Prism Awards celebrate the best of photonics

The world’s first cloud AI-based handheld Raman spectrometer; a system that derives accurate 3D measurements from 2D images; a handheld defect gauge that sizes manufactured parts as easily as taking a picture on a phone; and the first frequency-modulated continuous CW lidar for smart vehicles. These were just some of the technologies that are today the proud bearers of 2019 Prism Awards.

The eleventh annual Prism Awards took place last night at a gala event at San Francisco’s Marriott Marquis Hotel.

Never before has the Prism Awards recognized such a broad range of innovation from so many different companies from so many countries around the world.

The 2019 finalists, from small companies to large, are advancing technologies in the areas of healthcare, security, transportation, manufacturing, scientific discovery, research, and more.

**Winners, categories**

**CloudMinds’ XI AI Raman Spectrometer** (Detectors & Sensors category) is the world’s first cloud AI-based handheld Raman spectrometer with 785nm laser excitation.

**Double Helix Optics’ SPINDLE** (Diagnostics & Therapeutics) provides unparalleled precision 3D imaging and tracking, breaking through limitations in visibility to allow unprecedented study of inter- and intra-cellular interactions.

**Leica’s BLK3D** (Imaging & Cameras) looks like a smartphone, but under the hood, it is a 3D measurement and documentation machine designed to deliver accurate 3D measurements derived from 2D images.

**nLIGHT’s Corona** (Industrial Lasers) is a fiber laser with rapidly tunable beam quality. The Corona provides optimum beam characteristics for an unprecedented variety of processes and materials, addressing a key limitation of conventional fixed-beam lasers.

**Smart Vision Lights’ NanoDrive** (Light Sources) is an embedded technology that allows tens of amps to reach the LEDs of a light in 500 ns or less, resulting in a light that reaches its full LED power/length intensity when strobing.

**Modular Photonics’ OMPlex** (Optics & Optomechanics) devices are based on passive silica chips that increase data transmission rates and reach in optical fiber networks. The chip multiplexes a data signal into one mode in highly multimode fiber.

**Toptica Photonics’ DLC TOPO** (Scientific Lasers) builds on years of company innovation to deliver wide tunability, narrow linewidth output, and hands-free digital control over the 1.45μm to 4.00μm spectral range.

**4D Technology’s 4D InSpec XL** (Test & Measurement) is a handheld, non-contact part defect gauge that measures manufactured parts as easily as taking a picture on a phone. The device makes instant, qualifying, 3D measurements of surface features on manufactured parts being evaluated.

**Blackmore Automotive’s Doppler Lidar System** (Transportation) is the world’s first frequency-modulated CW lidar for autonomous vehicles. It gathers instantaneous velocity and long-range measurements of every detected point.

**QD Laser’s Retissa Display** (Vision Technology) is a retinal projection laser eyewear—an optical see-through, head-mounted display device using a miniature laser projector to draw images directly to the wearer’s retina.

**MATTHEW PEACH**

**INDUSTRY EVENTS**

**KEY LEGAL ISSUES: HAVE YOUR QUESTIONS ANSWERED, SIGN UP FOR A FREE SESSION**

8 AM-12 PM, So. Exhibit Level

**PHOTONICS INDUSTRY AND PUBLIC POLICY UPDATE**

9:15-9:45 AM, Rm. 21, No. Exhibit Level

**PHOTONICS WEST EXHIBITION**

10 AM-4 PM, North and South Halls

**STARTUP ALLEY**

11 AM-12:30 PM, Hall E, Demo Area

For the full schedule, see the technical program and exhibition guide or download the SPIE Conferences app. Some events require registration. Read daily news reports from Photonics West online: spie.org/PWnews
WHAT’S NEW AT OPTOSIGMA

Observe the latest developments in action at the OptoSigma Technology Demonstration Corner

See what we are doing with OptoNano™
Super-Resolution Microscopy System

View innovative solutions in portable power and energy measurement

We’re Now Selling Optical Tables. Popular Sizes Stock and Ready to Ship!

Check out our all-new Fiber Optics Product Line Including Fiber Alignment Stages

Stop by our booth for a chance to win great prizes or receive giveaways!
Booth #1427
Future shapes emerging from the quantum fog

A leading expert in quantum technology markets is more cautious than most future technologists, but says there’s still “plenty to dream about,” especially when he considers telecom, atomic clocks, and R&D possibilities. “Further down the road, there will be yet more apps for finance and banking, online gaming, security, and defense,” he predicts.

Thierry Robin, a partner at TEMATYS in France, serving companies like Coherent, Nikon, Siemens, Thales, and others in 18 countries, has reviewed current and potential quantum apps and markets. “Other studies for quantum technology foresee billions of dollars in the near future. We are more cautious than most.

There will not be any full commercial apps in the next 10 years, Robin told Tuesday’s Industry Events audience.

Huge funding is moving the sector, in North America, Europe, and especially China. He pointed to the 65 quantum startups in the field, including PoQ, which recently raised $65 million.

Main market areas are sensing, imaging, measurement, and communications.

Notable startups where sensors make use of atomic vapors include Twinleaf and QuSpin, Robin said.

For atomic clocks, the SWAP (size, weight, and power) is a challenge. “To have good sensitivity, you need a big SWAP. At the cheaper scale, sensitivity is not good, about the same as a quartz clocks. There’s no big advantage,” Robin said.

Atomic clocks now range from as low as $1,000 to the big ones at $1 million. That will form the first truly “huge market for quantum technology...the only one that will be really commercial.”

For encrypted communications, cryptographic key management and sharing between remote parties is another challenge.

“How do you distribute the key?” he asked. Teams of human couriers can be employed to do key exchanges, using tamper-resistant hardware security modules, or HSM boxes, that can cost up to $80,000 each. Currently, quantum devices are used in time measurement and synchronization systems, for example with GPS networks.

In five years, there will be advances in measurement for integrated circuits, for currents in batteries, and for magnetometers, gravimeters, and R&D testbeds.

Robin’s full study of markets, “Nanoscale Quantum Optics,” will be available by late March on the website of the funding agency, the European Commission.

CHALLENGES FACING SILICON PHOTONICS TECHNOLOGY

On Tuesday, industry experts gathered to discuss progress and challenges in silicon photonics design and fabrication. The technology, which integrates infrared laser sources with conventional electronics on silicon chips, accelerates data transmission to promise higher Internet speeds. Data centers, for example, use these chips. The chips could also serve a pivotal role in emerging technologies such as lidar in self-driving cars, for example, and as quantum computing components.

However, technical challenges remain, as speakers pointed out at the panel. “In particular, no one has figured out how to integrate a laser source onto the chip in a commercially viable way,” said Philippe Abiels of Belgium-based IMEC.

His company sells photonics transceivers that enable data rates of 50 gigabits per second and beyond. It’s difficult to engineer a laser based on silicon, so companies have largely used other materials, such as III-V semiconductors, to make a laser. But this introduces a host of other problems, such as how to bond the different materials together while maintaining cheap manufacturing costs.

That’s why some companies are pursuing alternatives to silicon, such as indium phosphide-based photonics. Gloria Hoefler of Infirnera, based in California, talked about her company’s indium phosphide-based photonics, where they have been able to integrate passive and active components onto one chip. “Indium phosphate really provides a lot of value in closing high-capacity optical links,” she said.

The industry is grappling with manufacturing efficiency. Luxtera has been able to automate much of their manufacturing processes, said Drew Guckenberger, who works at the company. After they started a new manufacturing facility in China, they were able to match its production in their other plants in just two weeks because the processes were so automated, he said.

In addition, the industry needs to outfit chip-making machines with a new capability to fabricate photonics designs, which are generally less orderly than electronics ones. Global Foundries is incorporating free-form design capabilities in which optical designers can draw arcs and circles that are crucial to photonics, said Steve Palmer, who works for the company.

Companies are also experimenting with different manufacturing models. Infirnera uses a vertical integration model in which they design and fabricate everything in-house, including all hardware and software needed for their product. In contrast, Luxtera uses a fabless model, in which the company designs chips in-house but outsources the actual fabrication.

Other speakers included Doug Gill of IBM and Ashok V. Krishnamoorthy of Axalume Inc.

In uncertain times, ‘keep your fingers crossed,’ say CEOs

Four-executive panel counsels industry on how to prepare for China “softening” and tariff woes.

No strangers to stress, four top photonics executives told an Executive Panel how they are preparing for whatever 2019 throws at them.

Debbie Gustafson, CEO of Energetiq Technology, now owned by Hamamatsu, said she works with SEMI, a group that lobbies in Washington for settling trade issues with China. But how to really prepare? “You stay on top of things, you prepare for growth, but act quickly as needed.”

“And we are keeping our fingers crossed,” she said with a laugh.

Other panelists were Yves LeMaitre, chief strategy officer of Lumament; Eric Mottay, president and CEO of Amplitude Systèmes in France; and Andreas Nitze, CEO of Berliner Glas Group in Germany.

“As CEO, a lot of my time is making sure people are feeling good, feeling like they are making a difference in the company. That great guy who’s developing everything – is he still happy?” Others echoed that principle. Said LeMaitre: “Keep the really smart people at your company and not going somewhere else. Then you can be the disruptive one.”

What’s the top issue you are facing? Mottay replied: “Stay on top of innovation in photonics. We (Amplitude) are a very diversified company. I respect that and stay mindful of all the markets we serve, and stay ahead of the curve.”

“In five minutes, I may be crying. It’s not looking too good with the trade war with China.” What will happen in 2019? “I don’t know. I need to embrace uncertainty.” To laughter, he said: “I will give you my prediction at next year’s Executive Panel.” On the China issue, LeMaitre said: “China should be 30 to 40 percent of total consumption of photonics. You can’t ignore what is going to happen there. We are very worried for the near future.”

Asked for his key current issue, Nitze replied: “Cash. Make sure you have enough cash in the bank. Second, is strategy: everything we do is in line with the market and the desires of our customers. Third, keep a diversified customer base.”

Which market segments offer the most potential for growth in 2019? Said LeMaitre: “Security, safety, computer space, and gaming. And augmented reality is a big area for growth. There is a sudden need for more information, and for high bandwidth. Those are the top two.”

“As sensors get more complex, and laptops get more involved, testing is more involved, So they will be spending more money on that side of equation. Sensors are everywhere. We see great potential in that sector.”
Planets, plasmas, pulses

The LASE Plenary covered the whole spectrum, from Cassini’s survey of Saturn, through reinforcing nuclear reactors and at-risk bridges, to powerful diode lasers.

On September 15, 2017, the Cassini spacecraft plunged into the clouds of Saturn, completing a profoundly successful mission that had been exploring Saturn for more than a decade. For most of the final six months before its scheduled demise, Cassini took a series of risky dives between Saturn and its rings, venturing into an unexplored and potentially hazardous region – something it was never designed to do. In the final LASE plenary lecture, Cassini project manager Earl Maize highlighted the efforts to repurpose the mission.

“We had to reconfigure a lot of the entire operating strategy for the mission in the environment inside Saturn’s rings,” Maize told Show Daily. “That was quite an engineering challenge.”

Using Saturn’s moon, Titan, as a slingshot, Cassini flung itself between Saturn and its rings. A missed shot and a collision with the rings would’ve been fatal, Maize said.

Once behind the rings, Cassini flew at 75,000 miles per hour, so fast that colliding with a grain of dust could destroy its instruments. Mission operators turned the spacecraft so that its antenna dish could shield it from such potential hazards.

On Cassini’s other side was Saturn’s atmosphere, which could disrupt the spacecraft or even pull it down. With the aid of new atmospheric models, Cassini managed to carefully graze the atmosphere and take a sample.

During the final descent, mission operators turned Cassini into a real-time probe, capable of collecting and sending data simultaneously – even until its last moments.

Cassini was a wild success with countless discoveries: geysers erupting from Saturn’s moon, Enceladus – which seems to have the necessary ingredients for life; the relatively young age of Saturn’s rings; and the alignment of Saturn’s magnetic poles and its rotational axis, which contradicts many theories of planetary magnetic fields.

“We wrote and rewrote the books on planetary systems,” Maize said.

**Plasma peening**

On more Earthly matters, Yuji Sano of the Japan Science and Technology Agency discussed recent advances in laser peening, a technique to make materials more resistant to fatigue and stress.

It works by using laser pulses to quickly heat the surface of a material, producing a rapidly expanding pocket of plasma. The sudden expansion generates shockwaves that propagate through the material, creating permanent strain and dislocations that strengthen the material.

Conventional laser peening requires a special coating to prevent the intense laser from melting or damaging the material. The need for such a coating makes laser peening difficult for some cases – for example, to prevent surface stress corrosion cracking in nuclear power reactors, which caused several accidents around the world in the 1990s.

Not only are nuclear reactors radioactive, the reactions happen underwater, making it difficult for workers to coat the material. However, by reducing the energy and duration of laser pulses, Sano and his colleagues developed a method of laser peening without any special coating. This technique has been used for nuclear reactors in Japan since 1999, and is now used in some reactors in the US.

