Q 53: Ultrakurze Pulse: Anwendungen III

Zeit: Donnerstag 16:30–17:45 Raum: VMP 6 HS-A

Q 53.1 Do 16:30 VMP 6 HS-A

Concepts of phase, amplitude, and polarization shaping — •Fabian Weise, Stefan M. Weber, Mateusz Plewicki, Ludger Wöste, and Albrecht Lindinger — Institut für Experimentalphysik, Freie Universität Berlin, Arnimalle 14, 14195 Berlin

Femtosecond pulse shaping is a very powerful technique and was successfully applied to a variety of different systems - especially in the field of coherent control. Extending the common parameters phase and amplitude by including the parameter polarization became an emerging topic in the past few years. Since physical systems are mostly three dimensional, adding the polarization increases significantly the controllability.

Initially, we will discuss different concepts of femtosecond polarization shaping and their experimental implementation. We present new setups for pulse shaping which enable us to simultaneously and independently modulate the parameter phase, amplitude, and polarization. We demonstrate the capabilities of these setups using systematic scans of the relevant pulse parameters and parametric example pulses.

Furthermore, we present the implementation in a feedback loop optimization of multi photon ionization of NaK in a molecular beam. The resulting pulse increases the ionization yield compared to a pulse without polarization modulation. The pulse form reveals the ionization dynamics including the orientation of the transition dipole moment of the participating electronic states.

Q 53.2 Do 16:45 VMP 6 HS-A

Controlling spectral hole intensities via self-phase modulation using tailored fs laser pulses — •Jens Köhler, Tillmann Kalas, Cristian Sarpe-Tudoran, Matthias Wollenhaupt, and Thomas Baumert — Universität Kassel, Institut für Physik und Center for Interdisciplinary Nanostructure Science and Technology (CINSaT), Heinrich-Plett-Str. 40, D-34132 Kassel, Germany

In previous experiments [1] we have removed a small interval of frequency components from the broad spectrum of an ultrashort laser pulse in order to study the refilling of the resulting spectral hole via self-phase modulation (SPM) as a function of the laser intensity. Recently, making use of femtosecond pulse shaping techniques we extended our studies by taking into account additional parameters like the magnitude of amplitude modulation and the spectral phase in the corresponding spectral range. By using the spectral phase as single control parameter holes with adjustable depth as well as an intensity overshoot in a narrow spectral band are observed. The optimization of the spectral hole generation and refilling process is discussed. Results on controlling the spectral hole intensities employing spectrally phase and/or amplitude modulated femtosecond laser pulses are presented. In addition, we suggest possible applications of these effects in the field of label-free nonlinear microscopy, such as the use as a new contrast mechanism for the investigation of transparent samples.

[1] A. Präkelt *et al.*: Appl. Phys. Lett. **87**(12), 121113 (2005)

Q 53.3 Do 17:00 VMP 6 HS-A

Pulse characterization in the UV down to 263 nm by autocorrelation measurement using diamond photodiodes — •Fabian Kleimeier[1], Thorben Haarlammert[1], Jean-Francois Hochedez[2], Ali BenMoussa[2], Udo Schühle[3], and Helmut Zacharias[1] — [1]Physikalisches Institut, Westfälische Wilhelms-Universität, Wilhelm-Klemm-Str. 10, 48149 Münster, Germany — [2]Royal Observatory of Belgium, Ringlaan 3, 1180 Brussels, Belgium — [3]Max-Planck-Institut für Sonnensystemforschung, Max-Planck-Str. 2, 37191 Katlenburg-Lindau, Germany

Interferometric second-order autocorrelation is a common way to characterise ultra-short pulses. Until recently this method was limited to wavelengths greater than 400 nm due to the lack of nonlinear materials or photodiodes with a sufficiently large bandgap. Solar-blind diamond pin-photodiodes developed within the LYRA project for the space mission PROBA-II have a bandgap of 5.5 eV, corresponding to a wavelength of about 225 nm, which permits two-photon absorption of light at wavelength longer than about 230 nm without significant background by a linear response. Using these diodes we were able to record fringe-resolved second-order autocorrelations of the second and third harmonic of a Ti:sapphire laser. The phase can be reconstructed by optimization algorithms using schemes like PICASO (femtosecond pulse retrieval by Phase and Intensity from Correlation And Spectrum Only).

Q 53.4 Do 17:15 VMP 6 HS-A

Self-referencing of optical frequency combs — •C. Grebing, S. Koke, and G. Steinmeyer — Max Born Institute, Berlin, Germany

Stabilization of the carrier-envelope phase (CEP) drift of femtosecond oscillators has found widespread application in frequency metrology and high-field nonlinear optics. To date, stabilization of laser oscillators exclusively relies on phase coherent locking of the measured carrier-envelope frequency f_{CE} to a reference [1]. Such locking always requires feedback into the laser, which, however, causes detrimental side effects on other laser parameter and requires complex locking electronics. Additionally, using the traditional stabilization sheme it is impossible to produce a pulse train with constant CEP ($f_{CE} = 0$), which would greatly simplify the set-up of CEP stable amplified systems. We propose and demonstrate a novel technique that allows for intrinsic stabilization of an optical frequency comb to zero offset. Our scheme does neither require any sophisticated servo electronics nor any feedback to the laser. It relies on splitting the output beam of a femtosecond oscillator by means of an acousto-optic frequency shifter (AOFS), with the zero-order signal being fed into an f-to-$2f$ interferometer. This interferometer serves to measure the f_{CE}, which is electronically filtered out and directly fed into the piezoelectric transducer of the AOFS. Doing so, the AOFS output in the first diffraction order experiences a shift by exactly f_{CE}, i.e., it is shifted to a constant CEP. Our method is readily applicable to any type of mode-locked laser, with the measurability of f_{CE} being the only prerequisite.

[1] A. Poppe, et al., Appl. Phys. B **72**, 373 (2001).

Q 53.5 Do 17:30 VMP 6 HS-A

Chromatic dispersion spectrometer for joint spectral measurements — Malte Avenhaus, •Andreas Eckstein, Peter Mosley, and Christine Silberhorn — Max-Planck-Institut for the Science of Light, Erlangen

We introduce a simple yet powerful method to measure the joint spectral intensitiy of ultrashort bi-photon states, applicable to a broad wavelength range. To this end we utilize the chromatic dispersion of an optical fiber as well as time-resolved single photon detection. The wavelength working range of our spectrometer is limited by photon detector sensitivity only. We achieve high resolution with moderate measurement times in the telecom wavelength regime and demonstrate resulting spectra from a KTP-based parametric downconversion source.