Innovation for Science

ULTRAFAST SYSTEMS

Products For Cutting Edge Photoscience

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HELIOS



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The Company ...

Ultrafast Systems is expert in the design and manufacture of optical spectrometers with high time resolution, with particular focus on femtosecond and picosecond time scales. Our family of products represents the state-of-the-art in technology and the utmost in user friendliness. No other manufacturer of time-resolved spectrometers has the same extensive range of products. Our software for experiment control and data analysis is without parallel.

Further details, features and specifications of our photoscience products and services can be found at **www.UltrafastSystems.com**. You can also find additional customer testimonials regarding both our products and customer service on the website. **Ultrafast Systems** was formed in 2002 and is located in Sarasota, Florida. Our U.S. based team of engineers, along with our international network of representatives, provide excellent service and support to our growing world-wide customer base.

The Products • • •

Ultrafast Systems Offers Five Time-Resolved Spectrometers:

HELIOS – a femtosecond transient absorption spectrometer with spectral resolution from the blue to the near infrared regions.

EOS – a **HELIOS** with an extended time window into nanoseconds and beyond.

HALCYONE – a fluorescence lifetime spectrometer with time resolution from femtoseconds to milliseconds by using a combination of upconversion and time-correlated single photon counting spectrometries in one box.

PROTEUS – a kinetic spectrometer with nanosecond time resolution.

KRONOS – a portable microsecond flash photolysis unit.

All systems are easily installed, have minimal footprints, use state-of-the-art components and come with user-friendly data collection software and outstanding data analysis software.

When reviewing the specifications of our products please note that we are prepared to work with clients who seek custom solutions or upgrades to their existing systems.

The Applications • • •

Our spectrometers are being employed in all aspects of research in modern photoscience. The instruments are used in areas of photophysics, photochemistry, photobiology, material science, nanoscience, and solar energy conversion and storage. Examples of research topics include electronic state deactivation, vibrational energy redistribution, electron and energy transfer both inter- and intra-molecularly and solvation dynamics. Processes can be measured at variable temperatures including cryogenic. Our systems also allow for the study of solid state samples.



Our Customers Say It Best •••

Gone are the days when you had to worry about spending months to set up a transient absorption spectrophotometer for the femtosecond laser system.

When we decided to purchase a femtosecond laser system, we approached Ultrafast Systems for help setting up the transient absorption instrument. Within a week of the arrival of the laser, the UFS engineers came over and set up the whole system in just one day. The next day we could already start collecting data. Since then it has been used without a hitch. For any new user it takes only few minutes to get acquainted with the software.

The Helios spectrometer from Ultrafast Systems is a state of the art technology that deserves to be on the bench top of every photochemist. The pricing of the whole package is modest and it is user-friendly. For us, it was a big savings of manpower and time.

With Helios we are planning to tackle many issues related to the charge transfer processes in semiconductor nanostructures and molecular clusters.

Prof. Prashant Kamat

The Notre Dame Radiation Laboratory, University of Notre Dame, IN.

HELIOS

I can certainly say that the attention to detail paid when developing the HELIOS instrument has paid off in terms of convenience and reliability.

Since the moment we've had the HELIOS installed it has become one of the most used pieces of equipment in our labs and has certainly rewarded the investment we've put in.

> Dr: Joel Hales Senior Research Scientist Georgia Institute of Technology

Features

User Friendly Software

Broad Probe Spectral Range (UV-NIR)

Multi kHz Data Acquisition Rates

Fiber Coupled High-Speed Multichannel Detectors

All Reflective Continuum Generator

Minimized Chirp of The Probe Pulse

Time Window - Up To 8 ns

Probe Reference Option

Reflection Mode Option

Can Be Fully Integrated With EOS

HELIOS

Femtosecond Transient Absorption Spectrometer

HELIOS is a broadband pump-probe femtosecond transient absorption spectrometer. A complete turnkey system, **HELIOS** comprises an optical unit and a PC containing the necessary data acquisition hardware and software (Helios 4.x). **HELIOS** is designed to work with an amplified Ti:Sapphire femtosecond laser. **HELIOS** comes with advanced data analysis software, **SURFACE XPLORER**, capable of various types of data processing including Global Analysis.

With its broad spectral coverage from UV to NIR and a time window of up to 8 ns, **HELIOS** will produce superb spectral and kinetic data needed for your investigations of photoexcitation events with ultrafast time resolution.