More recently, in 2018, Sano and his colleagues designed a handheld laser system. The typical lasers used for laser peening are about a meter wide and weigh several tens of kilograms; but the new one measures just 10 centimeters across, weighs less than one kilogram, and costs ten times less, making laser peening more accessible and affordable for a wider range of applications. Airbus, for example, is planning to use this technology, Sano said. Such a device would also be useful in factories and maintaining infrastructure.

For example, the American Society of Structural Engineers said 9 percent of the US’s more than 600,000 bridges were structurally deficient in 2017, requiring $123 billion to rehabilitate them. Cheaper laser peening could bring that cost down, Sano told Show Daily.

In another recent invention, Sano and his colleagues developed a laser peening technique that does not require water. In conventional laser peening, water helps constrain the burst of plasma, ensuring that the pressure is high enough to generate the necessary shockwaves. By using a femtosecond laser, the researchers found they could achieve high plasma pressure even without water.

Laser technology in general has been developing so fast, many advances in laser peening and other applications will likely be realized over the next several years, Sano said. “We can realize new technologies we couldn’t imagine at present.”

**High-power diode lasers**

One such technology is high-power diode lasers, which have seen tremendous progress as a workhorse laser in academia and industry, said Günther Tränkle of the Ferdinand Braun Institute (FBH) in the final plenary talk.

Typically based on gallium arsenide, these lasers are the world’s most efficient, dominating materials processing. Diode lasers, for example, pump the fiber and disk lasers used in cutting and welding. They are also crucial for the ultrashort-pulse high-energy lasers used in new particle accelerators. But such developments demand better diode lasers with improved efficiency, peak power, brilliance, and emission spectrum, Tränkle told Show Daily.

Recently, researchers at FBH have developed a triple asymmetric epitaxial layer design for the diode structure, which provides low resistance, low optical loss, low power saturation, and a low threshold current all at the same time. They reached record efficiencies that are 1.05 times higher than similar, symmetric designs.

This design can be used to make more efficient kilowatt laser bars. FBH is working with the German company Trumpf to design laser bars with ever increasing efficiency and beam quality.

Researchers have also been developing monolithically integrated gratings, increasing the power per emitter by 10 times, and doubling the efficiency. This technology enables diode lasers with a narrow and stable spectrum – suitable for solid-state laser pumping or sensing. Diode lasers can be combined to create powerful, efficient, and compact direct diode laser systems. In one method, known as wavelength beam combining, an external grating is used to merge multiple diode lasers into a single beam. In a more sophisticated technique, called coherent beam combination, a laser is split into multiple beams that are then amplified. As this kind of research continues to advance, Tränkle said, diode lasers will become a part of ever improving technology, with applications in everything from medicine to the lidar systems used for autonomous vehicles.

MARCUS WOO
New Image quality test stations:
ImageMaster® HR UltraPrecision and ImageMaster® HR TempControl

ImageMaster® HR TempControl - Testing image quality in temperature ranges from -40°C to 120°C

A challenging and critical aspect of optical design is to minimize the thermal effects on the optomechanical parameters by utilizing an athermal design. The ImageMaster® HR TempControl is used to test the functionality of the athermal optical design across a wide temperature range spanning from -40°C to 120°C. For this purpose, the optical performance is determined for a set of parameters and the results are presented as a function of temperature ranging from -40 to 120°C. In addition to determination of the MTF, the key measurement parameter is the change in both the flange focal length and effective focal length when the temperature changes.

The challenge for the optical design is to maintain consistency in the functionality of the optical components and mounting materials. Crucial lens parameters such as the effective focal length and flange focal length can be temperature-dependent and have an impact on the camera’s focusing function. The ImageMaster® HR TempControl can be used for measurements in both the VIS spectrum and IR range, and the system can be easily converted from VIS to IR – thereby covering the specific requirements from various areas, including the automotive industry, development of mobile phone lenses, and the military and aerospace sectors.

Experience a wide range of image quality test stations at Photonics West, TRIOPITICS booth #1459.

Highlights at our booth #1459

Alignment Turning of Mounted Lenses
ATS 100

Quality Control of Camera Modules
CamTest Focus

MTF Measurement Station
ImageMaster® HR
UltraPrecision

Optical Performance Testing of Waveguides
ImageMaster® Lab AR

Image Quality Testing of VR Lenses
ImageMaster® Lab VR

Flexible Goniometer for Quality Assurance
PrismMaster® Flex

Rotation-free Centration Measurement
OptiCentric® Linear

Fully Automated Cementing of Doublets
OptiCentric® 100 with LensAlign 2D Standard

Center Thickness Measurement of Single Lenses and Doublets
OptiSurf® LTM

Electronic Autocollimator for Angle Measurement
TriAngle

Wavefront and Surface Measurement
µPhase® Interferometer

www.trioptics.com
We are the Experts for micro optics.
Visit Booth 1765

Mini Lens

We're big at making mini lenses

www.fisba.com
BiOS Hot Topics: changing of the guard

The photonics community this year marked the retirement of long-time BiOS co-chairs Rox Anderson and James Fujimoto from those roles.

The near-capacity crowd at their ultimate session this week broke into applause as Anderson opened with “This is the largest meeting in the world for biomedical optics, and that’s because of you!” He added that the reason BiOS has grown so popular is the diversity of the intellect and specialties that are featured in the symposium, such as those involved in medicine, bioscience, and physics.

James Fujimoto introduced the new BiOS co-chairs, Jennifer Barton of the University of Arizona and Wolfgang Drexler of the University of Vienna. Touching on the impressive backgrounds of each, Fujimoto noted, “we know the conference will be in good hands.”

“Rox and I would like to take this opportunity to thank SPIE, program track chairs, conference chairs, and all of you in the community for the opportunity and the privilege to serve as co-chairs of BiOS all these years,” said Fujimoto.

“We’d all like to honor and thank Dr. James Fujimoto and Dr. Rox Anderson who have tirelessly served this community since 2004,” said new SPIE CEO Kent Rochford, as he presented the pair with awards for their service. “Their combined leadership has contributed significantly to the growth and importance of biomedical optics in the world and the BiOS symposium. Each has brought significant advances to how biomedical optics improve our healthcare.”

Rochford pointed out Fujimoto’s achievements as co-developer of optical coherence tomography (OCT), “a ubiquitous technology with many applications.” He noted that Fujimoto’s prolific career includes 15 patents, nine books, and more than 450 journal articles; and that he has received numerous awards for the development of OCT, including the 2017 Russ Prize from the National Academy of Engineering — considered the Nobel Prize of engineering.

Humanitarian efforts

“An active researcher, Rox Anderson conceived and developed treatments for birthmarks, lesions, and tattoo removal among other innovations,” said Rochford, adding that Anderson, “brings the wonderful perspective of having degrees in science as well as in medicine.” He noted Anderson’s more than 60 national and international patents, and the fact that he has co-authored over 250 scientific books and papers. “We also applaud Dr. Anderson for his humanitarian efforts to help children in the world who are scarred or disfigured in need of this help,” Rochford added.

Anita Mahadevan-Jansen of Vanderbilt University paid tribute to the late Warren S. Grundfest, professor of bioengineering and electrical and computer engineering at UCLA. “Grundfest was one of the founding fathers of BiOS, serving as symposium chair from 1998 to 2003,” said Mahadevan-Jansen. He was a pioneer in the translation of biomedical and biophotonics technology for improving patient care.

The evening included the presentation of the 2019 Biophotonics Technology Innovator Award to Stephen Boppart of the University of Illinois at Urbana-Champaign. The award honors Boppart’s achievement in computational OCT and its applications to basic and clinical sciences.

The SPIE-Franz Hillenkamp Postdoctoral Fellowship in Problem-Driven Biophotonics and Biomedical Optics was awarded to Jie Hui of the Boston University Photonics Center and Dr. Andreas Wartak of the Wellman Center for Photomedicine at Massachusetts General Hospital. Hui’s research is focused on a light-based approach to treat MRSA-caused diseases in the clinic. Wartak’s research will target an earlier, cheaper, and less invasive diagnosis of eosinophilic esophagitis (EoE), a poorly understood allergic inflammatory condition of the esophagus.

The final award presentation of the evening was the 2019 Britton Chance Biomedical Optics Award to Samuel Achilefu of the Washington University School of Medicine in St. Louis. Presented each year for outstanding lifetime contributions through development of innovative technologies that have facilitated advancements in biology or medicine, the award honors Achilefu’s work in optical and molecular imaging that enables cancer care and treatment.

Cancer vision

Following his award presentation, Achilefu gave the evening’s first technical presentation, “The Power of Light to See and Treat Cancer,” where he described his “Cancer Vision Goggles” – a headset that allows surgeons to visualize cancer in the operating room.

“We have developed a simple fluorescent molecule for imaging solid tumors and a wearable head-mounted device to visualize cancer in the operating room,” said Achilefu. “These combined products synergistically improve treatment outcomes. Now that we can visualize cancer in real time, we are using light from within the cancer cells to treat them.”

In conclusion, Achilefu acknowledged the many people who worked on the project: “surgeons, clinicians, students, engineers, physicists, chemists, biologists – basically it takes a village to do what we are describing today.”

Achilefu also acknowledged his friend and mentor Britton Chance. “Through his inspiration and the lessons learned from his hard work ethic, we’ve been able to push our technologies, not only to do the pre-clinical model, but also work with actual patients, and today we’re taking our technologies around the world to improve healthcare,” he said.

Long-time facilitator, Sergio Fantini of Tufts University, opened the quick-fire Hot Topics presentations, which covered several new developments in biomedical optics, specifically diffuse optical imaging, spectroscopy, fluorescence spectroscopy, optoacoustic tomography, multiphoton endoscopy, and OCT.

continued on page 34
WORLD CLASS LASERS & FIBERS

See us at Booth #8633

Industrial ultrafast lasers
Supercontinuum white light lasers
Low noise single-frequency lasers
Photonic crystal fibers & gain modules

sales@nktphotonics.com
www.nktphotonics.com
Photonics21 digs in for next phase of continental R&D

Building on some notable recent success stories, the European photonics platform is anticipating a busy 2019 for innovation.

With more than 2500 members, the Photonics21 “technology platform” represents much of Europe’s photonics community, embracing industry and research organizations alike. Working closely with the European Commission (EC), its members develop and implement a common photonics strategy within the framework of a public-private partnership (PPP) supported by Horizon 2020 funding that is intended to use and develop photonics technology to spur innovation, growth and jobs in Europe.

The past year saw a significant change within the organization. Aldo Kamper arrived as Photonics21’s new president in January 2017, but around 18 months later the Oram Opto Semiconductors CEO was recruited to head up the German cabling group Leoni, and departed his Photonics21 role.

As a result, the group is currently under the joint care of its two vice presidents, Giorgio Anania and Bernd Schulte. They told Show Daily about their hopes and plans for the organization and the wider industry through the coming year, and highlighted some new initiatives as the Horizon 2020 funding period draws to a close.

“Photonics21 remains in a strong position to foster European innovation and is committed to harnessing the power of light to solve our greatest global challenges,” Schulte and Anania stated.

From early 2019 onwards, we can expect to see further announcements of PPP-funded projects, as well as the return of the “#Next_photonics Prototype Your Idea” contest. This is a dedicated innovation challenge to push for more entrepreneurship in photonics, targeting PhD or Masters students, as well as creators with an idea for a photonics-based product that can transform into a real business. The competition, said to have proved very popular in 2018, offers a cash prize of €5000 and a real business. The competition, said to have proved very popular in 2018, offers a cash prize of €5000 and a real business.

“Photonics21 remains in a strong position to foster European innovation and is committed to harnessing the power of light to solve our greatest global challenges,” Schulte and Anania stated.

Looking to the future innovation program, they have some lofty aspirations. “If we can maintain a strong funding commitment, and strengthen the photonics PPP in Horizon Europe, then the instant diagnosis of major diseases, the eradication of all road accidents, and the creation of at least one million new jobs are some of the benefits that we expect will be generated by the photonics sector by 2030.”

Microscope tackles sepsis

One primary example of that ongoing innovation is a proprietary interferometric, lens-free microscope that is said to provide the fastest ever detection of sepsis. A life-threatening condition, sepsis is an inflammatory immune response to infections caused by bacteria including E. coli and Staphylococcus, which can lead to conditions such as meningitis. On the rise with the emergence of antibiotic-resistant pathogens, sepsis now kills over 20,000 people every day worldwide – more than prostate cancer, diabetic ketoacidosis, and HIV/AIDS combined.

