CFEL SCIENCE

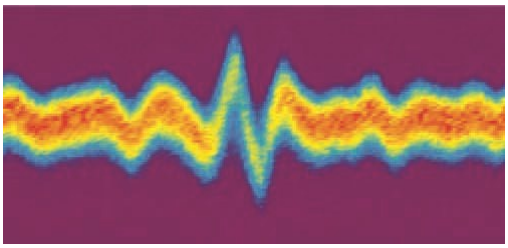
SEMINAR

7th December 2011 - 14:15
FLASH HALL (28c) - Seminar Room

Eleftherios Goulielmakis

Max Planck Institute of Quantum Optics, Garching, Germany

Sub-optical-cycle light field synthesis: Triggering & clocking the motion of electronics



I will discuss recent progress in lightwave technologies [1-4] with focus on the synthesis of sub-optical-cycle light transients [5] and their applications in attosecond science and spectroscopy. With novel types of light-field synthesizers, operating over a spectral bandwidth of more than 1.5 octaves spanning the Near IR, visible and ultraviolet part of the electromagnetic spectrum, we are able to synthesize isolated sub-optical cycle pulses (~ 2 fs duration) to characterize their fields utilizing attosecond streaking [1], and to craft their field shapes on demand.

To demonstrate the potential of new technologies for advancing attosecond spectroscopy and control, we exploit such light transients to ionize krypton atoms within a single intense field crest [5]. We probe both ionization as well as the ensuing dynamics in the generated ions by attosecond absorption spectroscopy [6].

We demonstrate, for the first time, an “all-optical” sub-femtosecond trigger of electronic processes which, when combined with EUV attosecond pulses [1], opens the door to attosecond pump - attosecond probe experiments in atoms, molecules and condensed matter. Owing to the sub-fs confinement of ionization, we have successfully triggered highly coherent electron motion in the valence shell of generated ions [7] and have been able to clock this motion with unprecedented accuracy.

[1] E. Goulielmakis *et al.*, Science **320**, 1614 (2008).
[2] R. Kienberger *et al.*, Nature **427**, 817 (2004).
[3] E. Goulielmakis *et al.*, Science **305**, 1267 (2004).
[4] E. Goulielmakis *et al.*, Science **317**, 769 (2007).
[5] A. Wirth et al., Science DOI: 10.1126/science.1210268 (2011)
[6] E. Goulielmakis et al., Nature 466, 739 (2010).
[7] N. Rohringer, R. Santra, Phys. Rev. A 79, 053402 (2009).

Host: Robin Santra – CFEL Theory Group