Seminar, Rochester Institute of Technology, Sep. 13, 2017

The art of nonlinear laser interaction – gateway to novel optical-mechanic-fluidic devices in transparent glass, fiber and film

Femtosecond laser light follows widely varying interaction pathways when focused inside of transparent materials, reacting further to powerful feedback mechanisms that seemingly counter our best intentions to channel laser energy into a preferred and reproducible process. The presentation examines fundamental interactions towards the practical means for managing laser processes in transparent glasses, including fibres and thin film, where one can exploit the concepts of microexplosions, photochemistry, interferometric cleaving disks, and self-focusing filamentation. These varied reactions and geometries underpin controllable means for fabricating new types of optical, micromechanical, and nanofluidic devices. We examine scientific principles towards engineering of three-dimensional (3D) optical circuits, 3D microfluidic networks, and cantilevers that enable highly functional and compact devices to form and integrate seamlessly for a wide base of advanced applications. We survey opportunities for smart catheters, fiber-cladding photonics, lab-in-a-fiber, and lab-in-a-film, demonstrating the unexplored future potential opened by the ‘magic’ of nonlinear laser interaction physics.