Approximately the size of a small book, the new microscope developed under the Photonics21 project entitled “Scalable point-of-care and label free microarray platform for rapid detection of sepsis”, or RAIS for short, has the potential to simultaneously detect more than one million biomarkers – the tell-tale signs of sepsis and many other diseases. Whereas current techniques can take as long as one day to perform a similar test, the new method combines photonics, microfluidics, and

continued on page 11
Alluxa

OPTICAL COATINGS REDEFINED

SPIE PHOTONICS WEST
FEBRUARY 5-7, 2019
BOOTH #4482 NORTH HALL

YOUR OPTICAL COATING PARTNER
alluxa.com

100W Femtosecond Fiber Laser
- Two Photon Imaging
- Three Photon Imaging
- Ultrafast Spectroscopy
- Microfluidic Chips
- OPO/OPA/OPCPA Pumping
- Femtosecond Laser Material Interaction

20W Supercontinuum Source
- OCT
- STED/Super-Resolution Imaging
- Flow Cytometry
- Photoacoustic Microscopy
- Nanophotonics
- Fluorescence Spectroscopy & Microscopy

+86 27 87204039
Sales@yslphotonics.com
www.yslphotonics.com
what its developers describe as “the world’s first while-you-wait test for skin cancer”.

The imaging system, intended to eliminate discomfort and uncertainty for patients, is able to fit every stage of disease identification within the short time of a single doctor’s appointment. Using a handheld scanner, they can peer beneath a patient’s skin to examine the microscopic landscape of a suspect lesion, performed in a hospital under general anesthesia to discover if it is spreading. This can take weeks to perform, is very expensive and can be debilitating for a patient. “About 80% of the time, the biopsy produces a negative result, with no sign of the cancer spreading. There has to be a better way: our scanner may radically improve the abilities of dermatologists to decide on the nature of a melanoma, [although]

RH points out that the RAIS microscope can simultaneously detect many biomarkers, including micro-ribonucleic acids and interleukins. “[I]t will let you know the bacteria source much earlier, allowing you to choose the correct treatment sooner,” he says. The RAIS project received a grant of €3 million via the photonics PPP under the Horizon 2020 program, with the team estimating that a commercial device based on its beta prototype could potentially provide results at a cost as low as €50 per patient.

Laser pen for ‘while you wait’ cancer test

The Photonics21 team says that another successful PPP-related development has been delivered by the Automatic Detection of Vascular Networks for Cancer Evaluation (ADVANCE) project team. They have produced a portable laser scanner that can diagnose a malignant melanoma in less than one minute, promising to become a process that takes just 20 seconds. Based on optical coherence tomography (OCT), a technique more commonly used in retinal screening, the scanner creates a 3D color image of microstructures and blood vessels under the skin – providing a diagnosis without the need for any invasive procedures.

Project leader Jon Holmes, from the UK company Michelson Diagnostics, explains: “Every melanoma above a certain thickness could have spread to other parts of the body. At present, all patients with such melanomas have to wait for a biopsy in a process that takes just 20 seconds. Based on optical coherence tomography (OCT), a technique more commonly used in retinal screening, the scanner creates a 3D color image of microstructures and blood vessels under the skin – providing a diagnosis without the need for any invasive procedures. Project leader Jon Holmes, from the UK company Michelson Diagnostics, explains: “Every melanoma above a certain thickness could have spread to other parts of the body. At present, all patients with such melanomas have to wait for a biopsy in a process that takes just 20 seconds. Based on optical coherence tomography (OCT), a technique more commonly used in retinal screening, the scanner creates a 3D color image of microstructures and blood vessels under the skin – providing a diagnosis without the need for any invasive procedures. Project leader Jon Holmes, from the UK company Michelson Diagnostics, explains: “Every melanoma above a certain thickness could have spread to other parts of the body. At present, all patients with such melanomas have to wait for a biopsy in a process that takes just 20 seconds. Based on optical coherence tomography (OCT), a technique more commonly used in retinal screening, the scanner creates a 3D color image of microstructures and blood vessels under the skin – providing a diagnosis without the need for any invasive procedures. Project leader Jon Holmes, from the UK company Michelson Diagnostics, explains: “Every melanoma above a certain thickness could have spread to other parts of the body. At present, all patients with such melanomas have to wait for a biopsy in a process that takes just 20 seconds. Based on optical coherence tomography (OCT), a technique more commonly used in retinal screening, the scanner creates a 3D color image of microstructures and blood vessels under the skin – providing a diagnosis without the need for any invasive procedures. Project leader Jon Holmes, from the UK company Michelson Diagnostics, explains: “Every melanoma above a certain thickness could have spread to other parts of the body. At present, all patients with such melanomas have to wait for a biopsy in a process that takes just 20 seconds. Based on optical coherence tomography (OCT), a technique more commonly used in retinal screening, the scanner creates a 3D color image of microstructures and blood vessels under the skin – providing a diagnosis without the need for any invasive procedures. Project leader Jon Holmes, from the UK company Michelson Diagnostics, explains: “Every melanoma above a certain thickness could have spread to other parts of the body. At present, all patients with such melanomas have to wait for a biopsy in a process that takes just 20 seconds. Based on optical coherence tomography (OCT), a technique more commonly used in retinal screening, the scanner creates a 3D color image of microstructures and blood vessels under the skin – providing a diagnosis without the need for any invasive procedures.

Fabric treats skin diseases

Other, less dangerous but debilitating skin conditions such as actinic keratosis (scaly spots on sun-damaged skin, often pre-cancerous), psoriasis (autoimmune disease causing abnormal skin) and acne can now be treated in a single 150 minute session, thanks to a new wearable photonics technology. Under another Photonics21 project, scientists at Texinov Medical Textiles, based in La Tour du Pin, France, led the development of “Fluxmedicare” – a knitted fabric that helps treat inflamed skin or lesions with photodynamic therapy (PDT).

Described by some users as a “miracle cure” in clinical trials, the pain-free approach is touted as offering the fastest way to eradicate the identified skin conditions, with no side effects. The knitted fabric acts like a waveguide to deliver therapeutic laser light to the entire region of skin requiring treatment.

Nadege Boucard, general manager of research and development at Texinov, said: “Fluxmedicare is unprecedented in the field of treating skin conditions. Since the lighting textile wraps around the contours of a patient, the light emitted by our device is the same level at every part of the body under treatment, meaning the beams are homogeneous.”

Photonics21 said of the project: “This development is yet another success for photonics technology. It has now been successfully tested in clinical trials and is ready to go, meaning more sufferers of such skin conditions will find new hope, quicker, easier, and in a painless appointment.”

Fluxmedicare was developed under the “PHOS-ISTOS” consortium, which secured EC grant support of €2.4 million. The team comprised participants from across Europe, including the diode laser manufacturer and Photonics West exhibitor Modulight.

MATTHEW PEACH
DUTCH BRIGHTEST SEES ALL COLOURS!

TEST AND MEASUREMENT SOLUTIONS FOR COLOUR AND LIGHT MEASUREMENTS IN DEVELOPMENT AND PRODUCTION PROCESSES

RHEA SPECTROMETER SERIES
- High-end cooled 2D CCD sensor
- Dark current compensated, virtually zero over entire integration range
- ND filter wheel for large dynamic range (incl. shutter)
- USB, RS232, Ethernet, ext. in/out trigger interfaces
- Selectable slit, grating to support various measurement applications between 200–1100nm

info@admesy.com  www.admesy.com

Next-generation ASSEMBLY LINE

New features and system layout. Made for industry, for FAB and HVM.

ficonTEC photonics assembly & testing

Visit #4353 to find out.
Fellowship winners tackle twin healthcare challenges

Researchers supported by SPIE-Franz Hillenkamp Postdoctoral Fellowships are developing photonics technologies to treat MRSA infections and diagnose esophageal disease. Both projects could have significant impact in clinics.

The challenge to healthcare posed by MRSA is an enormous global concern, given the resistance to several widely used antibiotics that these bacterial infections can possess.

A traditional first line of defense in hospitals and clinics has been stringent controls on cleanliness, to limit the spread of infection. But an optical technique under development at Boston University’s Photonics Center aims to eliminate the potentially deadly pathogens with a more targeted approach.

Jie Hui, a member of Ji-Xin Cheng’s group at Boston, is working on the use of blue laser light to disrupt the antibiotic-resistant bacteria, potentially allowing a treatment to be developed specifically for MRSA-caused diseases.

“It has been well documented for more than a decade that blue light has an antimicrobial effect, but its underlying mechanism has been a mystery and the treatment efficiency is limited, which has blocked the translation of this approach into clinics,” commented Hui. “Our research team discovered that staphyloxanthin, an endogenous pigment produced by the bacteria and bound in its membrane, is the specific molecular target for the blue illumination.”

Staphyloxanthin has an antioxidant action, a key element in the microbe’s defense against the reactive oxidation process employed by some conventional antibacterial treatments. Weaken or damage the staphyloxanthin, and you can deal a serious blow to MRSA’s formidable toughness.

In 2017, Hui’s project found that staphyloxanthin is prone to photobleaching by blue light, which ruptures cell membranes and kills the bacteria cells. This effect was proved to work on MRSA cultures, MRSA-infected macrophage cells, bacterial biofilms, and a wound infection model in mice. More recently, the project set out to address a long-standing question within the field: what is the best blue light source for killing MRSA?

“My recent work, grounded in the physics of staphyloxanthin photolysis, demonstrated that a pulsed blue laser source both reduces the potential photothermal effect when compared with continuous-wave light sources, and improves photolysis efficiency and depth, subsequently killing MRSA much more effectively,” said Hui. “We also revealed the detailed killing mechanism for MRSA, which opens many opportunities for clinical applications of our technology. These findings are novel and have high potential for development into a therapeutic platform in the clinic.”

This project builds upon work that won the group a Translational Research Award at last year’s Photonics West, and Jie Hui is now a recipient of a 2019 SPIE-Franz Hillenkamp Postdoctoral Fellowship in Problem-Driven Biophotonics and Biomedical Optics. This annual award, recognized during Saturday’s BiOS Hot Topics session, is one of a pair of fellowships targeted at interdisciplinary problem-driven research and opportunities for translating new technologies into clinical practice for improving human health.

Specific treatment strategies

“These findings are fascinating both to our research team and to the physicians we have met,” Hui commented. “Clinical applications of our technology to benefit patients would be even more exciting. Right now, we are working towards the clinical translation of this technology to treat specific diseases, for example skin and urinary tract infections caused by MRSA. As it moves towards the clinic, we will certainly face some technical challenges. One example is the light delivery system, where we may need to develop specific strategies to match each application.”

This may in turn involve different parameters for laser treatment in terms of dosage, illumination area, and treatment time, alongside the possible adoption of specific optical fibers for endoscopic and intravascular applications. The nature of each individual infected site and the general condition of a patient are also likely to influence which treatment is best, commented Hui. “Each individual case is unique. We are developing a framework to consider all of these factors in the context of their severity and determine the best course of treatment.”

In conclusion, the research team’s findings are an important step forward in developing a pragmatic yet effective treatment for MRSA, and the group is hopeful that the approach could find use in early-adopter hospitals within two years.

Jie Hui, a researcher at the Boston University Photonics Center, is working on a blue laser treatment for MRSA. He is hopeful that the approach could find use in early-adopter hospitals within two years. Photo: Boston University.
Room Temperature InAsSb Detectors

FOR MWIR SENSING APPLICATIONS

Environment
Consumer
Smart Building

221 Commerce Drive, Montgomeryville, PA 18936
(215) 368-6900
information@teledynejudson.com
www.teledynejudson.com

Metrology Services
Archer OpTx is now making contract measurement services available utilizing the most sophisticated metrology equipment for both mechanical and optical measurements.

- BFL
- EFL
- FFL
- MTF
- Centration (Wedge and Decenter)
- Beam Deviation
- Plane Angles of Prisms and Polygons
- Surface Angle and Tilt (0.2 arcsec)
- TIR (Total Indicated Runout)
- Wedge
- Radius of Curvature
- Multi Element Assembly Coaxiality
- PER Testing for Assemblies
- Transmitted Wavefront Aberration @633 nm
- Surface Flatness
- Surface Form/Figure/Irregularity
  - 2D or 3D
  - Subnanometer Resolution
- Surface Roughness
  - 2D or 3D
  - Subnanometer Resolution
- Surface Parallelism
- Surface Angle
- Surface Scratch-Dig
- Transmission and Reflectance
  - 185 nm – 3500 nm
  - 0° - 75° AOI

Avantes proprietary automated production process provides exceptional unit to unit reproducibility for OEM configurations.

Avantes
enlightening spectroscopy
info@avantes.com | www.avantes.com

BOOTH 333

Avanta

SPIE PHOTONICS WEST Booth #433
**Fellowship winners continued from page 13**

to play a role. Ultimately, each specific disease may well require its own particular treatment strategy.

Successful translation of any new biophotonics technology, whether for diagnostics or therapy, needs to be grounded on solid scientific studies as well as strong collaboration among scientists, engineers, and physicians. For medical devices in particular, it also requires significant investments to be put in place in order to bring them to market.

“We are very positive on the clinical translation of this particular technique,” Hui said. “Antibiotic resistance is currently a serious public health issue, and MRSA has been listed by the World Health Organization among its ‘priority’ pathogens—the 12 families of bacteria that pose the greatest threat to human health. This means our technique occupies a very valuable niche from the clinical point of view, as well as being simple, safe, and effective.”

The group is currently initiating a proof-of-concept clinical study using the blue-light technology, likely to take place this year. After that, Hui is hopeful of a smooth path through larger clinical trials and regulatory approval, with early-adopter hospitals perhaps able to deploy the technology within the next two years.

