K 1: Meßtechnik - Optische Verfahren und veränderliche Plasmen

Zeit: Montag 14:00–15:55 Raum: GW2 B2890

Hauptvortrag K 1.1 Mo 14:00 GW2 B2890

Wieviel Information transportiert ein Impuls ? Ist Information eine physikalische Größe ? — •Rudolf Germer — ITPeV und TU-Berlin, germer@physik.tu-berlin.de

Die Qualität einer physikalischen Messung hängt mit der Menge an Information zusammen, die den Meßprozeß begleitet. Der Zusammenhang mit der Anzahl abzählbarer Quanten wurde in den letzten Jahren u.a. beim Messen eines Widerstandes und im Zusammenhang mit dem Informationsgehalt von Bildern diskutiert. Hier kann am Beispiel eines elektrischen Impulses gezeigt werden, welche Kombination physikalischer Größen unabhängig von der Transformation dieses Impulses erhalten bleibt und damit ein Kandidat für die Information als einer physikalischen Basisgröße erscheint. Nebenbei bekommt auch die Sommerfeldsche Feinstrukturkonstante a eine anschauliche Interpretation. Die Information ist eine Kombination aus der Anzahl von abzählbaren Einheiten (hier das Plancksche Wirkungsquantum) und der Qualität dieser Quanten, die im Zusammenhang mit Energie oder Impuls erscheint.

K 1.2 Mo 14:35 GW2 B2890

Simulation of the Onset Conditions of a fs-Laser Induced Plasma and Micro Shock Wave Generation — •Marvin Tammen[1,2], Yun Kai[1,2], Theodor Schlegel[3], Walter Garen[1], and Ulrich Teubner[1,2] — [1]Hochschule Emden/Leer — [2]C.v.O. Universität Oldenburg — [3]Helmholtz-Institut Jena

Downscaling of shock waves towards micro scale is a development direction of shock waves research. In the current work, a femtosecond laser is applied to generate a micro plasma in a thin metal film as a target. The high-pressure and high-temperature plasma subsequently emits a strong shock wave, which is nature*s way to get out of the non-equilibrium state and quickly achieve balance. Of course, the early stage of the shock wave onset is extremely difficult to measure experimentally. Thus, in addition to setting up advanced diagnostics, comprehensive simulations are important. This presentation focuses on the theoretical side of the project, namely a computer simulation using the hydrodynamic code MULTIFS. The code takes into account the equations of states of the ions and electrons, material properties, opacity, radiation transport, heat conduction as well as the laser beam energy deposition mechanism, and it delivers the distribution of pressure, density and temperature of the target and the surrounding materials (in this case, e.g., ambient air). The density (or pressure) peak corresponds to the shock wave front. Via this simulation, important shock wave onset properties including the Mach number can be derived.

In total, the present work represents a new field of fluid mechanics research.

K 1.3 Mo 14:55 GW2 B2890

***XUV-PUMA* Development of a cross-correlator for Flash free-electron Laser** — •Martin Büscher[1], Sven Toleikis[3], Mark Prandolini[4], Beata Ziaja-Motyka[5,6], Niklas Borchers[1,2], and Ulrich Teubner[1,2] — [1]Institut für Laser und Optik, Hochschule Emden/Leer, D-26723 Emden — [2]Institut für Physik, Universität Oldenburg, D-26129 Oldenburg — [3]Deutsches Elektronen-Synchrotron DESY, D-22607 Hamburg — [4]Helmholtz-Institut Jena, Fröbelstieg 3, D-07743 Jena, Germany — [5]CFEL, DESY, Notkestrasse 85, 22607 Hamburg — [6]INP, PAS, Radzikowskiego 152, 31-342 Krakow, Poland

Fourth-generation free-electron lasers like FLASH operating in XUV (extreme ultraviolet) and soft X-ray spectral region between 4,2 - 45 nm, are machines allowing access to novel research-areas. Time-resolved experiments on femtosecond time scale in this wavelength region enable an insight into ultrafast processes on nanoscale. To monitor the FEL pulse duration and arrival jitter on a single-shot basis, a versatile diagnostic tool is needed. Such a tool, namely the *XUV-PUMA* (XUV Pulsdauermeßapparatur) is under development. It will provide single-shot basis information with the intention to be operated simultaneously to the user experiments at FLASH. The working principle is based on a plasma gate, where an optical laser pulse is used to probe the transmission change in a transparent material which is pumped by the FEL pulse. The required ultrashort probe laser pulses will be delivered by a sub-30fs, tunable NOPA laser system which is currently under development. This work is sponsored by BMBF - 05K16ME1

K 1.4 Mo 15:15 GW2 B2890

Characterization of attosecond pulse trains with megahertz repetition rate by interference of two-photon transitions — •Stephan Heinrich[1,2], Alexander Guggenmos[1,2], Fabian Apfelbeck[1], and Ulf Kleineberg[1,2] — [1]LMU München, Fakultät für Physik, Garching, Germany — [2]MPQ, Garching, Germany

The necessary IR intensity for high harmonic generation (HHG) in the XUV spectral range has limited previous experiments to kilohertz repetition rates. In the course of the MEGAS project (megahertz attosecond pulses for ultrafast photoelectron spectroscopy) in cooperation with the two Fraunhofer-Institutes IOF and ILT a novel HHG source with megahertz repetition rate was developed. It consists of an enhancement cavity with several kW circulating power in which attosecond pulse trains (APT) are generated.

Using the RABBITT technique (reconstruction of attosecond beating by interference of two-photon transitions) these pulse trains are then characterized by focusing them into a gas jet and detecting the emitted photoelectrons. Two-photon transitions give rise to sidebands which allow for the reconstruction of the electrical field of the APTs, which has never been done before at comparable repetition rates.

We present first experimental results of HHG at megahertz repetition rate and our progress in the complete characterization of APTs with a 10 kHz system. Once the megahertz HHG source is fully characterized, we are planning to use RABBITT in combination with angular resolved detection for experiments investigating photoemission delays and band structures in solid state targets.

K 1.5 Mo 15:35 GW2 B2890

Angle-resolved photoelectron spectroscopy utilizing attosecond pulse trains — •Alexander Guggenmos[1,2], Stephan Heinrich[1,2], Fabian Apfelbeck[1], and Ulf Kleineberg[1,2] — [1]LMU München, Fakultät für Physik, Garching, Germany — [2]Max-Planck-Institut für Quantenoptik, Garching, Germany

Attosecond physics has led to deep insights on electron dynamics in atoms, molecules and solids. One way to investigate processes on short timescales is the generation of isolated light pulses for attosecond electron streaking. Another approach with similar time resolution are attosecond pulse trains (APTs). Focusing APTs into a gas target photo ionizes the atoms and allows for the pulse characterization by means of the RABBITT technique. The spectral phase information of the APTs is encoded in the relative temporal position of a sideband maximum being created by the interference of neighboring harmonics through two-photon transitions. The characterized APTs allow now the access to photoemission processes in solids with RABBITT. Due to the APTs spectrum of many well separated harmonics with bandwidths of a few 100 meV this technique combines a narrowband excitation and high temporal resolution. This is the prerequisite for time- and angle-resolved photoelectron spectroscopy on band structures of solids. We will present experimental results on the characterization of APTs with a gas target as well as the RABBITT measurements on a tungsten crystal. This will allow for the subsequent step, combining RABBITT and ARPES in attosecond time resolved experiments investigating photoemission delays and band structures in gases and solid state targets.