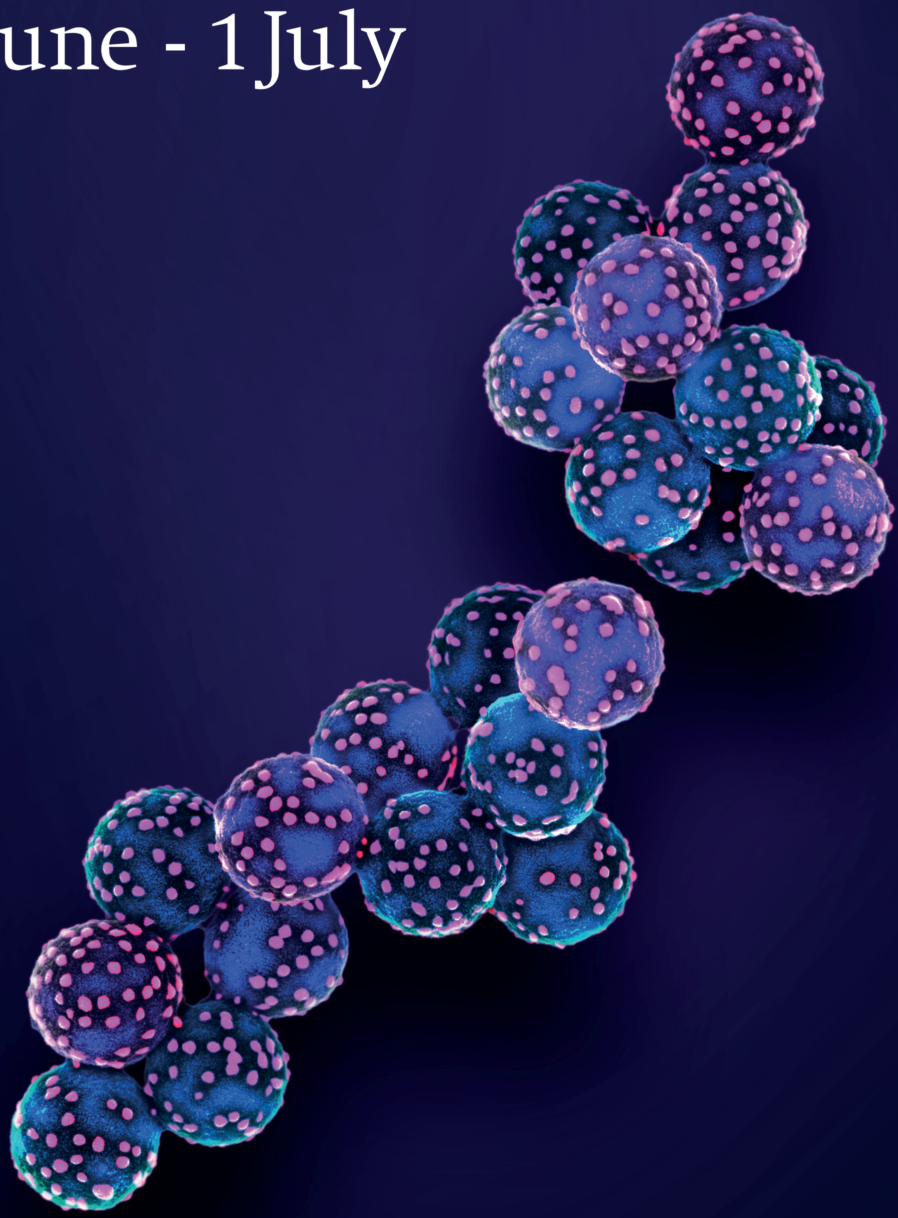
University of Basel

Swiss Nanoscience Institute

SNI
SWISS
NANOSCIENCE
INSTITUTE
EINE INITIATIVE DER UNIVERSITÄT BASEL
UND DES KANTONS AARGAU

Swiss NanoConvention 2016

30 June - 1 July



swiss mnt network
micro & nanotechnology

swiss nano convention

Swiss Nanoscience Institute
University Basel

Klingelbergstrasse 82
4056 Basel
Switzerland

www.nanoscience.ch

Cover illustration: Virus-imprinted nanoparticles (P. Shahgaldian, FHNW and M. Oeggerli, www.micronaut.ch).

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FOREWORD DIRECTOR SWISS NANOSCIENCE INSTITUTE

Dear colleagues

I am pleased to welcome you to the 6th Swiss NanoConvention (SNC). This is now the second time that Basel has the honor of hosting the SNC, an event that has become the prime showcase for nanoscience and nanotechnology in Switzerland. At the SNC, you will meet experts from the diverse fields of nanoscience and nanotechnology with plenty of opportunities for discussions and exchange of ideas with scientists from academia and industry.

The joint organizers of the conference, the Swiss Micro- and Nanotechnology Network, the Swiss Nanoscience Institute, and the Commission for Technology and Innovation, have attracted leading international and national nanoscientists from various fields as keynote and invited speakers – giving you a wealth of talks to choose from.

We will learn about their latest ideas and findings in topics such as quantum computing, nanobiology, nanoelectronics, and nanooptics. Talks will also cover 30 years of AFM, nano for energy, manufacturing technologies, sensing, and functional surfaces & interfaces, as well as the latest applications in a broad range of nanotechnology fields. The keynote lectures and scientific sessions are complemented by a poster session that provides the opportunity for lively discussions and a showcasing of nanotechnology-related products and research networks by more than 25 exhibitors. I look forward to meeting you during the breaks at the different exhibition booths and poster sessions.

I would like to thank all our sponsors for the generous support that has made it possible to bring together internationally renowned experts from all over the world. Please use the unique chance to informally exchange thoughts with friends and colleagues from various different disciplines and institutions and to enjoy two inspiring and exciting days here in Basel. This may very well be the basis for future research projects.

Best regards

Christian Schönenberger

Prof. Dr. Chr. Schönenberger
Swiss Nanoscience Institute
University of Basel

FOREWORD BASEL AREA

Dear visitors

What goes to make up a successful conference visit? Is it an inspiring set of presentations, creative talks during coffee breaks, new personal contacts with a prospective collaboration partner or the sudden idea for a new project when walking through the poster session?

Whatever it is for you, we, the public-private innovation and economic promotion agency BaselArea.swiss, formerly i-net innovations, are very glad to welcome you to the Swiss NanoConvention here in Basel. Nanotechnology has a strong history in the region of Northwestern Switzerland with the National Centre of Competence in Research "Nanoscale Science" selected in 2000, the first university to offer BSc and MSc degrees in nanoscience with the excellent reputation of the Swiss Nanoscience Institute (SNI) as a competence centre.

The Swiss NanoConvention is a great opportunity to grasp the different aspects of nanotechnology as an enabling technology in many different disciplines and from an academic and industrial point of view. New applications in the life sciences and medtech sectors offer new opportunities, for example, in diagnostics, active implants and personalized medicine. In addition, tiny sensors, data connections and information flow form the basis of both the Internet of Things and Industry 4.0.

Currently, innovative ideas and new concepts are often based on an interesting blend of microstructures, nanoscience, chemistry and biology. Will the term "nanotechnology" still be as new and exciting in 15 years as it is today? Maybe not. True innovation is rarely bound by definitions, and surprises are most welcome. Networking, personal interactions and serendipity are also factors that help to foster innovation as we understand it.

We wish you an inspiring Swiss NanoConvention conference with all the spicy ingredients for your success – enjoy it!

Christof Klöpper
Managing Director
BaselArea.swiss

Ralf Dümpelmann
Micro, Nano & Materials
BaselArea.swiss

PROGRAM, THURSDAY 30 JUNE 2016

08:00–18:00 Registration Open

09:15–09:30

Opening Session

Christian Schönenberger, Swiss Nanoscience Institute, Basel
Andrea Schenker-Wicki, Rektorin, University of Basel
Representative Main Sponsor, Congress Board Basel, Basel

09:30–11:00

PLENARY A

Chair: Klaus Ensslin and Christoph Gerber

QSIT Talk: Quantum Computing in Silicon with Donor Electron Spins
Michelle Y. Simmons
University of New South Wales, Sydney

Güntherodt Lecture: Atomic Force Microscopy to Study Processes of Life from the Cellular to Molecular Scale
Daniel Müller
D-BSSE ETHZ, Basel

11:00–11:30 Coffee Break / Exhibition Visit

11:30–13:00

30 years of AFM

Chair: Christoph Gerber & Ernst Meyer

Molecules Investigated by AFM with Functionalized Tips
Leo Gross
IBM, Zurich

Vectorial Scanning Force Microscopy Using a Nanowire Sensor
Martino Poggio
University of Basel, Basel

High-Speed Atomic Force Microscopy: The Dawn of Dynamic Structural Biochemistry
Simon Scheuring
INSERM / Aix-Marseille Université

Quantum Sensing and Imaging of Nano-magnetic Systems
Patrick Maletinsky
University of Basel, Basel

Nano for Energy

Chair: Andreas Hafner

Nano for Thin Film CIGS Solar Cells
Yaroslav Romanyuk
Empa, Dübendorf

Graphene in Organic Light Emitting Diodes
Jens Meyer
LUMILEDS, Aachen

Nanocomposite Optical Coatings for Solary Energy Applications
Andreas Schueler
EPFL, Lausanne

Photoinduced Long-Range Electron Transfer across Molecular Bridges and Wires
Oliver Wenger
University of Basel, Basel

CTI Micro/Nano Event

Welcome
Martina Hirayama & Raymond Zehringer
funding area

Latest News from CTI
Annalise Eggimann
Director of the Secretariat, CTI

AURORA: Augmented Reality Optical Retinal Display
Christophe Moser
EPFL

Poster Presentations

13:00–14:30 Lunch in Exhibiton and Poster area

14:30–16:00

Nanobiology

Chair: Roderick Lim

Mechanical Coupling between Assembly of Endocytic Proteins and Lipid Membrane Deformation
Aurélien Roux
University of Geneva, Geneva

DNA (Origami) Nanopores
Ulrich F. Keyser
University of Cambridge, Cambridge

Protein Nano-Crystallography and the Power of Diffraction
Jan Pieter Abrahams
University of Basel & PSI, Villigen

Molecular Systems Engineering with DNA
Hendrik Dietz
TU Munich, Munich

Manufacturing Technologies

Chair: Jens Gobrecht

3D Laser Lithography: No Limits?
Martin Wegener
KIT, Karlsruhe

Laser Additive Manufacturing of Nano-Structured Materials – Challenges and Opportunities
Christian Leinenbach
Empa, Dübendorf

3D Printing and Medical Applications an Overview
Ralf Schumacher
FHNW, Muttenz

As Smooth as Possible – Selective Surface Equilibration of Polymer Topographies
Helmut Schift
PSI, Villigen & FHNW, Windisch

CTI Micro/Nano Event

Wi-Fi-Based Live Video Trans-Mission for Medical Applications
Stefan Beetschen & Oliver Brütsch
Bruetsch Elektronik AG

Catch the unique opportunities of the Swiss Light Source at the PSI for Swiss SMEs
Aline Cossy-Gantner
Swiss Light Source Technology Transfer AG, PSI

