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UNIVERSITÄT BERN

Seminar über Ultrafast Science and Technology

Referent: Dr. Yunpei Deng, Paul Scherrer Institute PSI, Villigen Switzerland

Titel: Advancing Ultrashort Laser Pulse Technology: Controlling Ultrafast Electron Motion

State-of-the-art laser technology is on the verge of providing synthesized waveforms at optical frequencies. Such flexibility in shaping arbitrary light waveforms permits sculpting an electric force for steering electrons in any desired fashion within atomic, molecular and solid systems, on the electronic time scale. This has promising potential in pushing the frontiers of attosecond physics and of coherent control schemes to completely unexplored regions.
Optical parametric chirped-pulse amplifier (OPCPA) systems can produce nearly single-cycle pulses at a mJ energy level, or few-cycle pulses at a hundred mJ level. In my talk I will present the details of a mid-IR OPCPA laser system that I developed at MPQ. As I will show, this system has already demonstrated an output of 1.2-mJ, 1.5-cycle (10.3fs) pulses at 2.1μm central wavelength and at 3 kHz repetition rate. Such source is the key to achieving HHG X-ray photons in the keV domain, and is also important to a wide range of highly interesting applications, such as the investigation of ultrafast structural dynamics and conformational changes of relevant molecules in biology. An additional benefit of the IR carrier wavelength is the increased duration of its optical cycle (e.g. 7 fs for 2.1 μm) compared with a NIR pulse (e.g. 2.5 fs for 750 nm). The increased spacing between successive half-cycles of the laser pulse provides a sufficient time window to capture the full dynamics of an arbitrary sub-femtosecond relaxation process, before the identical process is re-triggered by the next half-cycle of the laser pulse. It is a powerful and unique source for coherent control, ionization and dissociation experiments. I will also show how an OPCPA system, which can be developed to deliver more than two-octave bandwidth pulses, is capable of producing sinusoidal-like, square, sawtooth or any arbitrary waveforms. Such laser pulses will open the door to many ultrafast coherent control applications.

Zeit: Donnerstag, 21.09.2017, 11:15 Uhr

Ort: **Hörsaal B116**, Gebäude exakte Wissenschaften, Sidlerstrasse 5, Bern, Schweiz