

Working Group "Young DPG" Arbeitskreis junge DPG (AKjDPG)

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With this year's program the Working Group young DPG wants to appeal to many participants. Those, who are new to the conference and are feeling lost in view of the many sessions and the many topics, we want to offer the chance to build a solid foundation and to learn about several topics of the conference on a beginners level. You are cordially invited to visit the tutorials on Sunday!

The PhD-Symposium explores the world of Quantum Optimal Control Theory. The symposium is especially designed to give an introduction into the topic on the level of BScs, MScs and PhDs.

In joint work with the Working Group Information (AGI) we also want to give the possibility to dive in and to discuss a hot topic determining their future, namely about the upcoming developments of the publication system. The first talk in the session will also contain a short tutorial on the subject.

With the Hacky Hour on Thursday, we want to give you the opportunity to share your favourite tools which you use in your daily research with all the other participants.

For participants at the end of their PhD and young PostDocs we offer in collaboration with the Working Group on Industry and Business (AIW) Lunch Talks during the lunch breaks (in German) on Tuesday and Thursday. Within these talks physicists who already gained experience in working in the economy will share their knowledge. With the Industry Day "Physiker in der Energietechnik" (in German), which is jointly organised by AIW, Working Group Energy (AKE) and AKjDPG, possible job positions for physicists in the world of energy technology are presented.

Last but not least, we also offer the opportunity to ease the hard scientific program and to learn about interesting topics in the atmosphere of an EinsteinSlam. Slammers will have the possibility to present physical topics to an audience and to demonstrate that they are the right person to own the Golden Albert. Since we also want to support networking between the conference's participants, we offer a Tower Building Contest on Tuesday right after the plenary talk and a pub crawl on Wednesday evening.

Everyone is welcome! We are looking forward to seeing you at our events!

Overview of Invited Talks and Sessions

(Lecture rooms U HS 326, U HS 224, U HS 323, U SR 124 and Audimax)

Tutorials

AKjDPG 1.1	Sun	16:00–17:00	U HS 326	Freie-Elektronen Laser für Röntgenstrahlen: Physikalische Prinzipien und technische Realisierung — ●JÖRG ROSSBACH
AKjDPG 1.2	Sun	17:00–18:00	U HS 326	Introduction to x-ray quantum optics — ●JÖRG EVERS
AKjDPG 2.1	Sun	16:00–17:00	U HS 224	How Ultrafast Spectroscopy Can Follow Molecular Reaction Dynamics in Real Time — ●PATRICK NUERNBERGER
AKjDPG 2.2	Sun	17:00–18:00	U HS 224	Theoretical Perspective on Time-resolved Spectroscopy of Molecular Systems — ●OLIVER KÜHN
AKjDPG 3.1	Sun	16:00–17:00	U HS 323	Quantum metrology from a quantum information science perspective — ●GEZA TOTH, IAGOBA APELLANIZ
AKjDPG 3.2	Sun	17:00–18:00	U HS 323	Quantum metrology with non-classical states of atoms — ●CARSTEN KLEMP

Invited talks of the PhD-Symposium – Optimal Control Theory in the Leading Domains of Quantum Technology (SYPS)

See SYPS for the full program of the symposium.

SYPS 1.1	Mon	14:00–14:30	U Audimax	Optimal control of many-body quantum systems — ●SIMONE MONTANGERO
SYPS 1.2	Mon	14:30–15:00	U Audimax	Light matter quantum interface based on single colour centres in diamond — ●FEDOR JELEZKO
SYPS 1.3	Mon	15:00–15:30	U Audimax	Principles of Quantum Systems Theory and Control Engineering — ●THOMAS SCHULTE-HERBRÜGGEN
SYPS 1.4	Mon	15:30–16:00	U Audimax	Quantum metrology with Rydberg atoms — ●SEBASTIEN GLEYZES, ARTHUR LARROUY, REMI RICHAUD, SABRINA PATSCH, JEAN-MICHEL RAIMOND, MICHEL BRUNE, CHRISTIANE KOCH

Invited talks of the symposium: Physiker in der Energietechnik – Industrietag (SYIT)

See SYIT for the full program of the symposium.