Taper-free laser cutting of micro-mechanical moponents
Janko Auerswald
Trumpf Maschinen AG

16:00–16:30 Coffee Break / Exhibition Visit

16:30–18:00

PLENARY B

Chair: Michel Calame

Ascending the Scales: Nano- to Micro- to Macro-machines for DNA Sequencing
Steven A. Henck
Roche, Santa Clara

CO_2 + H_2O + Sunlight $\rightarrow$ Chemical Fuels + O_2
Peidong Yang
University of California, Berkeley

CTI Micro/Nano Event

FluidFM Technology - Go beyond Imaging
Pascal Behr
Cytosurge AG

Keynote: PV on the Path to Becoming Mainstream
Patrick Hofer-Noser
Meyer Burger Technology AG

18:00 Apéro riche

PROGRAM, FRIDAY 1 JULY 2016

08:00–17:00	Registration Open	
09:15–10:45	**PLENARY C** Chair: Edwin C. Constable **Covalent Chemistry beyond Molecules** Omar M. Yaghi University of California, Berkeley **Everything SLIPS: Design of Novel Omniphobic Nanocoatings** Joanna Aizenberg Harvard University, Cambridge	
10:45–11:15	Coffee Break / Exhibition Visit	
11:15–12:45	**Imaging, Sensing & Quantum Technology** Chair: Michel Calame and Patrick Maletinsky **Nano-Scale Structural Characterization of Parkinson's Disease** Henning Stahlberg University of Basel, Basel **Imaging Nano-Scale Features over Extended Areas and Volumes** Oliver Bunk PSI, Villigen **Optoelectronic Properties of Single-Molecule Junctions** Guillaume Schull Université de Strasbourg, Strasbourg **Imaging Magnetism at the Nanoscale with a Single Spin Microscope** Vincent Jacques Université de Montpellier & CNRS, Montpellier	**Materials** Chair: Pierangelo Gröning **Bend Light for the Good of All?** Adrian von Mühlenen BASF, Basel **Towards Integrated Manufacturing of 2D Materials** Stephan Hofmann University of Cambridge, Cambridge **Designing Materials on the 10-nm Length Scales: from Photovoltaics to Optical Meta-Materials** Ullrich Steiner Adolphe Merkle Institute, Fribourg **Trapping, Reacting and Switching Molecules on Single Layer Hexagonal Boron Nitride** Oliver Gröning Empa, Dübendorf
12:45–14:00	Lunch in Exhibiton and Poster area	
14:00–15:30	**Nano- & Quantum-Optics and Applications** Chair: Christian Bosshard **Towards Quantum Hardware with a Semiconductor Quantum Dot** Richard Warburton University of Basel, Basel **Opto-Valleytronic Imaging of Atomically Thin Semiconductors** Alexander Högele LMU, Munich **Plasmonics for Optical Security and Filters** Benjamin Gallinet CSEM, Muttenz **Towards a 2D Platform for Micro- and Nano-Optics** Hans Peter Herzig EPFL, Neuchâtel	**Functional Surfaces & Interfaces** Chair: Werner Rutsch and Wolfgang Meier **Tailormade Polymer Monolayers and Networks for the Generation of Novel Microsystems and Engineered Biointerfaces** Jürgen Rühe IMTEK, Freiburg **Functional Surfaces through Immobilization of Synthetic Nanoarchitectures** Gesine Gunkel-Grabole University of Basel, Basel **Surface Functionalization of Titanium Implants - Challenges from the Medtech Industrial Perspective** Christiane Jung KKS Ultraschall AG, Steinen **Lithographic Radiation Grafting: a Versatile Approach to Functional Polymer Surfaces** Celestino Padeste PSI, Villigen
15:30–16:00	Coffee Break / Exhibition Visit	
16:00–17:30	**PLENARY D** Chair: Christian Schönenberger **Optical Techniques for Measuring the Dynamics of Viruses** Vinothan N. Manoharan Harvard University, Cambridge **The Alchemy of Vacuum "Hybridizing Light and Matter"** Thomas Ebbesen University of Strasbourg, Strasbourg	
17:30–17:45	**Farewell Session** Christian Schönenberger, Swiss Nanoscience Institute, Basel	
18:00	Apéro	

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TABLE OF SPEAKER

KEYNOTE SPEAKER

INVITED SPEAKER

EXHIBITORS

Stand Nr. 19
www.accurion.com

Stand Nr. 5
www.am-institute.ch

Stand Nr. 1
alumni-nano@unibas.ch

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www.attocube.com

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www.basf.com

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www.micronarc.ch

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www.nanoscribe.de

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www.nanosurf.com

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www.nccr-mse.ch

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www.psi.ch

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www.pfeiffer-vacuum.com

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www.nccr-qsit.ethz.ch

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www.schaefer-tec.com

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www.swisslitho.com

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Stand Nr. 29
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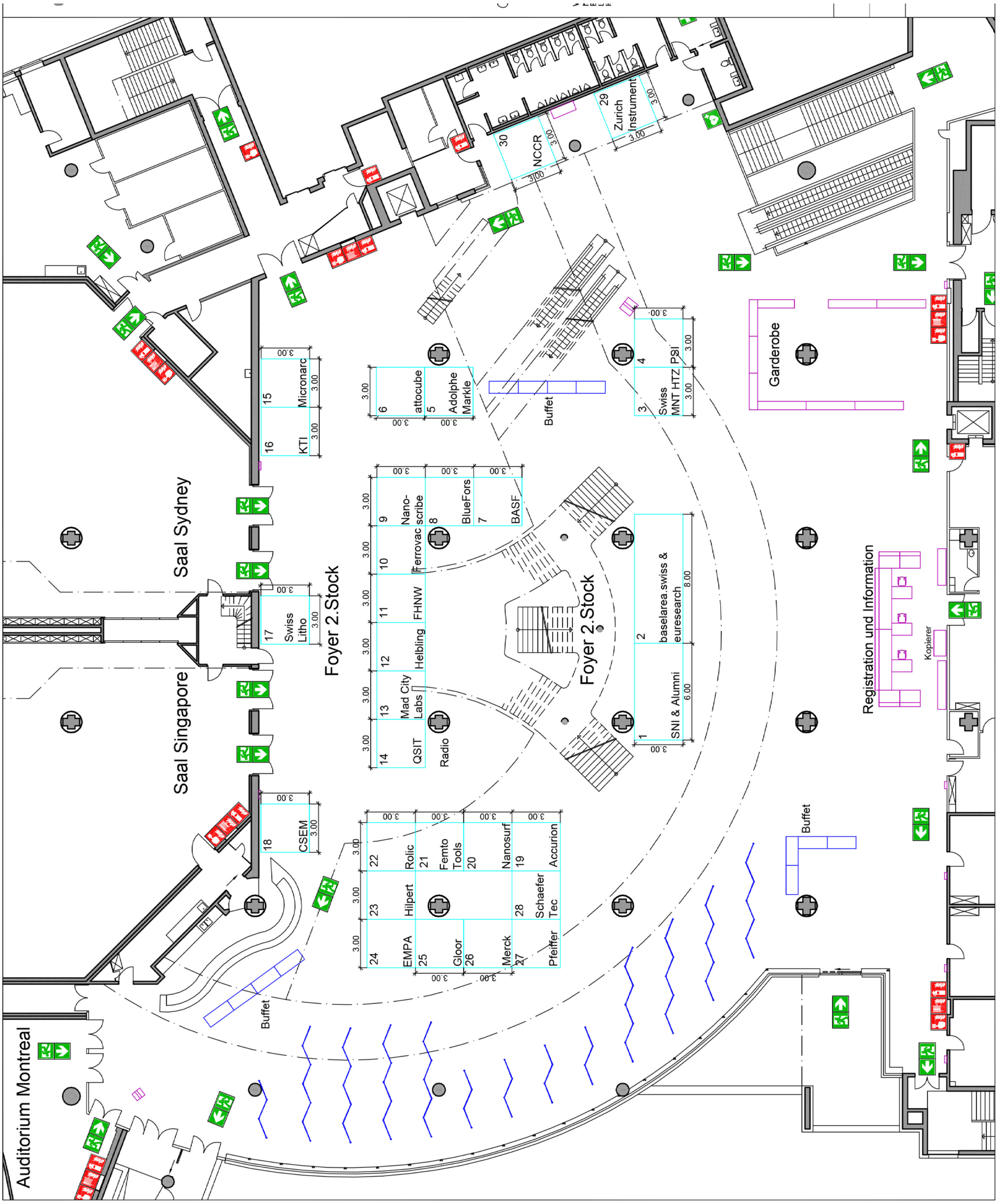
EXHIBITION FLOORPLAN



KEYNOTE SPEAKER

Room MONTREAL
30 JUNE 2016 — 9:30 - 11:00 am

MICHELLE Y. SIMMONS
University of New South Wales, Sydney, Australia

Quantum Computing in Silicon with Donor Electron Spins

ABSTRACT

Extremely long electron and nuclear spin coherence times have recently been demonstrated in isotopically pure Si-28, making silicon one of the most promising semiconductor materials for spin based quantum information. The two level spin state of single electrons bound to shallow phosphorus donors in silicon in particular provide well defined, reproducible qubits and represent a promising system for a scalable quantum computer in silicon. Using scanning tunneling microscope hydrogen lithography, we developed a unique fabrication strategy to precisely position individual P donors in a Si crystal aligned with nanoscale precision to local control gates necessary to initialize, manipulate, and read-out the spin states. During this talk I will focus on demonstrating spin transport and single-shot spin read-out of precisely-positioned P donors in Si. I will also describe our approaches to scale up using rf reflectometry and the investigation of 3D architectures for implementation of the surface code.

BIOGRAPHY

Professor Simmons is an Australian Research Council Laureate Fellow & Director of the highly successful Centre of Excellence for Quantum Computation and Communication Technology. Following her PhD in II-VI solar cells at the University of Durham in the UK in 1992 she became a Research Fellow at the Cavendish Laboratory in Cambridge, UK. In 1999, she was awarded a QEII Fellowship and went to Australia where she pioneered unique technologies to build electronic devices in silicon at the atomic scale, which opens up the prospect of developing a silicon-based quantum computer. She won several prices, most recently the CSIRO Eureka Prize.

KEYNOTE SPEAKER

Room MONTREAL
30 JUNE 2016 — 9:30 - 11:00 am

DANIEL MÜLLER
D-BSSE ETHZ, Basel, Switzerland

Atomic Force Microscopy to Study Processes of Life from the Cellular to Molecular Scale

ABSTRACT

Maintenance of cell shape is central to many aspects of biology such as organism growth, form and disease. To divide in tissue animal cells must round up to conduct mitosis. Here, we introduce AFM-based nanoscopic assays to characterize the drastic shape change of animal cells progressing through mitosis. We apply our assays in a massive screen to study the contribution of human genes to this process fundamental to life. Having found the major genes regulating cell shape changes in mitosis we apply our assay to control cancer cells progressing through mitosis. Then, we will introduce high-resolution AFM-based methods to characterize the cellular machinery playing commanding roles in animal cells. Cellular machines are imaged at sub-nanometer resolution at work, their interactions detected, and their free-energy landscape determined. Structurally mapping this information can unravel how the functional state of proteins is guided. Finally, we will overview very recent developments of AFM, which applied together with modern light microscopy, cell biological and genetic tools provide unique fascinating insight into how the machinery of the cell contributes to basic processes of life.

