BUIR LAKE
LABORATORIES
貝爾湖實驗室

PRODUCT BROCHURE

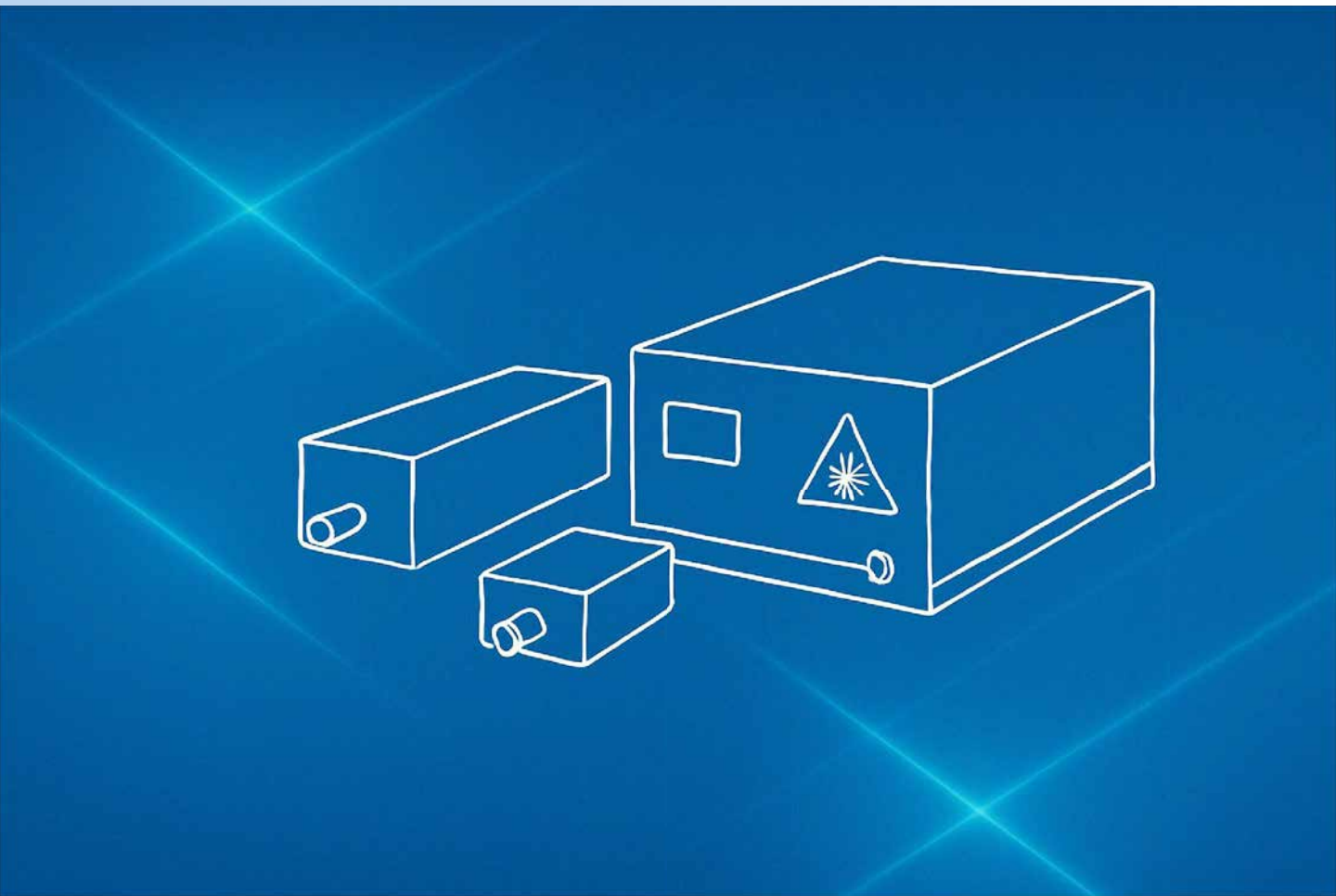
Buir Lake Laboratories

April 2025

Innovative Light, Powering the Future

Buir Lake Laboratories specializes in the R&D and application of ultrafast optical technologies, dedicated to providing high-performance femtosecond laser systems, optical components, and spectral analysis solutions for scientific research and industrial fields.

Mission: Empower scientific research and industrial advancement with cutting-edge optical technologies.
Vision: Become a global benchmark in ultrafast optics.



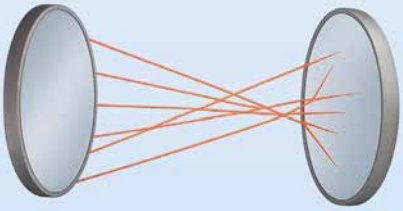
Products & Technologies

Wavelength & Pulse Width Tuning Systems

Ti:Sapphire Femtosecond Optical Parametric Amplifier (OPA)

Yb-doped Laser-Pumped Femtosecond OPA

Ultrafast Optical Components



Low-Dispersion Mirrors

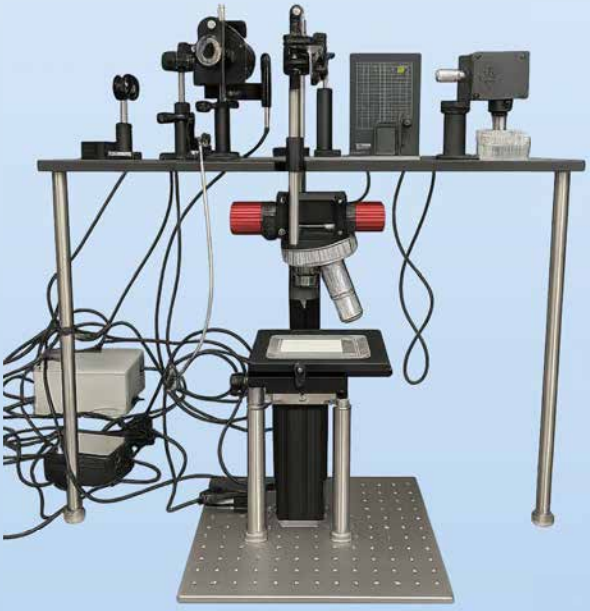
Pulse-Shaping Etalons

Spectrometer

Transient Absorption Spectrometer

Sum-Frequency Generation (SFG) Spectrometer

Stimulated Raman Imaging



Ti:Sapphire Femtosecond OPA

High Performance, Broadly Tunable Femtosecond Source

Optimized for Ti:Sapphire femtosecond laser systems, this OPA series delivers ultra-wide tunability from deep UV to mid-IR. Featuring industry-leading energy conversion efficiency, flexible energy configurations, and fully automated control, it is a powerful tool for ultrafast spectroscopy, nonlinear optics, and frontier scientific research.

