TOPTICA PHOTONICS

Press Release

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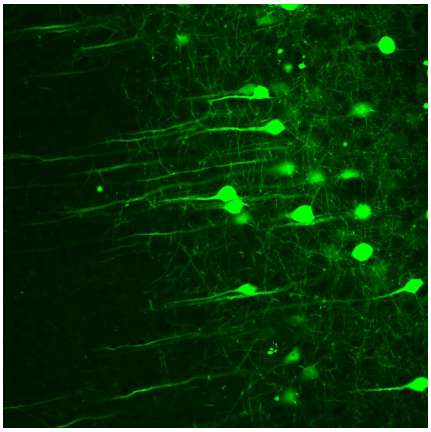
Lasers for Neuroscience

Easy to use fiber laser for 2-Photon Microscopy and 2-Photon Optogenetics in Neuroscience

2-photon fluorescence microscopy has become a key technology in biological imaging in neuroscience enabling three-dimensional, noninvasive studies of the neuronal structure and activity on the submicron scale. The contrast mechanism in 2-photon microscopy in neuroscientific research is based on the excitation of green or red fluorescent proteins, so called GFPs and RFP, by two photons in the infrared spectral range.
To drive this nonlinear process and to resolve the neurons deep within the living brain, femtosecond lasers with clean temporal pulse shape and average output powers of >1W are an essential prerequisite.



Two-photon imaging of GFP-labelled neurons from mouse brain.
Image courtesy: Dr. Hans Fried, DZNE Bonn, Germany

Going beyond pure imaging, all-optical interrogation is a novel approach to understand how active patterns in neuronal activity drive behavior. In such experiments the visualization of neuronal activity by 2-photon imaging is combined with 2-photon optogenetics to stimulate individual neurons by photoactivation of channelrhodopsins within the cell.
With the need of exciting many neurons in parallel, the laser requirements and microscopy technology for 2-photon optogenetics are fundamentally different from 2-photon imaging. Typically, high-power multi-Watt lasers at 1030-1040nm with repetition rates in the 100kHz - 1MHz range are used in combination with a spatial light modulator (SLM) to excite 10s to 100s of neurons simultaneously.

To support and drive the research in neuroscience TOPTICA is proud to introduce our laser portfolio for 2-photon imaging of GFPs and RFPs, our **FemtoFiber ultra 920** and **FemtoFiber ultra 1050**, and for 2-photon optogenetics of channelrhodopsins our **FemtoFiber vario 1030 HP**:

For details and help please get in touch: **www.toptica.com**

All lasers are fully matched to the requirements in neuroscientific research and besides being fully turn-key, quite, and compact, they are offering integrated dispersion pre-compensation (GDD) and integrated power control (AOM) to simplify operation and to allow the scientist to focus on their research!

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TOPTICA has been developing and manufacturing high-end laser systems for scientific and industrial applications for 20 years. Our portfolio includes diode lasers, ultrafast fiber lasers, terahertz systems and frequency combs. The systems are used for demanding applications in biophotonics, industrial metrology and quantum technology. TOPTICA is renowned for providing the widest wavelength coverage of diode lasers on the market, providing high-power lasers even at exotic wavelengths.
Today, TOPTICA employs 400 people worldwide in six business units (TOPTICA Photonics AG, TOPTICA eagleyard, TOPTICA Projects GmbH, TOPTICA Photonics Inc. USA, TOPTICA Photonics K.K. Japan, and TOPTICA Photonics China) with a consolidated group turnover of € 85 million.