CFEL SCIENCE

SEMINAR

25th April, 2017 – 11:00 am

CFEL-bldg. 99, seminar room II (EG.078)

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Modelocked thin-disk lasers: A path towards compact high-power THz sources

Coherent sources of THz radiation (0.1 THz – 10 THz) have become ubiquitous tools for a wide range of applications in science and technology. However, in many cases, the lack of table-top high-power sources in this wavelength region still hinders their widespread applicability. THz sources with high power (watt-level) are currently restricted to large accelerator facilities, or to very specialized systems such as p-Germanium lasers, which operate at impractical He cooling temperatures. On the other hand, sources of energetic few- or single-cycle THz pulsed generated by near-infrared femtosecond laser excitation have seen spectacular progress in the past years, enabling THz time-domain spectroscopy to emerge as a widespread tool for a variety of applications. However, in spite of this progress, their average power still remains limited, mainly because of the limited average power available from commercial NIR ultrafast sources.

In parallel to this progress, the emergence of new laser technologies has supported exponential progress of the average power available from ultrafast sources in the NIR in the last decade. In particular, one of the most promising technologies for high-average power and high-energy table-top NIR sources are mode-locked thin-disk lasers. This laser technology opens the way to unprecedented high average powers (multi-hundred watt femtosecond operation has been demonstrated) from simple multi-MHz table-top ultrafast systems. Nevertheless, the potential of these unique laser sources has not yet been exploited for the generation of energetic THz pulses with high-repetition rate.

Our group focuses their efforts on exploring the possibilities offered by these state-of-the art thin-disk laser sources for the generation of high-power THz radiation. In particular, we target to apply these sources in the context of the cluster of excellence RESOLV, to investigate the role of water in biological functions using THz spectroscopy. Ultrafast high power sources would allow following changes in dynamics during biological function or chemical reactions in real time. Biologically relevant studies demand to study solvated samples. Since water is highly absorbing in this frequency range, high-power and high repetition rate few-cycle THz sources are of paramount importance for future kinetic studies.

In this presentation, we will give an overview of the current state-of-the-art of thin-disk laser systems, with a focus on our ongoing efforts to generate high-power THz radiation, as well as foreseen experiments of THz spectroscopy of water samples.

Host: Franz Kärtner, CFEL-UX semianr