BIOGRAPHY

Daniel Müller holds the Chair of Biophysics at the Department of Biosystems Science and Engineering at the ETH Zürich. Located at Basel, Müller co-directs the Swiss National Competence Center of Research (NCCR) Molecular Systems Engineering at Basel. The motivation of the NCCR is to engineer molecular factories for biotechnological applications and to control cells, tissues and organs. Müller develops bionanotechnological tools and assays to image, sense and control proteins, protein assemblies and cellular systems.

KEYNOTE SPEAKER

Room MONTREAL
30 JUNE 2016 — 4:30 - 6:00 pm

STEVEN A. HENCK
Roche, Santa Clara, USA

Ascending the Scales: Nano- to Micro- to Macro-Machines for DNA Sequencing

ABSTRACT

We have developed a single molecule, nanopore-based SBS technology that accurately distinguishes tags on each of the four DNA nucleotides as they are incorporated by DNA polymerase. To exploit the potential of this sequencing technology, we have created a biological nanomachine consisting of a novel, isothermal polymerase attached to a biological nanopore which is inserted into lipid bilayers formed on an ASIC. The DNA polymerase forms tight ternary complexes with primer/template DNA and nucleotides. Tags on these nucleotides in the vicinity of the pore are readily captured by the pore, and electrical signals unique to each of the four nucleotides are detected by the IC. Upon complete incorporation of the nucleotide, the tag is cleaved and pulled through the pore making the polymerase-pore-template construct available for the next incorporation event. As each nanomachine operates on a single strand of DNA, the result is high throughput, real-time, single molecule DNA sequencing.

BIOGRAPHY

Steven Henck is the Life Cycle Leader for Genia Technologies, which was acquired by Roche in June 2014 and is now part of Roche Sequencing Solutions. Previously, he was a project leader at 454 Life Sciences. Before joining Roche, Steven was the President and CEO of Arbor Fuel Inc., a biotechnology company focused on creating microbes for the production of second generation biofuels and chemicals. Prior to founding Arbor Fuel, Steven was the Senior Vice President of Operations at CuraGen Corporation (NASDAQ: CRGN), where he led the development and clinical manufacturing launch of three therapeutic drugs in FDA clinical trials. Dr. Henck holds his PhD in Chemistry from Princeton University.

KEYNOTE SPEAKER

Room MONTREAL
30 JUNE 2016 — 4:30 - 6:00 pm

PEIDONG YANG
University of California, Berkeley, USA

CO_2 + H_2O + Sunlight --> Chemical Fuels + O_2

ABSTRACT

Solar-to-chemical (STC) production using a fully integrated system is an attractive goal, but to-date there has yet to be a system that can demonstrate the required efficiency, durability, or be manufactured at a reasonable cost. One can learn a great deal from the natural photosynthesis where the conversion of carbon dioxide and water to carbohydrates is routinely carried out at a highly coordinated system level. There are several key features worth mentioning in these systems: spatial and directional arrangement of the light-harvesting components, charge separation and transport, as well as the desired chemical conversion at catalytic sites in compartmentalized spaces. In order to design an efficient artificial photosynthetic materials system, at the level of the individual components: better catalysts need to be developed, new light-absorbing semiconductor materials will need to be discovered, architectures will need to be designed for effective capture and conversion of sunlight, and more importantly, processes need to be developed for the efficient coupling and integration of the components into a complete artificial photosynthetic system. In this talk I will discuss our latest efforts in this direction.

BIOGRAPHY

After studies in chemistry at the University of Science and Technology of China and Harvard University, Peidong Yang did a post-doc at the University of California, Santa Barbara before joining the faculty in the department of Chemistry at the University of California, Berkeley in 1999. He is Chair Professor in Energy, director for California Research Alliance by BASF, and co-director for the Kavli Energy Nanoscience Institute. He received several awards and fellowships. His main research interest is in the area of one dimensional semiconductor nanostructures and their applications in nanophotonics and energy conversion.

KEYNOTE SPEAKER

Room MONTREAL
1 JULY 2016 — 9:15 - 10:45 am

OMAR M. YAGHI
University of California, Berkeley, USA

Covalent Chemistry beyond Molecules

ABSTRACT

The precision with which molecular covalent chemistry is practiced is being realized in the new chemistry of metal-organic frameworks and covalent organic frameworks. This lecture will highlight the building block approach for (a) covalently stitching molecules together into nanoporous materials, (b) the covalent modification of the interior of such materials for carbon dioxide capture and water harvesting from air, and (c) the extension of this chemistry to molecular weaving of organic threads.

BIOGRAPHY

Omar M.Yaghi started his career in chemistry at the State University of New York and University of Illinois and became NSF Postdoctoral Fellow at Harvard University. In 2011, he became James and Neeltje Tretter Chair Professor of Chemistry at UC Berkeley and a Senior Faculty Scientist at Lawrence Berkeley National Laboratory. He is the Founding Director of the Berkeley Global Science Institute and the Co-Director of the Kavli Energy NanoScience Institute, and the California Research Alliance by BASF. His work encompasses the synthesis, structure and properties of inorganic and organic compounds and the design and construction of new crystalline materials.

KEYNOTE SPEAKER

Room MONTREAL
1 JULY 2016 — 9:15 - 10:45 am

JOANNA AIZENBERG
Harvard University, Cambridge, USA

Everything SLIPS: Design of Novel Omniphobic Nanocoatings

ABSTRACT

Liquids entrapped within a nanostructured solid begin to exhibit unique behaviors often providing the surrounding material with unprecedented properties. Recently we have introduced a new technology to create self-healing, anti-fouling materials (so-called Slippery, Lubricant-Infused Porous Surfaces, or SLIPS). These bioinspired coatings that mimic slippery surfaces of a pitcher plant outperform state-of-the-art materials in their ability to resist ice and microbial adhesion, repel various liquids, prevent marine fouling, or reduce drag. Generalized design principles for shear-tolerant nanostructured SLIPS and scalable methods to manufacture such coatings on glass, ceramics, polymers, fabrics and metals will be presented. We anticipate that slippery surfaces can find important applications as antifouling materials in medicine, construction, naval and aircraft industries, optical sensing, and as antifouling surfaces against highly contaminating media operating in extreme environments.

BIOGRAPHY

Joanna Aizenberg is the Amy Smith Berylson Professor and the Director of the Kavli Institute for Bionano Science at Harvard University. She pursues a broad range of research interests that include biomimetics, self-assembly, smart materials and bionano interfaces. Joanna is a Fellow of the American Academy of Arts and Sciences, APS and MRS. She received numerous awards from the ACS and MRS, and two R&D100 Awards for best innovations in 2012-2013. In 2015 she received Harvard's most prestigious Ledlie Prize that is awarded for the most valuable contribution to science made by a Harvard scientist.

KEYNOTE SPEAKER

Room MONTREAL
1 JULY 2016 — 4:00 - 5:30 pm

VINOTHAN N. MANOHARAN
Harvard University, Cambridge, USA

Optical Techniques for Measuring the Dynamics of Viruses

ABSTRACT

Simple viruses consist of RNA and proteins that form a shell (called a capsid) that protects the RNA. The capsid is highly ordered, with the proteins being arranged in an icosahedral shell. Many simple viruses are self-assembled: you can mix the RNA and the capsid proteins in a test tube, and they will spontaneously form infectious viruses. The self-assembly process is important to understand from the perspectives of both nanotechnology and medicine. But studying the dynamics of virus self-assembly is difficult, because the viruses are tiny (a few tens of nanometers in diameter), and they assemble quickly (taking somewhere between a microsecond and a second). I will discuss optical and interferometric techniques that we have developed to be able to see these tiny viruses and resolve their dynamics on sub-millisecond time scales.

BIOGRAPHY

Vinothan N. Manoharan is the Wagner Family Professor of Chemical Engineering and Professor of Physics at Harvard University. His research focuses on understanding how systems containing many particles suspended in a liquid – such as nanoparticles, proteins, or cells – organize themselves into ordered structures like crystals, viruses, and even living tissues. His lab uses optical techniques to watch these systems self-assemble in real time. The goal is to discover new, general physical principles that underlie complex systems.

KEYNOTE SPEAKER

Room MONTREAL
1 JULY 2016 — 4:00 - 5:30 pm

THOMAS EBBESEN
University of Strasbourg, Strasbourg, France

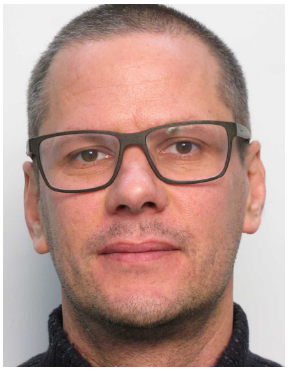
The Alchemy of Vacuum "Hybridizing Light and Matter"

ABSTRACT

Strong coupling of light and matter can give rise to a multitude of exciting physical effects through the formation of delocalized hybrid light-matter states. When molecular materials with high transition dipole moments are placed in the confined fields of metallic microcavities or surface plasmons, Rabi splittings approaching 1 eV are observed due to the interaction with the vacuum electromagnetic field. This leads to fundamental changes in the properties of the coupled system even in the dark. While strong coupling has been extensively studied due to the potential it offers in physics such as room temperature Bose-Einstein condensates and thresholdless lasers, the implications for molecular and material science have remained mostly unexplored. After introducing the fundamental concepts, examples of modified properties under strong coupling, such as enhanced charge transport in organic semiconductors and non-radiative energy transfer, will be given to illustrate the broad potential of light-matter states.

BIOGRAPHY

Thomas W. Ebbesen received his BA from Oberlin College (USA) and his PhD from Curie University in Paris. He then did research in both the US and Japan, most notably at NEC. He is currently the head of the Center for Frontier Research in Chemistry and the University of Strasbourg Institute for Advanced Studies. Ebbesen has received numerous awards for his pioneering research, including the 2014 Kavli Prize in Nanoscience for his transformative contributions to nano-optics. He is a member of the Norwegian Academy of Science and Letters and the French Academy of Science.



Room MONTREAL
30 JUNE 2016 — 11:30 am - 1:00 pm

LEO GROSS
IBM, Zurich, Switzerland

Molecules Investigated by AFM with Functionalized Tips

ABSTRACT

The fuctionalization of tips by atomic manipulation dramatically increased the resolution of atomic force microscopy (AFM). Using non-contact AFM and tip functionalization, we demonstrated atomic resolution on molecules, molecular structure identification, bond-order discrimination, measurement of the charge distribution within molecules, and adsorption geometry determination.
The combination of high resolution AFM with atomic manipulation now offers the unprecedented possibility to custom-design individual molecules by making and breaking bonds with the tip of the microscope and directly characterizing their products on the atomic scale. We recently applied this technique to generate and study reaction intermediates and to investigate chemical reactions trigged by atomic manipulation. We formed diradicals by dissociating halogen atoms and then reversibly triggered ring-opening and -closing reactions via atomic manipulation, allowing us to switch and control the molecule's reactivity, magnetic and optical properties.