“We really appreciate that the SPIE community recognizes our research work in this direction, by awarding both the prestigious SPIE-Franz Hillenkamp Postdoctoral Fellowship this year and SPIE Translational Research Award in 2018,” he commented. “Both awards are highly selective, and target the most promising biophotonics technologies with high translational potential. These awards have already drawn more attention to our research findings, and will further accelerate the translation of our technologies into the clinic and into the market. In the long run, I think these awards will prove to have benefited both the SPIE research community, and patients in the clinic.”

**Diagnosing esophageal disease with OCT “pill”**

At the Wellman Center for Photomedicine, located at Massachusetts General Hospital (MGH), Andreas Wartak’s research into optical diagnosis of eosinophilic esophagitis (EoE) is paving the way for an earlier and less invasive treatment of this allergic inflammatory condition of the esophagus, a disease whose exact nature is still not fully understood.

Diagnosis of EoE normally involves a biopsy performed with an endoscope, followed by histopathology analysis of the sample to examine the influx of a certain type of white blood cell that characterizes the condition. But this is by nature invasive, expensive, requires sedation, and is prone to high sampling variability. The Wellman Center project, based in the lab of Guillermo Tearney, is developing a more attractive optics-based alternative.

“We will apply a technique that has been recently developed in our lab, termed tethered capsule endomicroscopy (TCE), in which a pill descends down the esophagus when swallowed and is then withdrawn back up by means of a tether,” explained Wartak. “This capsule will incorporate a sophisticated new form of optical coherence tomography (OCT), for visualizing the inside of the esophagus at the cellular level.”

OCT’s ability to record depth scans of living samples from backscattered light is well established, in particular for ophthalmic imaging. But it is also well on its way to becoming a major technology for intraluminal diagnosis, especially in the cardiovascular and gastrointestinal systems.

“Our project tries to further extend the portfolio of gastrointestinal diseases that already profit from OCT’s tomographic imaging approach,” commented Wartak. “We will investigate epithelial tissue inflammation, as well as structural changes and sub-epithelial remodeling in EoE. This complementary information will provide key insights into disease development and progression over time, that should ultimately lead to an advance in research, diagnosis and therapy for EoE.”

As with most in vivo imaging modalities, the obstacles facing the Wellman Center project include the need for sufficiently fast imaging speeds to counteract the unavoidable sample motion. In this instance, movement mainly caused by peristalsis (muscle contractions in the digestive tract), which cannot be fully corrected by computational methods. Image resolutions able to reveal the smallest details of the biological processes under study have to be achieved.

MRSA bacteria, as seen under the electron microscope. Image: The Wellcome Trust.

“Bench-to-bedside translation can be a long and winding road, and there are definitely hurdles in the way of every technology striving towards the clinical market,” he said. “I believe there is now a clear trend of more biophotonic modalities, whether diagnostic or therapeutic, successfully making it into the clinic, and the drive towards translation now seems more pronounced. Nevertheless, there is always room for improvement and, in particular, the need for suitable funding.”

As a researcher from Europe now working in the US, Wartak has also observed some geographical differences in the translational funding structures, with the more extensive private funding opportunities available in the US potentially facilitating higher-risk proposals than the more conservative public agencies might opt to support.

Wartak’s receipt of the SPIE-Franz Hillenkamp Postdoctoral Fellowship will also now play a part, by allowing him to focus on the EoE research project, increasing the chances of a successful outcome.

“I personally feel motivated by the fact that my research not only seems meaningful to myself, but also to SPIE and thus to a wider general public,” he said. “Conferences, meetings, and conferences such as Photonics West are essential. Research is all about sharing discoveries, inventions and results, but it is at conferences that scientists like us have the chance to experience research in a more personal and probably more relatable way.”

TIM HAYES
up to 95% quantum efficiency
back illuminated sCMOS

depth cooled
down to -25 °C

ultra compact design

pcotech.com
Welcome to the optics.org Product Focus which we have published specifically for Photonics West 2019 in partnership with SPIE and the Photonics West Show Daily.

Here you will find an effective at-a-glance guide to some of the latest products available on the market with booth numbers if available making it easy for you to check out the products for yourself.

All this information and more can be found on the optics.org website. Simply go to www.optics.org for all the latest product and application news. Alternatively, why not sign up to our free weekly newsletter (www.optics.org/newsletter) and get the information delivered direct.

---

**Wavelength Meters – Fast and Accurate for CW and Pulsed Lasers**

Bristol Instruments’ wavelength meters are used by scientists and engineers who need to know the exact wavelength of their lasers. Systems are available for CW and pulsed lasers that operate at wavelengths from 375 nm to 12 μm. These systems use proven interferometer-based technology to measure absolute wavelength to an accuracy as high as ± 0.0001 nm and offer the fastest sustained measurement rate of 1 kHz. Continuous calibration with a built-in wavelength standard guarantees the reliable accuracy required for the most meaningful experimental results.

**Contact Details**
Bristol Instruments, Inc.
778 Canning Parkway
Victor, New York 14564
www.bristol-inst.com
info@bristol-inst.com
Tel: +1 (888) 934-2620
Fax: +1 (888) 934-2623

---

**Photonic Professional GT2: Printer for 3D Microfabrication**

Nanoscribe’s Photonic Professional GT2 is the world’s highest-resolution 3D printer. It lifts the boundaries of ultra-precise additive manufacturing for the fabrication of macro-scale structures with millimeter dimensions. The two-photon polymerization driven systems combine the technology of two-photon polymerization with a regular 3D printing workflow for additive manufacturing and massless lithography. New features, new tools, and new processes extend the microfabrication capabilities of Nanoscribe’s 3D printers and make them a valuable tool for scientific and industrial applications like photonics, micro-optics, micro-fluidics, MEMS, or biomedical engineering.

https://www.nanoscribe.de/en/products/photonic-professional-gt2/?pk_campaign=opticsorg

**Contact Details**
Nanoscribe GmbH
Hermann-von-Helmholtz Platz 1
D-76344 Eggenstein-Leopoldshafen
Germany
www.nanoscribe.de
info@nanoscribe.de
Tel: +49 721 60 82 88 40

---

**C-RED cameras, above and beyond: High Dynamic Range**

Exclusively for Photonics West, C-RED 2-600 + HDR is a high dynamic range (640x128 VEGA) InGaAs SWIR camera - ultra fast (600 FPS FF), very low noise (<30 electrons), very low dark (300 e/p/s), and High Dynamic (93dB linear dynamic range and true 16 bits image), all at the same size.

Designed for Scientific, Industrial or Surveillance applications where sensitivity, speed, dynamic and resolution are crucial, easy as plug-and-play, C-RED Cameras are able to empower any system.


**Contact Details**
First Light Imaging
Europarc Sainte Victoire, Bat 6
Route de Villablanc, Le Castel
13358 Meyrueis, FRANCE
www.first-light-imaging.com
contact@first-light.fr
Tel: +33 (0) 4 62 01 29 20

---

**OCT components**

OCT optics is introducing a new line of Fiber Optic Components for OCT Applications: High-Speed Polarization Controller/Scrambler, 33fps Electrically/Manual Controlled Optical Delay Line, Collimators/Focusers, Electrical Controlled Variable Attenuation, Faraday Rotators/Mirrors, Isolator, Fiber Pigtalled Ultra Stable Laser Module, Fixed Coupler, Polarizers, Reflectors, Directional Fiber Optic Power Monitors (Taps/Photodiodes), Miniature Inline Polarization Maintaining Splitters/Taps/Combiners, Polarization Maintaining Fixed Fiber Couplers/Splitters, Optical Circulator, Voltage Controlled Tunable Filter, Inline Fabry-Perot Tunable Filters.

**Contact Details**
OZ Optics Ltd
219 Westbrook Road, Ottawa,
Ontario, K4A 1L0
www.ozoptics.com
sales@ozoptics.com
Tel: +1 613-831-0981
Fax: +1 613-836-5089

---

**Iridian Spectral Technologies**

Iridian optical filters – providing “More Signal, Less Background” for LiDAR applications

LiDAR systems work with common laser wavelengths including 532nm and 1064nm with the wavelengths typically used in automotive applications being 905nm and 1550nm. Iridian provides customized optical filter solutions for LiDAR applications providing “More Signal, with Less Background” from design and manufacture of initial prototypes through to high volume production in our ISO9001:2015 certified Canadian operation.

- High transmission at the laser wavelength (>90%)
- Narrow bandwidths (<1nm to 20nm dependent on the system requirements)
- Deep blocking (OD3-5 or better over detector range)
- No maintenance/calibration needed; highly stable; environmentally robust and reliable
- Low sensitivity to angles of incidence (AOI) and temperature variation
- Low cost, high volume manufacturing capabilities

Link: https://www.iridian.ca/application-areas/optical-filters-liadar-applications/

**Contact Details**
Iridian Spectral Technologies
2700 Swannata Crescent, Ottawa,
ON, Canada K1G6R8
www.iridian.ca
sales@iridian.ca
Tel: +1 (613) 741-4513
Twitter: @IridianSpectral

---

**Voltage Multipliers Inc.**

10kV and 15kV High Voltage Optodiodes

OZ100 and OZ150 families feature high voltage isolation in a small package.

Reverse current, in μA, is generated when the diode junctions are exposed to light. The response is linear, meaning the current level can be used to control and monitor isolated systems. The optically clear over-encapsulation preserves light sensitivity, protects the device, and provides mechanical stability.

Applications include noisy industrial environments and sensitive instrumentation where high isolation is needed, or in controlled feedback systems like high voltage opto-couplers or voltage regulators.

**Contact Details**
Voltage Multipliers, Inc.
8711 W. Roosevelt Ave.
Vista, CA, USA 92081
www.voltagemultipliers.com/Aliases/LP/OZ100_and_OZ150.html
kspano@voltagemultipliers.com

---

**First Light Imaging**

Visit us at Booth #1059, French Pavilion
C-RED cameras, above and beyond: High Dynamic Range

Visit us at Booth #4548
OCT components

Visit us at Booth #4644
Iridian Spectral Technologies

Visit us at Booth #4589
Voltage Multipliers Inc.
**EKSMA OPTICS**

**Ultra High LIDT Laser Mirrors at 1064 nm**

EKSMA Optics offers ultra high damage threshold laser mirrors for 1064 nm laser wavelength with a laser induced damage threshold of >20 J/cm². Laser induced damage threshold of >20 J/cm² was measured for both s and p polarization pulses at 1064 nm, 10 ns, 20 Hz. AOI=45° under ISO standard 21254-2 1-000cm-1 conditions. New ultra high damage laser mirrors are produced using advanced IBS coating technology. Ultra high LIDT mirrors for other laser wavelengths are available upon request.

**Navitar**

**4K HDR Lens/Camera Modules, Large Format Imaging Systems**

Navitar imaging technologies being showcased this year include 4K HDR lens modules for UW and AV/forward-facing camera systems, large format zoom and fixed Resolv4K imaging lens systems, Pixelink polarization cameras for broader visual detection of material properties, and precision microscope objectives. We design, build, test and assemble optical solutions of the highest quality that are used in a new emerging markets.

**Pixelink a Navitar Company**

**New HDR and Polarization Camera Models with Sony IMX Pregius CMOS Sensors**

Pixelink has expanded their USB3 Vision industrial camera line with new HDR and polarization models. The PL-D755 and PL-D753, featuring Sony 3rd generation IMX202 and IMX242 sensors, capture and combine dual ADC images into a single hybrid HDR image directly on camera – making them ideal for HDR imaging applications such as moving parts inspection. The PL-D753-POL polarization machine vision camera, featuring Sony’s IMX250MZR image sensor with pixel-level quad polarization filter technology, offers broader visual detection and characterization capabilities of material properties over conventional monochrome sensors.

**Synopsys**

**Meet Optical Design Goals Faster and Better with CODE V**

Synopsys’ CODE V® has been leading optical design software innovation for over 40 years. Extended formulations help optical designers meet stringent packaging and image resolution requirements for compact camera systems. Sophisticated algorithms and built-in expert tools enable the design of cutting-edge AR/VR systems. Visit Synopsys in Booth #1259 at SPIE Photonics West 2019 to get a demo or contact us today for a free evaluation.

**Radiant Vision Systems, LLC**

**NIR Intensity Lens measures near-infrared light sources used for 3D sensing**

The Near-Infrared (NIR) Intensity Lens system from Radiant combines a Fourier-optic lens with 16 megapixel CCD imaging radiometer for precise characterization of NIR-emitting light sources used for facial recognition and other 3D sensing applications. The system captures angular data to ±0.7 degrees in a single image to efficiently measure radiant intensity across the distribution, and analyzes structured light patterns produced by diffractive optical elements (DOEs).

- Measure near-IR LEDs and lasers
- Capture light across ±0.7 degrees
- Output extensive DOE statistics
- Qualify facial and gesture recognition technology

**ADIT Electron Tubes**

**ADIT Electron Tubes introduces a complete range of Photodetector Modules:**

Photodetector modules are available in cylindrical and rectangular format for photon counting and analog signal detection using 25mm and 30mm diameter photomultiplier tubes.

