K 4: Laser Systems II

Zeit: Dienstag 16:30–17:30 Raum: HS 3

K 4.1 Di 16:30 HS 3

Front-end for highly efficient multi-cycle THz generation — •Wenlong Tian[1,2], Halil Olgun[1,3,4], Yi Hua[1,3], Damian Schimpf[1], Nicholas Matlis[1], and Franz Kartner[1,3] — [1]Center for Free-Electron Laser Science (CFEL), Deutsches Elektronen Synchrotron (DESY), Notkestraße 85, 22607 Hamburg, Germany — [2]School of Physics and Optoelectronic Engineering, Xidian University, Xi'an 710071, China — [3]Department of Physics and The Hamburg Centre for Ultrafast Imaging (CUI), University of Hamburg, 20355 Hamburg, Germany — [4]Helmholtz-Institut Jena, Froebelstieg 3, 07743 Jena, Germany

High energy (>10 mJ) multi-cycle pulses in the frequency range of 0.1 THz ~1 THz are desired for powering THz-based electron accelerators capable of reaching energies up to ~10-100 MeV. The highest conversion efficiency in generating such THz pulses by optical means achieved to date is around 0.13%. Recent theoretical work predicts 1.6% total conversion efficiency using laser pulses comprised of two narrow spectral lines separated by the desired terahertz frequency. There are several methods to generate such line pairs such as spectral filtering. Our strategy is to build a front-end source with two phase-stable laser lines and then amplify them jointly. As reported here, the front-end comprises two single-frequency continuous-wave lasers, which are subsequently chopped to sub-ns duration, and has several advantages: (1) Both the frequency separation between the two lines and the pulse duration are controllable; (2) flat-top pulses rather than Gaussian temporal profile are achievable, which is beneficial for the THz generation.

K 4.2 Di 16:50 HS 3

A new laser source for highly efficient multi-cycle THz generation — •Halil Tarik Olgun — DESY, Hamburg, Deutschland

Increasing the efficiencies of multicycle terahertz (MC-THz) is a critical step for the realization of the novel concept of a table-top free electron laser powered by MC-THz [1]. We developed a multi-narrow-line laser source whose parameters, including intensity profile, temporal shape, and spectral content are optimized for MC-THz generation based on recent results of numerical simulations [2] showing high efficiencies for optical-to-THz conversion using difference frequency generation in a periodically-poled 2nd order nonlinear crystal. Starting from two CW-lasers, whose relative wavelength separation can be tuned to desired terahertz frequency, sub-nanosecond pulses are chopped via acousto- and electro-optical modulators and amplified to several milliwatts at 2MHz repetition rate. In the next step, these pulses will be amplified further to millijoule level in a regenerative amplifier and used for MC-THz in a cryo cooled periodically poled lithium niobate.

K 4.3 Di 17:10 HS 3

A new laser source for highly efficient multi-cycle THz generation — •Halil Tarik Olgun[1,2,3], Wenlong Tian[1,4], Damian Schimpf[1], Nicholas H. Matlis[1], and Franz X. Kärtner[1,2,3] — [1]DESY, Hamburg, Germany — [2]University of Hamburg, Hamburg, Germany — [3]Helmholtz-Institut Jena, Jena, Germany — [4]School of Physics and Optoelectronic Engineering, Xian, China

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References

[1] F. X. Kärtner et al., Nucl. Instrum. Methods Phys. Res. A 829, 24*29 (2016).

[2] K. Ravi et al., Opt. Express 24, 25582-25607 (2016).