Parameter	Specification / Value Description
Pump Wavelength	750–850 nm
Output Wavelength	Signal: 1100–1600 nm; Idler: 1600–2600 nm; Extended wavelength coverage: 210–20000 nm
Pump Pulse Duration	30–200 fs
Output Pulse Duration	1.5x pump pulse duration; < 50 fs after prism pair compression
Pump Energy	200 μJ / 5 mJ (Standard Energy); 520 mJ (High Energy); Supports Twins configuration
Peak Output Energy Conversion Efficiency	>35% (Standard Energy); >40% (High Energy)
Long-term Output Stability	2% (Depends on pump laser)
Wavelength Tuning Method	Fully automatic, software controlled

Yb-doped Laser-Pumped OPA

Ultrabroadband Coverage: 200nm–18,000nm

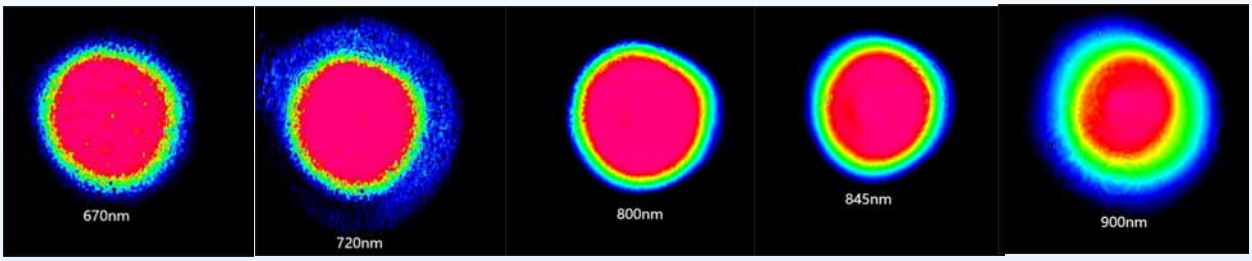
Designed for applications requiring ultra-wide wavelength coverage, ultrashort pulses, and high stability. Advanced automation (wavelength tuning, compressor optimization) streamlines experiments, enabling researchers to focus on discovery.

Parameter	Specification
Pump Conditions	>0.3μJ,150fs~3ps,1030nm (Supports higher repetition rate)
Output Wavelength Range	200nm~18000nm
Output Pulse Width	<25fs (Depends on pulse compression, supports >200 nm bandwidth)
Output Stability	<1% (Depends on the pump laser)
Wavelength Tuning Method	Automatically tunable
Pulse Compression Optimization	Automatic optimization
Temperature Control Accuracy	Better than 0.01∘

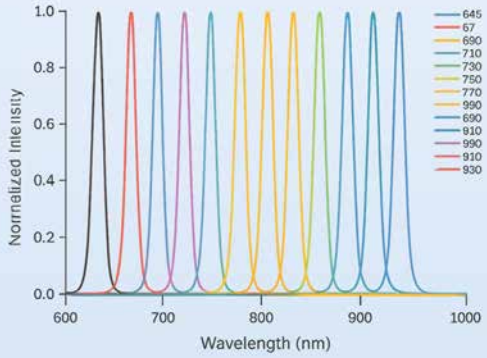
Ultrafast Spectroscopy
Nonlinear Optics Exp.
Multiphoton Microscopy
Mid-infrared Source Development

OPA-Vis: Performance

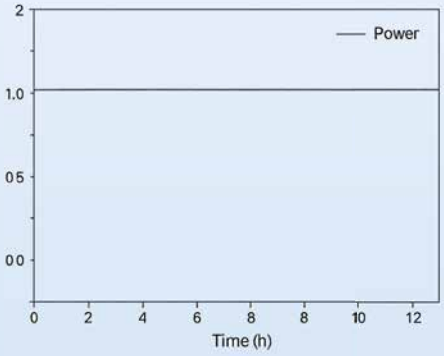
Data of OPA-Vis across key performance metrics, validating its exceptional quality as a **high-performance, high-reliability tunable visible light source**.



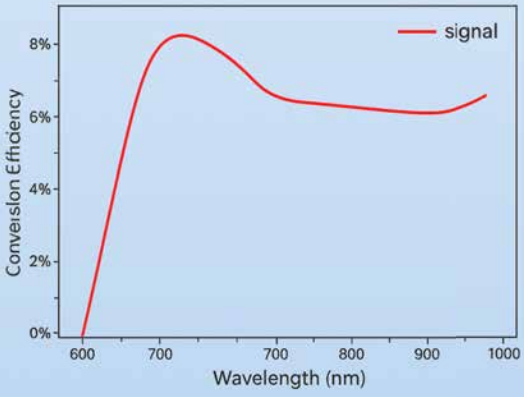
***Outstanding Beam Quality**: The output beam exhibits a uniform near-Gaussian distribution (typical $M^2 < 1.3$), ensuring excellent focusing characteristics and spatial resolution. This makes it an ideal choice for precision applications such as **microscopic imaging** and **pump-probe experiments**.*

