CFEL SCIENCE

SEMINAR

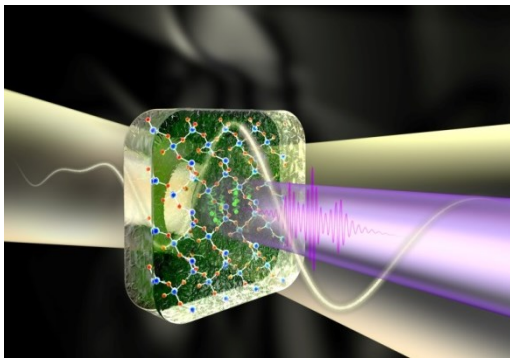
28th August, 2015 - 14:00
CFEL-bldg. 99, seminar room I (EG0.076)

Tran Trung Luu

Max Planck Institute of Quantum Optics, Garching

Extreme ultraviolet high harmonic generation and spectroscopy of solids

Extreme ultraviolet (EUV) high-harmonic radiation[1,2] emerging from laser-driven atoms, molecules or plasmas underlies powerful attosecond spectroscopy techniques[3-5] and provides insight into fundamental structural and dynamic properties of matter[6,7]. The advancement of these spectroscopy techniques to study strong-field electron dynamics in condensed matter calls for the generation and manipulation of EUV radiation in bulk solids, but this capability has remained beyond of the reach of optical sciences. Recent experiments[8,9] and theoretical predictions[10-12] paved the way to strong field physics in solids by demonstrating the generation of deep ultraviolet radiation[8] in bulk semiconductors, driven by femtosecond mid-infrared (IR) fields or the coherent up-conversion of terahertz (THz) fields to multi-octave spectra in the mid-IR and optical frequencies and their optical control[9]. In this talk, we will show that thin films of SiO_2 exposed to intense, few-cycle to sub-cycle pulses give rise to wide-band coherent EUV radiation extending in energy to ~ 40 eV. Our study indicates the close relation of the emitted EUV radiation to intraband currents of multi-petahertz (PHz) frequency, induced in the lowest conduction band of SiO_2. To demonstrate the applicability of high-harmonic spectroscopy to solids, we exploit the EUV spectra to gain access to fine details of the energy dispersion profile of the conduction band that are as yet inaccessible by photoemission spectroscopy in wide-bandgap dielectrics. In addition, we use the EUV spectra to trace the attosecond control of the intraband electron motion induced by synthesized optical transients. Our work advances lightwave electronics[5,13-15] in condensed matter into the realm of multi-PHz frequencies and their attosecond control and marks the eve of solid-state EUV photonics.



Host: Franz Kärtner, CFEL UX Seminar