

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

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Be welcome to this year's program of the Working Group young DPG!

To those, who are new to the conference and are feeling lost in view of the various sessions, we want to offer the chance to build a solid foundation and to learn about the hot topics of the conference. You are cordially invited to visit the tutorials on Monday morning!

With our PhD-Symposium we want to explore the current Trends in Atom Interferometry. The symposium is especially designed to give an introduction into the topic and will feature well known experts on the field.

Research data management is becoming an increasingly important topic in today's science. Since a lot of research data is acquired in the course of master's and doctoral theses, a structured handling of research data is very important for physics students. A Lunch Talk on Tuesday, given by Prof. Morgner, will focus on research data management and will tell us about the plans and goals of the consortium NFDI4Phys.

Last but not least, we want to ease the scientific program and offer you the opportunity to connect with your peers, even in times of virtual conferences. Be welcome to join us at the virtual pub quiz on Tuesday evening!

We are looking forward to seeing you at our events!

Overview of Invited Talks and Sessions

Invited Talks

AKjDPG 1.1	Mon	9:00– 9:45	H1	The orbital angular momentum of light — ●GIACOMO SORELLI
AKjDPG 1.2	Mon	9:45–10:30	H1	Photoionization with polarization-shaped ultrashort laser pulses — ●MATTHIAS WOLLENHAUPT
AKjDPG 2.1	Mon	9:00– 9:45	H2	spectroscopy at extreme limits — ●HANIEH FATTAHI
AKjDPG 2.2	Mon	9:45–10:30	H2	Cold molecules: the new frontier — ●GERHARD REMPE
AKjDPG 3.1	Tue	13:00–13:30	Audimax	Forschungsdatenmanagement in der Physik - die NFDI4PHYS-Initiative — ●UWE MORGNER

Sessions

AKjDPG 1.1–1.2	Mon	9:00–10:30	H1	Tutorial Chirality (joint session AKjDPG/Q)
AKjDPG 2.1–2.2	Mon	9:00–10:30	H2	Tutorial Modern Spectroscopy
AKjDPG 3.1–3.1	Tue	13:00–13:30	Audimax	Lunchtalk: NFDI4Phys
AKjDPG 4	Tue	20:00–21:30	Audimax	Online Pub-Quiz

AKjDPG 1: Tutorial Chirality (joint session AKjDPG/Q)

Time: Monday 9:00–10:30

Location: H1

Tutorial AKjDPG 1.1 Mon 9:00 H1
The orbital angular momentum of light — ●GIACOMO SORELLI — Laboratoire Kastler Brossel, Sorbonne Université, CNRS, ENS-Université PSL, Collège de France, Paris, France

Light carries energy, as well as linear and angular momenta. While the energy and the linear momentum were already understood in the second half of the nineteenth century, the history of the angular momentum of light is more recent. The angular momentum of an electromagnetic wave can be decomposed into two parts: a spin contribution associated with the vectorial nature of the electromagnetic field, and an orbital contribution which is related to the light's spatial intensity and phase profiles. The spin component of light was already studied in the thirties by Beth, who established a connection between angular momentum and circular polarisation. On the contrary, the orbital contribution was not investigated before the 1990s when Allen and coworkers showed that some paraxial light beams carry a well defined orbital angular momentum (OAM). These beams have a very peculiar spatial profile, which is characterised by a central dark area around the beam axis and a spiral phase front. In this talk, I first introduce the angular momentum of the electromagnetic field from a classical electrodynamics' viewpoint and present some paraxial light beams carrying OAM. I then quantise the electromagnetic field and discuss some quantum properties of the angular momentum of photons. Finally, I describe how OAM-carrying photons are produced in the laboratory and discuss some of their applications in quantum information.

