• **Products**
  - **Single Mode Diode Lasers**
    - iBeam smart
    - iBeam smart PT
  - **Single Frequency Lasers**
    - iBeam smart WS
    - TopMode
    - Holo-Litho 405
    - TopWave 266
    - XTRA II
    - **UV / RGB solutions**
  - **Tunable Diode Lasers**
    - ECDL / DFB Lasers
      - CTL
      - DL pro
      - DFB pro
      - MDL pro
    - **Frequency-Converted Lasers**
      - SHG pro
      - DL-SHG pro
      - TA-SHG pro
      - TA-FHG pro
      - TOPO
  - **Amplified Lasers**
    - TA pro
    - BoosTA pro
    - BoosTA
  - **Laser Driving Electronics**
    - DLC pro
    - SYS DC 110: Analog Control
  - **Laser Locking Electronics**
    - DigiLock 110: Digital Locking
    - FALC 110 & mFALC 110: Fast PID
    - PDH/DLC pro: Pound-Drever-Hall
    - PDD 110/F: Pound-Drever-Hall
    - PID 110: PID Controller
    - DLC pro Lock
  - **ps/fs Fiber Lasers**
- **FemtoFiber smart**
  - FemtoFiber smart 780
  - FemtoFYb 1030-400
  - FemtoFYb 1030-800
  - PicoFYb 1030
  - PicoFYb 1064
  - FemtoFErb 1560
  - FemtoFErb 1560 FD6.5
  - FemtoFErb 1950

- **FemtoFiber pro**
  - FemtoFiber pro TVIS
  - FemtoFiber pro NIR
  - FemtoFiber pro TNIR
  - FemtoFiber pro SCIR
  - FemtoFiber pro UCP
  - FemtoFiber pro SCYb
  - FemtoFiber pro IR
  - FemtoFiber pro IRS-II

- **FemtoFiber ultra**
  - FemtoFiber ultra 780
  - FemtoFiber ultra 920
  - FemtoFiber ultra 1050
  - FemtoFiber ultra 1560

- **FemtoFiber vario**
  - FemtoFiber vario 1030

- **FemtoFiber dichro**
  - FemtoFiber dichro midIR

- **FemtoFiber customized**
  - FemtoFiber CARS
  - FemtoFiber FluoLife
  - FemtoFiber Terahertz Freeze
  - FemtoFiber OPO
  - FemtoFiber Terahertz Pump-Probe
  - FemtoFiber Quantum Microscopy

- **Terahertz Systems**
  - **Frequency-Domain**
    - TeraScan
    - TeraBeam
    - Tuning Range Extension
    - Phase Modulation Extension
    - GaAs and InGaAs Photomixers
  - **Time-Domain**
    - TeraFlash pro
    - Imaging Extension
    - TeraFlash smart
    - TeraSpeed
    - Photoconductive Switches
• **Accessories**
  • Optomechanics
  • Schottky Receivers

• **Frequency Combs**
  • DFC CORE / DFC CORE+
  • DFC Wavelength Extensions
  • DFC BC / DFC MD
  • Complete DFC Systems
  • Locking Electronics
  • DFC SDL

• **Multi-Laser Engines**
  • iChrome CLE
  • iChrome MLE

• **Customized Solutions**
  • SodiumStar
  • 633 nm High Power
  • 213 nm 10 mW cw
  • 193 nm sub-mW

• **Wavemeters & Laser Diodes**
  • Optical Isolators
    • Single-Stage TOPTICA Isolators
    • Dual-Stage TOPTICA Isolators
    • Additional Isolators
  • Wavelength Meters
  • Photonicals
    • FiberDock
    • FiberOut
    • Optical Fibers
    • FPI 100 - Fabry-Perot Interferometer
    • Compact Saturation Spectroscopy
  • Laser Diodes
    • Fabry-Perot
    • AR-coated
    • DFB/DBR
    • Tapered Amplifiers
  • ToptiCalc

• **Applications**
  • Biophotonics & Microscopy
    • High-Content Analysis
  • Industrial Manufacturing
    • Raman Spectroscopy
    • Holography
    • Computer-To-Plate
  • Fundamental Quantum Technology
    • Atom Laser Cooling & Trapping
    • Ion Laser Cooling & Trapping
    • Degenerate Quantum Gases (BEC, DFG)
- Rydberg Excitation
- Optical Pumping & EIT
- Quantum Dots & Microcavities

- **Optical Microscopy**
  - Confocal Microscopy
  - Raman Microscopy
  - Multiphoton Microscopy
  - SHG Microscopy
  - THG Microscopy
  - Nearfield Chemical Imaging

- **Terahertz Sensing**
  - Plastic Inspection
  - Paint and Coating Layers
  - Industrial Quality Control
  - Material Research
  - Gas Sensing
  - Hydration Monitoring
  - Ultrafast Dynamics
  - Security

