TUT 1: Tutorial Attosecond Electron Dynamics (HL)

Attosecond physics aims at probing and manipulating electronic motion driven by strong laser fields on nanometer length and extremely short time scales. For some years, this field has captured the attention of atomic and molecular physicists. Very recently, several experimental and theoretical studies have started to explore strong-field attosecond electron dynamics in solid state nanostructures. It is the aim of this tutorial to give an introduction into this emerging field, to connect gas-phase and solid state attosecond science and to give perspectives for future work, in particular - but not exclusively - for young scientists. (Organizer: Christoph Lienau, University of Oldenburg)

Time: Sunday 16:00–17:55 Location: EW 201

Tutorial TUT 1.1 Sun 16:00 EW 201
Time delays in ionization: real, imaginary, and imagined — •Misha Ivanov — Department of Physics, Imperial College London, South Kensington Campus, London, UK

I will review recent work on trying to understand how much time does it take to liberate an electron from an atom or a molecule. I will focus on two ionization regimes: one-photon and tunneling, and on different ways to address this question both technically and conceptually. In particular, I will show how our attempts to tag an electron as it becomes free after tunneling have led to a better understanding of attosecond core rearrangement during tunneling.

Short Break (5 min)

Tutorial TUT 1.2 Sun 16:40 EW 201
Control of Electron Emission from Nanoscopic Systems by Ultrashort Laser Pulses — •Eckart Rühl — Physikalische Chemie, Freie Universität Berlin, Takustr. 3, 14195 Berlin, Germany

Recent progress in control of electron emission from nanoscopic dielectric systems by ultrashort laser pulses and related work is reviewed. Coherent control strategies of laser-induced processes of gas phase species have been established before. Such gas phase species are not limited to atoms, molecules, or clusters. More recently it has been shown that intense nanoparticle beams can be prepared in narrow size distributions as gas phase targets. Ultrashort, intense, and carrier envelope phase-stabilized laser pulses of 4-6 fs in the near infrared regime lead to novel electron emission processes as well as the control of electron motion in the attosecond time regime. This goes beyond well-known photoemission induced by one-photon absorption of ionizing radiation, where the electron spectra of nanoparticles and macroscopic condensed matter are dominated by low kinetic energy, inelastically scattered electrons. In contrast, few-cycle laser pulses yield electron spectra with phase-dependent emission of high kinetic energy electrons. This process has been shown to be unique for condensed matter and is not possible for atomic species. Details of the processes occurring on ultra-short time scales have been assigned by using semiclassical Monte-Carlo simulations. These results indicate that tunnel ionization, the laser field, dielectric near-field enhancement, and the Coulomb field of the liberated charges contribute. Prospects of these results are briefly discussed.

Short Break (5 min)

Tutorial TUT 1.3 Sun 17:20 EW 201
Attosecond science at nanometric needle tips — •Peter Hommelhoff — Max-Planck-Institut für Quantenoptik

Attosecond science, namely the steering of electrons with the electric field of well-controlled femtosecond laser pulses, has led to the generation of high-harmonic radiation, even to the generation of single isolated extreme-ultraviolet pulses with durations below 100 attoseconds ($1\,\mathrm{as} = 10^{-18}\,\mathrm{s}$), as well as to the measurement of intramolecular dynamics and ultrafast electron holography. These effects have been observed with atoms, molecules and clusters in the gas phase. We will report on the steering of electrons emitted from *nanoscale metal tips* with the help of phase-controlled low-power few-cycle femtosecond laser pulses. We will highlight the commonalities as well as the differences to the atomic physics system, and will give an outlook on future techniques such as ultrafast surface imaging.

TUT 2: Tutorial Innovations in synchrotron X-ray studies (MI)

This tutorial is related to the centenary of the famous Laue experiment of X-ray diffraction. It deals with various topical aspects of the application of synchrotron radiation covering a broad range of materials and methods.

