K 5: New Methods and Laser Diagnostics

Time: Wednesday 16:30–17:45 Location: K-H4

Invited Talk K 5.1 Wed 16:30 K-H4

Physikalische Information und Naturkonstanten — •Rudolf Germer — ITP e.V. — TU-Berlin

Die hier vorgestellte Art physikalischer Information basiert auf einer abzählbaren Menge von Wirkungsquanten h und der Energie E als eine die Zahl der Wirkungsquanten ergänzende Größe mit Bezug auf Genauigkeiten. Eine solche Information erscheint kleinstmöglich als Beziehung zwischen Objekten, Ereignissen u.a. in Form von Abständen, Zeitdifferenzen, Kräften* Bei Information tragenden Photonen finden wir $E = h*f = h*c/\lambda$. Information existiert aber auch holistisch in Bezug auf Gruppen physikalischer Objekte. Diese Idee lässt sich an einigen bekannten Beispielen der Physik demonstrieren. Im elektromagnetischen Fall führt dies dazu, daß die dort bekannten Quanten mit zahlreichen Naturkonstanten in der Geometrie des elektromagnetischen Quaders (EMQ) veranschaulicht werden können. Daraus folgt, daß mehr als ein Dutzend Naturkonstanten auf nur vier Ausgangsgrößen zurückgeführt werden können. Weitere Einzelheiten finden Sie im wikibook *Die abzählbare Physik*. Zur Diskussion : germer@physik.tu-berlin.de

K 5.2 Wed 17:15 K-H4

Attoseconds on a Chip - Time Domain Measurement of a Near-IR Transient — •Felix Ritzkowsky[1,2], Mina Bionta[2], Marco Turchetti[2], Yujia Yang[2], Dario Cattozo Mor[2], William Putnam[3], Karl Berggren[2], Franz Kärtner[1], and Phillip Keathley[2] — [1]Deutsches Elektronen Synchrotron (DESY) & Center for Free-Electron Laser Science, Hamburg, Germany — [2]Research Laboratory of Electronics, Massachusetts Institute of Technology, Cambridge, MA 02139, USA — [3]Department of Electrical and Computer Engineering, University of California, Davis, CA, USA

We report on a cross-correlation technique based on perturbation of local electron field emission rates that allows for the full characterization of arbitrary electric fields down to 5 fJ using plasmonic nanoantennas. Plasmonic nanoantennas in combination with ultrafast, few-cycle laser pulses allow for highly non-perturbative experiments that have previously only been demonstrated in the gas phase with high power, low repetition rate laser systems. By exploiting the plasmonic excitation in a metallic nanostructured device, electric field strengths exceeding $\sim$30 GV m^{-1} can be reached at the nanostructure with optical pulse energies of several tens of pJ. This enables sub-cycle attosecond electron bursts to be coherently driven by the electric near field of the plasmon, which we use to sample the near-infrared field-transients at the nanoantenna tip *in-situ*. These results show that this technique can resolve electric fields in amplitude and phase with a potential PHz bandwidth. This technique will enable time-domain spectroscopy to be applied from the infrared to the visible spectral range.

K 5.3 Wed 17:30 K-H4

Recording terahertz pulses and their spectra in single-shot at the ELBE facility, by associating the photonic time-stretch and DEOS techniques — •Christelle Hanoun[1], Christophe Szwaj[1], Eleonore Roussel[1], Serge Bielawski[1], Pavel Evtushenko[2], Christof Schneider[2], Anton Ryzhov[2], Michael Kuntzsch[2], and Sergey Kovalev[2] — [1]PhLAM Laboratory, UMR CNRS 8523, Lille University, France — [2]Radiation Source ELBE, Helmholtz-Zentrum Dresden-Rossendorf, Germany

Sources of intense terahertz radiation and/or high repetition rate are available for applications in several laser and accelerator facilities worldwide. This opened new opportunities, and several high-performance THz metrology systems have been demonstrated and employed for experiments. Nevertheless, some significant challenges in the field of THz measurements remain open. This concerns both Time-Domain Spectroscopy Applications as well as real-time diagnostics of the sources. We present here a novel THz electro-optic measurement strategy that aims at a high repetition rate (up to tens of millions of THz spectra per second when needed) thanks to the use of the so-called photonic time-stretch technique, and that is also capable of high effective bandwidth by using the recently introduced Diversity Electro-Optic Sampling (DEOS) retrieval technique (https://arxiv.org/abs/2002.03782). We will present the first tests of this design using terahertz pulses in the 100 nJ range, with 50 kHz repetition rate, generated by the Coherent Diffraction Radiation (CDR) source of ELBE, at Helmholtz-Zentrum Dresden-Rossedorf (HZDR).