- **Applied Quantum Technology**
  - Sensing & Metrology
  - Communication
  - Spectroscopy
  - Direct Frequency Comb Spectroscopy
  - Microwave Generation

- **Ultrafast Studies**
  - Pump-probe Spectroscopy
  - fs/ps Material Processing
  - 2-Photon Polymerization
  - Time-Resolved Microscopy
  - FLIM
  - OCT
  - Mid-IR Generation

- **Semicon / Metrology**
  - Scatterometry
  - Inspection
  - Ellipsometry
  - Microlithography
  - Lithography Optics Inspection

- **Astronomy & Geology**
  - Laser Guide Star
  - LIDAR Seeding
  - Distance Metrology

- **Technology**
  - Technical Tutorials
    - Tunable Diode Lasers
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- **FemtoFiber pro**
- **FemtoFiber ultra**
- **FemtoFiber vario**
- **FemtoFiber dichro**
- **FemtoFiber customized**

**Terahertz Systems**

- **Frequency-Domain**
  - TeraScan

- **Time-Domain**
  - TeraFlash pro
  - Imaging Extension
  - TeraFlash smart
  - TeraSpeed

- **Accessories**

**Frequency Combs**

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• **Technology**

**Technical Tutorials**
- Tunable Diode Lasers
- Tapered Amplifiers
- Frequency Conversion
- Femtosecond Fiber
- Terahertz
- Frequency Combs

**TOPTICA Proprietary**
- smart Series
- pro Series / Technology
- ultra Series
- CERO
- CHARM
- COOL
- FINE
- SKILL

**TOPTICA Python Laser SDK**

• **Company**

**Company Profile**
Applications

- Biophotonics & Microscopy
- Industrial Manufacturing
- Fundamental Quantum Technology
- Optical Microscopy
  - Confocal Microscopy
  - Raman Microscopy
  - Multiphoton Microscopy
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Ultrafast FemtoFiber Lasers for Multiphoton Microscopy

Microscopy using ultrashort laser pulses

Multiphoton microscopy strikingly enhances the optical resolution due to the stimulation of non-linear absorption in the focal region consisting of highest power density only. This technique requires a pulsed light source for the two- or multi-photon excitation of the respective fluorophores or sample material.

Fiber Lasers for Multiphoton Microscopy

In the last two decades Titanium:Sapphire (Ti:Sa) lasers were frequently employed as workhorse in many multiphoton setups, since they offered wavelength tunability and high output power at femtosecond pulse durations. Meanwhile modelocked fiber lasers became highly attractive for multiphoton microscopy, since Ti:Sa oscillators suffer from high complexity and challenging alignment routines. Here Toptica’s FemtoFiber lasers offer a broad variability in terms of wavelength, pulse energy and duration while these laser intrinsically do not demand any maintenance, alignment or water cooling.

Additional benefits are compactness, outstanding mode locking stability (SAM modelocking), ease-of-use and a competitive price. Toptica’s FemtoFiber lasers are ready to become the future workhorse for multiphoton- and other advanced microscopy techniques, like broadband Raman or other time resolved applications.

A widespread and important application ideally suited for the novel FemtoFiber dichro bioMP laser operating at 780 and 1050 nm is the 2-photon excitation is frequently used for live-cell imaging, due to a reduced photodamage compared to 1-photon excitation. Here the Erbium and Ytterbium pumped fiber laser of the FemtoFiber family offer wavelength also above 1 µm to allow for deeper penetration of the excitation beam in the investigated tissue.

Toptica’s third generation of FemtoFiber lasers are designed to cover the needs of scientists and professionals working with advanced multiphoton microscopy and spectroscopy instruments worldwide.

- **Related Products**
  - FemtoFiber pro NIR
  - FemtoFiber smart 780
  - FemtoFiber ultra 920
• Related Literature

- Application Note: Multiphoton microscopy using a femtosecond fiber laser system (2016)
- Brochure: Ultrafast Fiber Lasers
- Application Note: Fiber Lasers for Multiphoton Microscopy
- Article: Femtosecond Lasers for Life Sciences
- Article: Multimodal imaging paves the way forward in life sciences
- Article: Multimodale Bildgebung - Mikroskopie auf neuen Wegen (German)
- Article: One Plus One Equals Three - Multi-line fiber lasers for nonlinear microscopy (Lang, Optik + Photonik 2014)
- Article: Fiber for two-photon microscopy, BioOptics World 2011
- Article: Cell Division Stage in C. elegans Imaged Using Third Harmonic Generation Microscopy
- Article: Third-harmonic generation for the study of Caenorhabditis elegans embryogenesis

• Related Applications
  - SHG Microscopy
  - THG Microscopy

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