- Spectral range: 170nm to 950nm available
- Signal output: analog, TTL, USB
- Dual TTL and USB available
- Operates from +5 volts
- Dynamic range up to 1000 mV
- Choice of 3 software configurable counting modes
- HV and data retrieval controlled by dedicated application software

We welcome your inquiry for custom modules.

**ALPPhANOV**

**MIR-PULS – ALPPhANOV unveils a new femtosecond laser tunable over 1800-2100nm.**

Part of the PULS family product, MIR-PULS delivers 20mW of sub-300fs TTL pulses at 40kHz over the spectral range of 1800-2100nm. It offers a unique solution for applications such as bioimaging, optogenetics, spectroscopy or seed source for Thulium/holmium based amplifier systems. This new laser oscillator developed by ALPPhANOV illustrates its expertise in modeling, designing and prototyping innovative fiber laser sources.

Always with the user in mind, ALPPhANOV is also ready to customize this laser upon request.

**Contact Details**

- Tel: +44 (0)117 905 5330
- Fax: +44 (0)117 905 5331
- email: rob.fisher@optics.org

**Follow us on twitter @opticsorg**

**www.synopsys.com/optical-solutions/**

**www.eksmaoptics.com**

**www.navitar.com**
Advanced Laser Power / Energy Meter Features Sophisticated Touch-Screen Display

Ophir® Centauri is a compact, portable laser power / energy meter for precise measurements of laser performance over time. Features a large, sophisticated touch-screen for visual review of data using a wide range of display formats, such as Digital with Bargraph, Pulse, Chart, and Real Time Statistics Displays. Advanced math functions include Density, Scale Factor, and Normalize Against Baseline. Available in single and dual-channel versions. Compatible with all standard Ophir thermal, photodiode, and photometric sensors, including the award-winning BeamTracker power / position / size sensors.


DIAMOND announces innovative fiber optic interconnect solutions for demanding applications

Harsh Environmental surroundings can adversely affect the operation of systems utilizing fiber optics. To combat these conditions, DIAMOND has developed a wide range of strong, reliable, and customizable optical interconnect solutions. Diamond’s unique Multipurpose DM insert combines unparalleled fiber core concentricity and superior optical performance. In addition, IP ratings are met through solid and unique connector construction. In addition to the optical connectors, electrical contacts can also be integrated. Visit us in Booth #4786 in the North Hall to see the new and innovative DM Insert.

Ibsen offers highly efficient spectrometer platform specifically targeting Optical Coherence Tomography

The EAGLE platform comprises high resolution, compact, and robust spectrometers, suited for OEM integration into medical and industrial grade instruments for applications like Raman and SD-OCT. The EAGLE OCT-T5 spectrometer is very compact due to the use of Ibsen’s wide bandwidth transmission gratings. These unique gratings furthermore enable us to offer higher efficiency than any competing technology. The wavelength range of the standard version is 810 – 900nm, but can be customized to other ranges. EAGLE OCT-T5 is supplied with Teledyne L2V OctoPlus camera with 2048 tall pixels.

SID4 SWIR: High-resolution wavefront sensor from 0.9 to 1.7 µm for laser and optics metrology

Phasics offers metrology and imaging solutions to laser engineers, lens manufacturers and cell biologists. With a range covering UV to far infrared, our high resolution wavefront sensing solutions - based on the patented Quadriwave Lateral Shearing Interferometry technology - combine high accuracy, best-in-class dynamic range and ease of use. Visit us to discover how our new range of SWIR sensors fully characterizes laser sources, as well as assemblers and lenses used in free space optical communications, aerospace instruments and defense night vision.

**Ophir**

Visit us at Booth #927

**Advanced Laser Power / Energy Meter Features Sophisticated Touch-Screen Display**

**Bristol Instruments, Inc.**

Visit us at Booth #235

**Spectrum Analyzer — High Resolution and High Accuracy**

The Laser Spectrum Analyzer from Bristol Instruments operates as both a high-resolution spectrum analyzer and a high-accuracy wavelength meter. These systems are for scientists and engineers who need to know the spectral properties of their lasers that operate from 3.75 nm to 12 µm. With spectral resolution up to 2 GHz, wavelength accuracy as high as 0.0001 nm, and an optical rejection ratio of more than 40 dB, this instrument provides the most complete analysis needed for the most demanding applications.

**Diamond SA**

Visit us at Booth #4786 - North Hall

**DIAMOND announces innovative fiber optic interconnect solutions for demanding applications**

Harsh Environmental surroundings can adversely affect the operation of systems utilizing fiber optics. To combat these conditions, DIAMOND has developed a wide range of strong, reliable, and customizable optical interconnect solutions. Diamond’s unique Multipurpose DM insert combines unparalleled fiber core concentricity and superior optical performance. In addition, IP ratings are met through solid and unique connector construction. In addition to the optical connectors, electrical contacts can also be integrated. Visit us in Booth #4786 in the North Hall to see the new and innovative DM Insert.

**Ibsen Photonics**

Visit us at Booth #663

**Ibsen offers highly efficient spectrometer platform specifically targeting Optical Coherence Tomography**

The EAGLE platform comprises high resolution, compact, and robust spectrometers, suited for OEM integration into medical and industrial grade instruments for applications like Raman and SD-OCT. The EAGLE OCT-T5 spectrometer is very compact due to the use of Ibsen’s wide bandwidth transmission gratings. These unique gratings furthermore enable us to offer higher efficiency than any competing technology. The wavelength range of the standard version is 810 – 900nm, but can be customized to other ranges. EAGLE OCT-T5 is supplied with Teledyne L2V OctoPlus camera with 2048 tall pixels.

**Phasics**

Visit us at Booth #4165

**SID4 SWIR: High-resolution wavefront sensor from 0.9 to 1.7 µm for laser and optics metrology**

Phasics offers metrology and imaging solutions to laser engineers, lens manufacturers and cell biologists. With a range covering UV to far infrared, our high resolution wavefront sensing solutions - based on the patented Quadriwave Lateral Shearing Interferometry technology - combine high accuracy, best-in-class dynamic range and ease of use. Visit us to discover how our new range of SWIR sensors fully characterizes laser sources, as well as assemblers and lenses used in free space optical communications, aerospace instruments and defense night vision.

---

**Bristol Instruments, Inc.**

Visit us at Booth #235

**Spectrum Analyzer — High Resolution and High Accuracy**

The Laser Spectrum Analyzer from Bristol Instruments operates as both a high-resolution spectrum analyzer and a high-accuracy wavelength meter. These systems are for scientists and engineers who need to know the spectral properties of their lasers that operate from 3.75 nm to 12 µm. With spectral resolution up to 2 GHz, wavelength accuracy as high as 0.0001 nm, and an optical rejection ratio of more than 40 dB, this instrument provides the most complete analysis needed for the most demanding applications.

---

**Diamond SA**

Visit us at Booth #4786 - North Hall

**DIAMOND announces innovative fiber optic interconnect solutions for demanding applications**

Harsh Environmental surroundings can adversely affect the operation of systems utilizing fiber optics. To combat these conditions, DIAMOND has developed a wide range of strong, reliable, and customizable optical interconnect solutions. Diamond’s unique Multipurpose DM insert combines unparalleled fiber core concentricity and superior optical performance. In addition, IP ratings are met through solid and unique connector construction. In addition to the optical connectors, electrical contacts can also be integrated. Visit us in Booth #4786 in the North Hall to see the new and innovative DM Insert.

---

**Ibsen Photonics**

Visit us at Booth #663

**Ibsen offers highly efficient spectrometer platform specifically targeting Optical Coherence Tomography**

The EAGLE platform comprises high resolution, compact, and robust spectrometers, suited for OEM integration into medical and industrial grade instruments for applications like Raman and SD-OCT. The EAGLE OCT-T5 spectrometer is very compact due to the use of Ibsen’s wide bandwidth transmission gratings. These unique gratings furthermore enable us to offer higher efficiency than any competing technology. The wavelength range of the standard version is 810 – 900nm, but can be customized to other ranges. EAGLE OCT-T5 is supplied with Teledyne L2V OctoPlus camera with 2048 tall pixels.

---

**Phasics**

Visit us at Booth #4165

**SID4 SWIR: High-resolution wavefront sensor from 0.9 to 1.7 µm for laser and optics metrology**

Phasics offers metrology and imaging solutions to laser engineers, lens manufacturers and cell biologists. With a range covering UV to far infrared, our high resolution wavefront sensing solutions - based on the patented Quadriwave Lateral Shearing Interferometry technology - combine high accuracy, best-in-class dynamic range and ease of use. Visit us to discover how our new range of SWIR sensors fully characterizes laser sources, as well as assemblers and lenses used in free space optical communications, aerospace instruments and defense night vision.
**TOPTICA Photonics AG**

**Product Focus: Femtosecond Laser**

TOPTICA Photonics AG (based in Graefelfing/Munich, Germany) has introduced a new high-power fiber laser system for microscopy applications (neurosciences, 2-photon excitation), the 920 nm emitting FemtoFiber ultra 920. With a repetition rate of more than 1 Watt average power at 80 MHz, it delivers sub-100fs pulses, enabling high-speed applications in neurosciences and 2-photon excitation.

**Contact Details**

Letty Trevisan, Sales Engineer
Diverse Optics Inc., 1010 Regis Court, Rancho Cucamonga, CA 91730
Email: info@diverseoptics.com
Tel: +1 (909) 595-9330
Fax: +1 (909) 596-1452

**Visit us at Booth #641**

---

**Diverse Optics Inc.**

**Custom Polymer Optics**

Diverse Optics specializes in precision injection molding and single point diamond turning of custom polymer optics. Reduce cost, trim weight, improve performance, and simplify your product design by implementing precision polymer optics! We do it all, prototyping to series production of free-forms, spheres, micro-optics, aspheres, domes, convex/concave, plano/convex, bi-convex, diffractives, Fresnels, prisms, light-pipes, lens arrays, collimators, combiners, toroids, CPC's, TIR's, parabolics, off-axis, ellipticals, and more. Whether it's thousands of molded optics or a few diamond turned prototypes, we'll show you how polymer optics are perfected!

**Contact Details**

Letty Trevisan, Sales Engineer
Diverse Optics Inc., 1010 Regis Court, Rancho Cucamonga, CA 91730
Email: info@diverseoptics.com
Tel: +1 (909) 595-9330
Fax: +1 (909) 596-1452

**Visit us at Booth #2538**

---

**Archer OpTx Inc.**

**An Optical Bench that won't give you the Blues!**

Archer OpTx will soon be offering an optical bench representative of their optical quality at globally competitive pricing. This optical bench will be a turnkey, all-in-one solution to your metrology requirements. There is no need for purchasing expensive upgrades or software.

The new Archer OpTx optical bench will be capable of measuring focal lengths of 3mm – 2100mm in reflection and transmission. Live measurement standards of EFL, BFL, FFL, centration, radius of curvature, and MTF. MTF measurements with precision accuracy.

**Contact Details**

Archer OpTx Inc., 1288 Sigma Court, Rockwall, TX 75087 USA
Email: sales@archeroptx.com
Tel: +1-972-722-1064
Fax: +1-972-722-1063

**Visit us at Booth #333**

---

**SPI Lasers UK Ltd**

**redENERGY Pulsed Fiber Laser sets new levels of versatility!**

Our redENERGY G4 200W EP-Z pulsed fiber laser extends the power range of the G4 platform with greater pulse energy, peak power and pulse repetition frequency.

Combining these features with the G4’s range of pulses provide a high level of flexibility across a number of applications including high speed welding, cleaning, cutting and drilling.

**Contact Details**

SPI Lasers UK Ltd, 6 Wellington Park, Tollbar Way, Hedge End, Southampton SO30 2SU
Email: sales@spilasers.com
Tel: +44 (0)1489 779 696 – Option 1

**Visit us at Booth #1068, South Hall**

---

**Boston Micromachines Corp.**

**Boston Micromachines presents its new deformable mirror model, the 648-DM!**

Boston Micromachines is excited to introduce the latest addition to our deformable mirror portfolio, our 648-DM. This new-sized deformable mirror extends the available stroke of our mid-actuator count DMs to 3.5μm, up from 3.5μm, making it our largest device with 5.5μm stroke. The 648-DM enables high speed, high actuator count control with extended stroke.

Please stop by Booth 4440/440 for a chance to learn about our DM product line, broadband optical modulator technology and a see our newest adaptive optics SDO module demonstration.

**Contact Details**

Boston Micromachines Corp., 80 Spinelli PL, Suite 103 Cambridge, MA 02138
Email: moreinfo@bostonmicromachines.com
Tel: +1 617 868 4178

**Visit us at Booth #4440**

---

**Zygo Corporation**

**Precise and Versatile Laser Interferometers for Non-contact Metrology of Thin Optics**

Qualify critical thin glass components with Zygo laser interferometers. Measure thin, plane-parallel optics less than 1 mm thick – with unmatched precision, speed and ease-of-use. Industry-leading capabilities include form error characterization of multiple surfaces and thickness variation – simultaneously – with a single measurement! Improve quality and process control for advanced applications, including mobile device display flatness, AR/VR optics, and semiconductor wafer thickness.

