Technische Universität Braunschweig

PTB
Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

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B-IGSM Braunschweig International Graduate School of Metrology

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Rosetta – an Exciting Mission to the Origin of the Solar System

Prof. Dr. -Ing. Joachim Block

Present Position

- Head of the German Aerospace Center (DLR), Research Sites Braunschweig and Göttingen
- Chairman of the Forschungsregion Braunschweig (Braunschweig Research Region)

Scientific Background

- Graduated in Physics from the TU Braunschweig, PhD at the University of Kassel
- Honorary Professor at the TU Braunschweig, teaching on space missions etc.
- 25 years involvement in different space projects at the DLR

Abstract

The European Space Agency's cornerstone mission ROSETTA bound for the active comet 67P/Churyumov-Gerasimenko was a key undertaking dedicated to a better understanding of the early Solar System and of the accretion of the planets 4.6 billion years ago. Launched in 2004, the spacecraft cruised for more than ten years through the Solar System before it finally reached its distant target. The unexpected contour and composition of the comet surprised the entire scientific world. In November 2014, the lander "Philae" was separated from the main spacecraft and covered the distance to its final resting place on the surface on an adventurous descent trajectory. When the mission was finally completed in September 2016 it was already evident that it had been one of the most revealing scientific space missions ever.

Several institutes from Braunschweig and Göttingen were deeply involved in the design and construction both of the lander and of the scientific instruments on lander and main spacecraft. They also played a key role in the scientific evaluation.

Frequency and Time Metrology Activities at PTB – Do We Need Clocks at 10^{-18}?

Dr. Harald Schnatz

Present Position Head of department "Quantum Optics and Unit of Length", PTB

Academic Record

Harald Schnatz received the Dipl. Phys. degree, for his work on trapped ion laser spectroscopy, and the Dr. rer. nat. degree, for the development of the first Penning trap mass spectrometer for high-precision mass measurements on short-lived isotopes for the online isotope separator ISOLDE at the European Organization for Nuclear Research (CERN), Geneva, Switzerland, from Johannes Gutenberg University, Mainz, Germany, in 1982 and 1986, respectively.

He was with Heinrich Heine University of Düsseldorf, Germany, where he worked on laser-induced time-of-flight mass spectroscopy for two years.

He joined the Physikalisch-Technische Bundesanstalt (PTB), Braunschweig, Germany in 1989. In 1996, he performed the first phase-coherent frequency measurement of visible radiation using a conventional frequency chain. Since 2004, he has been the Head of PTB's working group "Unit of Length". With the development of frequency combs, he has performed a number of optical frequency measurements of different optical frequency standards. His current work includes the stabilization of lasers, nonlinear optics, wavelength standards and optical frequency measurements, and frequency dissemination. Since 2011, he is head of PTB's department "Quantum Optics and Unit of Length".

Abstract

Over the last decades we have seen a tremendous progress in the development of optical clocks. The best clocks now reach uncertainties at the low 10^{-18} regime within reasonable measurement time. Besides being candidates for a new definition of the SI unit "second", they allow for laboratory tests of fundamental physics and pave the way for novel applications in geodesy, navigation or telecommunication. I will introduce the basic concepts and capabilities of optical clocks, describe how clocks can be compared even over large distances and will present some applications.

Smart Metering

Prof. Dr.-Ing. Bernd Engel

Present Position	Head of the Institut für Hochspannungstechnik und elektrische Energieanlagen – elenia, TU Braunschweig Board Representative of the SMA Solar Technology AG

Academic Record

since 04/2017	Institut für Hochspannungstechnik und elektrische Energieanlagen – elenia, TU Braunschweig
since 2011	Board Representative of the SMA Solar Technology AG
2011	Institut für Hochspannungstechnik und elektrische Energieanlagen – elenia, TUBraunschweig
2003 – 2011	SMA Solar Technology AG, Kassel, Head of Research solar inverters and Senior Vice President Technology
1996 – 2003	Alstom Transport Deutschland GmbH, Salzgitter, Electroengineering, Site Engineering Director
1996	PhD about High Performance Mechatronics in Locomotive Engines
1991 – 1996	Research Associate at TU Clausthal
1985 – 1991	Studied General Electrical Engineering at TU Darmstadt, Diploma

