Q 39 Nichtlineare optische Effekte & Lichtquellen

Zeit: Dienstag 10:45–13:00 Raum: HU 2014a

Q 39.1 Di 10:45 HU 2014a

Filling a spectral hole via self-phase modulation — •Andreas Präkelt, Matthias Wollenhaupt, Cristian Sarpe-Tudoran, Andreas Assion, and Thomas Baumert — Universität Kassel, Institut für Physik und CINSaT, Heinrich-Plett-Str. 40, D-34132 Kassel, Germany

Self-phase modulation is used in different nonlinear optical experiments, such as nonlinear femtosecond laser pulse compression techniques and transient absorption spectroscopy. We used a spatial light modulator to remove an interval of frequency components from the spectrum of a femtosecond laser pulse. Spectral redistribution effects, due to self-phase modulation were studied close and below the threshold energies. We give a physical picture of the surprising effect that the removed frequency components are not only generated by self-phase modulation but even overshoot their neighboring frequencies in power spectral density. In addition, we investigate possible applications in the field of nonlinear microscopy.

Q 39.2 Di 11:00 HU 2014a

Orthogonal polarisierte Kelly-Seitenbänder in einem Erbium-Faserlaser — •Tom Voigt und Fedor Mitschke — Institut für Physik, Universitätsplatz 3, 18055 Rostock

Läuft ein Puls in einem passiv modengekoppelten Erbium- Faserlaser um, so kann das zugehörige optische Spektrum eine Reihe von Seitenbändern aufweisen. Das ist typisch für ein periodisch gestörtes Soliton. Dabei haben die Seitenbänder (Kelly-Seitenbänder [1]) eine charakteristische, annähernd symmetrische Anordnung. Aus ihren Positionen lassen sich Pulsdauer und Resonatordispersion bestimmen. Manchmal treten jedoch viele Seitenbänder in einer komplexeren Anordnung auf. Eine mögliche Erklärung wäre, dass gleichzeitig mehrere verschiedene Solitonen im Resonator umlaufen. Diese Hypothese wird von Untersuchungen an einem Erbium- Faserlaser in Figure-8-Konfiguration unterstützt, bei denen festgestellt wurde, dass zueinander orthogonal polarisierte Seitenbänder auftreten.

[1] S. M. J. Kelly, Electron. Lett. **28**, 802 (1992)

Q 39.3 Di 11:15 HU 2014a

Adaptive Kontrolle Hoher Harmonischer mittels räumlicher Strahlformung — •Dominik Walter, Ron Kemmer, Thomas Pfeifer, Robert Spitzenpfeil, Carsten Winterfeldt, Gustav Gerber und Christian Spielmann — Physikalisches Institut, Universität Würzburg, Am Hubland, 97074 Würzburg, Germany

Fokussiert man ultrakurze Laserpulse (800 nm, 10^{14} W/cm^2) in eine mit Gas gefüllte Hohlfaser, entstehen aufgrund nichtlinearer Effekte Hohe Harmonische im UV- und weichen Röntgenbereich. Bei geeignetem Gasdruck entsteht das harmonische Spektrum phasenangepasst zum IR-Puls, wobei auch die angeregten Fasermoden eine wesentliche Rolle spielen. Ziel ist es, durch räumliche Kontrolle des in die Hohlfaser eingekoppelten IR-Pulses die Anregung der Fasermoden und damit auch gleichzeitig das Spektrum der Hohen Harmonischen zu steuern. Dies geschieht durch Formung der 2D Phasenfronten des einfallenden Laserpulses mit Hilfe eines LCD-Pulsformers (768 x 768 Pixel). Die Optimierung wird dabei automatisch vom Computer durch einen evolutionären Algorithmus gesteuert. Wir zeigen, dass wir die erzeugten UV-Spektren nicht nur beeinflussen, sondern auch die Konversionseffizienz noch weiter steigern können. Die räumliche Intensitätsverteilung der Strahlung nach der Faser wurde untersucht und gibt Aufschluss über die physikalischen Hintergründe des Konversionsprozesses.

Q 39.4 Di 11:30 HU 2014a

Nanostructures observation with Near-field microscop in the finger print region (1500-4000 cm-1) — •Jean-Sébastien Samson, Andreas Bergner, Götz Wollny, Erik Brundermann, and Martina Havenith — Ruhr-Universität-Bochum, Physikalische Chemie 2,NC 2/72, 44780 Bochum

In contrast to optical techniques the middle infrared which is able to characterize different functional groups by their chemical fingerprint allows label free detection. the laser source we use is a high power optical parametric oscillator (OPO) made with a periodically polled Lithium Niobate crystal. This laser source is tunable between 1500 and 4000 cm-1 and is stable in wavelength and intensity. We use the cantilever of an AFM as a nanoemitter. first measurements were performed on a gallium implanted nanostructure that prooved that we are able to scan the chemical composition of a absolutly flat surface. The lateral resolution is 30 nm which correspond to lambda/100 and is far below the Rayleigh limit. this Set-up is very attractive for observation of surface plasmon in the infrared and imaging of functional group in living cells.

