CFEL SCIENCE

SEMINAR

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CFEL-bldg. 99, seminar room IV (O1.111)

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Spatial and temporal metrology of coherent ultrashort pulses in the extreme-ultraviolet domain

Ultrashort pulses in the extreme-ultraviolet (XUV) domain have a wide range of applications in fields such as plasma probing, spectroscopy, or the study of ultrafast dynamics in atoms and molecules.

Nowadays, there are three main sources of such pulses. High-order harmonic generation (HHG) in rare gases is able to provide attosecond pulses. However, their low energy limits their applications. The amplification of high-harmonic pulses in laser-driven plasmas has been demonstrated to provide energies of tens of microjoules. Higher pulse energies can be obtained from seeded XUV free-electron lasers (FELs), large-scale facilities with more limited accessibility.

In recent years, significant progress has been made with these sources towards the generation of shorter pulses. New techniques are necessary for full temporal metrology of such pulses. Additionally, many experiments, such as those involving nonlinear phenomena, require high XUV intensities. Efficient focusing of low-energy pulses can significantly increase their range of application. Good wavefronts are required in order to focus light pulses to high intensities, and the optics must be of high quality and precisely aligned.

This presentation reports the study of the spatial properties of high-harmonic pulses thanks to the use of an XUV Hartmann wavefront sensor. This device is also proven here to be useful for precise alignment of XUV optical systems with HHG sources.

The problem of performing full temporal characterization of XUV pulses is also discussed, and a new scheme for complete pulse reconstruction for seeded XUV FELs is presented. Finally, the first implementation of chirped pulse amplification (CPA) in a seeded XUV FEL is reported.

Host: Franz Kärtner – CFEL-DESY Ultrafast Optics