Contribution ID: **51** Type: **not specified**

Superpenetration Multiphoton Microscopy Enabled Through MEMS DM Technology

Tuesday, 3 September 2013 12:40 (20 minutes)

Abstract content
(Max 300 words)
Special Chars

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This paper will discuss the development and demonstration of a superpenetration multiphoton microscope (S-MPM) that will more than double the imaging depth achievable in highly scattering biological tissue. MPM technology has revolutionized the field of subsurface biological imaging, but its depth of penetration is limited. The severe scattering introduced by biological tissue – especially neural tissue – prevents most commercial MPM instruments imaging beyond a few scattering mean free paths. With this limitation, research on cells and cell networks at the frontier of neuroscience is constrained. A recent breakthrough in coherent light propagation and control through highly scattering media demonstrated the possibility of enhancing focal intensity by factors of several hundred on the far side of a medium, despite any amount of scattering, by using a spatial light modulator to modify the phase of the coherent light on the near side of the medium. In this paper we will discuss the combination of MPM and BMC's fast microelectromechanical spatial light modulators (MEMS SLMs) to offer a compelling way to exploit this breakthrough in optical science that will make a substantial impact on biomedical and neurobiological research.

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Session Classification: Session II : Imaging and Microscopy

Track Classification: Oral Presentation