CFEL SCIENCE

SEMINAR

19th* December *2017 - 11:00 a.m.

CFEL-bldg. 99, seminar room I (EG.076)

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Femtosecond Ho: YAG thin-disk oscillator enabling two-octave 5-20 µm frequency comb generation

Synchrotron infrared radiation is finding applications in diverse fields ranging from biology to material science due to its broad bandwidth and high coherence [1,2]. The spectral region spanning 500- 5000 cm- 1 is of particular interests for chemical identification, since most organic molecules exhibit characteristic fundamental vibrational absorptions in this window. Here we present a table-top system that can simultaneously cover a significant part of this 'finger-print' region at 24 mW-level average power. The system is based on a high power Ho:YAG thin-disk laser providing 220 fs pulses at 2 µm wavelength with 18.7 W average power and 77 MHz repetition rate. The output is then coupled into an endlessly single-mode fiber with a core diameter of 12 µm, where soliton self-compression occurs (Fig. 1) [3]. The resulting 15 fs pulse is subsequently focused into a gallium selenide (GaSe) crystal, where intra-pulse difference frequency generation (DFG) takes place to produce coherent radiation from 500-2250 cm-1 (5-20 µm) at 24 mW of measured average power (Fig. 1). The entire system has a footprint of 1.8 m x 0.6 m. This compact table-top system has the potential to bring broadband high brightness mid-infrared radiation to individual research labs.

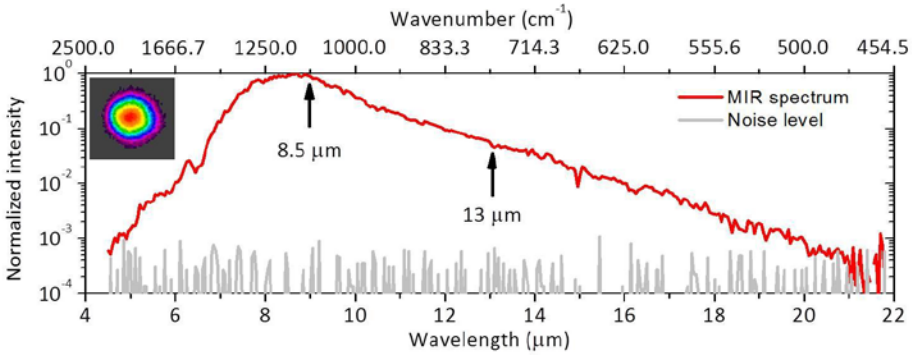

Fig. 1. Measured infrared spectrum and corresponding beam profile.

References

1. Miller L., Dumas P. Chemical imaging of biological tissue with synchrotron infrared light. Biochimica et Biophysica Acta (BBA) – Biomembranes. **1758**, 846 (2006)
2. Bechtel H., Muller E. et al. Ultrabroadband infrared nanospectroscopic imaging. PNAS. **111**,7191 (2014).
3. Zhang J., Mak K.F. et al., Multi-mW, few-cycle mid-infrared continuum spanning from 500 to 2250 cm-1. Light-Sci. Appl., accepted (2017).

Host: Franz Kärtner – CFEL-DESY Ultrafast Optics