Gravitational Waves: Measuring Tiny Ripples in Space-Time

Dr. Harald Lück

Present Position | Academic Record

since 2003	Staff member of Leibniz Universität Hannover, Institute for Gravitational Physics, leader of research groups
1997 – 2003	C1 position at Hannover University, Institute for Atomic and Molecular Physics
1993 – 1997	Staff member of the Max Planck Institute for Quantum Optics, Garching/Munich
1992 – 1993	Research assistant at Hannover University, Institute for Plasma Physics
1992	Doctorate Thesis at University of Hannover, Institute for Plasma Physics
1988	Research visit to Clarendon Laboratory at Oxford University
1981 – 1988	Study of Physics at Universität Hannover

Abstract

Gravitational waves are created by astrophysical events that release enormous amounts of energy in a short time. Yet, for measuring the resulting tiny distortions of space-time, the frontiers of sensing technologies had to be pushed to their physical limits. Gravitational wave detectors have reached unprecedented sensitivities and are now capable of measuring mirror displacements below an attometer. The presentation will give an overview of the gravitational waves detected and the technologies used to suppress the relevant noise sources.

High Resolution Sagnac Interferometry for the Geosciences

Apl. Prof. Dr. rer. nat. Dr. Ing habil. Karl Ulrich Schreiber

Present Position | Academic Record

since 2006	Apl. Professor at the Institute for Astronomical und Physical Geodesy, TU München
2001 – 2006	Privatdozent (Space Geodesy), TU München
1999	Habilitation / venia legendi in space geodesy
since 1999	Adjunct Professor, Department of Physics and Astronomy, University of Canterbury, Christchurch, NZ
1997	Research Leave Ring Laser: University of Canterbury, New Zealand
1988 –	Research Scientist: Forschungseinrichtung Satellitengeodäsie, TU München in the fields of Satellite and Lunar Laser Ranging Development of Optical Sagnac Interferometers
1984 – 1988	PhD in physics, Georg-August-Universität, Göttingen
1978 – 1984	Diploma in physics at the Georg-August-Universität, Göttingen

Scientific Interests

The development of large He-Ne based ring laser gyroscopes for precision measurements of the length of day and tests of general relativity | Applications of time coherent spectroscopy and delay compensated time and frequency distribution over distances of several hundred meters

Awards

2016	Christiaan Huygens Research Medal for significant contributions to the field of geoscience instrumentation from the European Geosciences Union

Abstract

Strap-Down inertial sensing gyroscopes, comprising a Sagnac interferometer, are essential for the attitude control of aircrafts – they keep helicopters and planes in the sky. What if the same technology is strapped down to the Earth? It will allow the observation and understanding of minute changes of the rate of rotation as well as variations of the orientation of the instantaneous axis of Earth's rotation. Unlike the response of the Earth as a whole, aircraft motion is highly dynamic. Therefore, we have to make a suitable gyro for the application in the geosciences significantly more sensitive and stable than aircraft gyros, improving them by many orders of magnitude. Large scale optical interferometers can be used for this purpose, but the requirements are demanding. We have built and explored a variety of monolithic and heterolithic ring lasers, spanning areas between 1 and more than 800 m^2. On this road of a high resolution monitoring of a global measurement quantity (Earth rotation) with a local sensor (ring laser), we have encountered a number of serious challenges. This talk provides an introduction to high resolution Sagnac interferometry and its application to the geosciences.

Why Minimal Intensity Holds Maximum (Resolution) Power

Prof. Dr. Stefan Hell

Present Position | Academic Record

since 2016	Director at the Max Planck Institute for Medical Research, Heidelberg, Department of Optical Nanoscopy
since 2002	Director at the Max Planck Institute for Biophysical Chemistry, Göttingen, Department of NanoBiophotonics
1997 – 2002	Group leader at the Max Planck Institute for Biophysical Chemistry, Göttingen
1994	Visiting scientist at the University of Oxford, England
1993 – 1996	Senior researcher at the University of Turku, Finland
1991 – 1993	Postdoctoral researcher, European Molecular Biology Laboratory, Heidelberg
1990	Doctorate in Physics, University of Heidelberg
1987	Diploma in Physics, University of Heidelberg

Awards (more recent)

2014	Kavli Prize in Nanoscience Nobel Prize in Chemistry

Abstract

A conclusive description of the basic principles of superresolution fluorescence microscopy (nanoscopy) spawns new nanoscopy concepts, as exemplified by the recent emergence of three powerful superresolution concepts: i) protected STED [1], ii) MINFIELD [2], and iii) MINFLUX[3]. Although they differ in several aspects, all these concepts harness a local intensity minimum (of a doughnut or a standing wave) for determining the coordinate of the fluorophore to be registered. MINFLUX nanoscopy uses an excitation intensity minimum to establish the fluorophore position, thus obtaining the ultimate (super)resolution: the size of a molecule [3].