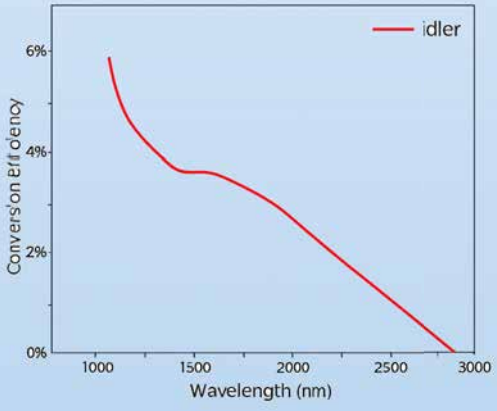


***Broad Spectral Output**:Delivering a widely tunable output spectrum from **600nm to 990nm**, the system provides **smooth spectral profiles** and **ample energy output**, perfectly meeting diverse application needs across the visible light spectrum.*



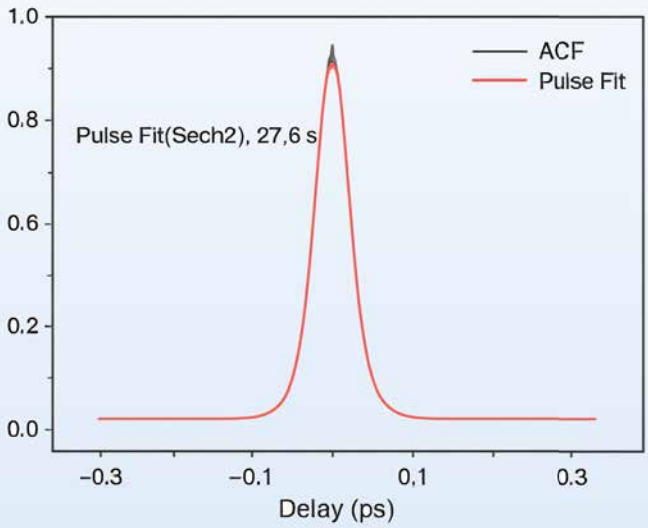
***Exceptional Long-Term Stability**:With power fluctuations maintained below **0.32% RMS** during continuous 12-hour operation, the system delivers **reliable performance** for extended-duration experiments and demanding applications.*

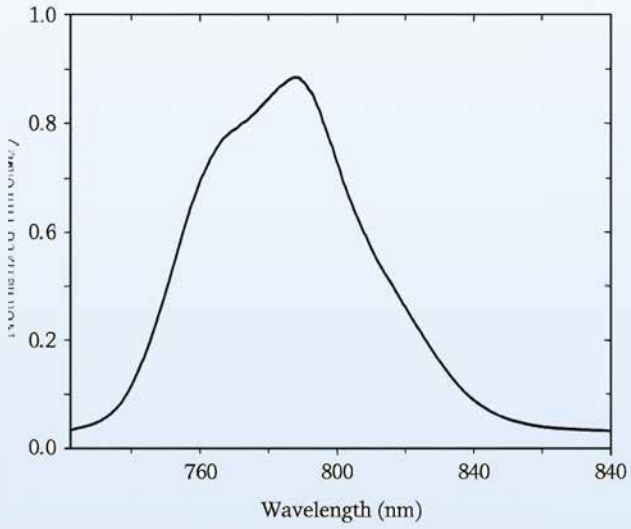




***High Energy Conversion Efficiency**:Delivering typical conversion efficiencies across primary tuning ranges/specified pump power levels to ensure users obtain sufficient optical power output.*