SYIT 1.1	Thu	10:30–11:10	U A-Esch 1	LOHC - wie Wasserstoff zum flüssigen Treibstoff bei Raumtemperatur wird — ●CORNELIUS VON DER HEYDT
SYIT 1.2	Thu	11:10–11:50	U A-Esch 1	Energiewende können Physiker auch ?! — ●MATTHIAS LANGE
SYIT 1.3	Thu	11:50–12:30	U A-Esch 1	Windenergietechnik als Arbeitsgebiet für Physikerinnen und Physiker — ●UWE RITSCHEL

Lunch Talk

PV V	Tue	12:45–13:30	U A-Esch 1	TRUMPF - Arbeiten als Physiker in einem globalen, innovativen Familienunternehmen — ●MALTE KUMKAR
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Sessions

AKjDPG 1.1–1.2	Sun	16:00–18:00	U HS 326	Tutorial X-Ray Lasers (joint session AKjDPG/A)
AKjDPG 2.1–2.2	Sun	16:00–18:00	U HS 224	Tutorial Molecular Spectroscopy (joint session AKjDPG/MO)
AKjDPG 3.1–3.2	Sun	16:00–18:00	U HS 323	Tutorial Quantum Metrology
AKjDPG 4.1–4.3	Wed	14:00–15:45	U SR 124	New concepts in scientific publishing (joint session AGI/AKjDPG)
AKjDPG 5	Thu	10:30–12:30	U SR 124	Hacky Hour - part 1 (joint session AGI/AKjDPG)
AKjDPG 6	Thu	14:00–16:00	U SR 124	Hacky Hour - part 2 (joint session AGI/AKjDPG)

Tower Building Contest

Tuesday, 12 March 2019 10:00 U Audimax

Physics Students' Theater

Tuesday, 12 March 2019 19:00 U Audimax

EinsteinSlam

Tuesday, 12 March 2019 20:00 U Audimax

Pub Crawl

Wednesday, 13 March 2019 20:00 Meeting point: U Audimax

AKjDPG 1: Tutorial X-Ray Lasers (joint session AKjDPG/A)

Time: Sunday 16:00–18:00

Location: U HS 326

Tutorial AKjDPG 1.1 Sun 16:00 U HS 326
Freie-Elektronen Laser für Röntgenstrahlen: Physikalische Prinzipien und technische Realisierung — ●JÖRG ROSSBACH — Institut für Experimentalphysik, Universität Hamburg, Luruper Chaussee 149, 22761 Hamburg

In diesem Tutorium werden die physikalischen Grundprinzipien des Freie-Elektronen Lasers erklärt. Für die Anwendung des Prinzips im Röntgenbereich ist der High-Gain-Modus besonders wichtig, der einen Betrieb ohne Spiegel erlaubt. Ebenso bedeutsam ist das SASE-Prinzip (Self-Amplified Spontaneous Emission), durch welches ein besonders robuster Betrieb ermöglicht wird.

Die resultierenden Eigenschaften der FEL-Strahlung werden erklärt, und es wird ein Einblick in die wesentlichen technischen Herausforderungen bei der Realisierung eines Röntgen-FELs gegeben.

Tutorial AKjDPG 1.2 Sun 17:00 U HS 326
Introduction to x-ray quantum optics — ●JÖRG EVERS — Max-

Planck-Institut für Kernphysik, Heidelberg

Over the last decades, tremendous progress has been made in the understanding and control of light-matter interactions. A particular driver in the field is quantum optics, which exploits quantum mechanical effects in this interaction, up to a point that now quantum technologies move into the focus of research. This progress was fueled and to a large degree relied on the parallel development of suitable laser sources. Motivated by these developments, recent improvements in existing and upcoming x-ray light sources prompt the question, whether similar concepts could also be exploited at x-ray energies. From the viewpoint of x-ray physics, this would not only be essential for fully exploiting the potential of these machines, but could also pave the way for new applications. In turn, from the viewpoint of light-matter interactions, x-ray quantum optics could also evolve into a fruitful new platform complementary to the existing ones. In this tutorial, I will introduce x-ray quantum optics, review some of the recent progress, and point out future challenges.

AKjDPG 2: Tutorial Molecular Spectroscopy (joint session AKjDPG/MO)

Time: Sunday 16:00–18:00

Location: U HS 224

Tutorial AKjDPG 2.1 Sun 16:00 U HS 224
How Ultrafast Spectroscopy Can Follow Molecular Reaction Dynamics in Real Time — ●PATRICK NUERNBERGER — Physikalische Chemie II, Ruhr-Universität Bochum, 44780 Bochum

Physicists and chemists are usually very familiar with absorption spectrometers. The obtained spectra provide information on energy levels and further properties of the substance at hand. Whereas one directly determines which photon is absorbed and how well, some of the most interesting information is not accessible in this way: what happens directly *after* the photon has interacted with the molecules?

