

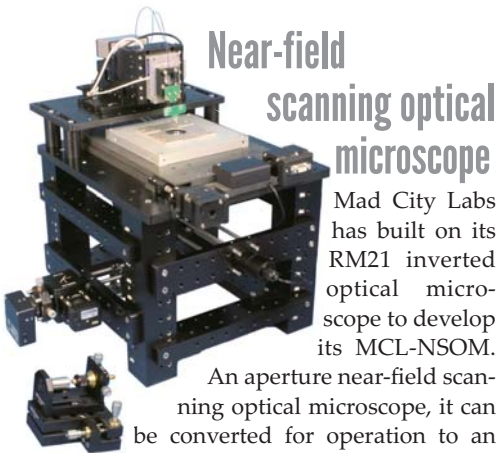
NEW PRODUCTS

Focus on lasers and imaging

The descriptions of the new products listed in this section are based on information supplied to us by the manufacturers. PHYSICS TODAY can assume no responsibility for their accuracy. For more information about a particular product, visit the website at the end of the product description.

Andreas Mandelis

Near-field scanning optical microscope



Mad City Labs has built on its RM21 inverted optical microscope to develop its MCL-NSOM.

An aperture near-field scanning optical microscope, it can be converted for operation to an aperture-less NSOM, atomic force microscope, and fluorescence optical microscope. It includes XYZ closed-loop nanopositioning for sample and fiber scanning to provide subnanometer precision and low-noise performance. LabVIEW-based software controls six axes of motorized automated positioning, including independent automation for fiber alignment to the optical axis. The MCL-NSOM includes fiber launch with an excitation source, an alignment camera, and an avalanche photodiode for detection. The versatile microscope can also accommodate ancillary excitation and detection optics. **Mad City Labs Inc.**, 2524 Todd Dr, Madison, WI 53713, www.madcitylabs.com

Laser dichroic beamsplitters

Semrock has developed laser dichroic beamsplitters with very high flatness to minimize reflected wavefront distortion and maximize the signal and the signal-to-noise ratio in superresolution microscopes. The BrightLine beamsplitters with $\lambda/10$ flatness are offered on 3-mm-thick glass to reduce sensitivity to mounting stress in custom optical systems. For setups in which maximizing the switching speed or minimizing the beam shift in transmission is critical, Semrock improved its 1-mm-thick BrightLine laser dichroic beamsplitters to $\lambda/2$ flatness. The optics can improve the performance of laser-based confocal and total internal reflection fluorescence illumination systems. They are suitable for reflecting imaging beams and for patterned illumination systems. The dichroic beamsplitters, which allow the use of larger-diameter illumination beams, provide researchers and instrument developers with system-design flexibility. **Semrock Inc.**, 3625 Buffalo Rd, Ste 6, Rochester, NY 14624, www.semrock.com

Shortwave IR camera

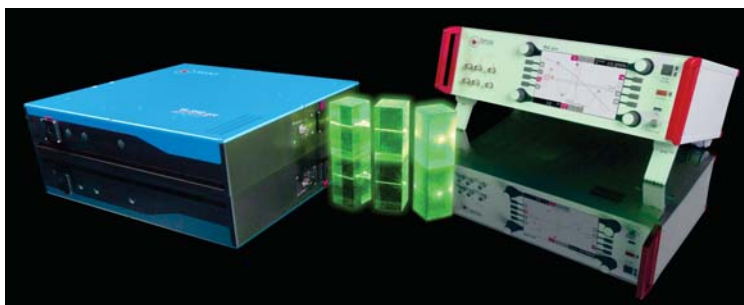
According to Princeton Infrared Technologies, its 1280SCICAM shortwave IR (SWIR) camera delivers the longest integration times and highest frame rates at megapixel resolution currently available. The lattice-matched indium gallium arsenide sensor operates in the visible to SWIR spectrum from 0.4 μm to 1.7 μm and features 1280 $\times$ 1024 resolution at frame rates greater than 95 fps at full-frame size. The camera's small 12 μm pitch and low read noise of less than 30 e^- and the imaging array's high quantum efficiency of more than 75% from 1.0 μm to 1.6 μm are suitable for scientific imaging in the SWIR and visible wavelengths.



A three-stage thermoelectric cooler integrated into a vacuum package provides the 1280SCICAM with three temperature set points for different conditions: 25 $^{\circ}\text{C}$ with no cooling, 0 $^{\circ}\text{C}$ fan cooled, and -50 $^{\circ}\text{C}$ water cooled. The on-board array has 14-bit digital output and snapshot exposure with no image lag. The camera's high dynamic range ratio is greater than 3000:1, with integration times ranging from 50 μs to more than 3 min. **Princeton Infrared Technologies Inc.**, 9 Deerpark Dr, South Brunswick Township, NJ 08852, www.princetonirtech.com

