The 883rd IMS colloquium

# Technology and applications of high-power femtosecond longwave lasers

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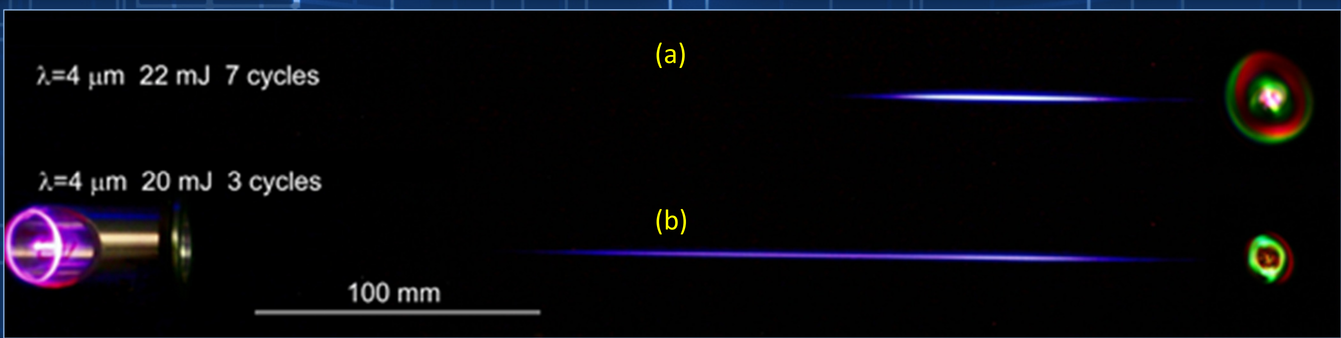
**Date&Time:** 2016/2/19 (Fri.) 16:00-
**Place:** IMS Research Building Room 201

At a μJ energy level, femtosecond longwave laser pulses in the wavelength range of 3—8 μm enable several sensing and imaging applications in chemistry and biology which rely on spectroscopies probing the molecular fingerprint spectral region. At a sub-mJ level, such mid-IR pulses become relevant to bond-selective probing of molecular dissociation via photo-ion and electron spectrometry and high-harmonic generation spectroscopy. At multi-mJ levels, as a consequence of a $\lambda^2$ scaling of ponderomotive energy, such longwave pulses are required as drivers for coherent and incoherent secondary radiation sources in the Xray and THz domains. From the level of tens of mJ, it becomes possible to initiate femtosecond filamentation in ambient air whereby the properties of mid-IR filamens and their formation mechanisms are strikingly different from the well-studied cases of traditional near-IR femtosecond lasers. In particular, mid-IR filaments are uniquely capable of initiating plasma-chemical reactions as a result of collisional excitation by hot electrons. Further energy scaling of such longwave few-cycle sources, eventually into the relativistic regime requiring >100 mJ and TW peak powers, would make it possible to exploit the wavelength scaling advantage for particle acceleration and enable replacement of single-shot dense targets by indestructible high-pressure gas targets. The talk will describe the application scope of amplified mid-IR pulses pursued at TU Vienna and review different schemes for the generation of such pulses. Progress in atmospheric filamentation and nonlinear long-wave pulse self-compression will be highlighted.

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