BIOGRAPHY

Leo Gross works since 2005 at IBM Research – Zurich together with Dr. Gerhard Meyer on atomic and molecular manipulation by scanning tunneling microscopy (STM) and atomic force microscopy (AFM), and on nanostencil lithography. Leo Gross received his PhD in Physics in 2005 in the group of Prof. Karl-Heinz Rieder at the Free University of Berlin. Before that he worked in the group of Prof. Harald Fuchs at the University of Münster and in the group of Prof. Ulrike Diebold at Tulane University, New Orleans.
Leo Gross' main research interest is the investigation of atomic and molecular adsorbates using low temperature STM and AFM. In 2009, he and his coworkers pioneered atomic resolution on molecules by AFM using functionalized tips.

Room MONTREAL
30 JUNE 2016 — 11:30 am - 1:00 pm

MARTINO POGGIO
University of Basel, Basel, Switzerland

Vectorial Scanning Force Microscopy Using a Nanowire Sensor

ABSTRACT

Self-assembled nanowire (NW) crystals can be grown into nearly defect-free nanomechanical resonators with exceptional properties, including small motional mass, high resonant frequency, and low dissipation. Furthermore, by virtue of slight asymmetries in geometry, a NW's flexural modes are split into doublets oscillating along orthogonal axes. These characteristics make bottom-up grown NWs extremely sensitive vectorial force sensors. Here, taking advantage of its adaptability as a scanning probe, we use a single NW to image a sample surface. By monitoring the frequency shift and direction of oscillation of both modes as we scan above the surface, we construct a map of all spatial tip-sample force derivatives in the plane. Finally, we use the NW to image electric force fields distinguishing between forces arising from the NW charge and polarizability. This universally applicable technique enables a form of atomic force microscopy particularly suited to mapping the size and direction of weak tip-sample forces.

BIOGRAPHY

Martino Poggio received his BA in physics from Harvard University in 2000 and his PhD from the University of California, Santa Barbara in 2005. In graduate school, he worked for Prof. David Awschalom on ultrafast optics and semiconductor spintronics. From 2005 until 2008, he worked as a post-doctoral fellow at the IBM Almaden Research Center in San Jose, CA on high sensitivity nuclear magnetic resonance force microscopy. In January 2009, he started working as an Argovia Assistant Professor in the Department of Physics at the University of Basel. In 2014, he was promoted Associate Professor.

Room MONTREAL
30 JUNE 2016 — 11:30 am - 1:00 pm

SIMON SCHEURING
INSERM, University of Aix-Marseille, France

High-Speed Atomic Force Microscopy: The Dawn of Dynamic Structural Biochemistry

ABSTRACT

The advent of high-speed atomic force microscopy (HS-AFM) has opened a novel research field for the dynamic analysis of single bio-molecules: Molecular motor dynamics membrane protein diffusion and assembly could be directly visualized. Further developments for buffer exchange and temperature control during HS-AFM operation provide further breakthroughs towards the performance of dynamic structural biochemistry using HS-AFM.

BIOGRAPHY

Simon Scheuring is the founder and head of the “Bio-AFM-Lab” laboratory U1006 INSERM / Université Aix-Marseille. He is a trained biologist from the Biozentrum (University of Basel, 1992-1996). During his PhD (Andreas Engel lab, 1997-2001), he learned EM and AFM, and got interested in membrane proteins. During his postdoc (Jean-Louis Rigaud lab, 2001-2004) at the Institut Curie in Paris, he learned membrane physical chemistry and developed AFM for the study of native membranes. As a permanent researcher (2004-2007) and junior research director (2007-2012) he set up his lab at the Institut Curie in Paris. Recently, he built the “Bio-AFM-Lab” INSERM/Université Aix-Marseille (2012-now).

Room MONTREAL
30 JUNE 2016 — 11:30 am - 1:00 pm

PATRICK MALETINSKY
University of Basel, Basel, Switzerland

Quantum Sensing and Imaging of Nano-Magnetic Systems

ABSTRACT

Single spins can yield powerful sensors to investigate magnetism at the nanoscale. Spins respond to magnetic fields by the Zeeman effect, they can exhibit quantum coherence, allowing for excellent sensitivities, and may be localized to atomic scales to yield nanoscale resolution. The electronic spin of the Nitrogen-Vacancy (NV) center in diamond combines these benefits with optical addressing and operation under ambient conditions. These unique features render NVs particularly attractive quantum magnetometers and enable highly promising applications in nanoscience and technology.
My group has realized various such NV-based quantum sensors with the goal of applying them to outstanding problems in condensed-matter physics. I will describe our approach to nanoscale NV magnetometry and discuss recent experiments that demonstrate its unique performance. These include nanoscale imaging of vortices in superconductors and the study of nanoscale domains in anti-ferromagnets. Our results illustrate the power of NV magnetometry in determining local properties of electronic systems with nanometric resolution and the potential of our technology for future explorations of nano-magnetic systems.

BIOGRAPHY

Patrick Maletinsky has been Assistant Professor at the Department of Physics of the University of Basel since 2012. He joined the department after his PhD at ETH Zurich and a subsequent postdoc at Harvard University. His interests lie in quantum-sensing, nanotechnology, quantum optics and solid state physics. For the last eight years, his focus has been the development and application of novel, diamond-based quantum-sensing technologies. This research has led to various patents and journal publications and up to date forms the cornerstone of his research in Basel.

Room SINGAPORE
30 JUNE 2016 — 11:30 am - 1:00 pm

YAROSLAV ROMANYUK
EMPA, Dübendorf, Switzerland

Nano for Thin Film CIGS Solar Cells

ABSTRACT

Solar cells based on Cu(In,Ga)Se2 (CIGS) absorbers exhibit the highest conversion efficiency among all thin-film technologies, currently peaking at 22.3% on rigid glass and 20.4% on polymer flexible substrate - the latter achieved by the Empa group. Even though the CIGS solar cells are essentially thin film devices that are manufactured without any nanocrystals or nano-patterning, there are several recently discovered phenomena that happen at nanoscale and are essential for achieving the highest efficiency. The talk will review recent exciting developments and future prospects in thin film solar cells.

BIOGRAPHY

Yaroslav E. Romanyuk received his PhD from EPF Lausanne in 2005. After his post-doctoral stay at the University of California, Berkeley, he joined Empa as a group leader in the Laboratory for Thin Films and Photovoltaics to research energy-related materials, transparent conducting oxides by vacuum and solution techniques. He holds several patents and has co-authored more than 90 research articles.

Room SINGAPORE
30 JUNE 2016 — 11:30 am - 1:00 pm

JENS MEYER
LUMILEDS, Aachen, Germany

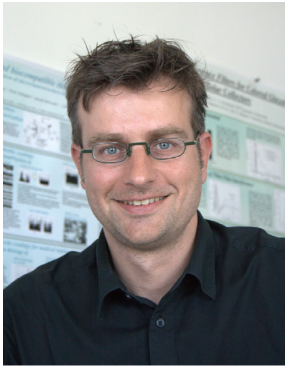
Graphene in Organic Light Emitting Diodes

ABSTRACT

Electrode materials combining high electrical conductivity and optical transparency are crucial components for organic light emitting diodes (OLED). Especially, for next generation flexible and bendable devices novel electrodes based on nanomaterials are required.
Among the range of intensely studied emerging transparent electrodes, graphene grown by scalable chemical vapor deposition (CVD) shows great promise as its two dimensional atomic crystal offers high elasticity, mechanical robustness, chemical inertness combined with remarkable electrical and optical properties. Even though CVD grown graphene has a high electronic mobility, the intrinsically low charge carrier concentration limits the overall conductivity. Thus, stable doping has become a key challenge to turn graphene into a highly conductive material that is suitable for OLED applications. In addition to high conductivity a transparent graphene electrode should also efficiently inject charge carriers into the organic device.
In this talk, I will discuss strategies to dope graphene which enable efficient charge injection by interface engineering and its subsequent integration in OLEDs. I will show that doped graphene electrodes can lead to OLED efficacies superior to state-of-the-art devices.

BIOGRAPHY

Jens Meyer holds a PhD in Electrical Engineering from the Technical University of Braunschweig, Germany. In 2009 he joined Professor Antoine Kahn's group at Princeton University as postdoctoral fellow. Two years later, he became a member of Philips Research (2011) in Aachen. As Senior Scientist, his research activities cover various aspects of organic light emitting diodes such as charge injection/transport, thin film encapsulation and transparent electrodes. Very recently, he joined Philips/Lumileds.



Room SINGAPORE
30 JUNE 2016 — 11:30 am - 1:00 pm

ANDREAS SCHUELER
EPFL, Lausanne, Switzerland

Nanocomposite Optical Coatings for Solary Energy Applications

ABSTRACT

Due to their fascinating optical and electronical properties, nanometer-scaled structures play an important role in solar energy conversion. Nanocomposite coatings consist typically of dielectric, semiconducting or metallic nanocrystals embedded in a host matrix. Physical effects of the nanometric scale, such as a high surface to volume ratio, surface plasmons and quantum confinement can result in interesting new material properties which might be exploited in solar energy conversion.
This overview tries to illustrate the large variety of existing and envisaged solar energy applications of nanocomposite thin films. Examples include colored coatings with high solar transmittance for façade-integrated photovoltaic modules and solar thermal collectors, photoluminescent quantum dot solar concentrators for photovoltaic energy conversion, electrochromic windows with switchable visible and energetic transmittance, as well as optical selective and thermochromic absorber coatings for smart solar thermal collectors.

BIOGRAPHY

After studies of Physics at the Universities of Freiburg i.Br., Ann Arbor (Michigan USA) and Basel, Dr. Andreas Schueler started a research group devoted to nanotechnology for solar energy conversion at Ecole Polytechnique Fédérale de Lausanne EPFL. Dr. Schüler is lecturing at EPFL, and supervising PhD and Master students. Topics of his current research include nanostructured coatings for selective solar absorbers, thermochromic solar collectors, electrochromic glazing, and photovoltaic applications. Dr. Schüler won the Solar Energy Journal Best Technical Paper Award in 2007 and 2013.

Room SINGAPORE
30 JUNE 2016 — 11:30 am - 1:00 pm

OLIVER WENGER
University of Basel, Basel, Switzerland

Photoinduced Long-Range Electron Transfer across Molecular Bridges and Wires

ABSTRACT

This talk will focus on photoinduced electron transfer in donor-bridge-acceptor molecules in solution, investigated by transient absorption spectroscopy and electrochemical methods. In the first part, unusual distance dependences of electron transfer rates will be discussed in the framework of Marcus theory. In particular, this will involve triarylamine-Ru(2,2'-bipyridine)32+-anthraquinone compounds in which the electron transfer rate increases with increasing donor-acceptor distance. The second part will focus on electron transfer across organoboron bridges which can be controlled by addition of fluoride anions due to strong Lewis acid / Lewis base interactions between the boron center and F-. In the last part, results from photoinduced charge accumulation studies with molecular pentads will be presented. Using two-photon excitation we are able to generate doubly reduces species resembling intermediates that occur in natural photosynthesis.