[1] Danzl, J. G., Sidenstein, S. C., Gregor, C., Urban, N. T., Ilgen, P., Jakobs, S., Hell, S. W. Coordinate-targeted fluorescence nanoscopy with multiple off states, Nat Photonics, 10, 122-128 (2016).

[2] Göttfert F., Pleiner T., Heine J., Westphal V., Görlich D., Sahl S. J., Hell S. W. Strong signal increase in STED fluorescence microscopy by imaging regions of subdiffraction extent, PNAS (2017).

[3] Balzarotti F., Eilers Y., Gwosch, K. C., Gynnå, A. H., Westphal, V., Stefani, F. D., Elf, J., Hell, S. W., Nanometer resolution imaging and tracking of fluorescent molecules with minimal photon fluxes, Science (2017) 10.1126/science.aak9913

In Situ Diagnostics for PEM Fuel Cells and Electrolysers

Dr. Gareth Hinds

Present Position Science Area Leader in the Electrochemistry Group at the National Physical Laboratory (NPL) in Teddington, Middlesex, UK

Academic Record

Gareth Hinds is an electrochemist/material scientist with research interests in electrochemical energy conversion and corrosion. He is Science Area Leader in the Electrochemistry Group at the National Physical Laboratory (NPL) in Teddington, Middlesex. His primary expertise is in the development of novel in situ diagnostic techniques and standard test methods for assessment of corrosion and material degradation in energy applications. Gareth has a strong track record of delivering innovative solutions to engineering problems with demonstrable impact on industry in a range of sectors, including oil and gas, power generation and electrochemical energy conversion and storage. He is the author of over 140 publications, including 62 peer-reviewed journal papers, 19 conference papers and 61 NPL technical reports.

Abstract

Polymer electrolyte membrane (PEM) fuel cell and electrolyser technology has the potential to solve the world's energy storage issues by providing an efficient route for storing and using excess renewable energy that would otherwise be wasted. Drivers for commercialisation include higher efficiency, security of supply, lower carbon emissions, silent operation and reduced air pollution. However, a major obstacle to widespread market penetration of such devices is the need to improve the durability of materials and components under the relatively severe operating conditions encountered in service, which can lead to loss of active catalyst area, membrane degradation and corrosion of metallic components.

In this presentation, an overview is given of the application of the NPL reference electrode technique to the study of degradation mechanisms in PEM fuel cells and electrolysers. An innovative through-plate configuration provides an IR-free measurement of electrode potential at the point of interest, facilitating separation of anode and cathode contributions to the cell potential. Use of an array of such reference electrodes allows mapping of the variation in electrode potential across the active area of the cell, which can provide useful information on highly heterogeneous transient processes. Examples are provided to highlight the insights gained using this technique and their implications for design optimisation.

The Exciting Physics of Spin Chains Precisely Fabricated by Single-Atom Manipulation *

Prof. Dr. Roland Wiesendanger

Present Position | Academic Record Roland Wiesendanger is professor of Experimental Physics at the University of Hamburg and head of the Interdisciplinary Nanoscience Center Hamburg as well as of the Collaborative Research Center of the German Research Foundation entitled "Magnetism from single atoms to nanostructures". His scientific interests include nanomagnetism and nanospintronics, molecular magnetism, unconventional mechanisms of superconductivity, and topological physics. Since the end of the eighties, Roland Wiesendanger pioneered the technique of Spin-Polarized Scanning Tunneling Microscopy and Spectroscopy which allowed the first real-space observation of magnetic structures at the atomic level. He also contributed significantly to the development of Magnetic Force Microscopy and invented the technique of Magnetic Exchange Force Microscopy – the first technique for visualizing atomic-scale spin structures of insulators. These unique techniques for resolving spin structures at the atomic scale have made it possible to study magnetic properties and interactions at the level of individual atoms as well as the atomic-scale spin structure of condensed matter, leading to numerous discoveries of novel types of magnetic states and phenomena in nanostructures and at surfaces.