Specifications ...

- Probe Spectral Range: UV-NIR (350-1600 nm)
- Spectral Resolution: VIS 1.5 nm, NIR 3.5 nm
- Time Window: Up To 8 ns
- Intrinsic Time Resolution: 7 fs, 2 fs Optional
- Data Format: 3-D Wavelength-Time-Absorbance
 Data Matrix In A Form of An ASCII CSV File, Which Can Be Easily
 Processed With Surface Xplorer Or Third Party Software
- Detectors: Fiber Coupled Multichannel High Speed Spectrometers With kHz Scan Rates
- Software: HELIOS 4.x LabView Based Software For Instrument Control And Data Acquisition – The Software Allows For Full Experiment Automation And Has Two Levels of User Access
- Dimensions: W-24" x L-36" x H-10" (W-610 x L-915 x H-250mm)



UTRAFAST SYSTEM

Sub-Nanosecond

EOS

We have been extremely happy with the EOS from Ultrafast Systems. For groups already equipped with a femtosecond amplified Ti:sapphire laser system, EOS offers a cost-effective, elegant, and high S/N solution for measuring transient spectra and kinetics beyond 1 ns.

The ability to study systems from femtoseconds to tens of microseconds (and longer) is important for many problems, including charge separation and recombination dynamics in photovoltaic and photocatalytic nanomaterials.

> Dr. Tim Lian Emory University

Features

User Friendly Software

Broad Probe Spectral Range (UV-NIR)

Time Resolution – 500 ps

Multi kHz Data Acquisition Rates

Fiber Coupled High-Speed Multichannel Detectors

Time Window - 400 Microseconds (With 1 kHz Lasers)

> Can Be Fully Integrated With HELIOS

ULTRAFAST SYSTEMS



for probe light generation. Researchers using femtosecond transient absorption for studying ultrafast kinetics of photoinduced processes can now extend the time window of investigation beyond several nanoseconds.

EOS, with its ~500 ps time resolution and the electronically controlled pump-probe delay is a perfect solution, and in combination with **HELIOS** provides continuous temporal coverage from femto- to milliseconds and beyond.

Transient Absorption Spectrometer

EOS is a broadband pump-probe sub-nanosecond transient absorption spectrometer

with an extended time window. Its patented design utilizes a photonic crystal fiber

Specifications ...

- Probe Spectral Range: UV-NIR (350-1600 nm)
- Spectral Resolution: VIS 1.5 nm, NIR 3.5 nm
- Time Resolution 500 ps
- Time Window 400 Microseconds (With 1 kHz Lasers)
- Data Format: 3-D Wavelength-Time-Absorbance Data Matrix In A Form of An ASCII CSV File, Which Can Be Easily Processed With Surface Xplorer Or Third Party Software
- Detectors: Fiber Coupled Multichannel High Speed Spectrometers With kHz Scan Rates
- Software: EOS 2.x LabView Based Software For Instrument Control And Data Acquisition – The Software Allows For Full Experiment Automation And Has Two Levels of User Access
- Dimensions: W-24" x L-36" x H-10" (W-610 x L-915 x H-250mm)

EOS

HALCYONE

The Halcyone upconversion system is easy to use. The team at Ultrafast Systems is willing to work with your individual needs.

If I for any reason have difficulty in obtaining a desired signal, they have also been willing to troubleshoot the problem with me until I can get the data I need.

> Dr. Jodi Szarko Northwestern University

Features

User Friendly Software

Broad Spectral Range (UV-NIR)

Time Window – Up To 1 ms

Reflection Mode Option

Works With Liquid And Solid Samples

Fully Automated Spectral And Kinetic Scanning

Can Measure Anisotropy Decays

Automatic Adjustment of SFG Crystal Angle

ULTRAFAST SYSTEM

Fluorescence Lifetime Measurement System

HALCYONE is an all-in-one-box fluorescence measurement system comprising a Fluorescence Upconversion spectrometer and a Time-Correlated Single Photon Counting instrument. In the upconversion mode **HALCYONE** has a time window of 3.3 ns and femtosecond time resolution. In the TCSPC regime the time window can be expanded up to 1 ms with 250 ps resolution.