Chair: E. Langer

Time: Sunday 16:00–18:15 Location: EW 202

Tutorial TUT 2.1 Sun 16:00 EW 202
2D und 3D Röntgenbildgebung mit Synchrotronstrahlung — •Tilo Baumbach — Karlsruher Institut für Technologie, Institut für Synchrotronstrahlung, 76344 Eggenstein-Leopoldshafen

Illustriert durch Materialforschung und Lebenswissenschaften entwickelt dieser Einführungsvortrag einen Überblick zu den wichtigsten physikalischen Prinzipien der Bildentstehung und Rekonstruktion. Das heute verfügbare methodische Ensemble erlaubt die weitgehend zerstörungsfreie Abbildung von Strukturen im Realraum mit Auflösung bis zur Nanoskala. Die besonderen Eigenschaften der Synchrotronstrahlung und ein rasanter Fortschritt bei abbildenden Röntgenoptiken und Detektoren, präziser Manipulatorik und leistungsfähigen Algorithmen ermöglicht die Verwendung und Kombination vielfältiger physikalischer Kontrastmechanismen wie z.B. Absorption, kohärente und inkohärente Streuung und Spektroskopie zur Abbildung von Realstrukturen inklusive der 2D und 3D Verteilung statistischer Struktureigenschaften. Variable örtliche Auflösung und die Kombination komplementärer Abbildungsmethoden ermöglichen korrelierte und hierarchische Bildgebung z.B. biologischer Systeme - vom Organismus zu einzelnen Organen, Gewebe, Zell- und subzellularer Strukturen. Zeitlich und örtlich hochauflösende abbildende Röntgentechniken sind wichtige Werkzeuge zur Erforschung der Mikro- und Nanowelt und deren Veränderung in Abhängigkeit von äußeren und inneren Bedingungen. Das Verständnis technischer oder biologischer Systeme wiederum fördert unsere Fähigkeit der gezielten Beeinflussung von makroskopischen Eigenschaften und Funktionalitäten.

Tutorial TUT 2.2 Sun 16:45 EW 202
Hochaufgelöste Röntgenbeugung an niedrigdimensionalen Halbleiterstrukturen — •Michael Hanke — Paul-Drude-Institut für Festkörperelektronik

Hochaufgelöste diffuse Röntgenbeugung ist eine weitestgehend etablierte Methode, um geringste mechanische Deformationen in Nanostrukturen nachzuweisen. So lässt sich neben der Form und Positionskorrelation sehr genau die Variation des lokalen Gitterparameters bestimmen. Eine zentrale Ursache für diese mechanischen Deformationen stellt die sich beim Wachstum einstellende chemische Zusammensetzung dar. Fern von Absorptionskanten verschwindet jedoch deren direkter Einfluss auf die diffuse Röntgenstreuung nahezu vollständig, während die mechanische Deformation als Kontrastmechanismus dominiert. Insofern lässt sich indirekt von der diffusen Streuung ausgehend, über den Umweg der Deformation, auf die chemischen Profile schließen.

Ohne deren detaillierte Kenntnis lassen sich die zugrunde liegenden, oft hochkomplexen Wachstums- und Selbstorganisationsphänomene kaum verstehen.

Der Vortrag gibt zunächst einen Überblick über verschiedene Verfahren der hochaufgelösten Röntgenbeugung und die Simulation diffuser Streuintensitäten im Rahmen der kinematischen Näherung. Beispielhaft wird die Strukturaufklärung an Objekten wie Nanowires, Einzelquantenpunkten, Quantenpunktmolekülen, deren Entwicklungsstadien sowie an freistehenden und vergrabenen Doppelringstrukturen im Nanometerbereich diskutiert.