Tunable multiwatt lasers

Toptica has announced that its frequency-doubled diode lasers now reach 2 W of output power in the spectral range from 550 nm to 565 nm. The higher power levels are made possible by proprietary tapered amplifier technology, modified electrical and thermal management, and improved frequency-doubling resonator technology. Suitable for applications in quantum technologies, the novel multiwatt laser sources feature tunability of several nanometers, mode-hop-free scanning of 30 GHz, and a linewidth of less than 100 kHz. Similar performances are achieved around 400 nm, 430 nm, and 480 nm. The TA-SHG pro product line of resonantly frequency-doubled, tapered, and amplified diode lasers covers a wavelength range of 316 nm to 675 nm with only a few gaps. The digitally controlled DLC TA-SHG pro offers remote control via PC, touch-screen operation, automatic alignment, and active output power stabilization. **Toptica Photonics Inc.**, 1286 Blossom Dr, Victor, NY 14564, www.toptica.com



Wavelength meter for pulsed lasers

Bristol Instruments designed its 871 series laser wavelength meter to rapidly and accurately measure the absolute wavelength of pulsed and CW lasers. Its 1 kHz measurement rate enables the wavelength characterization of individual laser pulses, and the resulting time resolution of 1 ms provides detailed wavelength analysis of tunable lasers.



With its novel Fizeau etalon design, the meter measures laser wavelength to an accuracy of ± 1 ppm (± 300 MHz at 1000 nm). The system operates from 350 nm to 1700 nm. Prealigned fiber-optic input ensures optimum alignment, and automatic pulse detection triggers data collection for asynchronous operation. Automatic calibration with a built-in wavelength standard ensures reliable performance. Via standard USB and Ethernet interfaces, the model 871 operates with a PC running Windows. Measurement data can be displayed using a Web-based application with a tablet or smartphone. **Bristol Instruments Inc.**, 50 Victor Heights Pkwy, Victor, NY 14564, www.bristol-inst.com

Widely tunable diode laser

New Focus, a Newport Corp company, has expanded its Velocity series of widely tunable diode lasers with the TLB-6740.

Featuring a tuning range from 2350 nm to 2450 nm and an extended wavelength range up to 2.4 μ m, it is capable of both fine (piezo) and coarse (DC motor) mode-hop-free tuning. The laser operates in single mode and provides more than 4 mW of free space power at 2400 nm with a linewidth of less than 200 kHz (measured over 50 ms). According to New Focus, Velocity series lasers offer high stability and low noise. Applications for the TLB-6740 include microcavity frequency combs, molecular spectroscopy, and fiber amplifier seeding. **New Focus**, 3635 Peterson Way, Santa Clara, CA 95054, www.newport.com



Single-mode fiber coupler

Siskiyou Corp's optomechanical devices for coupling light into single-mode fiber optics offer high-precision adjustment in compact packaging. They incorporate optics for focusing laser light into an FC-connectorized single-mode fiber optic. Tip and tilt mechanical adjustment permits accurate positioning of the focused beam with respect to the fiber end, but the adjustment can be decoupled from focus. In addition to that decoupling, ultra-high resolution and differential adjusters that achieve 2.75 arc-sec movement per 5° adjuster rotation deliver the precision needed to achieve optimum coupling efficiency in a very small volume. The system can also be used in reverse for high-precision collimation of single-mode fiber output. A fiber-optic coupler can be integrated with Siskiyou beamsplitter modules to build multibeam optical assemblies in completely sealed configurations. **Siskiyou Corporation**, 110 SW Booth St, Grants Pass, OR 97526, www.siskiyou.com



Scientific imaging camera

Critical Link has built its latest MityCCD camera around Hamamatsu's S11501-1007S back-thinned, area-scan CCD image sensor. It offers enhanced near-IR sensitivity enabled by a novel MEMS structure on the back of the sensor. According to Critical Link, the sensor's superior performance at wavelengths longer than 800 nm delivers advantages for photometric applications beyond those provided by previous-generation CCDs. In addition to its sensitivity, the sensor's binning capability makes it suitable for Raman spectroscopy detection: It enables higher signal-to-noise ratio and signal processing speed than methods that use external circuits to add signals digitally. The MityCCD camera platform provides on-board image processing with a digital signal processor and a field-programmable gate array for algorithm development. The software offers an easy-to-use interface for image setup, acquisition, viewing, and data analysis. **Critical Link LLC**, 6712 Brooklawn Pkwy, Syracuse, NY 13211, www.criticallink.com



intracavity neodymium-doped yttrium lithium fluoride single polarization green laser. It offers a TEM₀₀ with a beam propagation ratio (M^2) of less than 1.2 and outputs of 25 mJ and 45 W, with repetition rates of 1 kHz and 5 kHz, respectively. Pulse repetition rates range from single shot to 10 kHz. When the DS-527-25 is in a dual-head configuration, the high pulse energy is scalable up to 50 mJ for such applications as ultrafast titanium-doped sapphire amplifier pumping, particle image velocimetry, and diamond scribing. **Photronics Industries International Inc.**, 1800 Ocean Ave, Ronkonkoma, NY 11779, <http://photonix.com>

Optical parametric amplifier

Coherent has announced that its Opera-F optical parametric amplifier delivers wide tuning, high conversion efficiency, and sub-100-fs pulse duration when pumped by the company's Monaco ytterbium ultrafast amplifier. Its signal output is tunable from 650 nm to 900 nm, and the idler from 1200 nm to 2500 nm. When pumped by the Monaco at 40 W,