Switching between the two modes is facile and requires no optical setup changes. A 2D camera is used to ensure highly precise delay stage alignment. The spectral range of **HALCYONE** spans from VIS to NIR. **HALCYONE** can work with either a mode locked Ti-sapphire oscillator or with a regeneratively amplified Ti-sapphire laser.

Specifications ...

- Spectral Range: UV-NIR (400-1600 nm)
- Upconversion Mode: 400-1600 nm; TCSPC Mode: 160-900 nm
- Time Window: Upconversion Mode: 3.3 ns; TCSPC Mode: Determined By Time Interval Between Adjacent Laser Pulses Typical Values For Femtosecond Oscillators – 12 ns; For Femtosecond Amplifiers – 1 ms
- Intrinsic Time Resolution: 7 fs, 2 fs Optional
- Data Format: 3-D Wavelength-Time-Intensity Data Matrix Or Individual Spectra/Kinetics In A Form of An ASCII CSV File
- Software: HALCYONE 3.x LabView Based Software The Software Allows For Full Experiment Automation
- Dimensions: W-24" x L-36" x H-10" (W-610 x L-915 x H-250mm)



PROTEUS

Nanosecond Kinetic Spectrometer

PROTEUS is a complete turnkey nanosecond transient spectroscopy instrument with extensive spectral and temporal coverage. Its modular design allows for extra flexibility in the experimental setup. **PROTEUS** is used for monitoring photoinduced optical absorption changes. It utilizes a continuous recording method in which a photo-detector monitors the transmittance of the sample at a set wavelength in a continuous manner, before, during, and after the initiating laser pulse.

The detector output is fed to the digital oscilloscope, which acquires the waveform and stores it for eventual processing. Thus recording of the V(t) profile is done in real time. Repeating the process over a series of wavelengths allows the investigator to build up the dynamic surface for the light-induced transient, which is capable of providing rate data at different wavelengths and time-dependent spectra.

Specifications ...

- Spectral Range: UV-NIR (300-1600 nm)
- Time Resolution: 5 ns
- Time Window: 100 s
- Detectors: Amplified Si And InGaAs photodiodes
- Digitizer: 9-Bit 300 MHz Bandwidth, 2.5 Gs/sec Faster Digitizers Are Optional
- Data Format: Individual Kinetics In A Form of An ASCII CSV File Multiple Kinetics Can Be Easily Combined Into 3-D Wavelength-Time-Absorbance Data Matrix In SURFACE XPLORER
- Software: PROTEUS 3.x LabView Based Software The Software Allows For Full Experiment Automation – Supports Absorption, Emission, And Emission Corrected Absorption Measurements
- Dimensions: W-50" x L-18" x H-13" (W-1,270 x L-457 x H-330 mm)

The Proteus spectrometer has been consistently producing high quality data which has led to publications in peer-reviewed journals such as Journal of the American Chemical Society, Inorganic Chemistry, Journal of Physical Chemistry C and Dalton Transactions.

As this reliable system continues to produce high quality data, more publications are sure to come in the future.

> Dr. Aaron Rachford Department of Chemistry Bowling Green State University

Features

User Friendly Software

Broad Spectral Range (UV-NIR)

Requires microJ Pulse Energy

Adjustable Spectral Resolution

Flexible Optical Setup With Fiber Coupling Option

Large Detector Dynamic Range

Robust Photodiode Detectors

Supports 1 kHz Lasers



KRONOS

Using Kronos has resulted in students understanding fast reactions. We are utilizing it in my physical chemistry class and I am completely satisfied with it.

It is very easy to use and we are getting much use out of it, especially for undergraduate research.

Dr. Daniel J. McLoughlin Xavier University

Features

Extremely User Friendly

Compact With USB Interface

UV-VIS Spectral Range

Microsecond Time Resolution

High Sensitivity

No Laser Required

Safe To Use Without Eye Protection

Can Be Easily Moved Without The Need For Realignment

No Installation Required

Comes With Laboratory Manuals, Sets of Chemicals, Comprehensive Software, And A PC

ILLINARAST STRICK

Portable Microsecond Flash Photolysis Spectrometer

KRONOS is a portable flash photolysis spectrometer designed for transient absorption and emission measurements on the microsecond and longer time scale. It is targeted mainly as a chemical kinetics experiment in university or high school teaching laboratories. **KRONOS** can measure solid and liquid samples in transmission as well as emission modes. The **KRONOS** patent-pending design utilizes a Xe arc flash lamp as an excitation source, which allows for wavelength tunability.

