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Tailoring Ultrashort Laser Interactions for Moulding 3D Photonic and Optofluidic Microsystems

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Abstract: Nonlinear optical interaction is the new mantra of a rapidly growing and evolving research community harnessing the novel interaction physics of ultrashort duration laser light. For optically transparent media, such interactions have opened new possibilities for non-contact scribing and drilling at high speed, and forming three-dimensional (3-D) photonic and microfluidic structures inside bulk glass having micro- and nano-scale features. To this end, our research group (1) studies nonlinear laser interaction physics, (2) develops novel laser processing technology, and (3) enables fabrication of novel microsystems built on photonic devices, optical circuits, optofluidics, and photonic bandgap media. The presentation will survey our progress on all three areas and survey the practical opportunities emerging from high-repetition rate ultrashort pulsed laser systems that are associated with heat accumulation effects and benefits to accelerate process speed, anneal damage, and reduce thermal cycling damage in various transparent glasses. Collectively, burst femtosecond and picoseconds laser machining is emerging as a powerful new manufacturing tool for general-purpose processing of optical materials through to fabrication, integration, and packaging of optical telecom, sensing and optofluidic micro-systems.

Bio: Peter R. Herman earned MASc and PhD degrees studying lasers and diatomic spectroscopy in the Physics Department at the University of Toronto followed by postdoctoral study of x-ray lasers at the Institute of Laser Engineering in Osaka University, Japan in 1987. He joined the Department of Electrical and Computer Engineering at the University of Toronto in 1988 and holds a full professor position. Professor Herman guides a large research group that develops and applies laser technology and advanced beam delivery systems to control and harvest laser interactions in new frontiers of 3-D nanofabrication – extreme short wavelength, ultrashort duration, and high coherence – to craft novel combinations of passive and active lightwave circuits, photonic bandgap devices, lab-on-a-chip biophotonics, and micro-optical sensing systems. Professor Herman is a Fellow of the Optical Society of America, an active member of the OSA, IEEE, and SPIE, and co-chair of the SPIE Photonics West 'LASE' conference. His group interacts with numerous academic and industrial partners and has published more than 200 scientific journal and conference papers.
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