Proven solutions from the most trusted name in optical metrology. Confidence in metrology.

**Contact Details**

Zygo Corporation, Laurel Brook Road, Middlefield, CT 06455 USA
Email: inquire@zygo.com
Tel: +1 860-347-8506

**Visit us at Booth #1342**

---

**To announce your new product or to ensure your existing products get the visibility they deserve and are put in front of the industry’s key decision makers, make sure you are in the next issue of optics.org product focus.**

Distributed at:

**SPIE Defense+Commercial Sensing**

14 - 18 April 2019
Baltimore Convention Center, Baltimore, Maryland, United States

**Copy Deadline - 2 April 2019**

Contact one of our sales team on:

+44 (0)117 905 5330
email sales@optics.org

or visit us online to download the latest product focus media pack:

optics.org/advertise
Optics tech drives CES innovations

From smart glasses to autonomous vehicles, photonics technology and the world of consumer electronics seem closer than ever.

Photonics innovation has a long association with consumer electronics, right from the early days of liquid crystal displays, through the emergence of optical data storage in the 1980s, digital cameras, Blu-ray discs and the like. But the link has grown to such an extent in recent years that the topics under discussion at the annual CES event in Las Vegas and Photonics West have become increasingly intertwined.

At CES 2019 last month, that trend was once again in evidence. Photonics-based technology themes included the latest augmented, virtual, and mixed reality (AR/VR/MR) headsets and glasses, new micro-LED array displays, and a whole host of new lidar and camera systems designed for today’s driver assistance and tomorrow’s fully autonomous cars.

The clearest link between the two events is AR/VR/MR, and with good reason. Perhaps the greatest challenge facing the companies developing these technologies is to improve their size, weight, and performance to make them truly immersive and portable. And that comes right back to the fundamental optics involved, in particular the waveguides inside glasses and headsets.

Among those to present at Photonics West’s dedicated AR/VR/MR conference, DigiLens, a Santa Clara, California-based startup, was showcasing its waveguide technology at CES 2019. The company’s “DigiLens Crystal” platform is based around waveguides made under license by Taiwan-based Young Optics, and leverages digital light processor (DLP) technology from Texas Instruments. Glass companies offering the kind of high-precision wafers needed for mass production of suitable waveguides are also emerging as key players in the AR/VR/MR ecosystem, with Photonics West exhibitors Corning and Schott among those involved. Vuzix was another AR smart glasses vendor to present on the topic of waveguide technology at Photonics West.

In recent years CES has also become a key date in the calendar for the automotive industry, with car manufacturers using the post-holiday event to launch the latest features in their increasingly tech-oriented vehicles. Among this year’s major draws was Toyota, whose US-based subsidiary Toyota Research Institute (TRI) rolled out its new "P4" test vehicle on the Las Vegas stage. Toyota’s latest “Guardian” test vehicle for autonomous driving is mobbed by the media at CES 2019 in Las Vegas. The car features high-performance lidar units in its roof section, other lidar sensors around its chassis, radar, and numerous cameras. Photo: CES.

Among those to present at Photonics West’s dedicated AR/VR/MR conference was DigiLens, which at CES 2019 launched AR smart glasses said to offer a much-improved level of form-factor, optical efficiency (meaning longer battery life), and contrast.

The Sunnyvale, California, firm’s new “DigiLens Crystal” platform is based around waveguides made under license by Taiwan-based Young Optics, and leverages digital light processor (DLP) technology from Texas Instruments. Glass companies offering the kind of high-precision wafers needed for mass production of suitable waveguides are also emerging as key players in the AR/VR/MR ecosystem, with Photonics West exhibitors Corning and Schott among those involved. Vuzix was another AR smart glasses vendor to present on the topic of waveguide technology at Photonics West.

In recent years CES has also become a key date in the calendar for the automotive industry, with car manufacturers using the post-holiday event to launch the latest features in their increasingly tech-oriented vehicles. Among this year’s major draws was Toyota, whose US-based subsidiary Toyota Research Institute (TRI) rolled out its new “P4” test vehicle on the Las Vegas stage.

The P4 features high-performance lidar systems from Photonics West exhibitor Luminar Technologies on its roof, alongside a radar system, numerous cameras, and additional lidar sensors positioned around its body. Everything is motivated by improving safety and reducing the incidence of road collisions – nearly 40,000 lives are lost every year on US roads alone, among 1.25 million worldwide. And before unveiling the P4, TRI’s CEO Gil Pratt showed footage of an alarming three-car crash collected by and involving one of the company’s earlier “Platform 3.0” test vehicles, at the time in manual mode, on the I-80 interstate road close to San Francisco.

“Luckily, despite the severity of the crash, nobody was injured,” said Pratt. “We show you this now, not to wow you with technology, but because I want to take you through a question that we posed to ourselves that very day: could a Toyota Guardian (TRI’s driver assistance system) have prevented or mitigated this crash?”

The answer, he said, was yes. When TRI recreated the scenario on a test track, sensors on board the car showed that in the real crash it could have accelerated safely away from the encroaching vehicles as they approached, creating more space on the road and a safer driving “envelope”.

Meanwhile, back at the press launch event, Toyota announced an agreement with Blackmore to bring $20,000 lidar sensors to strategic partners.

The answer, he said, was yes. When TRI recreated the scenario on a test track, sensors on board the car showed that in the real crash it could have accelerated safely away from the encroaching vehicles as they approached, creating more space on the road and a safer driving “envelope”.

Among the lidar companies highlighting new advances at CES 2019 was Prism Award winner Blackmore, whose frequency-modulated multi-beam system now boasts a remarkable range of 450 meters, alongside a wide field of view. Already available for pre-order and with initial samples shipping now, Blackmore says that full systems will ship to customers from Q2 this year. That high performance comes at a cost of “less than $20,000” to strategic partners.

Augmented, virtual, and mixed reality (AR/VR/MR) technologies were again a huge trend at CES 2019, as well as the subject of a dedicated conference and expo at Photonics West earlier this week. Image: DigiLens.

Also at CES 2019 was the ear parts supplier Valeo, whose “SCALA” scanner is claimed to be the only mass-produced automotive lidar system currently on the market. The France-based company signed a deal with Intel subsidiary Mobileye to develop and promote a new autonomous vehicle safety standard combining a multitude of sensors, including lidar, with Mobileye’s mathematical safety model. Set against the brave new worlds of artificial intelligence, alternative realities, and self-driving vehicles, the humble television might seem rather outdated at CES these days. But that didn’t stop Samsung launching new models based on another emerging photonics technology — micro-LEDs. The Korean company’s 75-inch screens rely on arrays comprising myriad tiny emitters, claiming advantages in terms of brightness, modularity, lifespan, and a bezel-free design.

“These transformative TV displays are made up of individual modules of self-emissive micro LEDs, featuring millions of inorganic red, green, and blue microscopic LED chips that emit their own light to produce brilliant colors on screen – delivering unmatched picture quality that surpasses any display technology currently available on the market,” boasted Samsung.

MIKE HATCHER
Photonis now offers our MCP-PMTs optimized for LIDAR applications requiring fast timing and high spatial resolution.

This new MCP-PMT from Photonis enables detection over a wide dynamic range. Our customizable MCP-PMTs ensure the best match for your application.

Contact us today with your requirements
Email: science@photonis.com

www.photonis.com

Visit us at Booth #4279

MCP-PMT for LIDAR APPLICATIONS

OBSERVE OUR ENVIRONMENT

QUALITY & PRECISION. IN PERFECTION.

MULTI-AXIS SYSTEMS. CUSTOMER SPECIFIC SOLUTIONS.

• Highest precision and best dynamics
• Synchronized movement
• Various designs according to your needs
• Scalable strokes
• Optimization for different loads and dynamics
• Air bearings or clean room options available
• Expandable with adapted controllers or software to achieve the best results
SPIE updates enabled-markets report

Figures show core components market growing at nearly 7%

On Thursday morning after the Photonics West exhibitor breakfast, the SPIE industry team releases the latest update to its biennial Industry Report. The presentation will focus on gains in the photonics-enabled marketplace, examine trends across major market segments, and include a review of the core photonics components manufacturing business.

SPIE and its industry team has been providing a benchmark study for quantifying this complex industry since its initial analysis of the photonics components manufacturing industry was unveiled at Photonics West in 2013. Since then, its biennial studies have delivered industry metrics with a robust, consistent, and transparent methodology.

As diverse and dynamic as ever, the photonics industry continues to exhibit impressive growth. The business comprises a diverse set of technologies that underpin nine major market segments ranging from advanced manufacturing to consumer and entertainment. Global revenues from all photonics-enabled businesses and services now account for more than a 13% share of the global economy – as measured by global gross domestic product (GDP) – and the prospects are for continued gains across multiple segments.

Underlying the nine end-use market segments is the global photonics components manufacturing industry. Valued at an annual $227 billion in 2016, this element of the photonics industry is also growing. The SPIE Industry Report has tracked core components manufacturing since 2012 and projects an overall compound growth rate of 6.6% from 2016 through 2018.

Beyond revenue growth, the industry has also seen a positive change in perspective by the investment community, at the same time as a change in geographical distribution of revenues.

Traditionally, firms that serve end-use markets like consumer, healthcare, or defense have created much of the value associated with photonics commerce. They include the likes of Apple, Illumina, and Thales, and do not typically see themselves as photonics companies. Nonetheless, photonics components are key to these companies’ success. More recently, the technology and component providers have been able to capture a larger share of this value, and investment in photonics and photonics-enabled firms has skyrocketed since 2012.

As the overall investment in photonics and its vertical markets has grown, so has the concentration of photonics investment in Asia. The investment value of private placements in Asian targets is of substantially higher concentration in the photonics segment than in all other vertical segments combined, according to Linda Smith of Ceres Technology Advisors. As with the investment capital, the SPIE report shows a trend of photonics components revenues also shifting towards Asia, as China-based enterprises take a larger share of the components business.

For more on these and other industry trends, together with a detailed look at the photonics-enabled marketplace, join me and Jennifer Douris O’Bryan for the Photonics Industry and Public Policy Update at 9.15 am, after the Exhibitor Breakfast.

STEPHEN G. ANDERSON
RedWave Labs

Laser controllers and power supplies
Embedded control
Digital laser and temperature controllers
Amplifiers and detectors
Specialists in OEM integration

Booth 5568

Precision Automation Sub-Systems

PI provides precision motion and automation sub-systems based on:
- Air Bearings and/or Mechanical Bearings
- Standard and Custom Gantry
- EtherCAT®-based State-of-the-Art Motion Controllers
- Cartesian Robots and Parallel Kinematics Hexapods
- Linear Motors, Voice Coil and/or Piezo Motor Drives

Compact Hybrid Air Bearing Gantry XYZ Systems

10-axis touch panel test system with closed-loop force & position control based on a compact hexapod, linear motor stages, and a voice coil actuator

Physik Instrumente
www.pi-usa.us
508-832-3456 (East)
949-679-9191 (West)

PI designs and manufactures precision motion systems at locations in the USA, Europe, and Asia. With over 40 years of experience developing standard and custom products based on piezoceramic and electromagnetic drives and more than 1,300 employees in 13 countries, PI can quickly provide a solution for your positioning and automation projects in industry and research.
Lasers make the grade in Earth observation and space exploration

Astronomers, weather forecasters, and Earth scientists are among those now benefiting from the application of solid-state lasers in space.

Even by stellar historic standards, it has been a remarkable few months for space probes and their on-board optical instrumentation. Late 2018 saw the erstwhile Voyager 2 probe – complete with interferometer, ultraviolet spectrometer, photopolarimeter, and dual-camera imaging science system – finally leave the solar system. We’ve also witnessed some extraordinary imagery and data acquisition carried out by missions such as the Parker Solar Probe, the close encounter between OSIRIS-REx and asteroid Bennu, and ozone monitoring by the Earth-observing Sentinel-5P satellite.

Just weeks before Photonics West opened its doors the imaging instruments on NASA’s New Horizons mission captured the unusual “lumpy snowman” form of Ultima Thule, and a couple of days later China’s Chang’e 4 probe touched down on the far side of the Moon. Recent months have also seen the launch of the Bepi Colombo mission to Mercury, its payload featuring a laser altimeter and an ultraviolet (UV) spectroscopy probe, a laser-cooled atom experiment delivered to the International Space Station (ISS), and the deployment of laser terminals to quickly transmit huge data sets back to Earth from imaging satellites.

In terms of photonics equipment, perhaps most satisfying of all has been the recent arrival of a couple of solid-state lasers on board Earth-orbiting spacecraft.

Last August, the European Space Agency (ESA) finally launched its wind-monitoring Aeolus satellite. The first wind lidar instrument in space, it is based around a UV laser and is set to provide far more accurate and detailed monitoring of wind speeds than was previously possible.