The photoinduced transient species are interrogated by passing the output of a white LED through the sample. An LED source provides superior stability and low noise. After passing through the sample, the probe light passes through an interference filter which restricts the detector to viewing a 10 nm wide segment of the white light spectrum The detector voltage output is digitized and transferred to a PC for generation of a kinetic trace and for further manipulations.

Specifications ...

- Spectral Range: 390-700 nm
- Detector: Si Photodiode
- Digitizer: Built-In 16-bit, 250 kHz Bandwidth.
- Time Resolution: 15 Microseconds
- Built-In Excitation Light Source: Xe Arc Flash Lamp
- Built-In Probe Light Source: Broadband LED
- Sensitivity: Typical Background Noise In Kronos Is Within 0.2 mOD (single shot)
- Software: KRONOS 3.x LabView Based Software Supports Absorption And Emission Measurements





Data Analysis Software

The **SURFACE XPLORER** analytical software pack makes working with transient absorption data faster and more efficient. It combines strong presentational features, including simultaneous 3D and 2D data display, with powerful data analysis capabilities, such as temporal chirp correction, nonlinear fitting, SVD and Global Analysis.

Features ...

- Quick Navigation Through Transient Spectra And Kinetics
- Simultaneous Display of Multiple Spectra And/Or Kinetics
- Display And Manipulation of A 3D Surface For Viewing At Different Angles
- Selected Spectra And Kinetics Can Be Exported Into CSV Files
- Normalization of Spectra
- Normalization of Kinetics
- Temporal Chirp Correction
- Time Zero Adjustments
- Subtraction of Scattered Light & Background
- Anisotropy Calculation
- Non-Linear Fitting of Time Profiles
- Singular Value Decomposition of A 3D Surface Into Principal Components
- Reconstruction of A 3D Surface From Principal Components
- Global Analysis
- Simple Report Generation
- Facile "Stitching" of Surfaces Having Different Temporal And Spectral Ranges

Download The Free Demo of Surface Xplorer At...

www.UltrafastSystems.com/downloads.htm

Purchasing the HELIOS system has saved us a lot of time in building the instrument and writing the code. We use it all the time and it is great.

The Surface Xplorer software is very good for analyzing the data. I would highly recommend purchasing this instrument!

> Dr. Joy E. Haley Air Force Research Laboratory Wright-Patterson Air Force Base

After testing your software for the last 10 days we are now totally convinced that this is a great product.

Congratulations, you did a fantastic job!

Prof. Torsten Fiebig Northwestern University



TRANSPORT OPTICS



We offer universal **TRANSPORT OPTICS** kits that can be used to successfully couple our spectrometers to your laser system.

These kits include all optics and optomechanics necessary for dividing the beam at the output of the laser and coupling optical parametric amplifiers (OPA) and harmonics generators (HG) to our **HELIOS**, **EOS**, and **HALCYONE**, spectrometers.

HIGH SPEED SPECTROMETER



These **HIGH SPEED SPECTROMETERS** are designed to utilize the high repetition frequencies of modern pulsed lasers and deliver the scanning rates of up to 9,500 spectra/s (VIS) and 7,500 spectra/s (NIR). Their optical design is optimized to provide maximum light throughput in **HELIOS** and **EOS** spectrometers. They consist of an imaging spectrograph and a high speed multichannel detector.

The spectrograph utilizes a high-efficiency, ion-etched, aberration corrected holographic grating. The spectrograph design is optimized for maximum light throughput. Light is input via an optical fiber and travels directly to the grating. The grating simultaneously disperses and refocuses light onto the sensor without the use of any additional optics.

The height of the projected spectral image remains virtually the same as the diameter of the input optical fiber.

In this way the light spectrum can be focused on the sensor with minimal losses. The multichannel detectors have 0.5 mm tall pixels that are optimal for spectrometry.



We offer femtosecond second (SH) and third (TH) **HARMONICS GENERATORS** designed to work with a Ti-Sapphire oscillator or an amplified laser output near 800 nm. Two BBO crystals (type I) are utilized to produce SH and TH outputs with high efficiency.

The harmonics generator unit has dedicated outputs corresponding to ~267 nm, ~400 nm, and ~800 nm. These different outputs are easily directed into each of our **Ultrafast Spectrometers** to provide highly stable excitation sources.