BIOGRAPHY

Oliver Wenger received a PhD in chemistry from University of Berne in 2002. He then spent two years as a postdoc at Caltech and two years at Université de Strasbourg. Between 2006 and 2009, he was assistant professor at the University of Geneva, equipped with a professorship funded by the Swiss NSF. In 2009, he accepted a tenured W2 professorship at Georg-August-Universität Göttigen. In 2012, he moved to the University of Basel where works in the Department of Chemistry.

Room MONTREAL
30 JUNE 2016 — 2:30 - 4:00 pm

AURELIEN ROUX
University of Geneva, Geneva, Switzerland

Mechanical Coupling between Assembly of Endocytic Proteins and Lipid Membrane Deformation

ABSTRACT

Lipid membranes make the envelopes of cell compartments. They are formed by the spontaneous assembly of cellular phospholipids into bilayers. These bilayers are visco-elastic nano-surfaces that are selectively permeable to solutes. They thus allow for keeping the composition of cells and compartments different from their environment. However, to mediate exchanges between cells and their environment, or between compartments, lipid membranes are deformed into buds that contain elements (imbedded in the membrane or soluble) that need to be exchanged. The formation of these buds, that can be tubular or vesicular, is often mediated by large protein complexes. They have two functions, one is to deform the membrane into a bud, and the second is to break the connecting neck between the donor membrane and the bud, to release a free membrane carrier. This later reaction is called fission. My lab studies three endocytic coats, clathrin, dynamin and escrt proteins. I will show recent findings that lead to the conclusion that the highly dynamic assembly of these coats can deform the membrane but can be counteracted by membrane parameters, such as tension and rigidity.

BIOGRAPHY

Aurélien Roux went to Yale University for a post-doctoral position, where he developed a method to monitor membrane fission induced by dynamin. Between 2007 and 2010 at the CNRS and from 2010 to present at the University of Geneva, he continued working on the dynamin mediated membrane fission. Since 2015, he was appointed Associate Professor and has meanwhile focused on two other protein assemblies and studies the mechanics of membrane traffic and growing epithelia. Roux is a recipient of several prizes, including the 2013 Friedrich Miescher prize and an ERC grant.

Room MONTREAL
30 JUNE 2016 — 2:30 - 4:00 pm

ULRICH F. KEYSER
University of Cambridge, Cambridge, UK

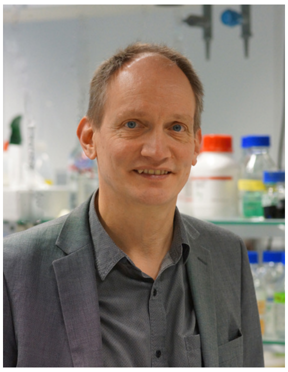
DNA (Origami) Nanopores

ABSTRACT

DNA nanotechnology has enabled the construction of DNA origami nanopores. These synthetic designer nanopores promise improved capabilities for enhanced single molecule detection. Here, we will review the recent developments of DNA origami nanopores both in lipid and solid-state membranes. These structures have extraordinary versatility and are a new and powerful tool in nanobiotechnology for a wide range of important applications also beyond molecular sensing. We discuss the current challenges and possible solutions that would enhance the sensing capabilities of DNA origami nanopores. Finally, we anticipate novel avenues for future research and highlight a range of exciting ideas and applications that could be explored in the near future. These include using these designer nanopores as model systems for protein channels.

BIOGRAPHY

Ulrich Keyser joined the group of Cees Dekker at TU Delft from 2003 – 2006, after his PhD in experimental physics in Braunschweig and Hannover. After a short intermezzo as Emmy Noether research group leader in Leipzig, he was appointed Assistant Professor in 2007 and Associated Professor in 2014 at the Cavendish Laboratory, University of Cambridge. His research focuses on the physics of membrane transport, controlling molecules in nanopores and mimicking protein channels. With the ERC Consolidator Grant (2015-2020) he will develop novel nanopores using DNA self-assembly techniques to enhance and understand molecular transport.



Room MONTREAL
30 JUNE 2016 — 2:30 - 4:00 pm

JAN PIETER ABRAHAMS
University of Basel & PSI, Basel & Villigen, Switzerland

Protein Nano-Crystallography and the Power of Diffraction

ABSTRACT

Cryo-electron microscopy (cryo-EM) is a powerful technique for studying macromolecular complexes. Analysis of EM images can produce near-atomic resolution maps, and can even distinguish different conformational states within a single sample. Radiation damage by the electron beam limits image contrast, and thus the resolution. EM also allows collecting data in diffraction mode and I will show that this enhances the signal by at least two orders of magnitude. These results can be quantified using 3D protein nano-crystals. I will show that 3D diffraction data of a single protein nano-crystal is sufficient for full structure determination. The physics that explain the signal improvement equally applies to non-crystalline samples that are normally investigated with cryo-EM. These results indicate that the combination of imaging, diffraction and phase extension methods as in crystallography, will further push the frontiers of cryo-EM.

BIOGRAPHY

Jan Pieter Abrahams is a structural biologist and currently professor at University of Basel and head of laboratory at the Paul Scherrer Institute. His passion is to study molecular structures (e.g. serpins, viruses, DNA repair proteins and others) and to show them in ways nobody has tried before. Inspired by the visionary, multidisciplinary approach at the LMB in Cambridge, where he worked from 1990 to 1997, he develops novel methods in high-resolution bioimaging, which include computation, chemistry and physics. He currently focuses his efforts on the analysis of protein 3D nano-crystals.

Room MONTREAL
30 JUNE 2016 — 2:30 - 4:00 pm

HENDRIK DIETZ
TU Munich, Munich, Germany

Molecular Systems Engineering with DNA

ABSTRACT

It is notoriously difficult to observe, let alone control, the position and orientation of molecules because of their small size and the constant thermal fluctuations that they experience in solution. Molecular self-assembly with DNA provides a route for placing molecules and constraining their fluctuations in user-defined ways and with up to Angstroem-scale precision. These positioning options open attractive and unprecedented avenues for scientific and technological exploration. In my talk, I will introduce some of the key concepts and methods, and highlight a number of recent developments.

BIOGRAPHY

Hendrik Dietz is professor of Biophysics at the Department of Physics since 2009 at the Technical University of Munich and principal investigator of the Laboratory for Biomolecular Nanotechnology. After his PhD in 2007 at the Technical University of Munich, he moved to Harvard Medical School for two years. He received numerous grants and fellowships. His current research focuses on using DNA as a programmable construction material for building nanometer-scale scientific devices with atomically precise features.

Room SINGAPORE
30 JUNE 2016 — 2:30 - 4:00 pm

MARTIN WEGENER
KIT, Karlsruhe, Germany

3D Laser Lithography: No Limits?

ABSTRACT

3D optical laser lithography or 3D printing has become a mature, reliable, widespread, and commercially available technology. In this talk, we review recent progress in regard to several aspects. Translating the concept of stimulated-emission depletion from microscopy to lithography has led to improved resolution beyond the diffraction barrier. The dip-in concept has enabled 3D structures with heights of millimeters, while maintaining sub-micron feature sizes. The shell-writing mode has further reduced writing times for certain geometries. The examples to be presented include helical metamaterials, cloaked contacts on solar cells, Hall-effect metamaterials, and 3D photonic architectures including single-photon emitters at controlled positions.

BIOGRAPHY

After completing his PhD in physics in 1987 at Johann Wolfgang Goethe-Universität Frankfurt (Germany), he spent two years as a postdoc at AT&T Bell Laboratories in Holmdel (USA). From 1990-1995 he was professor at Universität Dortmund (Germany), since 1995 he is professor at Institute of Applied Physics of Karlsruhe Institute of Technology (KIT). Since 2001 he is also department head at Institute of Nanotechnology of KIT. His research interests comprise optical laser lithography, metamaterials, and transformation physics.

Room SINGAPORE
30 JUNE 2016 — 2:30 - 4:00 pm

CHRISTIAN LEINENBACH
EMPA, Dübendorf, Switzerland

Laser Additive Manufacturing of Nano-Structured Materials – Challenges and Opportunities

ABSTRACT

Metal additive manufacturing (AM) techniques such as Selective Laser Melting (SLM) or Direct Metal Deposition (DMD) have been identified as an attractive option for the manufacture of novel functional components in comparison with conventional manufacturing techniques. They allow building components with complex 3D geometries layer by layer. However, the fast heating and very rapid consolidation of the material often lead to complex microstructures with unwanted properties. On the other hand, the short interaction time of the beam with the material allow for the processing of metastable phases which would not be possible with other manufacturing processes.
In this presentation, the challenges related to the beam-based additive manufacturing of nano-structured materials and the manufacture of samples with sub-µm feature sizes will be discussed and experimental results from ongoing projects will be presented. The examples given comprise the development of a novel nano-oxide dispersion strengthened TiAl alloy for the additive manufacture of high temperature components, selective laser melting of metal-diamond composite materials, or the additive manufacture of Si powder.

BIOGRAPHY

Christian Leinenbach received his MSc from the University of Saarbrücken (DE) in 2000 and his PhD from the University of Kaiserslautern (DE) in 2004. He has been working at Empa since 2005, currently in the position of a Senior Scientist and Head of the Alloy Design for Advanced Processing Technologies (ADAPT) Group in Dübendorf and Thun. From 2005 to 2014, he was adjunct lecturer for materials science at the University of Kaiserslautern. His research focusses on the materials science aspects in additive manufacturing of metals and composites.

Room SINGAPORE
30 JUNE 2016 — 2:30 - 4:00 pm

RALF SCHUMACHER
FHNW, Muttenz, Switzerland

3D Printing and Medical Applications - an Overview

ABSTRACT

3D Printing is said to be a game changer - especially for novel medical applications. Its layer-by-layer material deposition approach enables the fabrication of highly complex structures in ‚one production process‘. Besides biopolymers, a variety of bioceramics and also metals like titanium could be processed. In addition to this it enables the parallel production of different part designs and is therefore highly suitable for small lot sizes and steadily changing part designs. This allows the fast and affordable production of individualized surgical solutions such as bone implants but also cutting guides and bone substitutes.
This talk gives an overview on state-of-the-art 3D printed medial applications as well as an outlook in future research topics. Beside this it will address specific results of own research projects conducted at the FHNW and in collaboration with partners.

BIOGRAPHY

Ralf Schumacher is a lecturer and scientist at the FHNW School of Life Sciences, where he is leading the Medical Additive Manufacturing group and giving lectures on implant development and manufacturing. He has a diploma in mechanical engineering and a diploma in business and management. Since joining the FHNW in 2006 he was able to raise a ‘Medical Additive Manufacturing’ lab focusing on ceramic, metal and polymer materials. Ralf Schumacher is author and Co-author of more than 100 publications and gives talks on his research topics throughout Europe. He is in the advisory board of several 3DP related conferences and trade fairs in Germany and Switzerland.