Attempts to understand and forecast the wind date back as far as Aristotle in the 4th century BC. Today, wind profiles sampled down through the atmosphere are needed for accurate medium- to long-term weather forecasting, and are critical for modelling climate change. But until Aeolus, this information was not available from direct measurement: the best equivalent came from ground sensors and balloon monitors giving localized point measurements, followed by extrapolation through cloud tracking or computer simulations. Aeolus being in orbit changes that, and for the first time global wind fields can be mapped directly, in three dimensions.

Challenging development

“Using revolutionary laser technology, Aeolus will measure winds around the globe and play a key role in our quest to better understand the workings of our atmosphere,” announced ESA following the launch of the 1.4-tonne satellite aboard a Vega rocket last year. “Importantly, this novel mission will also improve weather forecasting.”

But the mission has also proved to be one of ESA’s most technologically demanding. Problems with the “Aladin” UV laser, in particular the damage caused to its system optics over an extended operating period, had delayed the original launch schedule by more than a decade. Thanks in part to technical breakthroughs made with a similar source – the green laser at the heart of NASA’s similarly delayed ICESat-2 mission – the Aeolus mission now looks set for major success.

A couple of weeks after launch, Aeolus sent back its first data, and in November Errico Armandillo, the retired head of ESA’s optoelectronics section, reflected on the development. “Today Aeolus is returning more wind data than all ground-based measuring systems put together,” he remarked. “But it took the sustained efforts of ESA labs and technical experts – in close cooperation with the Aeolus team – to make it fly.”

In fact ESA set up two new laboratories to solve its laser issues. It called in additional support from the German Aerospace Center to produce entirely new technical standards, which are now being applied to all subsequent laser missions. “The commercial space industry by itself could not have gone to the lengths we took,” Armandillo pointed out.

The idea of flying a wind-surveying lidar in orbit was nothing new. In fact it had been explored as long ago as the early 1980s, considered at one time for the ISS. And in fact the technology developed back then is now used to help guide rendezvous and docking operations with ISS-supplying cargo spacecraft.

Initially a high-energy carbon dioxide gas laser was earmarked for the lidar role, before the mid-1990s development of space-worthy pump laser diodes opened the door to far more compact solid-state designs. The Aeolus mission was pencilled in for a launch some time after 2000.

Based around a conventional Nd:YAG solid-state laser crystal, the UV wavelength selected is seen as essential for achieving the high level of back-scatter from both molecular and aerosol components to provide reliable lidar signals. But ESA saw the first signs of trouble in NASA’s ICESat mission, which was using a UV laser to map ice. Around the same time, ground tests on Aladin began to show laser-induced contamination of optics.

The key problem was then identified: out-gassing of organic molecules from Aladin’s laser equipment was accumulating on system lenses, before being carbonized by the high-energy UV laser pulses. As they grew, those deposits further absorbed the laser’s heat, distorting and darkening the optical components.

It meant that the original performance of the UV laser within Aladin was nowhere close to requirements. ESA says that when it ran a prototype version of the lidar system, its laser optics degraded by 50% in less than six hours of operations – not much use for a proposed three-year mission.

“The first solution was to take extreme precautions to remove all organics,” Armandillo said. “But this did not prove entirely possible. Even at just a few parts per billion of organics, contamination was still introduced.”

continued on page 27
Earth observation  continued from page 25
For more clues the team approached users of high-energy UV lasers in terrestrial applications. That included working closely with two German optics companies, LaserOptik and LayerTec, as well as experts at France’s Mégajoule facility – where lasers are employed to ignite nuclear fusion reactions – and the semiconductor industry. In principle, the answer proved remarkably simple. Injecting a small amount of oxygen allowed the contamination to burn up under the heat of the laser, in the process cleaning the lens. In tests, the ESA team says it saw this approach work in a matter of minutes.

**Laser breathing**
Rather than redesigning Aladin to work on a fully pressurized basis, small amounts of oxygen are released from a pair of 30-liter tanks. The oxygen gas flows close to the optical surfaces that are exposed to the UV laser, and gradually leaks out of the instrument enclosure.

“Just like us, the laser has to breathe,” explained laser engineer Linda Mondin in a report by ESA. “It’s very elegant because the burnt-up contaminants flow out of the instrument along with this oxygen, in the form of carbon dioxide and water.” Only 25 Pascals of residual oxygen pressure is needed – just one four-thousandth of standard atmospheric pressure.

Though contamination was the key issue facing the Aladin team, it was far from the only problem. Heat produced within the volume of the laser transmitter also needed removal. This was solved using ‘heat pipes’, which cool the laser by evaporating liquid and moving it to a space-facing radiator.

Solving the various problems has ultimately created new technology that is set to benefit a range of future missions. Aladin’s development has yielded ESA some world-leading optics and optoelectronics capability, along with a set of ISO-certified laser development standards for other laser-based missions – starting with the “EarthCARE” mission for clouds and aerosol monitoring. Pencilled in for launch in 2021, this will carry an atmospheric lidar instrument based around a 355 nm laser source to profile aerosols and thin clouds.

“It’s proved an extremely complex mission, and we’ve learnt an awful lot about lasers,” concluded Rondin, with Aeolus’s instrument manager Denny Wernham adding: “The fact we have a high-power UV laser instrument now working in space is testament to all of the hard work, ingenuity, and inventiveness of many dedicated engineers in industry, ESA, and elsewhere.”

“Aeolus is a world-first mission that will hopefully lead to many active laser missions in the future, and shows the true value of close collaboration between industry and ESA to find innovative solutions to very tough technical challenges.”

“There were so many ways it could go wrong, we were worried,” recalled Armandillo following the 2018 launch. “And then it worked! Those first wind profiles felt like Christmas coming early, a really amazing gift.”

**ICESat-2: up and running**
Just as Aeolus and its Aladin laser were starting to return those initial wind profiles from space, NASA launched its ICESat-2’ satellite from California’s Vandenberg Air Force Base.

Like Aeolus, the mission – comprising a single-instrument laser altimeter payload – was delayed and significantly over its original budget. But it has now deployed its Advanced Topographic Laser Altimeter System (ATLAS), flying in a polar orbit at an average altitude of 290 miles. Its job is to monitor annual changes in the height of the Greenland and Antarctic ice sheets, to a precision of just 4 mm.

Developed by the Virginia-based photonics and engineering services company Fibertek, the two flight lasers aboard ICESat-2 emit millijoule-scale nanosecond pulses at 532 nm and a repetition rate of 10 kHz. In continuous operation over the three years of the mission, that equates to around a trillion pulses in all – with Fibertek saying that the tough performance metrics represented a significant increase in the complexity and reliability requirements for a space-based laser system.

The optical design of ATLAS splits the laser source into three separate pairs of beams that are fired towards Earth at different angles, such that at ground level there is a 3.3 km gap between the beam pairs. This contrasts with the approach used on the original ICESat mission that flew between 2003 and 2009 but whose laser only operated at 40 Hz, and provides much denser cross-track sampling.

For Earth scientists and studies of climate change, the altimeter should yield a height measurement every 70 cm along the orbiting track, with Fibertek saying that elevation estimates in sloped areas and rough surfaces around crevasses will be much improved.

According to the ICESat-2 team, only about a dozen of the approximately 20 trillion photons that leave ATLAS with each laser pulse return to the satellite’s telescope after a round trip that takes around 3.3 milliseconds. To detect those scarce returning photons, the system is equipped with a 76 cm-diameter beryllium telescope. A series of filters ensures that only light of precisely 532 nm reaches the detectors, eliminating any reflected sunlight that might influence the results.

Just three months after launch, ICESat-2 was already exceeding scientists’ expectations. NASA said that the satellite

---

**High Specification Replicated Aspheric Mirrors & Gratings**
Cost effective solutions for volume requirements

- **Freeform Mirrors**
- **Off-axis Parabolic Mirrors**
- **Elliptical Mirrors**
- **Holographic Diffraction Gratings**
- **Hollow Retroreflectors**
- **Miniature UV Spectrographs**

Visit us at Photonics West
Booth #1972

Spectrum Scientific, Inc.
+1 949 260 9900
sales@ssioptics.com
Earth observation

The Aladin laser, seen here in ground tests before launch, is at the heart of the Aeolus satellite. It is now in polar orbit, providing direct measurements of global wind patterns for improved weather forecasting. Initial results are said to be excellent. Photo: Selex-ES.

Not long before the launch of the Aeolus and ICESat-2 sources, another laser system made its way to the ISS, where it is now carrying out quantum research inside the orbiting Cold Atom Lab (CAL). Part of a scientific payload that arrived in May 2018, it is based around commercial laser equipment and capable of trapping potassium and rubidium isotopes.

Cold Atom Lab

By July, the space lab had produced Bose-Einstein condensates (BECs) of rubidium atoms in orbit for the first time, controlled by scientists on the ground at NASA’s Jet Propulsion Laboratory (JPL) in California. Robert Thompson, CAL project scientist and a physicist at JPL, said at the time. “It’s been a long, hard road to get here, but completely worth the struggle, because there’s so much we’re going to be able to do with this facility.”

Although shrinking the BEC-making equipment to the size demanded for launch to the ISS has been a huge challenge, the advantages of the environment are enormous, from the point of view of quantum experimentation. Unlike on Earth, the persistent microgravity allows scientists to observe individual BECs for 5-10 seconds at a time, and to repeat measurements for up to six hours every day.

In fact this was not quite the first cold atom experiment in space. In January 2017 the “MAIUS-1” sounding rocket launched a diode laser system for laser cooling and rubidium atom interferometry to an altitude of 243 kilometers, before returning to the ground. Developed by Humboldt University Berlin’s optical metrology research group, initial results confirmed that it was possible to carry out research on laser-cooled atoms in space, and in November 2018 the German consortium reported that it had carried out a remarkable 110 experiments on BECs during the six minutes of space travel that were possible.

Another diode-pumped solid-state laser currently traversing the solar system sits inside an altimeter setup destined for the planet Mercury. Launched by the ESA in October, the Bepi Colombo probe is a collaboration with the Japan Aerospace Exploration Agency (JAXA).

Designed and built by a Swiss-German-Spanish team led by engineers at the University of Bern, the altimeter kit will be used to map Mercury’s topography and surface morphology in unprecedented detail, and is said to be the first such instrument developed for a European interplanetary mission. Based around a Q-switched, nanosecond-pulsed Nd:YAG source operating at 10 Hz, it will fire relatively high-energy (50 mJ) bursts of 1064 nm light at the planet, and collect reflections from the surface around 5 ms later using a silicon avalanche photodiode, via a narrowband filter.

Elsewhere in the solar system, NASA’s OSIRIS-REx mission has just completed its approach to the asteroid Bennu, where it is now in close orbit. Ultimately, it is set to grab a sample from the surface of the orbiting rock and bring it back to Earth, but before that Bennu had to be mapped in considerable detail to ensure that the spacecraft could be maneuvered into exactly the right orbit to achieve the close fly-by.

That operation relied on another laser altimeter featuring a lidar scanner, to generate a detailed three-dimensional map of Bennu’s shape. Built by the Canadian Space Agency, it will help the OSIRIS-REx team identify the best location from which to grab a sample. Two lasers are on board: a high-energy source to scan the asteroid at distances between 7.5 km and 1 km from the surface, and a second low-energy emitter that can be used for rapid time-of-flight imaging down to 225 m.

Mike Hatcher
Fujikura has been manufacturing specialty fusion splicers since the 1980s. Everything we’ve learned along the way goes into our splicers and is backed by our industry-leading support team. Whether splicing 80 μm PM fibers or double-clad LDF fibers for high power lasers, you’ll splice with confidence using the FSM-100 family of Fujikura Fusion Splicers that has been leading the industry for nearly a decade.

Pictured right: Manufactured in 1988, Fujikura led the way in specialty splicing innovation with the FSM-10PM fusion splicer. This long history of innovation continues today.
New frequency doubled 780nm lasers with narrow linewidth, low noise, and high output power

With the new Koheras HARMONIK, NKT Photonics offer high power frequency doubling to our popular low noise Koheras fiber lasers. The HARMONIK delivers high power with low noise and an excellent beam quality for cutting edge quantum physics projects. The standard system delivers up to 7 W output power in the 775-780 nm wavelength range with the same sub-kHz linewidth an ultra-low noise that have made the Koheras single-frequency lasers the industry standard.

Find the new Koheras HARMONIK system on display at booth #8633.
Congratulations to the 2019 Prism Awards

Winners

Detectors & Sensors
CloudMinds

Diagnostics & Therapeutics
Double Helix Optics

Imaging & Cameras
Leica

Industrial Lasers
nLIGHT

Light Sources
Smart Vision Lights

Optics & Optomechanics
Modular Photonics

Scientific Lasers
TOPTICA Photonics

Test & Measurement
4D Technology

Transportation
Blackmore

Vision Technology
QD Laser
Advance Your Innovation with End-to-End Photonic Solutions

From discrete components, to turnkey modules, to complete systems...
Engage Excelitas for single-source ease and reliability across every aspect of your system’s photonic requirements.

Discover your partner for providing enabling photonic technologies and custom OEM expertise.