Abstract

A magnetic nanowire on the surface of a spin-orbit coupled s-wave superconductor is a fascinating platform, which has been proposed for observing the emergence of zero-energy Majorana bound states at the ends of the wires [1]. Majorana states can encode topological qubits and ultimately provide a new direction in topological quantum computation [2]. Most recently, evidences for topologically non-trivial end-states were experimentally found for self-assembled ferromagnetic Fe nanowires on superconducting Pb(110) substrates by using scanning tunneling microscopy and spectroscopy (STM/S) as well as non-contact atomic force microscopy methods [3-6]. Here, we demonstrate the fully-controlled bottom-up fabrication of artificial 1D atomic chains from individual magnetic Fe adatoms on high spin-orbit coupled non-superconducting Pt(111) and superconducting Re(0001) substrates by utilizing STM-based atom-manipulation techniques at T=350 mK. Spin-polarized STM (SP-STM) measurements indicate the presence of non-collinear spin textures, i.e., spin spiral ground states, stabilized by interfacial Dzyaloshinskii-Moriya interactions similar to self-assembled Fe chains on Ir(001) investigated earlier [7]. Tunneling spectra measured spatially resolved on the Fe-atom chain on Re(0001) reveal the evolution of the local density of states (LDOS) inside the superconducting gap as well as the development of zero-energy bound states at the ends of the chain, which are distinguishable from trivial end states by systematically increasing the number of atoms within the Fe-atom chain. The experimental results will be compared with model-type calculations supporting the interpretation of the spectroscopic signatures at the ends of the chains as Majorana bound states.

* work done together with Howon Kim and Khai Ton That [1] H.-Y. Hui et al., Sci. Rep.. 5, 8880 (2015) [2] J. Alicea et al., Nature Phys. 7, 412 (2011) [3] S. Nadj-Perge et al., Science 346, 602 (2014) [4] M. Ruby et al., Phys. Rev. Lett. 115, 197204 (2015) [5] R. Pawlak et al., NPJ Quantum Information 2, 16035 (2016) [6] B. E. Feldman et al., Nature Phys. 13, 286 (2017) [7] M. Menzel et al., Phys. Rev. Lett. 108, 197204 (2012).

How to Archive Comparable In Vitro Nano-Toxicological Measurements – Applying Basic Metrological Principles

Dr. Matthias Rösslein

Present Position Senior Scientist, Empa – Swiss Federal Laboratories for Materials Science and Technology, Switzerland

Academic Record

Matthias Rösslein studied chemistry at the University of Basel (Switzerland) from 1981 to 1985. There, at the Institute of Physical Chemistry, he also received his PhD degree for work in high-resolution spectroscopy of open shelled cations in 1989 with "summa cum laude". Afterward, he spent close to 2 years as a postdoc at the University of Chicago performing high-resolution infrared spectroscopy. From 1991 to 1995 he worked as an assistant professor at University Zurich (Switzerland) in the field of the kinetic of photo dissociation. In 1996, Matthias Rösslein joint Empa, Swiss Laboratories for Materials Science and Technology. Thence-for-ward, he specialized as one of the world leading experts in "evaluation of measurement uncertainty and metrology". In 2006 he was appointed to a position as "Senior Scientist" and joined the now named "Particles-Biology Interaction" laboratory focusing mainly on the application of metrological principle to in vitro assays elucidating the effect of engineered nanomaterials on different cell types. This activity occurs in close collaboration with related groups at the National Institute of Standard and Technology (NIST) in the USA, where he had the status as a foreign guest researcher between 2008 and 2014. In further works he is focusing to bring the concept of measurement uncertainty to genomics and transcriptomics in the context of clinical everyday work. Currently, Matthias Rösslein heads the measurement science part of the translational science Horizon 2020 project EU-NCL. This project focuses on the preclinical safety assessment of potential nanomedications.

Abstract

The field of nanotoxicology has been impaired by large controversies about published results for many years. They were often contradicting and led to anxieties in the public, regulatory bodies and industry, who had been hoping for breakthrough new materials with unique properties. The stalemate could only be overcome with the introduction of basic metrological principles that have been previously applied to numerous other field of measurement science. They provide the picture of a three-legged stool with "Validation", "Traceability", and "Measurement Uncertainty" as the three legs. The lecture provides an introduction to the application of basic principles in biological measurements and highlights their application to in vitro assay evaluating the effect of nanomaterials. It also shows the success of this approach with its verification at different instances. Most recently it is the backbone of translational science within the Europe project, bringing potential non-biological complex drugs (nanomedications) into clinical trials.

