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New Techniques for Signal Optimization in Harmonic and Multiphoton Absorption Fluorescence Microscopy

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Nonlinear imaging with ultrafast lasers continues to broaden its application base as a significant tool for exploring and understanding biological structure and function at the microscopic level. The challenge is significant - the biological community needs to be able to quantitatively visualize 100 cubic micrometer volumes with a resolution of 50 nm, and do so in a dynamic fashion – millisecond time scales are desirable. In order to achieve these demanding imaging requirements we need to strive to achieve new levels of efficiency – improved resolution is a function of how many photons can be extracted from ever smaller volumes. Towards this end, in this talk we discuss new methods for fiber delivery of femtosecond pulses, spatio-temporal characterization of femtosecond pulses through high-numerical aperture optics, and adaptive spatio-temporal control of these pulses.