

# Review of Scientific Instruments New Products

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## AFFILIATIONS

Center for Advanced Diffusion-Wave and Photoacoustic Technologies (CADIPT), 5 King's College Road, Toronto, Ontario M5S 3G8, Canada

In order to supplement manufacturers' information, this department will welcome the submission by our readers of brief communications reporting measurements on the physical properties of materials which supersede earlier data or suggest new research applications.

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## NEW INSTRUMENTS AND COMPONENTS

### Near-infrared (IR) microspectrometer

AP Technologies now offers the latest microelectromechanical (MEMS) grating-collimator microspectrometer from OTO Photonics. It claims the RedSparrow-Series RS1680 brings the size, performance, and cost benefits of the company's UltraMicro-Series technology to the near-IR band. RedSparrow measures a compact  $40 \times 40 \times 18 \text{ mm}^3$  ( $<30 \text{ cm}^3$ ), including the removable external control board. However, according to the company, the rigid metal package and optical bench provide excellent thermal, humidity, and shock/vibration stability performance. The instrument uses a 128-pixel near-IR indium gallium arsenide sensor for operation from 950 nm to 1700 nm with a full width at half maximum resolution of 8–13 nm. OTO's MEMS-based microspectrometers replace the collimator-plane grating-focusing mirror optical structure used in traditional Czerny–Turner spectrometers with a nonspherical, mass-producible micro-sized component that combines grating and focusing functions. To eliminate aberrations, the microchip concave grating technology leverages patented algorithms to calculate curvature and ray tracing. The optical input is via an

industry-standard SMA-905 multimode fiber connector. The externally mounted control board incorporates a 16-bit, 15-MHz analog-to-digital converter with electrical interface featuring a high-speed (480 Mbps) micro universal serial bus (USB) 2.0 connector or 8-pin extension port. OTO's SpectraSmart spectral management software is supplied with RedSparrow and includes a Windows software development kit. Example code for control via Linux is available upon request. AP Technologies Ltd., The Coach House, Watery Lane, Bath BA2 1RL, United Kingdom. (+44 (0) 1225 780400) <https://www.aptechnologies.co.uk>



### Standard and high-performance cameras

The new ace 2 camera series from Basler includes two product lines: the economical ace 2 Basic, for standard vision-system applications, and the ace 2 Pro, for more demanding requirements. Both lines—each with four models—feature state-of-the-art complementary metal-oxide-semiconductor sensor technology, optimized hardware design, and GigE or USB 3.0 interfaces, and both can be combined with the company's extensive accessory portfolio. The Basic models are equipped with Sony's IMX392 sensor. They offer 2.3-megapixel resolution at a frame rate of 51 fps in the GigE version and up to 160 fps with the USB 3.0 interface. The ace 2 Pro line offers the company's advanced in-camera features Compression Beyond and Pixel Beyond. Compression Beyond compresses image data directly in the camera's field-programmable gate arrays (FPGAs) in real time without sacrificing image quality. It makes more bandwidth available, which ensures higher frame rates, especially with GigE—up to two to three times the rate, depending on the image content. If required, the image data can be stored in compressed form in full resolution and therefore require much less storage capacity. Pixel Beyond uses an interpolation method developed by Basler to change the pixel size and thereby allow

adjustments of sensor characteristics, so resolution can be scaled and the amount of data reduced. Pixel Beyond can be used to simulate other sensor models, so the characteristics of discontinued sensor models can be reproduced individually. That allows for redesigning without reconfiguring the entire vision system. *Basler, Inc., 855 Springdale Drive, Suite 203, Exton, Pennsylvania 19341, USA. (610-280-0171) <https://www.baslerweb.com>*

model is designed for green fluorescent protein and related imaging probes and  $\text{Ca}^{2+}$  indicators. The 1064-nm version matches well with red-shifted  $\text{Ca}^{2+}$  indicators and red fluorescent proteins. Thanks to its high-fidelity femtosecond pulse quality, it is also a suitable tool for supercontinuum generation. *Coherent, Inc., 5100 Patrick Henry Drive, Santa Clara, California 95054, USA. (800-227-8840 or 408-764-4000) <https://www.coherent.com>*



