Seminar über Ultrafast Science and Technology

Referent/in: Dr. Hiroaki Minamide, Team Leader, RIKEN center for Advanced Photonics, RIKEN, Sendai, Japan

Titel: THz-driven surface plasmon polariton undulator

Recent progress of high-brightness terahertz (THz)-wave generation and detection would be presented, which are based on nonlinear wavelength conversion between infrared and THz-wave applications. The injection-seeded THz-wave parametric generator (is-TPG) technique can support THz-wave sensing with a high dynamic range of over 100 dB. Broadband tunability from 0.8 to 4.7 THz can identify mixed molecules in atmosphere. Additionally, a high repetition rate of up to 100 kHz can provide real-time measurement for various applications. The THz-wave linewidth was almost 4 GHz, corresponding to near Fourier-transform-limited pulses.

Moreover, a backward optical parametric oscillators operating in the terahertz (THz)-frequency region have been developed with a mirrorless structure and a tunable wavelength. The robust and small (palmtop-sized) THz-wave source will facilitate the use of THz-frequency waves in many applications proposed in various fields. The backward optical parametric oscillator (OPO) is a promising light-source device offering many practical applications. A theory of the backward OPO was proposed as early as 1966. The wavelength conversion under a particular condition generates counter-propagating waves inside a nonlinear crystal, enabling a self-feedback effect without a cavity.

In this talk, a recent tera-photonics research in RIKEN would be reported with the above-mentioned contents.

Referent/in: Dr. Katsuhiko Miyamoto
Associate Professor, Chiba University, Graduate School of Engineering, Molecular Chirality Research Center, Japan

Titel: Terahertz vortices generation by utilizing Tsurupica vortex phase plate

Terahertz (THz) imaging systems have been attracting much attention in many fields, such as biomedical, security, and nondestructive testing; however, their spatial resolutions are mostly limited to a sub-millimeter scale owing to the diffraction limit. An optical vortex with an annular intensity profile and orbital angular momentum (characterized by a topological charge \( \ell \)) provides us a variety of potential research opportunities, such as space division multiplexing optical communication, optical tweezer and manipulation, and chiral materials fabrication. In particular, it enables us to develop a ‘super-resolution’ microscope (with a spatial resolution beyond the diffraction-limit) based on nonlinear fluorescence depletion phenomena.

A THz vortex will open the door toward the achievement of ‘super-resolution’ THz imaging system with a micrometer-scale spatial resolution beyond the diffraction limit. In recent years, we have proposed a vortex phase plate (VPP) for THz vortex generation, formed of Tsurupica polymer with extremely low-frequency dispersion and high transmission in the THz region, and we have successfully produced a monochromatic and a broadband THz vortex outputs at a high conversion efficiency (>70%). In this presentation, we review state of the art THz vortex generation by employing the Tsurupica-VPP. We also discuss the possibility of ‘super-resolution’ THz imaging system, in which linear/nonlinear transmission behaviors of bilayer graphene was two-dimensionally detected at a high spatial resolution beyond the diffraction limit.

Zeit: Montag, 22.07.2019, 10:15 Uhr

Ort: Hörsaal B116, Gebäude Exakte Wissenschaften, Sidlerstrasse 5, Bern, Schweiz