Room SINGAPORE
30 JUNE 2016 — 2:30 - 4:00 pm

HELMUT SCHIFT
PSI, Villigen, Switzerland

As Smooth as Possible – Selective Surface Equilibration of Polymer Topographies

ABSTRACT

Optical polymer microlenses are used in various devices, including smartphones. Since they are so small, they have to be processed using novel 3D lithographic methods that build the lenses out of thin layers (e.g. grayscale electron or laser writing). However, these often result in roughness, which has adverse effects for optical applications. If a surface has to be subsequently smoothed out, it must be achieved using a method that only modifies the tiny surface and does not change the underlying layers or overall shape. For this a method known as TASTE was developed. It involves selectively changing the material properties of the part of the sample that needs modification, i.e. locally confined in lateral or vertical direction. By use high energy exposure the polymer is modified at a defined depth of the surface by chain scission followed by molecular weight dependent reflow at elevated temperatures. For surface smoothening of microlenses we have found 172 nm UV exposure to be the ideal fit for this application. This provided high enough damage in a 200 nm thick surface skin layer and negligible etching, which allowed smoothening out up to 100 nm roughness.

BIOGRAPHY

Helmut Schift graduated as an electrical engineer from Karlsruhe University. He is head of the Polymer Nanotechnology Group at the PSI and lecturer at the FHNW. He is one of the pioneers of nanoimprint lithography, for which he has developed process knowhow and tools, along with a range of applications. In the large European Project (NaPANIL) he was responsible for the subproject Manufacturing Technology. Within a network of partners, a tool box was created enabling the upscaling of 3D nanofabrication processes, which is documented in the NaPa Library of Processes.

Room MONTREAL
1 JULY 2016 — 11:15 am - 12:45 pm

HENNING STAHLBERG
University of Basel, Basel, Switzerland

Nano-Scale Structural Characterization of Parkinson's Disease

ABSTRACT

Parkinson's Disease (PD) is the second most common neurodegenerative disease. PD affects ~2% of individuals over 60 years of age. The loss of neurons in a central region of the human brain (called substantia nigra) leads to tremor and other neuromotor deficits. The affected brain regions show dense "blobs" of several tens of micrometers in size that are found in the affected neurons (so-called Lewy-bodies). Lewy-bodies are commonly associated with the protein alpha-synuclein that is involved in normal neuronal function. In order to understand the biological processes behind the formation of Lewy bodies, we study the alpha-synuclein and its consequences on neurons, using nano-scale tools.
Alpha-synuclein (a-syn) can have various forms, for example the aggregation in fibrils. The fibril formation is a transmissive process that can lead to the growth of other fibrils in a prion-like process. Even though the presence of a-syn fibrils is correlated with PD, it was previously not known, how these fibrils lead to neuronal death. We used biochemical and biophysical methods to produce and characterise a-syn, and developed nano-technology tools to study its biophysical behaviour and impact on neurons.

BIOGRAPHY

Henning Stahlberg studied Physics at the TU Berlin and came to Switzerland for his PhD at EPFL. He habilitated in Basel in Biophysics in the area of transmission electron microscopy with proteins. In 2003, he moved to California US for an assistant professorship. In 2009, he could be committed as director of C-CINA as full professor of the biocenter at University of Basel. The main focus of his research is on studying various membrane protein systems and neurodegeneration by employing high-resolution electron microscopy.

Room MONTREAL
1 JULY 2016 — 11:15 am - 12:45 pm

OLIVER BUNK
PSI, Villigen, Switzerland

Imaging Nano-Scale Features over Extended Areas and Volumes

ABSTRACT

Hierarchically structured materials are abundant in nature and technology. Examples are bone, wood, concrete, polymers and composite materials and in a broader sense also complex systems like integrated circuits and brain tissue. Understanding structure property relationships of materials and the function and malfunction of complex systems requires techniques that address a large range of length scales. Two X-ray imaging techniques operating on 2D and 3D samples will be introduced. (1) Ptychographic imaging is a novel quantitative 3D imaging technique complementing electron microscopy. On samples in the few 10 micrometer range resolution better than 20 nm can be achieved. (2) Scanning small-angle X-ray scattering (SAXS) images density and orientation of nano-scale structures spatially resolved over square centimeters or in 3D over many cubic millimeters. It bridges the gap between high-resolution small field-of-view and low resolution large field-of-view techniques. Examples from life and material sciences and chip inspection are shown.

BIOGRAPHY

Oliver Bunk is heading the Laboratory for Macromolecules and Bioimaging at the Paul Scherrer Institute (PSI). Recurrent themes of his research are a strong interest in cross-disciplinary projects, the use of X-ray techniques and the development and perfection of experimental methods. He contributed to the introduction of new X-ray techniques like phase-contrast imaging of macroscopic objects using Talbot interferometry, high-resolution nano-tomography using so-called ptychographic coherent diffraction imaging and scanning small-angle X-ray scattering to bridge the nano- with the macro-scale.

Room MONTREAL
1 JULY 2016 — 11:15 am - 12:45 pm

GUILLAUME SCHULL
University of Strasbourg, Strasbourg, France

Optoelectronic Properties of Single-Molecule Junctions

ABSTRACT

Future ultrafast devices may rely on hybrid electronic-plasmonic circuitry. A keystone for the realization of such components is the production of transducers allowing to controllably couple electrical and plasmonic signals. Single-molecule light sources can be coupled to surface plasmons and have the ability to produce single-photon and narrow line emission, two mandatory characteristics for quantum computation applications. Conserving these characteristics for a single-molecule integrated in a hybid electronic-plasmonic circuit is challenging because of the required contact to metallic electrodes which alters the properties of the molecule. Recently, we showed that intrinsic radiative transitions of molecular junctions may be recovered when elongated molecules are used as bridging element. In my presentation, I will report on the ultra narrow-line emission from an electrically addressed molecular emitter suspended in the plasmonic junction of a scanning tunnelling microscope (STM). I will show how progressive lifting of the emitter from the substrate provides control over the temporal coherence of the emission, which is finally limited by interactions with low energy phonons.

BIOGRAPHY

Guillaume Schull did his PhD in the nanophotonic group of F. Charra at the Commissariat à l'Energie Atomique (CEA), Saclay in 2006. From 2006 to 2009, he joined the STM group of R. Bernt at the University of Kiel. In 2009, he changed to the University of Strasbourg as an CNRS Researcher. His research focus is on electronic and optical properties of individual atoms and molecules on surfaces using low temperature scanning tunneling microscopy and spectroscopy (STM – STS). He habilitated in 2012.

Room MONTREAL
1 JULY 2016 — 11:15 am - 12:45 pm

VINCENT JACQUES
ENS Cachan, Orsay, France

Imaging Magnetism at the Nanoscale with a Single Spin Microscope

ABSTRACT

In the past years, it was realized that the experimental methods allowing for the detection of single spins in the solid-state, which were initially developed for quantum information science, open new avenues for high sensitivity magnetometry at the nanoscale. In that spirit, it was recently proposed to use the electronic spin of a single nitrogen-vacancy (NV) defect in diamond as an atomic-sized magnetic field sensor. This approach promises significant advances in magnetic imaging since it provides non-invasive, quantitative and vectorial magnetic field measurements, with an unprecedented combination of spatial resolution and magnetic sensitivity under ambient conditions. In this talk, I will show how scanning-NV magnetometry can be used as a powerful tool for fundamental studies in nanomagnetism, focusing on magnetic vortices in ferromagnetic dots and domain walls in ultrathin ferromagnetic wires.

BIOGRAPHY

Dr. Vincent Jacques (35 years old) is a permanent CNRS researcher at Laboratoire Charles Coulomb (Montpellier, France). His research is mainly focused on the study of Nitrogen-Vacancy (NV) defects in diamond and their applications in various fields of research ranging from quantum optics and quantum information science, to nanoscale sensing and hybrid quantum systems. He received in 2013 the prize Edouard Branly from the "Fédération française des sociétés scientifiques", which is attributed every year to a young French physicist.

Room SINGAPORE
1 JULY 2016 — 11:15 am - 12:45 pm

ADRIAN VON MÜHLENEN
BASF, Basel, Switzerland

Bend Light for the Good of All?

ABSTRACT

BASF highlights Nanotechnology as a key enabler for a sustainable future in their “we create chemistry” strategy. A recent development, a nano-technology based insulation product called Slentite™, needs half of the space by equal performance as compared to traditional insulation materials thanks to the process controlled size of nano pores.
BASF’s technology scouting and incubation team pushes radiation management further from mid infrared to shorter wavelengths. The combination of micro- and nano patterns, optical materials and scalable processes opens up a vast field of applications: optics for PV cell enhancement, LED light management and daylight management. In an open innovation approach supported by CTI and FP7, BASF established with CSEM and other partners the ground for a potential technology field.

BIOGRAPHY

Dr. Adrian von Mühlenen heads a technology incubation team within applied materials and systems research at BASF. Since 2012, he is part of the core team that is setting up technology incubation in one out of three competence centers within BASF. Previously, as founding member of a Research and Technology Organization satellite in the Basel area, he and his team were delivering proof of concept in high risk and high uncertainty projects in industrial and publically funded projects. Dr. von Mühlenen earned a dipl. Ing. In micro engineering and a PhD degree at the Swiss Federal Institute of Technology in Lausanne (EPFL).

Room SINGAPORE
1 JULY 2016 — 11:15 am - 12:45 pm

STEPHAN HOFMANN
University of Cambridge, Cambridge, UK

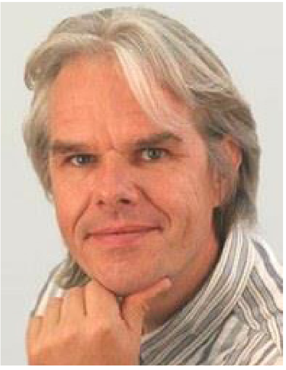
Towards Integrated Manufacturing of 2D Materials

ABSTRACT

The commercial potential of 2D materials hinges on the development of growth and integration techniques that are scalable and allow an adequate level of structural control. Chemical vapor deposition (CVD) can uniquely serve the demand for integrated manufacturing of “electronic-grade” nanomaterials and the talk will focus on our progress in scalable CVD and device integration approaches of highly crystalline graphene and hexagonal boron nitride (h-BN) films. The systematic use of in-situ metrology, ranging from high-pressure XPS to in-situ STM and environmental electron microscopy, allows us to reveal the key mechanisms that dictate crystal phase, structural, defect, interfacial and heterogeneous integration control at industrially relevant conditions. The talk will outline the potential of the direct CVD of various 2D heterostructures as well as current challenges for integrated manufacturing and industrial device integration of these 2D materials.

BIOGRAPHY

Dr. Stephan Hofmann is a Reader in Nanotechnology at the Engineering Department of the University of Cambridge, where he heads a group and large research effort on advanced nanomaterials and their device integration. He holds degrees from the Technische Universität München and the University of Cambridge. He is the recipient of an ERC Starting Independent Researcher Grant, leads large grants/consortium on CVD enabled 2D Material Technology and is co-director of the Doctoral Training Centre in Nanotechnology. Among his numerous awards is the 2014 ACS Journal of Physical Chemistry C Lectureship.