• Lasers & Illumination
• Optics & Optomechanics
• Sensors & Detection
• Electronic Components & Systems
• Sophisticated Custom Solutions

Engage us for your next photonic solution at:

SPIE Photonics West 2019 (San Francisco)
Excelitas Booth #1441 | REO Booth #2041 | Axsun Booth #345
‘Speedier, smarter’ 3D world

Faster speeds and more detail are must-do items for the future of 3D printing. Taking six days to grind out a single part is unacceptable, a panel of four 3D experts agreed.

Industry panelists saw the needed 3D evolution on the horizon. The 3D Printing and Industry 4.0 panel included Ralf Kimmel of Trumpf; Melissa Orme of Morf3D; Behrang Poorganji, of GE Additive; and Lynn Sheehan of Allagi Inc.

Kimmel said that if 3D can achieve higher productivity, that will mean faster printing, “and the payoff will be a shorter build time. Multiple lasers and better-performing scanner systems are required for the next step,” Kimmel said. “We will see multiple lasers working on many scanners, well coordinated and synchronized, with better control of the power over the beam path.

“Control over power distribution together with scanner performance is key.”

Today, if a scanner comes to an edge, it slows down, and then has to accelerate again, he explained. “You must correlate all this, the speed, power, and movement position. There is a lot to do.

“It is happening, but we’re not on a perfect level. To be more productive, you need to add more operating systems.”

For Orme, the current powder bed approach, now at 50 microns diameter, needs to go smaller, to 10 microns in diameter. She admitted powder bed will remain the standard. “It is necessary, and we can make very complicated parts can be made. But it’s just a step to whatever the future technologies will be. In 20 years, perhaps there will be technologies other than powder-bed fusion that will be faster, with better resolution, and finer details.

“We need 3D to be able to make parts faster, at higher resolution, and cheaper. I’m certain new technologies will point the way to reach those goals.”

At GE Additive, Poorganji said 3D additive manufacturing is “the new revolution,” from medical to automotive apps. “We are expanding our inventories,” he said, using power from 25-100 μm, and 3D has created a $5 billion cost efficiency.

GE analyzed an A-CT7 aircraft engine and found that 70 percent of the engine could be 3D printed. And they found that engines with many parts made in a single 3D printing have more durability, can save fuel, and weigh less, with up to 60 percent reduction in time to market.

At Allagi, Sheehan said a hardware set called Opticus for monitoring additive manufacturing makes a digital twin of a part being created. It can stop the process and even fix the problem, he said.

FORD BURKHART

Changing how we see light

On Tuesday, a panel of LED lighting experts provided examples of the innovative applications that go well beyond the simple replacement of conventional sources with more efficient LEDs. The panel offered insights into the technology innovations that are providing new benefits and capabilities that were never achievable with conventional sources.

In his opening remarks, panel moderator Robert V. Steele noted that the lighting market is undergoing a transformation of a magnitude not seen since the invention of the incandescent bulb.

Energy efficiency and cost savings have been the main drivers of this transformation, but other factors, such as light quality, color tuning, and controllability, have become equally important in moving the market forward.

LED technology embodied in lamps and luminaires has captured more than 50% of the $80 billion worldwide lighting market, and the near-complete penetration of this market with LED sources is in sight.

“Several technology companies are now working on controls of various types to control light levels in buildings with occupancy sensors, daylight sensors, etc.,” said Steele, a solid-state lighting consultant. “Lumileds and Osram are the major LED suppliers working on adaptive lighting; European auto companies such as Audi and Mercedes are taking the lead on incorporating automotive forward lighting technology into their cars.”

Jay Shuler, Director of Product Marketing at Xicato, opened the session talking about general trends in LED lighting that are going “beyond on and off.” As an example, he showed a quick case study being done at the Smithsonian’s National Portrait Gallery using controlled lighting to “create a whole new viewing experience for visitors.”

Instead of constant bright light being shown on each picture, the lights remain in dim lighting until someone walks in front of the portrait, then the lighting slowly increases to full light, boosting the color as the picture comes into view. After the viewer walks away, the light slowly dims. “This makes for a more interesting display,” said Shuler. “This also helps preserve the art.”

Bенно Spinger from Lumileds Germany discussed Lumiled’s work with adaptive headlights enabled by pixelating LED sources – in particular, adaptive driving beam technology for road vehicles. “At the moment, headlamps are really complicated with the LEDs, it’s more of an electro-mechanical system,” said Spinger. “These systems can make a complex system much simpler.”

The final speaker, Thor Scordalis, General Manager-Americas at Leotec LLC, talked about what he termed “Non-Energy Benefits” of LED lighting. These included improved safety and health of the user, reduced operating and maintenance costs, as well as increased productivity and comfort for users.

KAREN THOMAS

IMPLANTED LEDS HELP MANAGE ORGAN DYSFUNCTION

New soft, wireless implants can monitor and modulate organ behavior using LED light, a demonstration at Photonics West revealed. Implants remove the tethers used in other nerve-stimulation systems.

The technology will be useful in deep brain research, said John Rogers, a professor of materials science and engineering, biomedical engineering, and neurological surgery at Northwestern University and keynote speaker on wireless optoelectronics at the Optogenetics & Optical Manipulation Conference.

In one project, his system was used to send and receive signals from the bladder. The system detected an overactive bladder in a lab animal, and used LED light to reduce the urge to urinate. That approach, Rogers said, could treat incontinence and an overactive bladder.

The wireless systems provide closed-loop control over the nerves that govern organ function and “can eliminate disease or dysfunction without drugs,” Rogers said.

His approach uses thin, battery-free implants that control an overactive bladder in animal models using a microscale LED. It emits photons that illuminate nerves in the bladder, where injected proteins make the cells sensitive to light.

Whenever the system detects frequent voiding events, the sensing relies on a soft band that wraps around the bladder to electronically determine, through a change in resistance, the extent of bladder filling at any given time. A battery-free control unit in the abdomen captures that data and sends it to an external PC for an assessment of bladder activity using advanced data analytics.

“If overactivity is identified, then a signal is wirelessly passed back to the control unit, which then causes the LED to activate,” Rogers said. “The light inhibits the activity of bladder nerve endings, thereby preventing voiding.”

Rogers’ team has developed an app that runs on a phone to display the data and the system’s recommendation, and can let users intervene in the decision to stimulate or not.

FORD BURKHART
Frequency-modulated lidar sensor enhances control of autonomous vehicles

Insight LiDAR has developed Digital Coherent LiDAR, a chip-scale, long-range lidar sensor targeted at the autonomous vehicle market. Digital Coherent LiDAR is based on Frequency Modulated Continuous Wave (FMCW) technology, which offers certain advantages over the current generation of Time-of-Flight (ToF) lidar sensors. This company is a spin-out of Insight Photonic Solutions, a developer of highly linear, swept-wavelength laser sources for imaging and sensing applications.

Autonomous vehicles require a variety of sensors to interpret the world around them and to make accurate, timely decisions. While ninety-three percent of autonomous vehicle experts interviewed by UBS investment bank believe that lidar is a prerequisite for autonomous vehicles, today’s legacy lidar sensors either do not provide the performance or the price needed for wide-scale deployment. Legacy lidar either does not have the ability to see faint objects at a distance, or it cannot meet industry cost targets, due to expensive laser sources and fiber amplifiers.

Insight’s Digital Coherent LiDAR was developed based on more sensitive FMCW detection techniques and software-programmable waveforms that have been used in FMCW radar for over 40 years. Insight LiDAR’s FMCW sensor offers a factor of 10 to 100 higher sensitivity than ToF lidar while simultaneously offering direct Doppler velocity measurement.

The higher sensitivity, enabled by FMCW detection, drives Digital Coherent LiDAR’s long-range capability; 200 m to 600 m, and is especially critical for safe level 4 and 5 autonomous vehicle operation. Digital Coherent LiDAR is further enhanced by Insight’s proprietary true solid-state, fast-axis scan architecture. This unique feature enables Insight LiDAR to both precisely steer the beam and encrypt the critical fast-scan axis through software alone, with no moving parts.

“Lidar designers have long known the advantages of FMCW detection, but the critical laser sources have been large and expensive. Over the past ten years, we’ve developed and refined unique, patented technology that improves both the diagnostic sensitivity and specificity for discriminating early cancer from normal tissue,” Chen said.

“This opens the way for personalized medicine with cancer-killing lasers to bolster the immune system by boosting T cells,” added Chen. “The technology has the potential to improve cancer surgery, minimize the time patients are under anesthesia, and lower health-care costs largely by way of its improved contrast and depth of tissue penetration relative to visible light,” said Vahrmeijer.

KAREN THOMAS

OUTSMARTING TUMORS: LASERS BOOST T CELLS

To fight the toughest cancers – those in the pancreas – an evolving method combines tumor-killing lasers to bolster the immune system by boosting T cells.

The strategy, called immunotherapy, has been developed by Wei R. Chen of the University of Central Oklahoma. Since 1995, Chen’s team has been developing a combination of targeted laser phototherap y and injection of an immune system stimulant that releases new antigens.

“This opens the way for personalized medicine with cancer-killing lasers to bolster the immune system by boosting T cells,” Chen said.

“The technology has the potential to improve cancer surgery, minimize the time patients are under anesthesia, and lower health-care costs largely by way of its improved contrast and depth of tissue penetration relative to visible light,” said Vahrmeijer.

KAREN THOMAS

BIOS Hot Topics continued from page 07

BRIGHT ideas

Clare Elwell of University College London opened the session with her research using new optical imaging techniques to understand the human brain, including the Gates Foundation-funded BRIGHT (Brain Imaging for Global Health) project. She and her team use functional near infrared spectroscopy (fNIRS) to investigate the impact of malnutrition on infant brain development. The team is currently working on imaging the first brain imaging of infants in Africa.

Jeanine Bautista of the University of California, San Francisco, noted how NIRS studies of the developing brain are paving the way for better diagnosis of conditions in developing countries. “We are using NIRS for decades in high-resource areas, unaware of the need for it in a global health project,” she said.

Ewel noted how NIRS studies of the developing brain are paving the way for early markers of autism. And following its successful implementation in resource-poor settings, NIRS is now finding application as a brain-imaging tool in global health studies.

Zhiwei Huang discussed the work of his group in the Optical Bioimaging Laboratory at the National University of Singapore with spectroscopic cancer detection. He and his team have developed an integrated Raman endoscopy and wide-field imaging technique for real-time in vivo tissue Raman measurements during clinical endoscopy.

“We developed an endoscope-based autofluorescence imaging and spectroscopy system for in vivo tissue diagnosis and characterization,” said Huang. “Preliminary results show that combining spectroscopy with imaging techniques can improve both the diagnostic sensitivity and specificity for discriminating early cancer from normal tissue.”

“With the development of our technology, we can now see the cellular structures in the tissue, as well as the optical properties of the tissue,” said Huang.

“We’ve been to the moon, but still haven’t been able to see the lymphatics,” said Eva Sevick-Muraca of the University of Texas Houston in her opening remarks on aging as seen through the lens of translational biomedical optics. There is strong evidence that chronic inflammation contributes to a number of conditions prevalent with aging, including peripheral vascular disease, rheumatoid arthritis, and Alzheimer’s disease.

Eva Sevick-Muraca of the University of Texas Houston in her opening remarks on aging as seen through the lens of translational biomedical optics. There is strong evidence that chronic inflammation contributes to a number of conditions prevalent with aging, including peripheral vascular disease, rheumatoid arthritis, and Alzheimer’s disease.

“Optical imaging that exploits invisible near infrared fluorescent light has the potential to improve cancer surgery, minimize the time patients are under anesthesia, and lower health-care costs largely by way of its improved contrast and depth of tissue penetration relative to visible light,” said Vahrmeijer.
ONE-STOP SHOP FOR FIBER LASER COMPONENTS

1500W Clearcut™ Fiber Bragg Grating

- Low Temperature
- 1.0 to 3.0nm Bandwidth
- Volume or Customization
- 20 Year’s Manufacturing Experience
  Ensures Outstanding Reliability

We Are Hiring

- International Sales/Sales Manager/Director
- Production Line Manager/Engineer
- Sourcing Manager
- Product Manager (Passive/Active Components)
- Engineering Manager (Process Control and Yield Improvement)
- Product Development Manager
- Post-Doctoral Fellow
  Study on High Power Optical Devices
  Packaging Technique for Semiconductor Devices
  Study on OCT Optical Engine Design
  Study on Fast Frequency Swept Laser

For More Information
Please visit our booth or contact hr@fiber-resources.com
www.fiber-resources.com
We deliver innovations that matter.

At Novanta, we solve complex technical challenges. Customers rely on our engineering expertise to develop lasers, beam steering sub-systems, precision motors and encoders, and machine vision cameras for a wide range of photonics applications. Our innovations enable our OEM customers to improve productivity, achieve breakthrough performance and enhance people’s lives. Because those are the innovations that matter.

www.novanta.com

VISIT NOVANTA AT BOOTH #1834

Cambridge Technology • Celera Motion • JADAK
Laser Quantum • Synrad

NOVANTA COMPANIES