References: Krug et al., 2011, Angew. Chem. Int. Ed. Engl. 50(6): 1260–1278; Roesslein, 2013, Int. J. Mol. Sci. 14: 24320–24337; Hirsch, 2011, Nanomedicine 6(5): 837–847; Roesslein, 2015, Chem. Res. Toxicol. 28(1): 21–30; Elliott, 2017, ALTEX 34(2): 201–218

Ocean Acidification: an Emerging Metrological Challenge

Dr. Paola Fisicaro

Present Position — Head of the Inorganic Chemistry Department at Laboratoire national de métrologie et d'essais LNE, Paris

Academic Record

Dr. Paola Fisicaro is head of the Inorganic Chemistry Department at LNE since 2007. She has recognised experience in metrology in chemistry. Her activities focus on the development of metrological references in new and challenging areas in the fields of environment, food and nanoparticles, aiming at contributing to the implementation of EU Directives or International Policies as well as to the dissemination of the measurement capabilities to laboratories to ensure the comparability of their measurement results.
Dr. Fisicaro is currently the deputy chairperson of the Inorganic Analysis working group of the Comité Consultative de la Quantité de Matière (CCQM-IAWG) and has been the convenor of the sub-committee for Inorganic Analysis of the EURAMET TC-MC (technical committee for Metrology in Chemistry) between 2011 and 2014.
Paola Fisicaro is co-author of about 50 papers in peer-reviewed journals and more than 60 presentations at international conferences.

Abstract

The ocean plays a key role in climate change as it acts as a carbon "sink". Climate change is therefore the main reason for the growing interest in the oceanic carbon cycle studies.

pH is one of the parameters used to gather information on the carbonate equilibria in seawater. However, discrepancies have been noticed in the data for seawater acidity due to the existence of several measurands for the same quantity.

The major hurdles to comparability include limitations and inconsistencies in the current definitions of the variables, the specificities of the seawater matrix, the complexities of operating in the marine environment, the variety of measuring techniques and instrumentation, the multiplicity of calibration methodologies in use, the lack of (or discordance regarding) reference material, the dearth of common validated procedures, and the scarcity of metrological expertise and rigor in relevant stakeholder and end user communities.

This talk aims to describe the different measurands for seawater acidification and the strategies developed by some NMIs in collaboration with the oceanographic community to ensure the SI traceability of the measurement results in this field.

The Challenge of Measuring Trace Levels of Gas Pollutants and Short-Lived Species in Air

Annarita Baldan

Present Position Consultant in chemistry, VSL – Nederlands Metrologisch Instituut

Academic Record

Annarita Baldan has a Master degree in Pharmaceutical Chemistry and Technology and a specialisation in Environmental Pollution. She has worked for almost three years at the Joint Research Centre of the European Commission (Ispra, Italy) and specifically at the European Reference Laboratory for Air Pollution.

She is now working at VSL (Dutch Metrology Institute) for more than 15 years, first as a scientist and currently as a consultant. Her main research work is devoted to gas analysis and specifically to the development of the metrological infrastructure in air quality and atmospheric chemistry. Her research activities include the development of primary reference gas mixtures containing volatile organic compounds (VOCs) at trace concentration levels, by use of gravimetric and dynamic primary preparation techniques and the development of methods for purity determination of liquid organics. Further she participates in international projects as consultant on QA/QC activities in air quality and she is active member of several standardisation bodies including CEN/TC264 "Air Quality" and ISO/TC158 "Gas Analysis".

Annarita Baldan has been the coordinator of the successful EMRP MACPoll project (Metrology for air chemical pollutants) and she is now managing the KEY-VOCs project (Metrology for VOC indicators for air pollution and climate change).

Abstract

New developments in high-end technologies and automation have largely influenced the measurement of air pollution and atmospheric chemistry. More accurate and sensitive analytical techniques are now available that allow detecting very low concentrations of hazardous gas pollutants and, in many cases, background levels of short-lived reactive species. These species are key indicators for climate change.

In the last years, cheap, portable and fast sensing devices are appearing on the market which, if validated, may lead to a new way to perform measurements of air quality.

Besides maintaining and developing new calibration standards and Certified Reference Materials to underpin air monitoring and to allow compliance with environmental regulations, Gas Metrology is playing an important role in validation of these new measurement technologies and in testing of new materials that will allow detection limits far beyond the state of the art.

Microplastics in the Environment

Dr. Bettina Liebmann

Present Position Expert in environmental analysis at the Environment Agency Austria (EAA – Umweltbundesamt GmbH)

Academic Record

Bettina Liebmann holds a PhD degree in chemical engineering from Vienna University of Technology (Austria), where she worked for several years as researcher and lecturer on sustainable process engineering and chemical data analysis. At the Environment Agency Austria, she is working as expert in environmental analysis with focus on new and emerging topics. From 2014 onwards, microplastics in the environment and in consumer products evolved to be her main topic. She has implemented the analysis of microplastics by micro FT-IR spectroscopy and imaging at EAA's laboratory, where she investigated microplastic in a variety of projects. In addition to her practical experience, she is author of several reports and presentations on plastics and microplastics in the environment. At EAA she has also co-ordinated research projects on nanoparticles in waste water treatment, and Uranium dynamics in the soil-water-plant system.