Tutorial AKjDPG 1.2 Mon 9:45 H1

Photoionization with polarization-shaped ultrashort laser pulses — ●MATTHIAS WOLLENHAUPT — Carl von Ossietzky Universität Oldenburg

Nowadays, multiphoton ionization (MPI) using advanced light sources and sophisticated detection techniques is investigated to observe and control ultrafast quantum dynamics. In this tutorial, we present an introduction to the coherent control of photoionization with ultrashort laser pulses and give an overview of experimental techniques for femtosecond laser pulse shaping and tomographic reconstruction of 3D photoelectron momentum distributions. Based on relevant experiments, we will discuss the underlying physical mechanisms of controlled MPI. In the first experiment, phase-locked double pulse sequence laser pulses are used to control interferences in the momentum distribution of free electron wave packets [1]. We introduce non-perturbative control by manipulation of dressed state population dynamics through the optical phases. The main part of the tutorial deals with 3D control of the momentum distribution of free electron wave packets. We discuss the creation of vortex-shaped photoelectron momentum distributions with counterrotating circularly polarized femtosecond laser pulses [2] and highlight experiments with bichromatic carrier-envelope phase-stable polarization-tailored laser pulses to generate c7 rotationally symmetric and asymmetric momentum distributions [3].

[1]M. Wollenhaupt et al., Phys. Rev. Lett. 89, 173001 (2002).

[2]D. Pengel et al., Phys. Rev. Lett. 118, 053003 (2017).

[3]S. Kerbstadt et al., Nat. Comm. 10, 658 (2019).

AKjDPG 2: Tutorial Modern Spectroscopy

Time: Monday 9:00–10:30

Location: H2

Tutorial AKjDPG 2.1 Mon 9:00 H2
spectroscopy at extreme limits — ●HANIEH FATTAHI — Max Planck Institute for the Science of Light

This tutorial is devoted to novel methods for laser spectroscopy. I will give an overview of the fundamentals of spectroscopy, and techniques to resolve electron/molecular dynamics. The tutorial is concluded by discussing emerging spectroscopy techniques and their application in hyperspectral imaging.

Tutorial AKjDPG 2.2 Mon 9:45 H2
Cold molecules: the new frontier — ●GERHARD REMPE — Max Planck Institute of Quantum Optics, Hans-Kopfermann-Str. 1, 85748 Garching, Germany

Understanding the world around us requires understanding molecules

and their interaction with other molecules at the most fundamental quantum level. Towards this goal, radically new cooling and trapping techniques need to be developed for molecules which cannot straightforwardly be manipulated with lasers. Exploiting the presence of a permanent electric dipole moment especially of polyatomic molecules, the new techniques include electrostatic skimming, guiding and trapping, Stark and centrifuge deceleration, as well as cryogenic buffer-gas and Sisyphus cooling. With suitable techniques combined in one setting, it is now possible to prepare samples of simultaneously cold, dense, and slow molecules for, e.g., high-resolution spectroscopy and dipolar-collision studies, thus opening up new possibilities for fundamental-physics and quantum-information experiments. The talk introduces basic concepts of this promising research and discusses selected achievements.

AKjDPG 3: Lunchtalk: NFDI4Phys

Time: Tuesday 13:00–13:30

Location: Audimax

Invited Talk AKjDPG 3.1 Tue 13:00 Audimax
Forschungsdatenmanagement in der Physik - die NFDI4PHYS-Initiative — ●UWE MORGNER — Leibniz Universität Hannover

Erfassen, Verarbeiten und Verfügbarmachen von Daten ist seit jeher das Kerngeschäft der Wissenschaft. Mit wachsender Menge an Daten erwächst die Notwendigkeit eines strukturierten Forschungsdaten-Managements (FDM) - basierend auf übergreifenden Standards. Im Rahmen der Initiative zum Aufbau einer Nationalen Forschungsda-

teninfrastruktur (NFDI) formiert sich gerade ein neues Konsortium, das die Fächerkreise Bio-, Atom-, Molekül-, Plasmaphysik und Optik einbezieht. Darin geht es um die Definition von übergreifenden Datenformaten, von Metadaten-Standards, von Qualitätskriterien und um das öffentliche Bereitstellen in Repositorien. Der Vortrag kann noch keine Ergebnisse oder viele Antworten präsentieren, er führt aber in die vielfältigen Frage- und Problemstellungen ein und erläutert anhand von Beispielen das geplante Vorgehen. Es entsteht eine Vision, wie sich durch FDM unsere Forschung in Zukunft verändern wird.

AKjDPG 4: Online Pub-Quiz

Time: Tuesday 20:00–21:30

Location: Audimax

Pub-Quiz