### Compact ultrafast lasers

Coherent has designed its Axon family of femtosecond lasers to deliver low cost, reduced complexity, and a small footprint. The air-cooled lasers address demanding applications such as multiphoton microscopy, material nanoprocessing, two-photon polymerization, terahertz spectroscopy, and semiconductor and thin-film metrology. The first two models of the series have fixed output wavelengths of 920 nm and 1064 nm; future models will offer additional wavelengths. The Axon lasers feature 1 W of average power with integrated, software-controlled group-velocity-dispersion precompensation. The output has a pulse width of <150 fs and an 80-MHz pulse repetition rate. A major application of the Axon lasers is multiphoton microscopy: the 920-nm

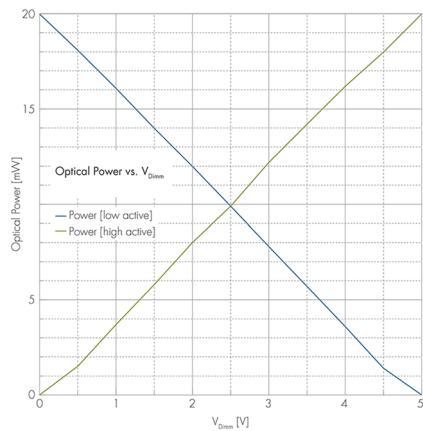
### Tunable femtosecond laser

According to KMLabs, its Y-Fi VUV is the first commercial tunable femtosecond source to deliver vacuum ultraviolet (UV) light, a capability that lets users probe material and molecular properties on ultrafast time scales. The Y-Fi VUV offers discrete wavelength tunability from 6.0 eV to 10.8 eV, which was previously only available at a synchrotron. In angle-resolved photoemission (ARPES) experiments, that tunability allows surface effects to be distinguished from bulk effects. For time-of-flight studies of molecules, the Y-Fi VUV can differentiate among otherwise identical isomers. It can be focused down to below 10  $\mu\text{m}$ , which allows for examination of new types of samples, including polycrystalline, spatially inhomogeneous, and faceted materials. The source produces pulses with durations below 250 fs, so users can probe ultrafast dynamics of molecules and materials. Its 1-MHz repetition rate allows for rapid data collection. Y-Fi VUV is “application ready,” including the appropriate focusing and beam-steering elements to enable fast integration with experimental apparatus. It can be used with a window between the source and the experimental chamber, ensuring that applications that require ultrahigh vacuum such as ARPES will remain contamination-free. In addition to ARPES, Y-Fi VUV may enable breakthrough research in photoemission electron microscopy, photoionization mass

spectroscopy for combustion research, and other studies of next-generation materials and molecular systems. *KMLabs, Inc., 4775 Walnut Street, Suite 102, Boulder, Colorado 80301, USA. (303-544-9068) <https://www.kmlabs.com>*

### Digital laser drivers

Laser Components has made available digital laser drivers with a microcontroller for selected laser modules in its Flexpoint series. The module is connected via RS-232 or USB and can be used for digital control and monitoring. Users can program operational settings such as output power, trigger, pulsation, and modulation. Monitoring functions include system uptime, module temperature, laser diode current, and more. Those parameters can be used to track the aging process of the laser module to prevent downtime through proactive maintenance. In addition, the use of a microcontroller ensures stable output power and good linearity between the control voltage and the analog output power. *Laser Components USA, Inc., 116 South River Road, Building C, Bedford, New Hampshire 03110, USA. (603-821-7040) <https://www.lasercomponents.com>*