Abstract

The term "microplastics" generally summarizes plastic particles that are less than 5 mm in diameter. It can be attributed to various sources. So called primary microplastics include plastic granules purposefully manufactured for further conversion, but also those microplastics for intentional use in consumer goods. Secondary microplastics, however, are derived from the breakdown of macro plastic items (e.g. packing material, car tyres), mostly littered in the environment. Comprehensive scientific studies show plastic pollution of the seas, but only little is known about pollution of freshwater systems, soil and air. To understand the emerging environmental problems caused by microplastics, the potential sources and key pathways into habitats are presented. We will have a look at identification methods of microplastics in environmental media and discuss the challenges scientists face in quantifying microplastics in the environment.

Solar UV Radiation Metrology: Supporting Health and Climate Research

Dr. Julian Gröbner

Present Position | Academic Record

since 2005	Senior Scientist at the Physikalisch-Meteorologisches Observatorium Davos, World Radiation Center, Davos, Switzerland. Member of the Institute Management (Institutsleitung). Head of Department with six scientists and one technician. Head of the Infrared Radiometry Section (since 2005), the World Optical Depth Research and Calibration Section of the World Radiation Center (since 2007) and Head of the World Calibration Center for UV (WCC-UV) (since 2008). As of 2017, co-head of the World Radiation Center (WRC).
2000 – 2005	Research Scientist at the Joint Research Center of the European Commission in Ispra, Italy. Responsible for the set-up and operation of the European Reference Centre for ultraviolet radiation measurements (ECUV).
1996 – 1998	Master and PhD at the Leopold Franzens University of Innsbruck. Diploma thesis "Proton-Antiproton mass comparison in a high precision Penning trap" at the European Centre for Nuclear Research (CERN) in Geneva, Switzerland; PhD in atmospheric physics at the Institut für Medizinische Physik at the University of Innsbruck. PhD thesis "Ultraviolet solar radiation measurements using a high precision spectrometer"

Abstract

Solar UV radiation has important effects on the Atmosphere, Plants and Animals and on human health in particular. While small amounts of solar UV radiation have beneficial effects on human health through the production of Vitamin D, exposure to high doses of solar UV radiation may result in acute and chronic health effects on skin, eye and immune system. While solar radiation measurements have been performed for more than 100 years, measurements of the ultraviolet part of the solar spectrum have shown significant challenges to achieve the desired uncertainties. Only in recent years methods and procedures have been developed to a level where measurements of solar UV radiation have become fully traceable to SI units with uncertainties close to what is achievable in the laboratory. Among other factors, solar UV radiation is strongly modulated by atmospheric ozone. The discovery of decreasing ozone levels therefore lead to an international effort regulated by the Montreal protocol on substances that deplete the ozone layer. The expected recovery of the ozone layer is expected to be seen within the next few decades, which is, however, influenced by changes in the climate system.

Metrology for High Voltage Direct Current

Dr. Anders Bergman

Present Position Senior specialist in the field of calibration for high voltage and high current, RISE Research Institutes of Sweden, Borås

Academic Record

Anders Bergman received both his BSc (1971) and his PhD (1994) in physics from Uppsala University, Sweden. His PhD thesis "In situ calibration of voltage transformers on the Swedish national grid" is based on the calibration of the total complement of voltage transformers on the Swedish 220 and 400 kV grids. After being involved in the design and construction of a 100 MeV cyclotron at Scanditronix in Uppsala, he was engaged in the metrological aspects of high voltage testing at the high voltage laboratory at ASEA with emphasis on impulse voltages and partial discharges, followed by a period as project engineer for high voltage direct current (HVDC) projects. Since 1988, he has been with RISE Research Institutes of Sweden in Borås where he is now senior specialist in the field of calibration for high voltage and high current.

Dr. Bergman is primarily engaged in calibration activities in fields of high voltage engineering which are needed by industry and he has developed several major reference systems, which are used for on-site calibration of high voltage measurement systems. He is also involved in international standardization and has developed several major reference systems, which are used for on-site calibration of high voltage measurement systems. He is recipient of the 1906 award from IEC (International Electrotechnical Commission).

Abstract

Energy transmission by high voltage direct current (HVDC) is steadily increasing in the world, both at the highest power levels, but also at medium power, for example in connections of remote wind-parks to the main a.c. grid. Although principles for d.c. side measurements are known since long, support from metrology has not been on par with the needs. In response to perceived needs, recent development has attempted to remedy this situation, and an overview will be given on the needs and challenges for metrology in this area.

