Applications of optical pulse shaping in the millimeter-wave and sub-THz regimes

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Abstract : Optical pulse shaping techniques, in which user-specified ultrashort pulse fields are synthesized via parallel manipulation of optical Fourier components, are now widely adopted. Furthermore, mode-locked lasers producing combs of frequency stabilized spectral lines have resulted in revolutionary advances in frequency metrology. However, until recently pulse shapers addressed spectral lines in groups at low spectral resolution. Line-by-line pulse shaping, in which spectral lines are resolved and manipulated individually, leads to a fundamentally new regime for optical arbitrary waveform generation (OAWG), in which the advantages of pulse shaping and of frequency combs are exploited simultaneously.

In this talk, results on programmable line-by-line shaping of various types will be presented. OAWG promises broad impact both in optical science, allowing for example coherent control generalizations of comb-based time-frequency spectroscopy, and in technology, enabling new truly coherent multi-wavelength processing concepts for spread spectrum lightwave communications and photonically-assisted millimeter-wave (MMW) generations. We will present our recent results on remote generation of high-modulation-depth photonic millimeter-wave (MMW) waveforms by applying line-by-line pulse shaping on a phase-modulated continuous-wave laser frequency comb. Potential applications of such flexible photonic transmitter in sub-THz and even THz regimes will also be discussed.