### New design for high-sensitivity spectrograph

Horiba Scientific has announced a new design for its recently introduced Lumetta fixed grating spectrograph. The new design houses an F/2 spectrograph with a large-area sensor that enables optimal light gathering. According to the company, it



features the highest optical throughput in the compact spectrograph class. As an imaging spectrograph, Lumetta enables advanced techniques such as multitrack spectroscopy and fast hyperspectral imaging. With its scientific-grade 1 charge-coupled device deep-cooled to  $-50^{\circ}\text{C}$  and very-low-noise 16-bit electronics, Lumetta offers the highest sensitivity in its class for low-light applications, Horiba claims. Lumetta's signal-to-noise ratio is 1200:1. Its deep cooling allows signal integration for hours—a feature the company says is not readily available on other instruments in the compact class. *Horiba Scientific Division of Horiba Instruments, Inc., 20 Knightsbridge Road, Piscataway, New Jersey 08854, USA. (732-494-8660) <http://www.horiba.com>*



## NEW DETECTORS, MEASUREMENTS, AND MATERIALS

### Optical profiler

The fifth generation of Sensofar Metrology's S neox is a high-performance, noncontact three-dimensional (3D) optical-profiler microscope system. Designed for subnano-, nano-, and microscale measurement, it offers advanced inspection and analysis capabilities. According to the company, new algorithms allow the S neox to outperform existing optical 3D profiling microscopes, especially in terms of speed. Data acquisition is taken at 180 fps, and standard measurement acquisition is five times faster than before. According to the company, the S neox's design has been enhanced in terms of the flexibility, stability, and durability required for both research and development and quality control (QC) laboratories. Active illumination focus variation, an optical technology for measuring the shape of large rough surfaces, has been improved to allow for reliable adjustment of local focal distance even on optically smooth surfaces. A thin-film measurement technique lets users measure the thickness of optically

transparent layers quickly, accurately, nondestructively, and with no sample preparation. Another feature, differential interference contrast, can emphasize very small height differences not visible with other imaging techniques; high dynamic range mitigates reflection and drop-out points on highly reflective surfaces (local slopes and/or different materials). The S neox is equipped with a long-lifetime light-emitting diode light source and a six-position motorized nosepiece. There are no moving parts in the sensor head, which provides for long-term stability, accurate measurement repeatability, and a long lifetime. As in the former S neox, a rotational stage with a five-axis high-precision motorized rotating module can be attached to the system. The S neox comes with SensoSCAN 7 which drives the system with a clear, intuitive, and user-friendly interface, coupled with new SensoVIEW software for a broad range of analysis tasks. Automated analysis modules have been created to make QC procedures easier with Senso-PRO. For more powerful and flexible data analysis, a state-of-the-art surface analysis software based on Mountains technology, SensoMAP, is available. *Sensofar Metrology, Parc Audiovisual de Catalunya, Ctra. BV-1274, KM 1, 08225 Terrassa, Spain. (+34937 00 14 92) <https://www.sensofar.com>*



### Optical thickness gauge

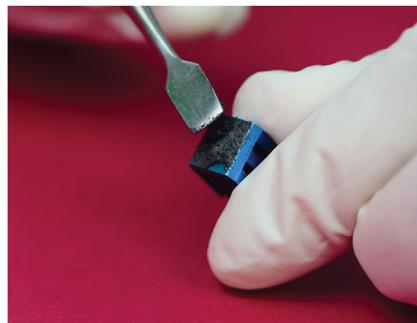
Bristol Instruments has added the model 157LS optical thickness gauge to its line of interferometer-based precision instruments. It uses light to measure material thickness up to 40 mm, with an accuracy of  $\pm 0.1\ \mu\text{m}$  and a repeatability of  $\pm 0.02\ \mu\text{m}$ , and without damage or deformation. Total thickness and up to 31

individual layers can be measured simultaneously. The new model extends the company's precise thickness-measurement capability to applications such as multielement lens assemblies and thicker optical components. *Bristol Instruments, Inc., 770 Canning Parkway, Victor, New York 14564, USA. (585-924-2620) <https://www.bristol-inst.com>*