The main topics are:

- Measurement of high dc currents up to several kA: dc current transformers based on zero-flux technology, traceability limits
- Measurement of high dc voltages up to a few MV: Recent advances in traceability for HVDC, development of a 1MV reference at 20 µV/V uncertainty
- Metering energy at the dc side: methods and equipment
- Measurement of losses of convertor sub-modules and of convertor stations: The problem of loss under fast changing voltages and currents, performance verification, differences of ac and dc side power measurements

Diffractive Imaging of Nanoparticles and Nanoplasma Dynamics

Dr. Daniela Rupp

Present Position	Junior research group leader at the Max Born Institute in Berlin
Academic Record	
2013 – 2017	Postdoctoral researcher with Prof. Thomas Möller at the TU Berlin
2010	Visiting scholar at LCLS (Linac Coherent Light Source), Stanford, with a DAAD fellowship
2008 – 2013	PhD fellow at the TU Berlin with Prof. Thomas Möller. Thesis: Ionization and plasma dynamics of single large xenon clusters in superintense XUV pulses.
2002 – 2008	Studies of Physics in Augsburg, Berlin and Sevilla
Scientific Interests	Intense X-ray matter interaction | non-equilibrium dynamics in highly excited matter on the nanoscale | structure formation on the nanoscale | advancing coherent diffractive imaging techniques, particularly time-resolved imaging

Abstract

Ultra-intense pulses from short-wavelength free-electron lasers (FEL) turn condensed matter into highly excited plasmas within only a few femtoseconds. While this plasma formation constitutes an unpleasant artifact termed "ultrafast radiation damage" for coherent diffractive imaging (CDI) applications, it promises unparalleled opportunities to prepare and study extreme plasma states in a well-controlled way. A precise understanding of ultrafast interactions of matter under intense extreme ultraviolet (XUV) and X-ray pulses is therefore a major focus of FEL research. Atomic clusters and nanodroplets in the gas phase are fascinating nanoscale laboratories for laser-matter interaction studies due to their simple geometric and electronic structure and the possibility to change their size from the molecular to the bulk limit.

Single-shot diffractive imaging allows to determine the shape of the short-lived and non-depositable specimen such as superfluid helium nanodroplets. Furthermore, the light-induced dynamics during and after the illumination with the intense short wavelength pulse become visible in the diffraction patterns. However, ultrafast changes of the electronic structure occur on a sub-femtosecond timescale and cannot be temporally resolved using the currently available femtosecond pulses from free-electron lasers. Our recent demonstration of diffractive imaging of single nanoparticles with intense XUV pulses from a laser-based high-harmonic generation (HHG) source thus opens a door to ultrafast coherent diffractive imaging with phase-controlled multicolor fields and attosecond pulses.