Q 39.5 Di 11:45 HU 2014a

Harmonic generation and Dynamic localization in a driven two-level system, non-perturbative results using the Floquet-Green operator — •Dario F. Martinez — Max-Planck-Institut für Physik komplexer System, Nöthnitzer Str. 38, 01187 Dresden

A general solution for the quasienergies and eigenstates of this system is obtained using the Floquet-Green formalism. From the time-evolution operator we study the general features of the dynamic localization of the system and also obtain general non-perturbative expressions for the time-dependent dipole moment. We discuss the different kinds of harmonics generated by the external driving and their dependence on the initial state and on the different parameters of the problem.

Q 39.6 Di 12:00 HU 2014a

Self-focusing of ultrashort intense laser pulses in gases: A variational analysis of the nonlinear Schrödinger equation — •E. Arevalo and A. Becker — Max-Planck-Institut für Physik komplexer Systeme, Nöthnitzer Str. 38, 01187 Dresden

We investigate the process of self-focusing of an ultrashort intense laser pulse in gas medium. To this end, we use the self-similarity assumption of the electric field envelope together with a phase correction. In the latter we take into account the low-intensity background part of the pulse via perturbation theory. The ansatz is used as a trial solution in a variational method and solutions for the width, intensity and self-focusing distance of the pulse are derived. The results are in good agreement with numerical solutions over a broad range of input powers and show the important influence of the low-intensity background of the pulse on its propagation dynamics.

Q 39.7 Di 12:15 HU 2014a

Resonant light scattering by optical solitons — •Andrey Gorbach[1], Sergej Flach[1], Victor Fleurov[2], and Andrey Miroshnichenko[3] — [1]Max-Planck-Institut fuer Physik komplexer Systeme, Noethnitzerstr. 38, Dresden 01187, Germany — [2]Tel Aviv University, Tel Aviv 69978, Israel — [3]Australian National University, Canberra ACT 0200, Australia

The process of light scattering by optical solitons in a planar waveguide with an inhomogeneous refractive index core is considered. A specific core configuration is proposed, which supports resonant reflection (Fano resonances) as well as resonant transmission of light by optical solitons. All resonant effects can be easily controlled in experiment by changing the soliton amplitude.

Q 39.8 Di 12:30 HU 2014a

Diode-pumped compact broadband femtosecond white-light laser sources using tapered fibers — •Jörn Teipel[1], Diana Türke[1], Harald Giessen[1], Alexander Killi[2], and Uwe Morgner[2] — [1]Institut für Angewandte Physik, Wegelerstr. 8, D-53115 Bonn — [2]MPI für Kernphysik, Saupfercheckweg 1, D-69117 Heidelberg

The generation of supercontinua in photonic fibers with different kinds of laser sources has recently gained a lot of attention. It was shown that femto-, pico-, and even nanosecond pulses are suitable for continuum generation. Theoretically there is a large market for white light laser sources, e.g., for OCT, for frequency metrology, or in spectroscopy and microscopy. But the generally expensive fs laser system limits the number of applications. Therefore, our approach was the reduction of the costs of the laser system in combination with a minimization of its size. The Yb:glass oscillator has the ability of generating fs pulses and the advantage of being directly diode-pumped, which dramatically cuts the costs of this laser system. At the same time the size of the system becomes very compact. We report on the combination of a cavity dumped Yb:glass oscillator that runs at a wavelength of 1040 nm with tapered fibers of different diameters, and thus different zero-dispersion wavelengths. The laser has a repetition rate of 166 kHz, a pulse duration of 250 fs, and

a maximum pulse energy of 300 nJ. Furthermore, we use the frequency-doubled output of this laser at 520 nm with 300 fs pulse duration and a maximum pulse energy of 50 nJ. Respectively, up to 1200 nm and 400 nm broad single mode supercontinua were generated - well suited for the above mentioned applications.

Q 39.9 Di 12:45 HU 2014a

Amplitude and Phase Coherence Properties — •Diana Türke, Sebastian Pricking, and Harald Giessen — Institut für Angewandte Physik, Universität Bonn, Wegelerstraße 8, D-53115 Bonn

The coherence properties of supercontinuum trains generated in tapered fibers as well as in photonic crystal fibers have become a demanding topic, as they are the key issue when trying to compress visible light pulses below a one femtosecond pulse duration. Pulse compression based on a pulse shaper is needed to adjust the phases of the different spectral components with respect to each other in order to achieve the required flat phase. Therefore, the pulse-to-pulse phase noise of the spectral components is a very critical parameter. Our approach is gaining direct experimental access to the phase noise by measuring the pulse-to-pulse coherence and the amplitude noise of the supercontinuum by using an asymmetric Michelson interferometer with different arm-length to interfere subsequent pulses.

Additionally, the contribution of amplitude noise to the visibility of the spectral interference pattern is investigated.

We find a large degree of coherence in a wide range of spectral components for certain input pulse conditions.