### Graphene-filled epoxy

Master Bond has developed a two-part epoxy adhesive system for applications that require high thermal conductivity. EP30NG contains a specialty graphene filler that contributes to its high compressive strength—22 000–24 000 psi upon cure—and enhanced dimensional stability. EP30NG achieves a thermal conductivity of  $5.5\ \text{W}/(\text{m K})$  at room temperature. It has a low coefficient of thermal expansion of  $24\text{--}26 \times 10^{-6}\ \text{in/in}^{\circ}\text{C}$  and exhibits a Shore D hardness of 85–95. EP30NG is suitable for bonding applications where some contact pressure can be applied. The minimum bond line thickness is 0.18 mm, since graphene nanoparticles tend to agglomerate to form larger particles. The epoxy system is formulated to cure at room temperature or more rapidly at elevated temperatures. Part A has a thick paste consistency, and Part B is a low-viscosity liquid. EP30NG bonds well to various substrates, including metals, composites, ceramics, glass, and many plastics. The service temperature range is



–60–300 °F. The product is available in 30-cc jar kits, half-pint kits, and pint kits. *Master Bond, Inc., 154 Hobart Street, Hackensack, NJ 07601-3922. (201-343-8983) <https://www.masterbond.com>*

## BIOINSTRUMENTATION AND BIOTECHNOLOGIES

### Flexible multiple-wavelength laser engine

The latest member of Toptica's iChrome multilaser engine family, the compact iChrome FLE, addresses the need for multiple-wavelength lasers in advanced biophotonics procedures such as microscopy, cytometry, and high-throughput screening. It is suitable for most microscopy techniques, such as confocal, super-resolution, light-sheet, stochastic optical reconstruction, fluorescence recovery after photobleaching, and fluorescence resonance energy transfer. The iChrome FLE's extended platform can be configured with up to seven laser lines in the range of 405–647 nm and with one or two fiber outputs. Its design is compact and flexible, yet robust, and it offers simple, maintenance-free operation. Toptica's proprietary frequency-doubled diode-laser technology allows fast, direct modulation to the 532, 561, and 594 nm laser lines and completely zero-emission when the laser is turned off. According to the company, that capability was previously only available in a continuous-wave diode-pumped solid-state laser source combined with an acousto-optic modulator. An optional fiber switch makes it possible to address two different modalities or microscope setups; it can also be used to split power to both fibers at a desired ratio. The computer-controlled splitter can easily be fine-tuned to an exact splitting ratio. As with all iChrome laser engines from Toptica, the iChrome FLE is equipped with proprietary Constant Optical Output Level–Auto Calibration

(COOL<sup>AC</sup>) technology. The fully automated alignment technology accomplishes instrument setup with a simple push of a button; there is no need to manually align lasers or optics. *Toptica Photonics, Inc., 5847 County Road 41, Farmington, New York 14425, USA. (585-657-6663) <https://www.toptica.com>*

### Nanoparticle tracking analyzer

The latest generation of Analytik's ZetaView QUATT has a multiwavelength video-tracking microscope for rapid analysis of size, concentration, fluorescence, electrophoretic mobility, and subpopulations of individual nanoparticles such as extracellular vesicles, exosomes, and viruses. With the addition of three laser sources, the new instrument expands on the ZetaView's existing fluorescence capability, adding multiwavelength excitation to its antibleach fluorescence technology and thereby enhancing nanoparticle analysis specificity. Using proprietary nanoparticle tracking analysis (NTA) technology, ZetaView instruments can capture on video the Brownian motion of each particle. Based on the different diffusion movements of large and small particles in the surrounding liquid, the instruments can determine the hydrodynamic diameter of the particles. Following the movement of the particles in an applied electric field, the charge state of the particle surface (zeta potential) can be measured. As a consequence, pattern parameters, such as intensity fluctuations, surface geometry, and shape of the particles, as well as particle concentration, are recorded and can be used to distinguish subpopulations. ZetaView QUATT houses four different wavelength lasers. One, two, or four different fluorophores or dyes with different excitation and emission spectra can be analyzed on the same sample, and biomarker ratios calculated. Automatic filter sliders activated by a simple mouse click in the software let users switch between lasers and between fluorescence and scattering modes. According to the company, multiwavelength fluorescence NTA reduces total measurement times, minimizes the amount of sample required, and improves experimental reproducibility.