Tutorial TUT 2.3 Sun 17:30 EW 202

New Lightsources and New Opportunities in Time-resolved Soft X-ray Spectroscopy — •Martin Beye — Helmholtz-Zentrum Berlin, Berlin, Germany

In this tutorial, I will quickly introduce novel pulsed X-ray sources (especially free-electron lasers like FLASH in Hamburg and LCLS in Stanford, USA) that enable soft X-ray spectroscopy on the ultrafast timescale relevant for electron dynamics and chemical bond making and breaking. After showing how we solve the experimental challenges connected with these new sources, I will feature some results from spectroscopy on correlated materials, where the ultrafast timescale allows to disentangle electronic and lattice degrees of freedom. We study how the excitation with a femtosecond laser destroys orbital and/or charge ordering phenomena. I will close with results on spectroscopy of chemical reactions where we can make full use of the element specificity of soft X-rays to study the dynamics of molecular bonds during chemical reactions. I will show results from reactions in the liquid phase as well as catalytic reactions on surfaces. A fundamental understanding of the ultrafast processes is relevant for applications in the chemical industry. This might allow to specifically tailor active surfaces, for example new catalytic converters in car exhausts.

TUT 3: Tutorial and Panel Discussion Scientific Writing (SOE, AGjDPG)

Although the publication of research results is one of the most essential things for being successful in science, for many scientists writing papers can be an exhausting thing. Especially for those who are at the beginning of their scientific career there are many unclear questions concerning the topic "scientific writing". How should the manuscript be written? Which results should be presented in the paper and how? With the help of experienced editors from some of the most important international journals our tutorial will try to demystify the topic and will answer the above and other related questions. A special intention is to provide young physicists with useful information since their chances to learn more about writing scientific publications are usually very rare. Our tutorial is, therefore, divided into two equal parts. In the first our panel guests will give a short introduction to the topic, whereas in the second part we will pick up some particular aspects for a group discussion. This part will also be open for questions from the audience.

Time: Sunday 16:00–18:30 Location: H 0105

Tutorial TUT 3.1 Sun 16:00 H 0105

Tutorial for authors and referees — •Hernan Rozenfeld — APS Editorial Office. Ridge, NY USA.

In this talk we will start by explaining how editors process a manuscript that is submitted for publication to an APS journal, including a brief overview on how we choose referees. We will show how to write a well-structured manuscript and what is expected in each section and will provide some hints on how to prepare referee reports. After the presentation the audience will be given a chance to ask questions to a panel of editors from different journals.

Tutorial TUT 3.2 Sun 16:20 H 0105

From submission to publication with IOP journals - a guide for authors — •Tim Smith — IOP Publishing, Bristol, UK

This talk will provide an overview of the editorial process involved in publishing a research paper in IOP journals. Particular focus will be placed on the process of editorially assessing articles for suitability (including referee selection), the expectations of referees in assessing key criteria for publication and tips for authors in preparing a manuscript for submission. Finally I will take a look at Video Abstracts (recently launched by New Journal of Physics) and how these can represent a new option for authors looking to broaden the reach of their work.

Tutorial TUT 3.3 Sun 16:40 H 0105

Preparing and submitting a scientific paper — •Rachel Won — Nature Photonics, Tokyo, Japan

Rachel will talk you through the concept of scientific detailed information and the guidelines on scientific manuscript preparation and submission, as well as an overview on the editorial and peer-review processes. You will learn what editors seek, how to write a good cover letter and a good scientific paper, and how to make an appeal.

Tutorial TUT 3.4 Sun 17:00 H 0105

Writing to meet expectations — •Mark Buchanan — 35a West St, Abbotsbury, UK

The human mind isn't a blank slate. Readers come to any scientific paper – indeed, to any piece of writing – with preconceptions, expectations, habits and instincts, some genetically hard wired. Effective communication aligns itself with such instincts, avoiding needless confusion by laying out arguments in a style that meets readers' expectations and works with the human brain, not against it. I'll illustrate these points with examples from scientific papers.

There will be a panel discussion with all invited speakers after their contributions, chaired by Stefan Hildebrandt (Editor in chief pss-journals).