Kern, Phys. Rev. Lett. 98, 056601 (2007).

O 5.3 Mon 11:45 MA 043

***Ab initio* Study of Spin-polarized Bound States in Magnetic Dimers on Metal Surfaces** — •Oleg O. Brovko, Valeri S. Stepanyuk, and Patrick Bruno — Max-Planck-Institut für Mikrostrukturphysik, Weinberg 2, D-06120 Halle, Germany

Interaction of single adatoms with surface state electrons has been shown to produce a bound state below the surface state band bottom [1,2]. Similar states have been revealed at nonmagnetic Cu chains [2]. Using *ab initio* KKR Green's function method we study the spin-polarized bound state arising at magnetic dimers on noble metal surfaces. We demonstrate that the spin-splitting of the bound state can be utilized to determine the exchange coupling of a magnetic dimer.

[1] L. Limot, E. Pehlke, J. Kröger, and R. Berndt, Phys. Rev. Lett. 94, 036805 (2005). [2] V. S. Stepanyuk, A. N. Klavsyuk, L. Niebergall, and P. Bruno, Phys. Rev. B 72, 153407 (2005)

O 5.4 Mon 12:00 MA 043

Quantum resonators on metal surfaces: theoretical and experimental studies — •L. Niebergall[1], N.N. Negulyaev[2], V.S. Stepanyuk[1], P. Bruno[1], J. Repp[3], G. Meyer[4], and K.-H. Rieder[5] — [1]Max Planck Institute of Microstructure Physics, 06120 Halle, Germany — [2]Physics Department, Martin-Luther-University Halle-Wittenberg, 06099 Halle, Germany — [3]Institute of Experimental and Applied Physics, University Regensburg, 93053 Regensburg, Germany — [4]IBM Research, Zurich Research Laboratory, 8803 Rueschlikon, Switzerland — [5]Institute of Experimental Physics, FU Berlin, 14195 Berlin, Germany

Confinement of surface-state electrons on metal surfaces can lead to many interesting effects [1-3]. Here, we present a combined experimental and theoretical studies on adatom motion in quantum resonators. Using STM technique we construct two parallel monatomic Cu chains on Cu(111). Quantum confinement of surface electrons between chains is revealed. Experimental and theoretical studies demonstrate that adatom motion inside the resonators at low temperature is determined by quantized electronic states in resonators.

1. V.S. Stepanyuk et al., Phys. Rev. Lett. 94, 187201 (2005).
2. L. Niebergall et al., Phys. Rev. Lett. 96, 127204 (2006).
3. V.S. Stepanyuk et al., New J. Phys. 9, 388 (2007).

O 5.5 Mon 12:15 MA 043

Self-organized surface ripples as a source of magnetic anisotropies — •J. Fassbender[1], M. O. Liedke[1], A. Keller[1], S. Facsko[1], D. Marko[1], A. Hanisch[1], J. Grenzer[1], E. Cizmar[2], and S. Zvyagin[2] — [1]Forschungszentrum Dresden-Rossendorf, Institute of Ion Beam Physics and Materials Research, Bautzner Landstrasse 128, 01328 Dresden, Germany — [2]Forschungszentrum Dresden-Rossendorf, High Magnetic Field Laboratory, Bautzner Landstrasse 128, 01328 Dresden, Germany

In thin film magnetism surface and interface morphologies are impor-