Room SINGAPORE
1 JULY 2016 — 11:15 am - 12:45 pm

ULLRICH STEINER
Adolphe Merkle Institute, Fribourg, Switzerland

Designing Materials on the 10-nm Length Scales: from Photovoltaics to Optical Meta-Materials

ABSTRACT

The performance of materials in not only governed by its chemical constituents, but also how these are assembled. This is particularly important for material that consist of several functional ingredients the interplay of which must be carefully controlled. This talk will cover several aspects of controlled assemblies on length scales that are difficult to reach using "top-down" methodologies. Macromolecular self-assembly provides a powerful way of structural control that can be employed in the synthesis of a wide range of materials, both organic an inorganic. Self-assembly techniques were employed in the manufacture of optical materials, particularly optical meta-materials, several types of solar cells and cathode materials for batteries and super-capacitors.

BIOGRAPHY

Ullrich (Ulli) Steiner studied physics at the University of Konstanz, Germany. He gained his PhD in 1993, working with Prof. J Klein and Prof. G. Schatz at the Weizmann Institute, Israel. After post-doc positions at the Weizmann Institute and the Institute Charles Sadron, France, he returned to Konstanz where he finished his habilitation in 1998. He joined the faculty of the University of Groningen as full professor in 1999 and became the John Humphrey Plummer Professor of Physics of Materials at the University of Cambridge in 2004. Since 2014, he holds the chair of Soft Matter Physics at the Adolphe Merkle Institute in Switzerland.

Room SINGAPORE
1 JULY 2016 — 11:15 am - 12:45 pm

OLIVER GRÖNING
EMPA, Dübendorf, Switzerland

Trapping, Reacting and Switching Molecules on Single Layer Hexagonal Boron Nitride

ABSTRACT

In order to fill the CMOS "Triade" of 2D materials, the interest in layered materials besides graphene has substantially risen in recent years. In this Triade, the role of graphene can be dual, serving as metal and as semiconductor. Transition metal dichalcogenides have proven their potential to act as intrinsic direct or indirect semiconductors, leaving the place of the dielectric to be filled. In this context, hexagonal boron nitride (h-BN) has established a strong position, having the potential to support and electrically insulate graphene, while preserving its high carrier mobility.
We will review how the choice of the single crystalline metallic substrate can influence the properties of the CVD grown, single layer h-BN layer in view of superstructures, which modulate the topography and the surface potential. We will discuss the origins of the templating function of the so-called h-BN/Rh(111) "nanomesh", which makes it a kind of single molecule Petri dish. We give perspectives of on-surface chemical synthesis of graphene nanostructures and discuss the charging phenomena of individual molecules on metal supported single layer h-BN.

BIOGRAPHY

Dr. Oliver Gröning received his PhD from the University Fribourg in 1999 on the topic of the field emission properties of nanocarbon structures. After a two years Post-Doc at the same University working with academic and industrial partners on the technological implementation of carbon nanotube electron emitters, he joined the Swiss Federal Laboratories for Materials Testing and Research (EMPA) in 2001, where he is today deputy head of the nanotech@surfaces laboratoy and holds the position of a distinguished senior researcher. His research interests span from surface self-assembly and on-surface nanostructure synthesis to the investigation of catalytic process on intermetallic compounds.

Room MONTREAL
1 JULY 2016 — 2:00 - 3:30 pm

RICHARD WARBURTON
University of Basel, Basel, Switzerland

Towards Quantum Hardware with a Semiconductor Quantum Dot

ABSTRACT

A quantum dot, a nano-structured semiconductor, is an emitter of single photons and a host for a spin qubit. The host semiconductor can be tailored in many ways; there are also nano-fabrication options to engineer the photon and phonon modes. These are all powerful advantages. However, application as quantum hardware places stringent demands: the photons should be indistinguishable; the spin should retain its coherence over many spin rotations. Progress in meeting these demands will be reported. In particular, a significant improvement in the quality of the photons will be presented along with a time-averaged spin dephasing time approaching a micro-second.

BIOGRAPHY

Richard J. Warburton is Professor of Experimental Condensed Matter Physics at the University of Basel, Switzerland. He moved to Basel from Heriot-Watt University, Edinburgh. Richard Warburton holds MA and DPhil degrees from the University of Oxford, and a habilitation from Ludwig-Maximilians-University, Munich. He has published more than 200 papers mostly in semiconductor physics. His recent research has focussed on the physics of semiconductor quantum dots with the goal of creating useful quantum hardware. He is currently Co-Director of the NCCR project QSIT (Quantum Science and Technology).

Room MONTREAL
1 JULY 2016 — 2:00 - 3:30 pm

ALEXANDER HÖGELE
Ludwig-Maximilian-Universität, Munich, Germany

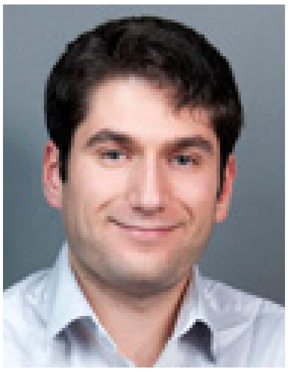
Opto-Valleytronic Imaging of Atomically Thin Semiconductors

ABSTRACT

Layered transition metal dichalcogenides such as molybdenum disulfide (MoS2) represent semiconductor building blocks of van der Waals heterostructures for potential applications beyond conventional opto-electronics. In the monolayer limit, these materials host band-edge electrons with quantized valley degrees of freedom which map onto photon polarization by virtue of sizable light-matter interaction. We utilized this correspondence between the valley and the photon polarizations to develop efficient means of direct and quantitative imaging of the valley degree of freedom in atomically thin semiconductors. Using monolayer MoS2 we highlight the potential of „opto-valleytronic“ imaging to identify crystalline disorder such as grain boundaries or quantum dot type point defects, and to shed light on site-specific valley polarization dynamics.

BIOGRAPHY

Alexander Högele studied Physics at the University of Heidelberg and LMU Munich. His PhD work at the LMU on laser spectroscopy of semiconductor quantum dots was awarded the PhD prize of the „Münchener Universitätsgesellschaft“. From 2006 to 2009, he developed methods for optical manipulation of quantum dot nuclear spins and cryogenic spectroscopy of carbon nanotubes as a post-doc at ETH Zurich. Since 2009, Alexander Högele is Assistant Professor of Experimental Physics at the LMU with research focus on quantum optical phenomena in nanoscale materials. In 2013, he received an ERC Starting Grant.



Room MONTREAL
1 JULY 2016 — 2:00 - 3:30 pm

BENJAMIN GALLINET
CSEM, Muttenz, Switzerland

Plasmonics for Optical Security and Filters

ABSTRACT

Plasmonics involves the interaction of light with metallic structures at the nanoscale, which enables in particular the generation of strong color effects in the visible and near infrared range. The fabrication of plasmonic nanostructures using ultra-violet (UV) imprint and thin metallic coatings is reported. Wafer-scale fabrication and process compatibility with cost-efficient roll-to-roll production are demonstrated, which paves the road towards an industrial implementation. The color, phase, polarization and direction of the transmitted light are controlled by tuning the process parameters and the symmetry of the nanostructures. A family of devices is presented, for which the potential for sensing, filtering, anticounterfeiting, optical security for document protection and solar light management is evaluated.

BIOGRAPHY

Dr. Benjamin Gallinet received his Master Degree in Physical Engineering in 2009 and his PhD degree in Photonics in 2012 from the Ecole Polytechnique Fédérale de Lausanne (EPFL). He received in 2009 the Jean Landry research prize. His research interests range from plasmonics, nanophotonics to computational optics and electromagnetics. He is currently Senior R&D Engineer at CSEM in Muttenz, Switzerland, where he leads projects in thin film optics for sensing and light management. He has co-authored over 20 peer-reviewed publications and is co-inventor in over 6 patents.

Room MONTREAL
1 JULY 2016 — 2:00 - 3:30 pm

HANS PETER HERZIG
EPFL, Lausanne, Switzerland

Towards a 2D Platform for Micro- and Nano-Optics

ABSTRACT

Nano-photonics, where optical structures can manipulate light at the sub-wavelength scale, is making important advances towards optical communications, imaging and sensing. In particular, two-dimensional (2D) concepts are interesting to realize integrated systems and to align components at the nanoscale. A novel platform suitable for fundamental investigations of light propagation through micro- and nano-structures will be discussed. This platform is based on a dielectric multilayer that sustains Bloch surface waves (BSWs). The modification of the top surface to customize complete 2D microsystems can be produced by modern patterning techniques.The results obtained confirm the possibility of developing a multilayer platform that would pave the way for integration of thin (a few tenths of nanometers) photonic components using wafer-scale production. For now, 2D prisms, gratings, lenses, waveguide arrays and optical disk resonators have been realized. The BSW platform is a powerful tool for research. The propagation of surface waves through optical structures can be monitored by near-field imaging. This opens the door to fundamental investigations of beam propagation phenomena.

BIOGRAPHY

Dr. Hans Peter Herzig is professor at the École Polytechnique Fédérale de Lausanne (EPFL) and former President of the European Optical Society. His research interests include micro and nanoscale optics. He started his career 1978 in industry with the company Kern, Aarau, before entering the University of Neuchâtel in 1983. In 2009, he joined the faculty with the EPFL. Dr. Herzig served as Chairman for conferences of EOS, IEE, IPS, OSA, and SPIE. He is the Editor of a well-known book on micro-optics (published in English and Chinese), author of 15 book chapters and over 160 journal papers.

Room SINGAPORE
1 JULY 2016 — 2:00 - 3:30 pm

JÜRGEN RÜHE
IMTEK, Freiburg, Germany

Tailormade Polymer Monolayers and Networks for the Generation of Novel Microsystems and Engineered Biointerfaces

ABSTRACT

All interactions of materials with their respective environments are controlled by the topography and chemical composition of their surfaces. Examples are the adhesion between two objects, wetting of surfaces by contacting liquids and the adsorption of molecules from the surrounding medium. Accordingly, it is important to develop chemical tools, which allow the attachment of tailor-made polymer molecules to surfaces of different chemical composition. In the presentation a new strategy will be presented which allows generating novel, micro-patterned polymer coatings with tailor-made properties with high spatial resolution on a variety of different substrates.
We show some examples how such designed surfaces can be used to control the wetting properties of surfaces, determine adhesion of cells to artificial surfaces or prevent the formation of biofilms on surfaces. We give examples how the surface properties of materials can be adapted according to an external stimulus and describe how the obtained materials can be used for the generation of materials with extremely unusual wetting properties or new bioanalytical devices, such as DNA, RNA, protein or polysaccharide chips.

BIOGRAPHY

Prof. Dr. Jürgen Rühe holds the chair for Chemistry and Physics of Interfaces at the Department of Microsystems Engineering at the University of Freiburg, Germany. His research interest is mainly in the area of polymer coatings, especially in the area of micro- and nanosystems, the generation of novel metamaterials, tailor-made biointerfaces, wetting and the development of new (chip-based) bioanalytical devices.

