Subterawatt Few-Cycle Mid-Infrared Pulses from a Single Filament

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Filamentation-assisted pulse compression in the gas phase is shown to enable the generation of subterawatt few-cycle pulses in the mid-infrared. With both spatial modulation instabilities and excessive plasma scattering of the mid-infrared beam prevented through a careful choice of the gas pressure and the input peak power, providing single-filament regime of pulse propagation, peak powers as high as 0.3 TW are achieved in a truly single-mode, almost diffraction-limited 35-fs output at a central wavelength of 4 $\mu$m. Applications in molecular spectroscopy, semiconductor electronics, high-field physics, standoff detection, and innovative X-Ray sources are envisaged.

![Figure 1: Pulse compression of mid-IR pulses to sub-cycle pulse widths in a filament induced in a high-pressure gas: GS, grism stretcher; GC, grating compressor; D, diaphragm; SM, spherical mirror; W, CaF2 wedge, BS, thin-film beam splitter; DL, tunable delay line; S, spectrometer](image_url)