Characteristics and Comparisons of OPCPA

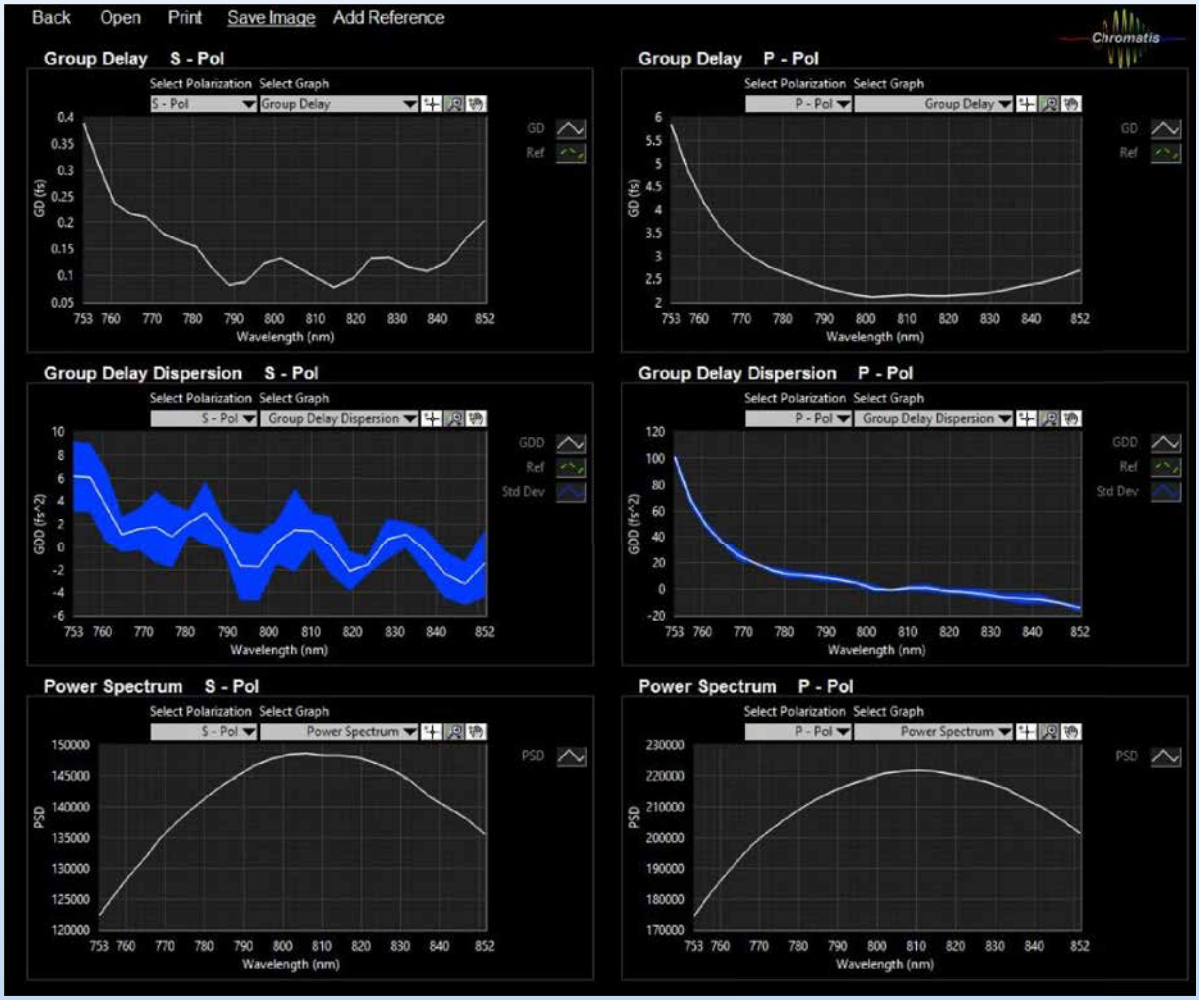




Model	OPA-VIS	OPA-NIR	OPA-MIR	OPCPA
Pump Average Power	up to 100W	up to 50 W	up to 30 W	Up to 100W
Pump Pulse Energy	0.3μJ - 4mJ	40μJ - 2mJ	40μJ - 2mJ	20μJ - 4mJ
Repetition Rate	0 - 10MHz	0 - 1MHz	0 - 1MHz	0 - 1MHz
Output Wavelength Range	630 - 990nm (signal) 1060 - 2600nm (idler)	1600 - 2060nm (signal) 2060 - 2800nm (idler, CEP stable)	1300 - 2060nm (signal) 2060 - 5000nm (idler, CEP stable)	750 - 800nm (fixed)
Long Term Stability	1.5% @ 8hours (up to 0.3%)	1.5% @ 8hours	1.5% @ 8hours	1.5% @ 8hours
Conversion Efficiency[1]	>15% signal+idler (@ 690 nm + 2030 nm)	>18% signal+idler (@1936nm + 2200nm)	>10% signal+idler (@1936nm + 2200nm)	>10%
Direct Output Pulse Width	<1.2 * pump pulse width	<1.2 * pump pulse width	<1.2 * pump pulse width	/
Compression Module	Fixed λ: <60 fs @ 800 nm,Tunable λ:<100 fs @ 700-950nm	/	/	<30 fs @ 800 nm (optional: <20fs)
Wavelength Extension Module	Signal + idler 2nd harmonic, 4th harmonic	Signal + idler 2nd harmonic, 4th harmonic DFG: 4000 - 30000nm	Signal + idler 2nd harmonic, 4th harmonic DFG: 4000 - 30000nm	/
Output Bandwidth[3]	150-250cm^{-1}, Optional: >450cm^{-1}, <100cm^{-1}	150 - 250cm^{-1}	150 - 250cm^{-1}	Optional: >100nm

Femtosecond Low Dispersion Mirror

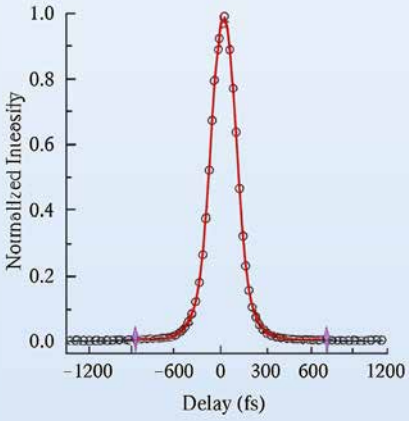
Our **femtosecond low-dispersion mirrors** leverage advanced coating technology to **minimize GDD** while maintaining **high reflectivity** within the target wavelength range. They are the optimal choice for building and optimizing **femtosecond laser systems**. We offer a series tailored to common femtosecond laser wavelengths, including **800 nm (Ti:Sapphire)**, **1030 nm (Yb-doped)**, and **515 nm (Yb-doped SHG)**, with support for standard incident angles (**0°** and **45°**) and **custom solutions**.



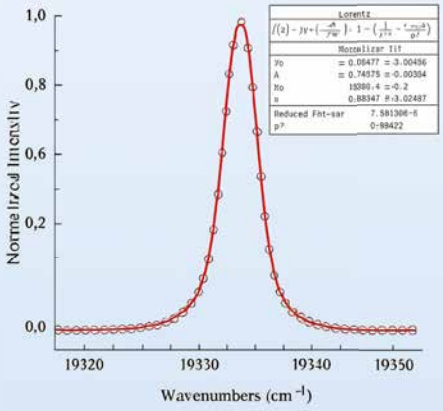
*The graph illustrates the measured **group-delay dispersion (GDD)** and reflectivity curves of an **800 nm@45° low-dispersion mirror**. Over the **750–850 nm range**, the GDD is tightly maintained at **0 ± 10 fs²** (for **s-light**).*

Etalon Performance

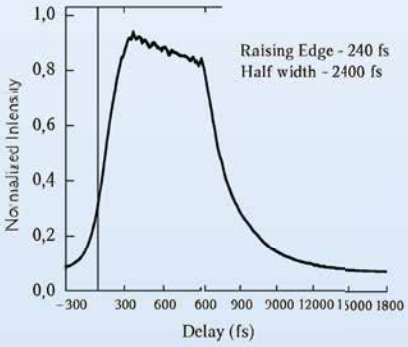
The etalon (Fabry–Pérot interferometer) feature a free spectral range (FSR) >50 nm, covering center wavelengths from **400 to 2400 nm**, with selectable linewidths of **0.1–15 cm⁻¹**. These components are ideal for high-resolution spectral analysis experiments such as SFG and SRS, enabling efficient generation of spectrally compressed, high-precision flat-top RF light with a bandwidth of hundreds of GHz.



Time-Domain Linewidth from self-heterodyne coherence interference



***Spectral Linewidth Fitting**: Baseline curves and model fitting results (~**3.5 cm⁻¹**) using **Lorentzian function fitting**.*



***Actual Time-Domain Spectral Measurement**: Includes **rising edge** and **falling edge** characteristics.*

Applications:

Spectral & temporal analysis: Evaluates linewidth performance and spectral efficiency.