Quite intuitively, one needs to measure at a later time to find out. Instead of looking only at the reaction's start and finish, a comprehensive approach has to follow the dynamics in real time in order to identify intermediates and decipher the underlying reaction mechanisms. For this, laser pulses in the femtosecond range are required, since photophysical processes and photochemical reactions (where bonds are cleaved and formed) may occur on an ultrafast time scale.

In this tutorial, the basics of ultrafast molecular spectroscopy are introduced. Different experimental implementations and the applicability to systems ranging from diatomic molecules to large biosystems are discussed. Two versatile approaches, transient absorption and coherent two-dimensional spectroscopy, are analyzed in detail with illustrative examples.

Tutorial AKjDPG 2.2 Sun 17:00 U HS 224

Theoretical Perspective on Time-resolved Spectroscopy of Molecular Systems — ●OLIVER KÜHN — University of Rostock, Institute of Physics, 18059 Rostock, Germany

Experiments in ultrafast spectroscopy have advanced to an unprecedented level of sophistication, being able to unravel even the finest details of molecular dynamics. Applications range from gas phase dynamics to the initial steps of photosynthesis, thereby encompassing many orders of magnitude as far as time and frequency scales are concerned. The analysis and interpretation requires advanced theoretical methods that can cope with the challenges provided by the experimental data. Here, ideas from electronic structure theory and quantum dynamics meet, areas which evolved separately so far.

In this tutorial, basic concepts of theoretical time-resolved spectroscopy will be discussed using applications from recent literature. In particular it will be shown that in the weak-field limit a rigorous and practical formulation of (non-)linear signals in terms of multi-time response functions can be given. Their information content is fully explored within two-dimensional spectroscopies, which have been developed to probe vibrational as well as electronic excitation dynamics.

[1] V. May and O. Kühn, *Charge and Energy Transfer Dynamics in Molecular Systems*, Wiley-VCH, 2011; [2] P. Hamm and M. T. Zanni, *Concepts and Methods of 2D Infrared Spectroscopy*, Cambridge, 2011; [3] M. Schröter, S. D. Ivanov, J. Schulze, S. P. Polyutov, Y. Yan, T. Pullerits, O. Kühn, *Phys. Rep.* 567, 1 (2015).

AKjDPG 3: Tutorial Quantum Metrology

Time: Sunday 16:00–18:00

Location: U HS 323

Tutorial AKjDPG 3.1 Sun 16:00 U HS 323
Quantum metrology from a quantum information science perspective — ●GEZA TOTH^{1,2,3} and IAGOBA APELLANIZ¹ — ¹Theoretical Physics, University of the Basque Country UPV/EHU, E-48080 Bilbao, Spain — ²IKERBASQUE, Basque Foundation for Science, E-48011 Bilbao, Spain — ³Wigner Research Centre for Physics, H-1525 Budapest, Hungary

We discuss how quantum systems can be used for parameter estimation. We present the central notions of the field such as the quantum Fisher information and the Cramér-Rao bound. We review basic findings on how the precision of the parameter estimation scales with the number of particles in a linear interferometer. The best scaling achievable is quadratic, however, quantum entanglement is needed to surpass the linear or shot-noise scaling. Finally, we explain how uncorrelated noise limits the highest achievable precision in practice. We present the theory of quantum metrology based on concrete setups using highly entangled quantum states, such as Greenberger-Horne-Zeilinger states,

spin squeezed states, Dicke states and singlet states.

Tutorial AKjDPG 3.2 Sun 17:00 U HS 323
Quantum metrology with non-classical states of atoms — ●CARSTEN KLEMP — Institut für Quantenoptik, Leibniz Universität Hannover, Deutschland

This tutorial will give an introduction to quantum metrology with non-classical states of atoms, with a focus on experimental aspects. The tutorial will start with an introduction to the basic concepts. I will then present the main experimental methods for the creation of entangled many-particle states in neutral atomic ensembles: Quantum non-demolition measurements, cavity interaction, collisional interaction. I will review the classes of entangled states, that have been created experimentally, and describe methods for the quantification of entanglement, including squeezing parameters and entanglement depth. Finally, I will present some highlight applications in the field of metrology.

