Q 53: Ultrashort Laser Pulses I

Time: Thursday 11:00–12:00 Location: K/HS2

Q 53.1 Thu 11:00 K/HS2

Observation of pulse dynamics and self-compression along a filament — •Martin Kretschmar[1], Carsten Brée[2], Tamas Nagy[1,3], Ayhan Demircan[1], Heiko G. Kurz[1], Uwe Morgner[1], and Milutin Kovacev[1] — [1]Leibniz Universität Hannover, Institut für Quantenoptik, Hannover — [2]Weierstrass-Institut für angewandte Analysis und Stochastik, Berlin — [3]Laser-Laboratorium Göttingen, Göttingen

Filaments emerge when the focusing nature of the Kerr-effect is counteracted by plasma-defocusing, leading to the formation of a long, high-intensity propagation region. Complex spatio-temporal dynamics taking place during the filamentation process strongly influence the propagating pulse. Here, we report on the direct experimental observation of pulse-splitting dynamics along a femtosecond filament. The pulse experiences a significant self-shortening during the propagation, leading to pulse durations of 5.3 fs. The pulses are measured without external pulse compression. A compression factor of eight is achieved in a single filamentary stage. Theoretical modeling of the fundamental pulse propagation confirms our experimental observations and gives further insight into the nonlinear dynamics occuring along a filament.

Q 53.2 Thu 11:15 K/HS2

Passively CEP stabilised few-cycle laser pulses in the near-infrared — •Jörg Robin[1], Jan Vogelsang[1], Christoph Lienau[1], and Petra Gross[1,2] — [1]Carl von Ossietzky Universität, 26129 Oldenburg — [2]Universität Osnabrück, 49076 Osnabrück

Understanding fundamental mechanisms on a femtosecond timescale such as charge transfer processes in light harvesting structures [1] or the coherent motion of electrons in the vicinity of metallic nanostructures [2] requires an ultrafast pulsed laser source. Here, we demonstrate a passively carrier-envelope phase (CEP) stabilised source [3] delivering two-cycle laser pulses of up to 220 nJ pulse energy and tunable between 1200-2100 nm [4]. Pulses at up to 5 kHz from a regenerative titanium:sapphire chirped pulse amplifier generate a white light continuum, from which both a broadband spectrum in the visible and a narrowband spectrum in the infrared are parametrically amplified in two non-collinear stages pumped by the second harmonic of the driving pulses. By recombining both stages via difference frequency generation CEP fluctuations cancel to within $<$800 mrad RMS shot-to-shot and $<$50 mrad RMS averaged over 100 pulses, both measured over 20 minutes by spectral f-to-2f interferometry. This compares favourably to similar systems [5] and makes our system highly suitable for the experiments mentioned above. [1] Pittalis, S., Delgado, A. et al. Adv. Funct. Mater. (2014), doi:10.1002/adfm.201402316 [2] Piglosiewicz, B. et al. Nat. Photon. 8, 37 (2014) [3] Cerullo, G. et al. Laser Photonics Rev. 5, 323 (2011) [4] Vogelsang, J., Robin J. et al. Opt. Express 22, 25295 (2014) [5] Homann, C. et al. Opt. Lett. 37, 1673 (2012)

Q 53.3 Thu 11:30 K/HS2

High-order harmonic generation from ablated nanoparticle plasmas — •Michael Wöstmann[1], Pavel Redkin[2], Jiaan Zheng[1], Henrik Witte[1], Rashid Ganeev[3], and Helmut Zacharias[1] — [1]Physikalisches Institut, Westfälische Wilhelms Universität, Deutschland — [2]Smarkand State University, Usbekistan — [3]Institute of ion-Plasma and Laser Physiks, Usbekistan

Plasmas from laser ablated nanoparticles and solid targets are used for high harmonic generation (HHG). These new materials potentially lead to increased efficiencies of the process as well as to higher cut-off energies. Some materials also show a single enhanced harmonic through Fano resonances in the recombination step. As source an amplified Ti:sapphire laser system with pulse durations of about 40 fs and pulse energies of up to 4 mJ at a repetition rate of 1 kHz is used. For the ablation a small part of the uncompressed radiation from the same laser is branched off. The delay between the pulses depends on the mass of the ablated material. HHG has been studied for Cu, Zn, Ag and carbon and silver. Comparative conversion efficiencies are presented for laser ablated carbon plasmas and gaseous argon plasmas.

Q 53.4 Thu 11:45 K/HS2

High-power ultraviolet to mid-IR multi-color OPCPA system for femtosecond pump-probe experiments — •Matthias Baudisch[1], Michael Hemmer[1], and Jens Biegert[1,2] — [1]ICFO-Institut de Ciencies Fotoniques, 08860 Castelldefels, Barcelona, Spain — [2]ICREA-Institucio Catalana de Recerca i Estudis Avançats, 08010 Barcelona, Spain

Here we report for the first time on an OPCPA-based high peak-power multi-color radiation-source at 160 kHz repetition-rate with phase-coherent outputs from 400 nm to 3300 nm. Typically, visible to mid-IR multi-color sources are based on cascaded parametric down-conversion schemes driven by amplified Ti:sapphire lasers, resulting in weak outputs in the mid-IR in comparison to the fundamental. In contrast, our approach uses the signal and idler from a high-power mid-IR OPCPA to generate the multiple wavelengths. Using cascaded up-conversion we are able to generate stable femtosecond outputs at 3100 nm, 1600 nm, 800 nm and 400 nm with peak powers of 360 MW, 156 MW, 65 MW and 40 MW at a repetition rate of 160 kHz. All output pulses are intrinsically synchronised, allowing pump-probe experiments with sub-100 fs resolution. These unique operating parameters make this source an enabling tool for novel time-resolved nonlinear spectroscopy experiments in the mid-IR.