Light sources: Delivers wavelength-tunable, spectrally compressed light with high precision.

Advanced spectral applications: Supports high-resolution techniques like SRS and spectral design.

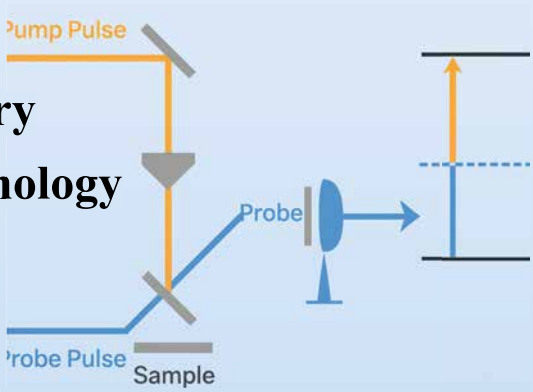
High-Sensitivity Transient Absorption Spectrometer

Capture molecular dynamics in the picosecond realm and unravel photochemical and physical processes.

Femtosecond transient absorption spectroscopy is a powerful technique for studying **ultrafast kinetic processes** following photoexcitation. Utilizing the **"pump-probe" method**, it enables real-time tracking of ultrafast phenomena such as excited-state formation and decay, energy/charge transfer, intermediate generation, structural evolution. Our spectrometer delivers a **complete, high-performance, and ultra-stable solution** to explore uncharted photoinduced processes.

Applications:

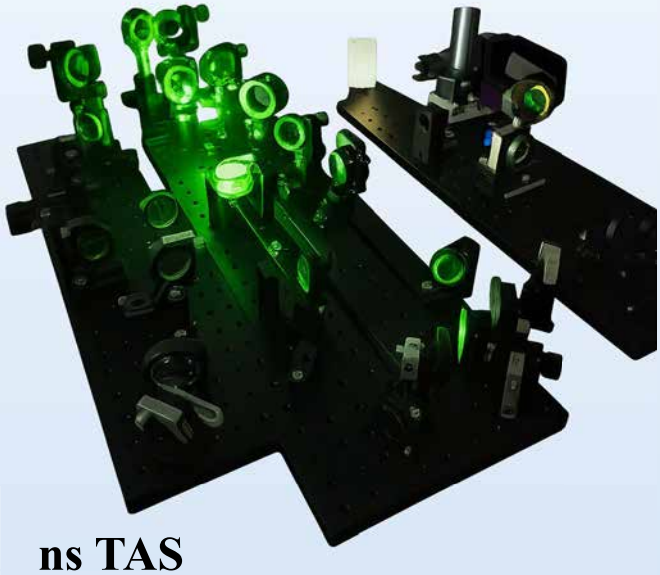
- **Photophysics & photochemistry**
- **Materials science & nanotechnology**
- **Biomolecular dynamics**
- **Photovoltaic device analysis**



Specification	Performance
Time Resolution	<100 fs / <1 ns
Wavelength Range	350–2200 nm (→13 μm)
Sensitivity	ΔOD < 0.00001
Time Window	fs–ms (adjustable)
Data Rate	Multi-kHz

Femtosecond/Nanosecond Transient Absorption Spectrometer

we offer specialized **femtosecond (fs)** and **nanosecond (ns)** transient absorption spectrometer systems. Engineered for distinct temporal windows, these systems enable precise capture of ultrafast processes spanning **sub-picoseconds to microseconds and beyond**.

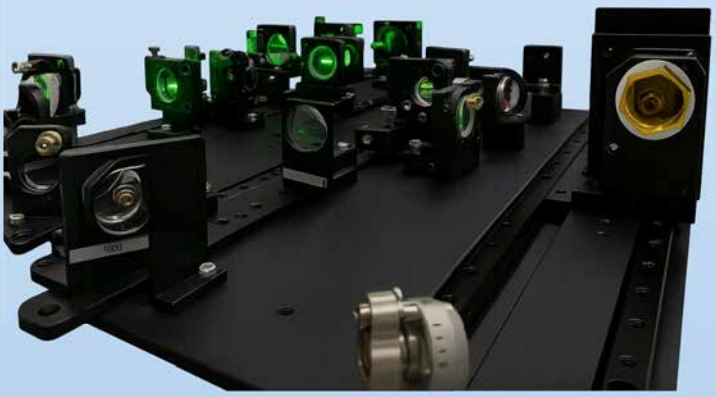


ns TAS

- **Probe wavelength**: 400–990 nm
- **Time resolution**: 1 ns
- **Time range**: 0–5000 ns
- **Applications**:
  - **Triplet exciton** generation/decay/quenching
  - Radical reaction kinetics
  - Photocatalytic intermediate evolution
  - Biomolecular dynamics at **ns–µs scales**