AKjDPG 4: New concepts in scientific publishing (joint session AGI/AKjDPG)

Time: Wednesday 14:00–15:45

Location: U SR 124

Invited Talk AKjDPG 4.1 Wed 14:00 U SR 124**Beyond Open Access: SciPost** — •JEAN-SÉBASTIEN CAUX — Institute of Physics, University of Amsterdam, Science Park 904, Postbus 94485, 1090 GL Amsterdam, The Netherlands

SciPost [1] is a by-and-for scientists initiative aiming to provide a Genuine Open Access [2] replacement infrastructure for the scientific publishing industry. Its journals are characterized by being open access for both readers (no subscription or reading fees) as well as authors (no author fees/APCs), giving generous licenses (CC-BY) with copyright to the authors. All editorial work is performed by active professional scientists, without competing financial or corporate interest. As an organization, SciPost is purely not-for-profit and community-owned, and follows a cost-slashing consortial business model.

This talk will outline the initiatives main aspects (with emphasis on its open peer-witnessed refereeing protocol), current status, and upcoming expansion plans, in view of recent developments in policy and business.

[1] <https://scipost.org/>[2] <https://jscaux.org/blog/post/2018/05/05/genuine-open-access/>**Invited Talk** AKjDPG 4.2 Wed 14:45 U SR 124**Multi-Stage Open Peer Review: Integrating the strengths of traditional peer review with the virtues of transparency and self-regulation** — •ULRICH PÖSCHL — Max Planck Institute for Chemistry, Mainz, Germany

The traditional forms of scientific publishing and peer review do not live up to the demands of efficient communication and quality assurance in today*s highly diverse and rapidly evolving world of scholarly research and teaching. They can be advanced by interactive and trans-

parent forms of review, publication, and discussion open to the scientific community and to the public. The concepts and achievements of interactive open access publishing and multi-stage open peer review will be presented and discussed, building on more than 15 years of experience with the interactive open access journals of the European Geosciences Union and related developments (ETAI, JIME, SciPost Physics, F1000 Research etc.). Further initiatives and perspectives of open access will also be address (OA2020 etc.).

U. Pöschl, *Frontiers of Computational Neuroscience*, 6, 33, doi:10.3389/fncom.2012.00033, 2012https://www.atmospheric-chemistry-and-physics.net/pr_acp_Poschl_FrontiersNeuroscience2012_MultiStageOpenPeerReview.pdf

A Short History of Interactive Open Access Publishing, Copernicus Publications, 2011

https://www.atmospheric-chemistry-and-physics.net/pr_short_history_interactive_open_access_publishing_2001_2011.pdfhttps://www.atmospheric-chemistry-and-physics.net/about/news_and_press.html<https://www.mpic.de/forschung/publikationen/openaccess.html><https://oa2020.org/be-informed/>**AKjDPG 4.3 Wed 15:30 U SR 124****Discussion** — •UWE KAHLERT¹, ENRICO STEIN², JEAN-SÉBASTIEN CAUX³, and ULRICH PÖSCHL⁴ — ¹RWTH Aachen University — ²TU Kaiserslautern — ³Institute of Physics, University of Amsterdam — ⁴Max Planck Institute for Chemistry, Mainz

How can new concepts improve the dissemination, transparency and quality control of scientific results and publications? We will discuss these aspects with the speakers of this session.

AKjDPG 5: Hacky Hour - part 1 (joint session AGI/AKjDPG)

Time: Thursday 10:30–12:30

Location: U SR 124

During the Hacky Hour sessions researchers are encouraged to present their favorite tool they use for their daily scientific work. You may submit your contribution as Post Deadline Talk. The program will be set up at short notice and can be found at <http://tagungen.jdpg.de/> and on the conference’s (online) bulletin board.

AKjDPG 6: Hacky Hour - part 2 (joint session AGI/AKjDPG)

Time: Thursday 14:00–16:00

Location: U SR 124

During the Hacky Hour sessions researchers are encouraged to present their favorite tool they use for their daily scientific work. You may submit your contribution as Post Deadline Talk. The program will be set up at short notice and can be found at <http://tagungen.jdpg.de/> and on the conference’s (online) bulletin board.