K 4: Poster

Time: Tuesday 16:30–19:00 Location: Empore Lichthof

K 4.1 Tue 16:30 Empore Lichthof

Compression of multi-mJ, 35-fs to the few-cycle regime — •Yinyu Zhang[1], Philipp Wustelt[1,2], Max Moeller[1,2], Max Sayler[1], and Gerhard Paulus[1,2] — [1]Institute for Optics and Quantum Electronics, Jena, Germany — [2]Helmholtz Institut Jena, Jena, Germany

Laser pulses of few optical cycles duration and high pulse energy have become fundamental tools for many ultra-intense and ultrafast nonlinear science experiments, such as high-harmonic generation (HHG) and attosecond physics. Here we present a study of few-cycle pulses with multi-mJ pulse energy from a Ti: Sapphire laser system with 35-fs pulse duration. The pulse compression by a hollow core fiber (HCF) filled with gradient pressure of noble gases and filamentation were studied. The experimental parameters and the compression results from two compression mechanisms were compared.

In addition, the efficiency of coherent pulses combination of delayed pulses were tested for compression through a HCF and filamentation. The birefringent crystals, quartz and calcite with different thickness were used for temporal pulse division and coherent combination. Pulses with 10-fs pulse duration and multi-mJ energy were generated with different compression techniques

K 4.2 Tue 16:30 Empore Lichthof

Excited State Dynamics and Conformations of a Cu(II)-Phthalocyanine-Perylenebisimide Dyad — •Kevin Wilma[1], Thomas Unger[2], Manuel Hollfelder[3], Christoph Hunger[4], Sinem Tuncel[4,5], Anna Köhler[2], Mukundan Thelakkat[4], Stephan Gekle[3], Jürgen Köhler[1], and Richard Hildner[1] — [1]Experimentalphysics IV, University of Bayreuth — [2]Experimentalphysics II, University of Bayreuth — [3]Physics Department, University of Bayreuth — [4]Applied Functional Polymers, University of Bayreuth — [5]Technical University of Gebze, Turkey

We investigate a new molecular donor-bridge-acceptor system, a Cu(II)-phthalocyanine (CuPc) covalently linked via a long, flexible spacer group to a perylenebisimide (PBI), for its potential use in solar cell applications. In order to get insights into the excited state dynamics and the conformation of this dyad, we performed time-resolved polarization anisotropy and pump-probe measurements in combination with molecular dynamics simulations. The data suggest the existence of two conformations of the dyad: an extended conformation and a highly stable folded structure, in which PBI and CuPc are stacked on top of each other. The extended dyad shows emission from both PBI and CuPc. In contrast, for the folded conformation the emission of the dyad is strongly quenched, due to energy transfer from the PBI to CuPc (3 ps) and subsequent intersystem-crossing (300 fs) from the first excited singlet state of CuPc into the triplet state. Finally (non-)radiative deactivation of the triplet state takes place within 25 ns.

K 4.3 Tue 16:30 Empore Lichthof

An XUV and soft X-ray split-and-delay unit for FLASH II — •Matthias Rollnik, Sebastian Roling, Frank Wahlert, Michael Wöstmann, and Helmut Zacharias — Westfälische Wilhelms-Universität Münster, Germany

An XUV and soft X-ray split-and-delay unit is built that enables time-resolved pump-probe experiments covering the whole spectral range of FLASH II from $h\nu = 30$ eV up to 1500 eV. With wave front beam splitting and grazing incidence angles sub-fs resolution with a maximum delay of -6 ps $< \Delta t < +18$ ps will be achieved. Two different coatings are required to cover the complete spectral range. Therefore, a design that is based on a three dimensional beam path allows choosing the propagation via two sets of mirrors with these coatings. A Ni coating will allow a total transmission on the order of $T = 55\,\%$ for photon energies between $h\nu \approx 30$ eV and 600 eV at a grazing angle of $\theta = 1.8°$ in the variable delay line. With a Pt coating at a grazing angle of $\theta = 1.3°$ a transmission of $T > 29\,\%$ will be possible for photon energies up to $h\nu = 1500$ eV. For a future upgrade of FLASH II the Ni coating can be used at a grazing angle of $\theta = 1.3°$ to cover a range up to $h\nu \approx$ 2500 eV.

K 4.4 Tue 16:30 Empore Lichthof

Wavefront propagation study concerning the influence of non-ideal mirror surfaces inside a split-and-delay unit on the focusability of XFEL-pulses — •Victor Kärcher[1], Sebastian Roling[1], Liubov Samoylova[2], Karen Appel[2], Frank Siewert[3], Harald Sinn[2], Ulf Zastrau[2], and Helmut Zacharias[1] — [1]Westfälische Wilhelms-Universität Münster — [2]European XFEL GmbH, Hamburg — [3]Helmholtz-Zentrum Berlin für Materialien und Energie

For the High Energy Density (HED) instrument at the SASE2 - Undulator at the European XFEL an x-ray split-and-delay unit (SDU) is built covering photon energies from $h\nu = 5$ keV up to $h\nu = 24$ keV. This SDU will enable time-resolved x-ray pump / x-ray probe experiments as well as sequential diffractive imaging on a femtosecond to picosecond time scale. In order to reach intensities on the order of 10^{15} W/cm^2 the XFEL pulses will be focused by means of compound refractive lenses (CRL) to a diameter of $D = 24\,\mu$m. The influence of wavefront disturbances caused by height- und slope-errors of the mirrors inside the SDU on the quality of the two focused partial beams is studied by wavefront propagation simulations using the WPG-framework.