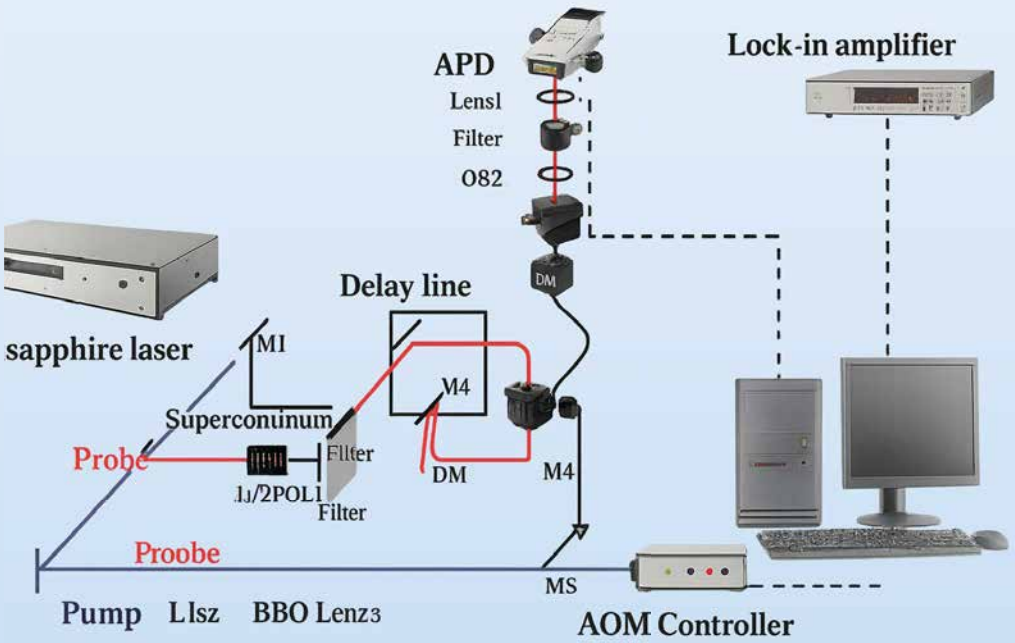
fs TAS

- **Pump wavelength**: 330–2600 nm (adjustable)
- **Probe wavelength**: UV 350–500 nm / VIS 480–990 nm
- **Time resolution**: 300 fs
- **Time range**: 0–4 ns
- **Applications**:
  - Intramolecular/intermolecular **ultrafast energy/charge transfer**
  - Solvation dynamics & vibrational relaxation
  - Carrier cooling/recombination in semiconductors
  - Coherent oscillations (e.g., wavepacket dynamics)



Micro-Transient Absorption Spectroscopy System

Our **micro-transient absorption spectroscopy system** integrates microscopic imaging with transient absorption technology, delivering **micron-level spatial resolution** for ultrafast dynamics studies. This breakthrough enables precise **point detection** and **area scanning** of spatially heterogeneous samples (e.g., micro-structured devices, single crystals, biological cells), effectively eliminating the signal averaging limitations of conventional large-spot measurements. By directly correlating kinetic processes with sample microstructures, the system provides **comprehensive 3D insights** across temporal, spectral, and spatial dimensions—an indispensable tool for advanced materials, micro/nano-devices, and life sciences research.



•**Ultrahigh spatiotemporal resolution**: Combines **femtosecond lasers** with microscopic scanning for **μm-scale spatial** and **fs-level temporal** resolution.

•**Adaptive scanning modes**: Supports both **pump-probe synchronous scanning** and **fixed-pump/probe-scanning** for versatile experimental needs.

•**High-sensitivity detection**: Utilizes an **APD-lock-in amplifier** combo to accurately capture weak signals.

•**Integrated control**: **LabVIEW-based automation** streamlines operation with one-click scanning and data acquisition.

Time-Resolved Photoluminescence (TRPL) Spectrometer

The Time-Resolved Photoluminescence (**TRPL**) Spectrometer is an essential tool for investigating excited-state dynamics in materials. Utilizing ultrafast pulsed lasers for sample excitation and high-sensitivity, high-time-resolution single-photon detection technology (typically TCSPC), it precisely records the temporal distribution of emitted photons. By analyzing fluorescence/phosphorescence decay curves, it provides critical parameters such **as excited-state lifetimes**, **carrier recombination rates**,**energy transfer efficiencies.**

Parameter	Specification
Excitation Wavelength	Matches femtosecond laser output (customizable)
Emission Range	200 nm – 1000 nm
Time Resolution	<80 ps
Time Window	Up to 1 ms
Sensitivity	Single-photon detection level

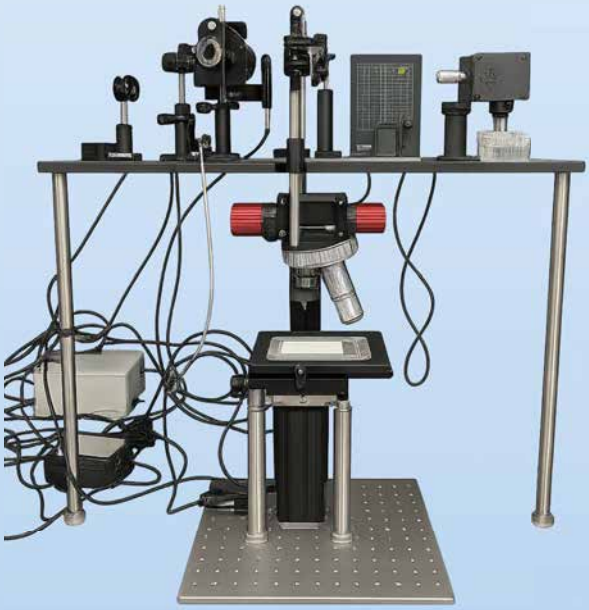
- **Materials science research**
- **Optoelectronic device performance analysis**
- **Biomolecular dynamics studies**
- **FLIM imaging**
- **FRET**

Multiphoton Fluorescence and Fluorescence Lifetime Imaging

The **Multiphoton Fluorescence Lifetime Imaging (MP-FLIM) Microscopy System** combines the deep penetration, 3D tomography, and low photodamage advantages of **Multiphoton Excitation Microscopy (MPM)** with the molecular environment detection capabilities of **Fluorescence Lifetime Imaging (FLIM)**. This cutting-edge technology not only captures high-resolution structural images but also non-invasively reveals critical functional information in live samples

Parameter	Specification
Excitation Wavelength	700 nm–1300 nm (customizable)
Detection Wavelength	400 nm–700 nm
Time Resolution	<50 ps
Imaging Depth	Up to 1 mm (sample-dependent)
Spatial Resolution	XY: 0.3 μm; Z: 1 μm
Data Acquisition Rate	Up to 80 MHz (system-configurable)

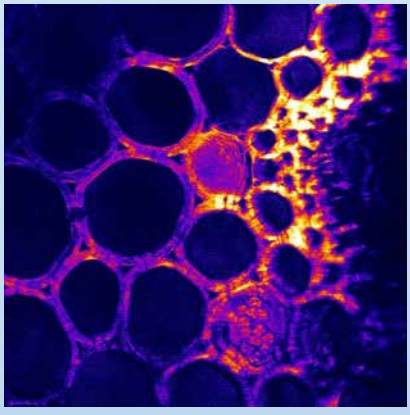
- **High-resolution imaging**: Captures cellular-level structural details
- **Deep tissue imaging**: Ideal for live tissue research
- **High-sensitivity detection**: Suitable for low-concentration fluorescence signals
- **Modular design**: Facilitates system upgrades and maintenance
- **User-friendly software**: Streamlines operation and improves experimental efficiency