Q-switched laser

Photronics Industries has introduced model DS-527-25, a single-mode Q-switched

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the Opera-F provides power up to 3 W, pulse energy up to 3 μ J, and a 1 MHz maximum pulse repetition rate. It includes a noncollinear stage to generate pulsewidths as short as 50 fs, followed by a collinear stage that delivers broad wavelength tuning. The output wavelength is tuned through software, with no physical adjustment needed. The Opera-F is suitable for scientific experiments needing high data acquisition rates or a high level of signal averaging. Applications include liquid phase pump-probe experiments, including solvation mechanics and studies of advanced solid-state materials; multibeam imaging setups that use a spatial light modulator; and advanced multiphoton microscopy studies in neuroscience. **Coherent Inc.**, 5100 Patrick Henry Dr, Santa Clara, CA 95054, www.coherent.com

Rapid-scan mid-IR laser

Daylight Solutions' Hedgehog tunable laser head combines CW or pulsed output, high power, and fast tuning speed



to enable the rapid acquisition of molecular spectra with high wavelength accuracy, signal-to-noise ratio, and repeatability. According to the company, the compact Hedgehog, which is built on Daylight's quantum cascade laser technology, is the first mid-IR laser that provides both fast, broad tuning and high-fidelity output. Center wavelengths range from less than 4 μ m to greater than 13 μ m. The laser offers tuning speeds to more than 1000 cm^{-1}/s , tuning ranges up to 400 cm^{-1} , and average or peak powers up to 400 mW. The small sealed head and rugged design make it suitable for laboratory use and OEM integration. Molecular sensing applications include time-resolved spectroscopy, cellular imaging, process control, and pollutant and chemical and biological agent detection. **Daylight Solutions Inc.**, 15378 Avenue of Science, Ste 200, San Diego, CA 92128, www.daylightsolutions.com

High-brightness fiber-coupled pump module



Dilas has introduced a high-brightness, single-emitter-based, fiber-coupled diode laser pump module that delivers 9 W of output power into a 106.5 μ m fiber core at a wavelength of 793 nm, with a numerical aperture of 0.15. The module's design features a small footprint and low height: Its simplified, robust package measures 61.9 mm $\times$ 21.5 mm $\times$ 9.6 mm. The output power is attained by optically combining into the delivery fiber the output of single emitters connected electrically in series. The device features a maximum operating current of 4.0 A with greater than 40% efficiency at 9 W of output power. It can operate at a high temperature of 45 $^{\circ}\text{C}$ and requires less dedicated cooling capacity in a harsh environment. The module is suitable for pumping thulium-doped (Tm^{3+}) fiber lasers for eye-safe applications. **Dilas Diode Laser Inc.**, 9070 South Rita Rd, Ste 1500, Tucson, AZ 85747, www.dilas.com

Taccor comb

Laser Quantum has launched its taccor comb femtosecond laser. It consists of a powerful 1 GHz turn-key titanium-doped sapphire laser with a matched dispersion compensation module, supercontinuum generation, and ultra-stable f -to- $2f$ interferometer. It provides an electrical output signal at the carrier-envelope offset frequency with at least 45 dB signal-to-noise ratio in 300 kHz bandwidth. The supercontinuum generation fiber coupling is stable for long periods; long-term variations can be compensated with piezo actuators that are controlled via a touch-screen interface.



According to Laser Quantum, the taccor comb benefits users who work with frequency combs, including researchers in metrology, optical clock precision, and exoplanet exploration. It features large comb spacing of 1 GHz to allow easy determination of the comb mode index and high achievable power per frequency comb tooth. **Laser Quantum USA**, 3083 Lawrence Expwy, Santa Clara, CA 95051, www.laserquantum.com

Ultralow-noise scientific cameras

Princeton Instruments engineered its Sophia series of ultralow-noise cameras to address demanding low-light-level scientific applications, including astronomy, *in vivo*

small-animal imaging, chemiluminescence, soft x-ray imaging, and spectroscopy. Based on a 2K $\times$ 2K sensor format, Sophia's multiple-port, back-illuminated CCDs provide large pixel size, fast pixel speed, and minimal pixel noise. According to the company, the 30.7 mm $\times$ 30.7 mm photosensitive array with 15 μ m $\times$ 15 μ m pixels detects 23% more photons per pixel than equivalent back-illuminated sensors with 13.5 μ m $\times$ 13.5 μ m pixels. ArcTec cooling technology, which uses only air assist, minimizes dark noise by cooling the CCD to less than -90°C . Princeton Instruments' eXcelon sensor technology broadens sensitivity over a wide wavelength range, reduces unwanted fringes in the near-IR region, and improves signal-to-noise ratio. With a USB 3.0 data interface and multiple-port readout capabilities up to 16 MHz, Sophia provides high frame rates. **Princeton Instruments**, 3660 Quakerbridge Rd, Trenton, NJ 08619, www.princetoninstruments.com