Room SINGAPORE
1 JULY 2016 — 2:00 - 3:30 pm

GESINE GUNKEL-GRABOLE
University of Basel, Basel, Switzerland

Functional Surfaces through Immobilization of Synthetic Nanoarchitectures

ABSTRACT

Amphiphilic block copolymers possess several exciting properties including the ability to self-assemble into membranes that structurally resemble cell membranes. Moreover, the polymers can add beneficial properties to the membrane such as increased stability and tunability. The huge variety of monomers available to synthesize block copolymers gives access to a library of functionalities that are explored to specifically modulate interactions.
Planar polymer membranes on solid support are an excellent model system to study membrane-specific properties and interactions, and they can be employed to generate surfaces with predetermined activity. Besides the formation of planar membranes, amphiphilic block copolymers can also self-assemble into spherical, nanometer-sized architectures such as micelles and vesicles. Through chemical modification of the polymer chains, the nanoarchitectures can be decorated with reactive moieties to facilitate their immobilization and to yield functional nanostructured surfaces. Overall, this advantageous combination of synthetic polymers and biomimetic membranes opens up a plethora of potential applications as functional surfaces and beyond.

BIOGRAPHY

Dr. Gunkel-Grabole is fascinated by the interplay between polymer surfaces and biological systems. In particular, she is passionate about the rational design of nanostructured surfaces with innovative functions. Bringing expertise in polymer chemistry from her masters with Rainer Haag (Berlin) and her PhD with Wilhelm Huck (Cambridge), she is now dedicated to generate functional nanosystems as a postdoc in the group of Wolfgang Meier (Basel). In the future, she aims to realize the full potential of polymeric nanostructures especially for biomedical applications.

Room SINGAPORE
1 JULY 2016 — 2:00 - 3:30 pm

CHRISTIANE JUNG
KKS Ultraschall AG, Steinen, Switzerland

Surface Functionalization of Titanium Implants - Challenges from the Medtech Industrial Perspective

ABSTRACT

Because of its natural surface, oxide layer titanium shows excellent biocompatibility and is used for a number of medical implants in particular in trauma, orthopaedic and dental field. However, the implant surface must have additional properties, such as i.e. roughness, hydrophilicity or antibacterial effect to be functionally relevant at the implant-bone and -tissue interface. The talk will focus on an electrochemical approach to functionalize the surface with antibacterial copper. The copper deposits have a size of few nanometres up to 2 micrometres and are homogeneously distributed over the treated surface. In addition, copper can also be incorporated into the oxide layer when specific process parameters are used. The functionalized surface is characterized with different techniques and with biological in-vitro assays. Based on the results it is concluded that copper-modifying implant surfaces is a feasible approach and has the potential for industrial up-scaling. However, to bring such a process and copper-functionalized implants to market, a number of hurdles have to be overcome.

BIOGRAPHY

Christiane Jung studied chemistry at the Humboldt University, Berlin and post-graduated in biochemistry. Thereafter, she did her PhD in theoretical and physical chemistry in 1980 and habilitated in physical biochemistry. She was lecturer at the University of Potsdam, Germany for 10 years and group leader at the Max-Delbrück Center for Molecular Medicine, Berlin. Research stays at the University of Illinois and the INSERM Institut de Biologie Physico-Chimique, Paris. Since 2005, she is the head of R&D at KKS Ultraschall AG, Medical Surface Center, Switzerland. Her focus is on surface refinement of medical devices in the Medtech industry.

Room SINGAPORE
1 JULY 2016 — 2:00 - 3:30 pm

CELESTINO PADESTE
PSI, Villigen, Switzerland

Lithographic Radiation Grafting: a Versatile Approach to Functional Polymer Surfaces

ABSTRACT

Radiation-induced grafting is a simple and elegant method to adapt the properties of polymeric substrates via introducing chains of other polymers at their surface or in the bulk. Beams of electrons, photons or ions of sufficient energy are used to break chemical bonds in the polymer substrate or at its surface in order to create radicals, which act as initiators in a subsequent graft polymerization.
We are combining structuring technologies with radiation-induced grafting and post-polymerization modification in order to functionalize specific areas on polymer substrates. While micro- to millimeter sized structures are achieved with large-area activation tools and masking techniques, structures with nanometer resolution are obtained using extreme ultraviolet interference or electron-beam lithography. Using a series of examples, we will demonstrate the high versatility of the lithographic grafting process to produce surfaces with locally defined properties and functionalities including pH- or light-switchable wettability and enzyme activity.

BIOGRAPHY

Celestino Padeste received his PhD in inorganic chemistry in 1989 from the University of Zurich. After a Post-Doc on surface analysis of catalyst systems at the University of New South Wales in Sydney/Australia, he was, in 1993, employed at the Paul Scherrer Institute in the Laboratory for Micro- and Nanotechnology. His research is focused on the design of functional surfaces using micro- and nanostructuring methods, including synchrotron-based lithography, in combination with polymer grafting, chemical surface modification and protein immobilization.

PRACTICAL INFORMATION

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The following organizational details have been summarized in order to help make your experience at SNC 2016 both efficient and enjoyable.

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E-Mail: outreach-sni@unibas.ch
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Emergency numbers

Police:	117
Fire:	118
Ambulance:	144

Registration & Information Desk

Wednesday, 30 June:	8.00 am – 6.00 pm
Friday, 1 July:	8.00 am – 5.00 pm

Badges & Access

All participants must wear the conference name badge for admission to all conference events (sessions, exhibition and aperitifs).

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Complimentary WiFi will be available at SNC 2016.

Camera & Filming Policy

Please refrain from taking any photos or videos during any of the oral presentations.

Cell Phones & Alarms

As a courtesy to all participants, please ensure that all cell phones and other alarms (watches or pagers) are turned off during the presentations.

Smoking

Smoking is forbidden within all facilities used for SNC 2016.

Language

The official language of SNC 2016 is English, including all oral and poster presentations as well as all printed supports.

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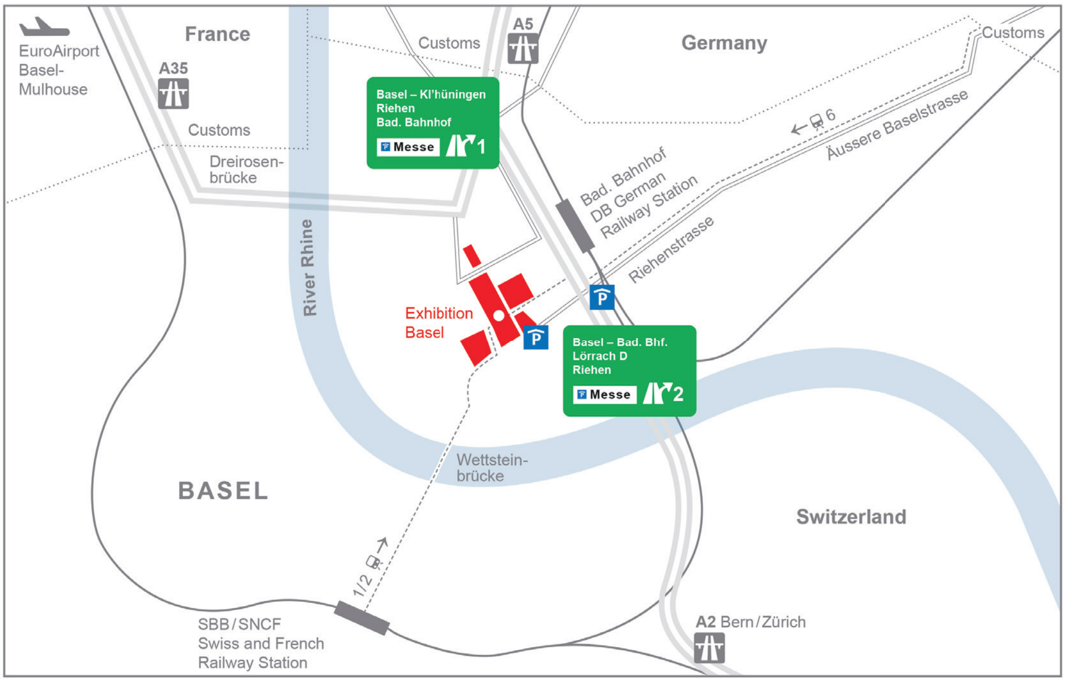

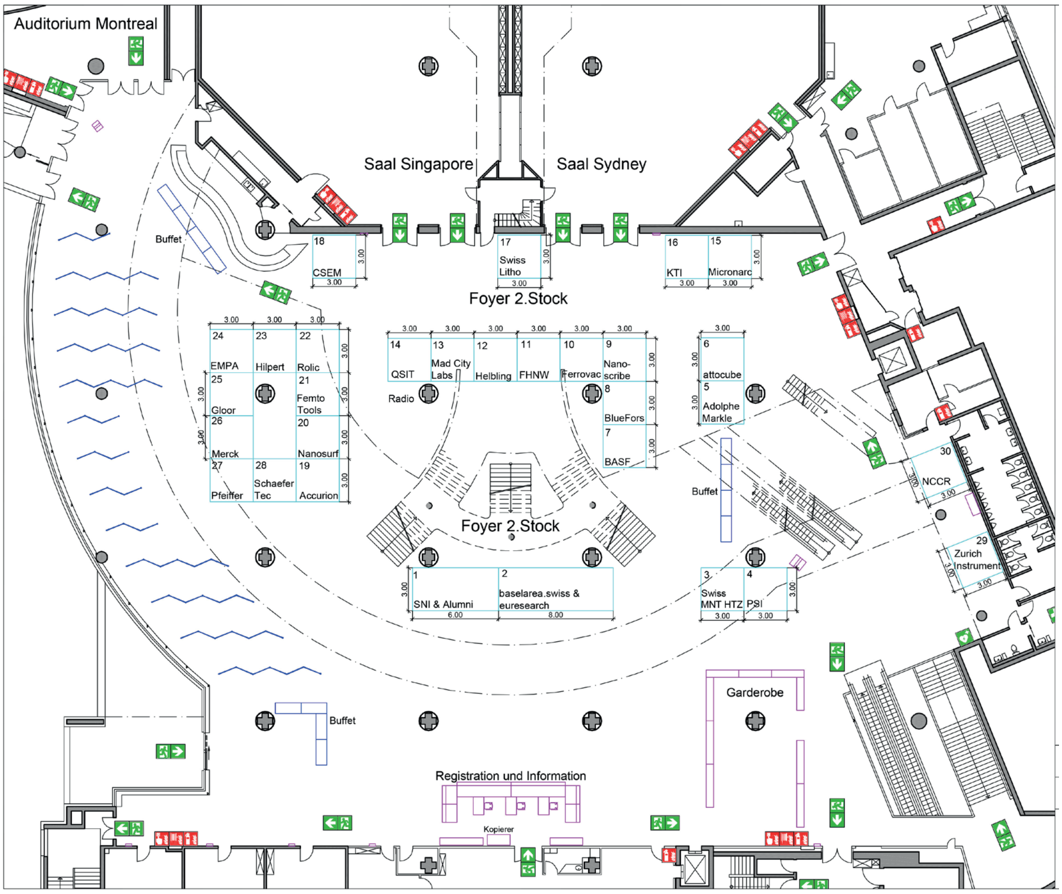

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