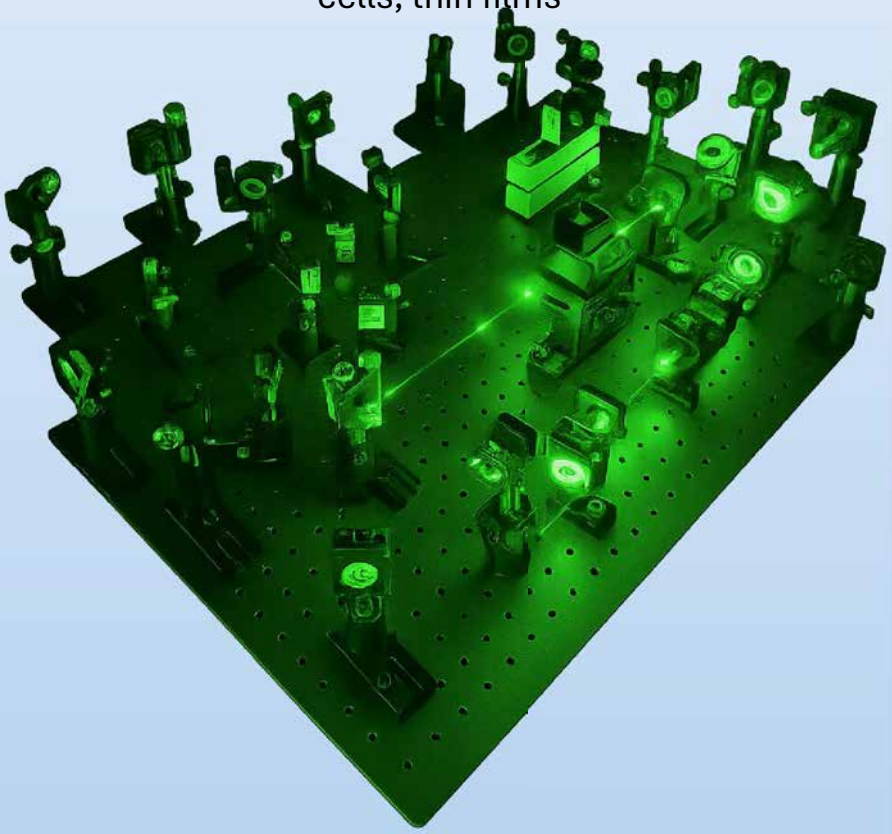


Stimulated Raman Spectroscopy/Imaging System

Our **Stimulated Raman Scattering (SRS) Microscopy System** represents a breakthrough in label-free chemical imaging, delivering real-time, high-resolution visualization of molecular-specific information within samples. This advanced system dramatically improves signal-to-noise ratio and imaging speed, overcoming traditional Raman imaging limitations to provide unprecedented **life sciences research**, **materials science studies** etc.

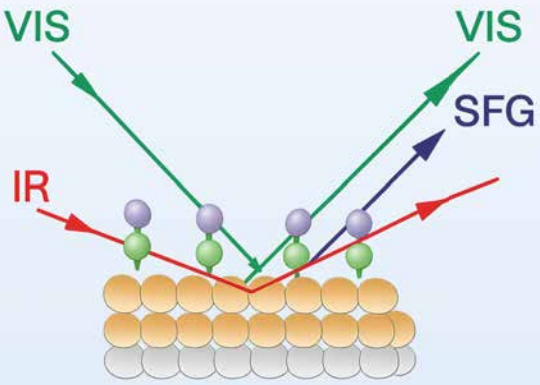
Spectral Technology	Spectral-focusing SRS
Detection Sensitivity	Noise as low as 10^{-8} $Hz^{0.5}$
Single Scan Range	700 cm^{-1} (supports rapid full-range scanning)
Spectral Resolution	Better than 15 cm^{-1}
Imaging Speed	Up to 30 frames/second
Spectral Bands	2800–3200 cm^{-1} (C-H stretch) 400–1800 cm^{-1} (fingerprint region)
Sample Compatibility	Liquids, solids, biological tissues, cells, thin films





Sum-Frequency Generatioin (SFG) Spectrometer

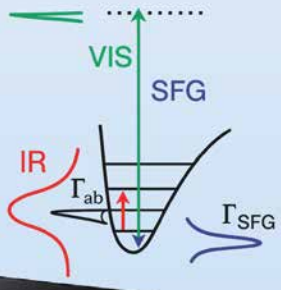
Precisely detect the molecular structures, orientations, and dynamics of surfaces and interfaces.