Posters

Last Name	Title of Poster
Abdelhakeem	Proposed Design of a Meganewton Load Cell Traceable to Smaller Deadweight Force Standard Machines
Àlvarez Rios	Optoelectronics Miniaturized Radiometers for Mars Exploration Missions
Balceris	Characterization of magnetic nanoparticles via frequency and time dependent magnetization and relaxation measurements
Banjanac	Development of methods for synthesis and characterization of nanobiocatalyst systems
Bezshlyakh	Fabrication and Characterization of Microlens Arrays
Bhardwaj	Hole transport materials for excitonic solar cells: Poly(3,4-ethylenedioxythiophene) and its derivatives for PV metrology
De Souza Lobo	Quantum Metrology Applied to Information Technology
Dickmann, W.	Absorption measurements in bulk silicon
Dickmann, J.	Thermal noise of grating reflectors in high-precision experiments
du Toit	Real-time state estimation and feedback control of an oscillating qubit via weak measurements and weak measurement reversal.
Greeff	Metrology aspects of liquefier dynamics control in 3D printing
Guo	Optical optimization for the broadband multi-reflection system applied for the spectroscopic trace gas-sensing instrument
Gupta	Contamination of Toxic Elements in Paddy Crops of Punjab Region, India
Hampel	THz microscope with superconducting Josephson-cantilever
Hassan	Dynamic Force Transfer Standard: Design and Identification
Heimbach	Measurement of radiation induced damages in DNA molecules and correlation with the electrical resistance
Jantzen	Contamination induced errors in dimensional measurements
Krieg	Hybrid n-GaN/p-PEDOT structures for optoelectronic applications fabricated by oxidative CVD
Langfahl-Klabes	2D-Reconstruction of the tip geometry for deconvolution of tactile measurements
Molle	Probing the same inter-dye-distance of sub 10 nm by using the super- resolution DNA-PAINT and FRET technique on DNA Origami
Naumenko	Examination of hydrogen influence on physical properties of natural gas and metrological characteristics of its metering systems
Nazari Asl	Noise characteristics of capacitive electrodes
Ostermann	Implementation of a metrological UHV-STM
Pessoa	Development of metrology protocols of new chalcogenides materials related to process parameters
Porsiel	The synthesis and metrology of colloidal semiconductor nanocrystals
Rodiek	Absolute single-photon source based on a nitrogen-vacancy center in nanodiamond for radiometry
Rojas Hurtado	Optomechanical interactions on silicon nanostructured surfaces
Salhi	Effective collision strengths of He-like neon
Schmidt	SI-Traceable Quantification of Specific Disease Related Biomarkers by Raman Spectroscopy
Schneider	Calibration strategy for a new realization of luminous intensity
Schöneweiß	Entwicklung eines metrologischen Konzepts zur Charakterisierung luftgeleiteter Ultraschallfelder am Arbeitsplatz
Schroeter	Electronic transport properties of nanostructured MnSi-films
Schulz	The Effect of Space-Time Curvature on Energy Levels and Decay Properties of Hydrogen-Like Atoms
Schumann	Real world metering vs. legal test methods
Sefer	Very low gas flow measurements of inert gases using in vacuum metrology
Setiadi	Fluxgate Sensor Characterization Based on Resistance, Impedance, Inductance, and Mutual Inductance
Singh	Pinch Technology: A Simple Design Approach for Optimization of Solar Cell Thickness
Steinki	High magnetic field behavior of $NbFe_2$
Struszewski	Laser-based measurement of complex high frequency signals
Sudwischer	DNA-Origami for the Nanoscale Positioning of Polysaccharide Molecules
Sumin	Evaluation of geometrical parameters of workpieces in serial production under harsh environmental conditions by referring to calibrated reference parts
Weidinger	Expanding the Torque Calibration Range by a 5 MN·m Torque Transfer Standard
Won Dias Victorette	Use of the Zernike polynomial to describe flat screen shape used in optical metrology
Wu	Optical metrology of nanostructed color filters for non-invasive biomedical diagnosis
Wünsch	Single-molecule-study of interactions between gold nanostructures and fluorescent dyes on DNA origami
Zimmermann	Towards metrological characterization of single GaAs nanowire device

Timetable

	Tuesday 8 August	Wednesday 9 August	Thursday 10 August	Friday 11 August
08:30		Harald Lück **Gravitational Waves: Measuring Tiny Ripples in Space-Time**	Paola Fiscaro **Ocean Acidification: an Emerging Metrological Challenge**	Anders Bergman **Metrology for High Voltage Direct Current**
09:00				
09:30		Ulrich Schreiber **High Resolution Sagnac Interferometry for the Geosciences**	Annarita Baldan **The Challenge of Measuring Trace Levels of Gas Pollutants …**	Daniela Rupp **Diffractive Imaging of Nanoparticles and Nanoplasma Dynamics**
10:00				
10:30		Coffee Break	Coffee Break	Coffee Break
11:00		Stefan Hell **Why Minimal Intensity Holds Maximum (Resolution) Power**	Bettina Liebmann **Microplastics in the Environment**	
11:30				
12:00		Lunch	Lunch	Lunch
12:30				
13:00	**Arrival**			
13:30		Gareth Hinds **In Situ Diagnostics for PEM Fuel Cells and Electrolysers**	Julian Gröbner **Solar UV Radiation Metrology: Supporting Health and Climate Research**	
14:00	Meinhard Schilling **Welcome**			**Departure**
14:30	Joachim Block **Rosetta – an Exciting Mission to the Origin of the Solar System**	Roland Wiesendanger **The Physics of Spin Chains Precisely Fabricated by Single-Atom Manipulation**	**Exercise**	
15:00				
15:30	Coffee Break	Coffee Break	Coffee Break	
16:00	Harald Schnatz **Frequency and Time Metrology Activities at PTB**	Matthias Rösslein **How to Archive Comparable In Vitro Nano-Toxicological Measurements …**	**Exercise**	
16:30				
17:00	Bernd Engel **Smart Metering**			
17:30				
18:00	Dinner	Dinner	Dinner	
18:30				
19:00				
19:30	**Student Poster Session**	**Student Poster Session**	**Exercise Presentation/ Student Poster Session**	
20:00				