*Analytik Ltd., Barn B, 2 Cygnus Business Park, Middle Watch, Swavesey, Cambridge CB24 4AA, United Kingdom. (+44 (0) 1954 232 776) <https://analytik.co.uk>*



## NEW FACILITIES AND HARDWARE

### Analog-to-digital data-acquisition board

Teledyne SP Devices has launched its compact, flexible ADQ8-8C data-acquisition board with 500-MHz analog input bandwidth. Its high channel density and an open FPGA architecture make the digitizer suitable for large-scale physics installations and original equipment manufacturer product integration. Resources are available for customized real-time digital signal processing. The eight-channel ADQ8-8C is available in PCIe and MTCA.4 form factors and allows for compact, cost-efficient multichannel system design. The versatile analog front-end (AFE) features



programmable DC offset, input voltage range, and  $50\ \Omega$  and  $1\ M\Omega$  input impedance. The device features 1 GByte on-board acquisition memory and up to 3.2 GByte/s data transfer to a host personal computer, hardware trigger, and accurate multichannel synchronization capabilities. Since the AFE supports a wide variety of detectors, it can be used in many applications. Those include particle physics, Thomson scattering, quantum technology, scientific instruments, semiconductor test, and time-of-flight applications. Teledyne SP Devices, 700 Chestnut Ridge Road, Chestnut Ridge, New York 10977, USA. (914-598-6666) <https://spdevices.com>

## NEW LITERATURE AND SOFTWARE

### Simplified fluorescence imaging software

PicoQuant and Zeiss have released a plug-in for Zeiss's ZEN imaging software (blue edition). The plug-in allows a Zeiss laser scanning microscope and an upgrade kit from PicoQuant to capture fluorescence lifetime imaging (FLIM) and fluorescence correlation spectroscopy data. Multidimensional imaging experiments such as z-stacks and time-lapse series can now be performed more simply, with

FLIM acquisition measurements defined and started in the familiar ZEN imaging software environment. Time-resolved data are automatically acquired using the motorized laser combining unit and Pico-Quant's SymPhoTime 64 software. After acquisition, the results can be analyzed with the easy-to-use SymPhoTime tools. *PicoQuant, Rudower Chaussee 29, 12489 Berlin, Germany.* (+49-30-1208820-89) <https://www.picoquant.com>



### Electronic design software

Keysight has unveiled PathWave Design 2020, which includes the latest releases of its electronic design-automation software to accelerate workflows for radio frequency (RF), microwave, 5G, and automotive design. The PathWave Design 2020 software suite includes PathWave Advanced Design System (ADS) 2020, PathWave RFIC Design (GoldenGate) 2020, PathWave System Design (SystemVue) 2020, and PathWave RF Synthesis

(Genesys) 2020. According to the company, the software suite's new tools and enhancements can shorten the design cycle and speed product development. Its libraries and customized simulators reduce setup time, and improved automation lessens manual work. The software integrates circuit design, electromagnetic (EM) simulation, layout capabilities, and system-level modeling. It reduces the time needed to import and export designs and to fix errors associated with changing tools. Two integrated EM simulators for RF and power electronics designs reduce EM simulation setup time. Users can stay current on the latest 5G new radio standards with updated 5G virtual test benches. Improvements in data analytics allow for rapid analysis, such as on circuit simulations. *Keysight Technologies, Inc., 1400 Fountaingrove Parkway, Santa Rosa, California 95403-1738, USA.* (800-829-4444) <https://www.keysight.com>