K 4.5 Tue 16:30 Empore Lichthof

A split-and-delay unit for the European XFEL: Enabling hard x-ray pump/probe experiments at the HED instrument — •Sebastian Roling[1], Karen Appel[2], Stefan Braun[3], Peter Gawlitza[3], Harald Sinn[2], Frank Wahlert[1], Ulf Zastrau[2], and Helmut Zacharias[1] — [1]Westfälische Wilhelms-Universität Münster — [2]European XFEL GmbH, Hamburg — [3]Fraunhofer IWS, Dresden

For the High Energy Density (HED) instrument at the SASE2 - Undulator at the European XFEL an x-ray split-and-delay unit (SDU) is built covering photon energies from $h\nu = 5$ keV up to $h\nu = 24$ keV. This SDU will enable time-resolved x-ray pump / x-ray probe experiments as well as sequential diffractive imaging on a femtosecond to picosecond time scale. Further, direct measurements of the temporal coherence properties will be possible by making use of a linear autocorrelation.The x-ray FEL pulses will be split by a sharp edge of a silicon mirror coated with Mo/B_4C and W/B_4C multilayers. Both partial beams will then pass variable delay lines. For different wavelengths the angle of incidence onto the multilayer mirrors will be adjusted in order to match the Bragg condition. Because of the different incidence angles, the path lengths of the beams will differ as a function of wavelength. Hence, maximum delays between ± 1.0 ps at $h\nu = 24$ keV and up to ± 23 ps at $h\nu = 5$ keV will be possible. Measurements of the reflectance of the multilayer coatings have been performed at the ESRF yielding a maximum reflectance of the Mo/B_4C coating of R = 0.85.

K 4.6 Tue 16:30 Empore Lichthof

Ripple-Bildung in der Oberfläche von Metallen und Hartstoffen durch Bestrahlung mit Femtosekundenlaserstrahlpulsen — •Andy Engel, Manuel Pfeiffer und Steffen Weissmantel — Hochschule Mittweida, University of Applied Sciences, Technikumplatz 17, 09648 Mittweida, Germany

Es werden Ergebnisse von Untersuchungen zur Ripple-Bildung in der Oberfläche von Metallen und Hartstoffen durch Bestrahlung mit Ultrakurzpuls-Laserstrahlung präsentiert. Für die Versuche wurde eine Femtosekundenlaseranlage mit einem integrierten Clark-MXR CPA 2010 (Lasersystem: Wellenlänge 775 nm, Repetitionsrate 1 kHz, maximale Pulsenergie 1 mJ, Pulsdauer 150 fs) genutzt. Im Fokus dieser Arbeiten stand die Ermittlung der Abhängigkeiten der Ripple-Entstehung von den applizierten Laser- und Prozessparametern. Es wurden grundlegende Untersuchungen zur Entstehung der Ripple-Strukturen durchgeführt. Hierbei wurde insbesondere der Einfluss der Oberflächenmorphologie, der Schichtdicke aufgebrachter Hartstoffschichten sowie der Pulsanzahl analysiert. Des Weiteren werden Ergebnisse zum Einfluss der Polarisation der auftreffenden Laserstrahlung auf die Ausbildung der Ripple-Strukturen präsentiert. Auf der Grundlage der durchgeführten Arbeiten können Parameterbereiche und Bearbeitungsregime aufgezeigt werden, welche eine homogene und zeiteffiziente Erzeugung von Ripple-Strukturen in den untersuchten Materialien ermöglichen.

K 4.7 Tue 16:30 Empore Lichthof

Einzelpulsabtrag von Metallschichten mit ultrakurzen Laserpulsen unterschiedlicher Pulsdauer — •Peter Lickschat, Jörg Schille, Markus Olbrich, Lutz Schneider, Alexander Horn

und Steffen Weissmantel — Laserinstitut Hochschule Mittweida, Technikumplatz 17, D-09648 Mittweida

Grundlagenuntersuchungen zum Abtragprozess mittels ultrakurzer Laserpulse werden präsentiert. Bei den Untersuchungen wurden Einzelpulsabträge auf Platin-, Aluminium- bzw. Goldschichten realisiert, um Abhängigkeiten des Abtrages von der Fluenz und der Pulsdauer aufzuzeigen. Die Pulsdauer wurde im Bereich von 200 fs bis 10 ps und die Fluenz der Laserpulse von 0,8 J/cm^2 bis 15 J/cm^2 variiert. Zum Vergleich und zur Interpretation der Ergebnisse wurden der Ablationsdurchmesser, die Ablationstiefe und das ablatierte Volumen bestimmt. Dabei zeigte sich, dass in Abhängigkeit von der Pulsdauer bei gleicher Fluenz sich sowohl der Ablationsdurchmesser als auch die Ablationstiefe und damit verbunden auch das pro Laserpuls ablatierte Volumen ändern. Die Änderung der unterschiedlichen Ablationskenngrößen ist dabei stark materialabhängig. Die höchste Effizienz (abgetragenes Volumen pro mittlerer Leistung) des Abtragsprozesses wird bei den untersuchten Materialien in unterschiedlichen Parameterfenstern erreicht.