ADVANCES IN ULTRAFAST LASERS IMPROVE MULTIPHOTON MICROSCOPY

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The emergence of compact, fully automated, and widely wavelength-tunable femtosecond lasers has resulted in explosive growth in their use in a broad array of multiphoton microscopy techniques. Laser manufacturers have constantly improved the performance characteristics of these sources to meet the requirements of the biomedical user community for imaging with improved cell viability and deeper tissue penetration.

We will summarize the latest advances in the development of user-friendly and flexible sources for nonlinear and multimodal microscopy, and how they benefit the end user and progress application development. This will include an overview of automated, compact Tisapphire lasers plus accessories for extending their wavelength range, like OPO and supercontinuum sources for long wavelength imaging and CARS microspectroscopy and microscopy [1, 2].

Special attention will be given to the Spectra-Physics® InSight™ compact and fully automated one-box ultrafast laser [3]. This novel source delivers from one output beam sub-120 femtosecond pulses, which are continuously wavelength-tunable from 680 nm all the way through 1,300 nm. This 620 nm wide tuning range is about twice that of the Tsapphire lasers, which are the current workhorses in multiphoton microscopy. Most importantly this new laser provides convenient access to the relative transparency window of tissue in vivo beyond 1,000 nm, where scatter of excitation light is reduced and tissue penetration depth is increased [4]. Integrated, automated dispersion compensation allows for optimizing the pulse width within the specimen to further improve image quality and penetration depth. In addition, the laser features an optional second femtosecond output beam at 1,041 nm, which can be effectively utilized for dual-wavelength excitation and multimodal nonlinear imaging applications, including femtosecond CARS microspectroscopy and microscopy [5].