MAX PLANCK INSTITUTE
OF MICROSTRUCTURE PHYSICS

PETER HERMAN
DEPT. ELECTRICAL AND COMPUTER ENGINEERING,
UNIVERSITY OF TORONTO

SHAPING ULTRAFAST LASER INTERACTION – GATEWAY TO NOVEL 3D PHOTONIC INTEGRATED DEVICES

ABSTRACT

Confined ultrafast laser interactions driven with controlled beam shapes are a major opportunity today for internal three-dimensional (3D) nano-structuring of transparent materials with tailored optical and mesoscopic properties. This presentation explores the fundamental beam propagation and interaction physics for generating narrow filaments, light sheets, and non-aberrated or aberrated beams as single or multiple beamlets into glass substrates. Computer generated beam shaping with a spatial light modulator (SLM) is targeted here towards aberration-free 3D processing inside of bulk glasses, cylindrical fibers, and thin transparent films. The beam delivery can be tailored to enhance or inhibit the ultrashort nonlinear light interaction and facilitate the formation of filaments into refractive index structures or into open capillaries. A wide gamut of photonic and micro/nano-mechanical structures can then be assembled in the bulk glass, or film, or along the core waveguide of optical communication fibre. Such additive and subtractive means of nano-processing enables the fabrication of fiber core and cladding photonics and lab-in-fibre devices not previously conceived.

The processes enable formation of volume gratings, optical waveguides, micro-mechanical structures, microfluidics and nano-channels that can be combined and integrated for micro-engineering of highly functional and compact micro-systems for photonics to biosensing.

References:
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