UV-CONTINUUM

Generating a continuum in fluorite (CaF2) allows for probing transient species down to at least 350 nm. CaF2 has a higher continuum generation threshold and a lower thermal conductivity compared to sapphire, so it is necessary to continually move the substrate during white light generation. The **UV-CONTINUUM** is a fluorite-based continuum generation module for **HELIOS** with the spectral range of 350 nm - 750 nm. The module is fully integrated into the **HELIOS** continuum generator.

It includes a high quality CaF2 crystal mounted on a computer-controlled motorized translation stage for moving the crystal and thereby providing a stable high quality continuum. The stage controls are integrated into the HELIOS data acquisition software.

TRANSLATING SAMPLE HOLDER



With solid samples, photodegradation can result in erroneous data. To overcome this problem, we recommend that you use the **2D TRANSLATING SAMPLE HOLDER** that can move your samples in a scanning pattern and cover an area of ca 120 mm².

With the **TRANSLATING SAMPLE HOLDER** you have the ability to vary the speed and density of scans. The sample holder is computer controlled with the drivers integrated into the software of the **HELIOS**, **EOS**, and **HALCYONE** spectrometers.

BEAM ALIGNMENT TOOL



The **BEAM ALIGNMENT TOOL** is designed for monitoring beam pointing stability and beam collimation in **HALCYONE** and **HELIOS** spectrometers. In these instruments two beams need to be focused in the same small spatial area. One of these beams is sent through a variable optical delay stage, thereby changing its optical path length by as much as 2 meters.

Thus the alignment of the optical delay stage is a critical requirement for obtaining reliable data. Most commonly the wavelength of the beam sent through the delay stage is around 800 nm, a wavelength that is difficult to see by eye, posing additional difficulties for the alignment. The silicon sensor in a camera detects 800 nm light very well and therefore produces a clear image of the beam profile.

Applications • • •

- Optical Delay Stage Alignment
- Beam Profile Monitoring
- Beam Pointing Stability Control

Features • • •

- High Quality Digital Image (640x480)
- Plug & Play USB Interface
- Drivers Are Integrated Into HELIOS And HALCYONE Software

FLOW CELL

This **FLOW CELL** assembly utilizes the top quality peristaltic pumps. It has a zero-maintenance motor, whisper-quiet gear boxes and user-friendly control electronics, all in a compact, vibration isolated housing. The peristaltic pump of the flow cell has virtually zero "dead" volume to make working with small sample volumes possible.

Compatibility • • •

The **FLOW CELL** is fully compatible with all our spectrometers. For the 1 kHz laser repetition rate and a 2 mm cuvette this assembly provides pseudo single shot conditions allowing to photoexcite a fresh volume of the sample with each laser pulse.

The Assembly Includes ...

- Peristaltic Pump Assembly With A Vibration Isolation Platform
- Universal Power Supply
 2 mm Thick Quartz Cuvette
 Cuvette Holder
- Tubing / A Variety of Tubing Is Available To Accommodate Almost Any Solvent
- Flask Clamp Pedestal Posts

Performance Specifications • • •

- Flow Rate: 50-1700ml/min (Variable)
- Flow Speed (For 2 mm Cuvette): >1,125 mm/sec
- Operating Temperature: 10-70 °C



MAGNETIC STIRRING SYSTEM

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The **Magnetic Stirring System** uses a magnetic field to transmit torque to a Teflon coated magnetic bar inside of a sample cell. Due to its small size, the stirring bar fits into even 2 mm thick cuvettes. Since the rotation of the stirring bar is achieved with a magnetic field the stirrer can be used with hermetically sealed cells.

The Assembly Includes ...

- Variable Speed Controller With A Magnetic Base For Secure Positioning On A Laser Table
- Post Holder With A Magnetic Base For Secure Positioning On A Laser Table
- Motor
- Teflon Coated Stirring Bars 6x1.5mm (Pack of 10)
- Universal International Power Supply

Features • • •

- Compact
- Continuously Variable Rotation Speed
- Works With Hermetically Sealed Cuvettes
- Magnetic Base of The Speed Controller Secures The Controller On Steel Breadboards
- Magnetic Base of The Motor Assembly Does Not Require Bolting Down

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ULTRAFAST SYSTEMS Time-Resolved Spectrometry Solutions

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