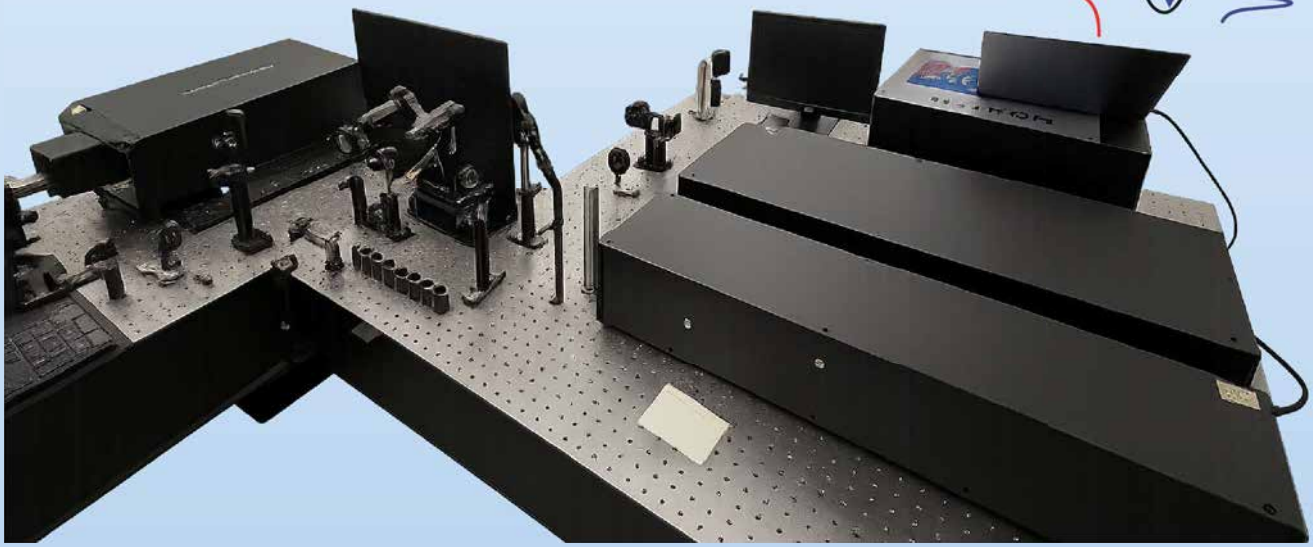


Sum-Frequency Generation Spectroscopy (SFG) is a unique surface/interface-sensitive nonlinear optical technique that selectively probes molecular layers at interfaces, providing chemical structure, orientation, and dynamic information while minimizing bulk phase interference. Our advanced SFG spectrometer combines precision optics with stable laser technology, ideal for studying gas/solid, gas/liquid, liquid/liquid, solid/liquid, and complex buried interfaces.

Applications

- **Surface chemistry**
- **Biomembrane research**
- **Materials science**
- **Environmental science**





Time-Resolved Terahertz Time-Domain Spectroscopy (TR-THz-TDS) Instrument

Revealing ultrafast material dynamics | Non-contact detection of photo-generated carrier evolution

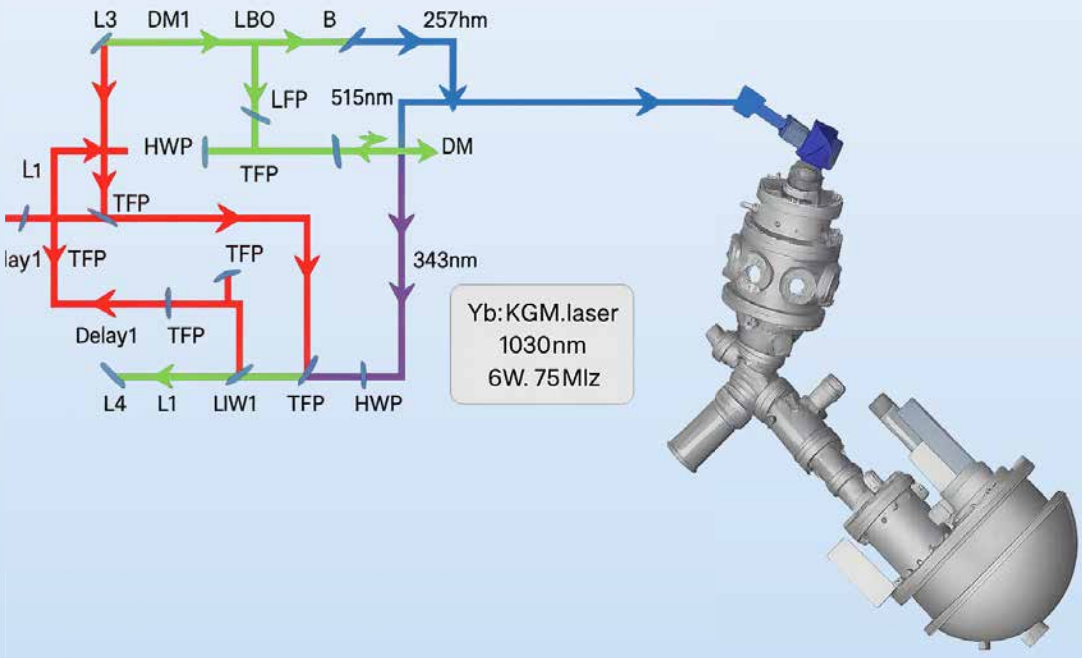
Time-Resolved Terahertz Time-Domain Spectroscopy (TR-THz-TDS) is an advanced non-contact spectroscopic system that captures materials' electrical/optical responses from femtosecond to nanosecond timescales by analyzing THz pulse propagation. Utilizing femtosecond/picosecond lasers with high-precision delay lines, it achieves sub-femtosecond resolution for studying ultrafast processes in semiconductors, biomedicine, security screening, and industrial inspection through comprehensive time-frequency domain analysis.

Applications:

- **Materials Science**: Studies carrier dynamics and phase transition processes
- **Biomedicine**: Non-destructive detection of water content and structural changes in biological tissues
- **Semiconductor Research**: Analysis of conductivity and carrier lifetime in semiconductor materials
- **Security Screening**: Identification and analysis of chemicals like drugs and explosives
- **Industrial Testing**: Non-destructive measurement of coating thickness and material defects

Time-Resolved Photoelectron Spectroscopy/Photoemission Electron Microscopy (TR-PEEM)

Time-Resolved Photoelectron Spectroscopy/Photoemission Electron Microscopy (TR-PEEM) is an advanced surface analysis technique that combines photoelectron spectroscopy's energy resolution with electron microscopy's spatial resolution. Using femtosecond laser pump-probe technology, it captures nanoscale ultrafast electronic dynamics, proving invaluable for semiconductor research, photocatalysis, and biomaterials studies.



Applications:

- **Semiconductor Research**: Carrier dynamics and interface effects
- **Biomaterials**: Electronic structure and reaction mechanisms
- **Photocatalysis**: Electron transfer processes
- **Energy Materials**: Electron behavior in energy conversion

Service and Support

Comprehensive Assistance, Hassle-Free Collaboration

- **24/7 Technical Consultation**
- **Global Rapid Response**
- **Free System Training & Lifetime Maintenance**

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