

SPIE. PHOTONEX + VACUUM EXPO **review**

Free Digital Forum
Online Only
5 - 9 October 2020

spie.org

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PHOTONEX + VACUUM EXPO 2020 DIGITAL FORUM

- *Hyperspectral Imaging*
- *Quantum Technologies*
- *Biomedical Microscopy*
- *Silicon Photonics*
- *A round-up of some of the latest products available from the exhibitors*

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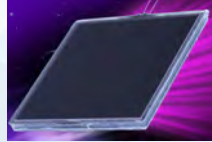
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LDX Optronics



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Welcome to Photonex+Vacuum Expo 2020

An extraordinary event in an extraordinary year.



*Laurence Devereux, SPIE Europe
Photonex+Vacuum Expo Programme
Development.*

The 2020 Photonex+Vacuum Expo event is being held for the first time under the ownership of SPIE and, while we are disappointed that this event is not live and in-person as planned, our team has been working hard to develop this free virtual

exhibition and digital conference.

Photonex+Vacuum Expo has always been an exhibition-led event and that is still true this year with more than 50 exhibitors showcasing their systems and products. Some you will see featured in this Review, which informs you how to get in touch with them.

If you want to know more about how they can help you in your work then you can watch demonstrations and how-to videos on the event website – see Product Demonstrations.

We encourage you to engage actively with these companies online and this is now possible in a chat environment.

The technical talks are also more accessible than ever. SPIE, with the assistance of some excellent organising committees for the various technical conferences, is pleased to be able to make it possible for you to

watch and chat with the event's more than 60 speakers in a fantastic selection of nine parallel programmes.

You can watch the live plenaries and participate in live events (or catch up later in the archive – so you won't miss a thing). We are using Slack as a channel for asking questions during live plenaries, to be presented to the speaker after their presentation. Zoom chat will also be used.

So please treat the event as live. In normal years I would be suggesting you mark your calendar with "At Photonex+Vacuum Expo", but can I suggest this year it should be "Busy watching presentations at the Photonex+Vacuum Expo Digital Forum".

Finally, don't forget to use the SPIE Conference App, which will help you to set up a schedule of presentations and avoid missing live events. **So register now.**

Welcome to Photonex 2021 in Glasgow



*Dr. Andrew Brown, SPIE Senior Director for
Global Business Development.*

SPIE is delighted to announce that in 2021 Photonex+Vacuum Expo will take place at the SEC Centre in Glasgow 28-30 September, 2021. This will be the start of alternate year rotation between Scotland and England intended to showcase the burgeoning photonics sector across the whole of the UK. In partnership with companies, universities, and government organisations, Photonex+Vacuum Expo will bring international visibility to the UK's £13.5 billion photonics industry.

The technical programme will be expanded to include international conferences covering research, development and applications in key areas including quantum technologies, space and sustainability, biophotonics, high-speed imaging, silicon photonics and vacuum technologies. The enhanced programme will attract global participation while bringing visibility to

the UK's world-class research and industrial capability.

At the centre of the event, the Photonex+Vacuum Expo trade shows will feature a broad representation of companies from the UK and beyond with products and services that compete in global markets.

A robust programme of industry-oriented content will provide access to market data, investment information, and business programming. Photonex+Vacuum Expo 2021 will provide an experience for the international community to gather, exchange ideas, network and create new business opportunities whilst enjoying the hospitality of Scotland.

We look forward to seeing you online for this year's Digital Forum and in person in Glasgow in 2021.

Photonics 2020 and beyond

From recent years' upward market trends, via growing support and expectations from the government, to the possible impacts of the Covid-19 pandemic, it is a great challenge to predict what is likely to happen to the photonics sector. **John Lincoln**, Chief Executive, UK Photonics Leadership Group, puts on his thinking cap.

None of us will forget 2020. If we turn the clock back just nine months we were looking to understand the impact of a landslide Conservative victory in the first December election in almost 100 years giving certainty to Brexit – even if its full implications remain unknown. No one's forecasts had global pandemic, global lockdown and international travel ban on the front (or final) page of the risk register.

Six months on from lock-down we have learnt much as a society, industry and individuals. Many have asked what the impact has been on photonics. In April, we were one of the first industries to take a temperature check with a quick questionnaire. The resilience of the photonics sector was evident with 90% of manufacturers reporting that they had been able to continue production through the lockdown and only 50% indicating they had or intended to use any of the government emergency support measures.

We should perhaps not have been surprised. When we think of the high value UK photonics manufacturing, people densities on the factory floor are relatively low and adjustable to social distancing. People in many other roles from sales to engineering are used to working on the road to service a global customer base – to work from home is more comfortable and productive than trying to do it in an airport lounge.

But this restriction on air travel also means we were not out there, meeting customers and suppliers, feeding the order pipeline and ensuring the smooth operation of the supply chain. Disruption to the sales process was flagged in April, but for many the long-term impact was too early to forecast.



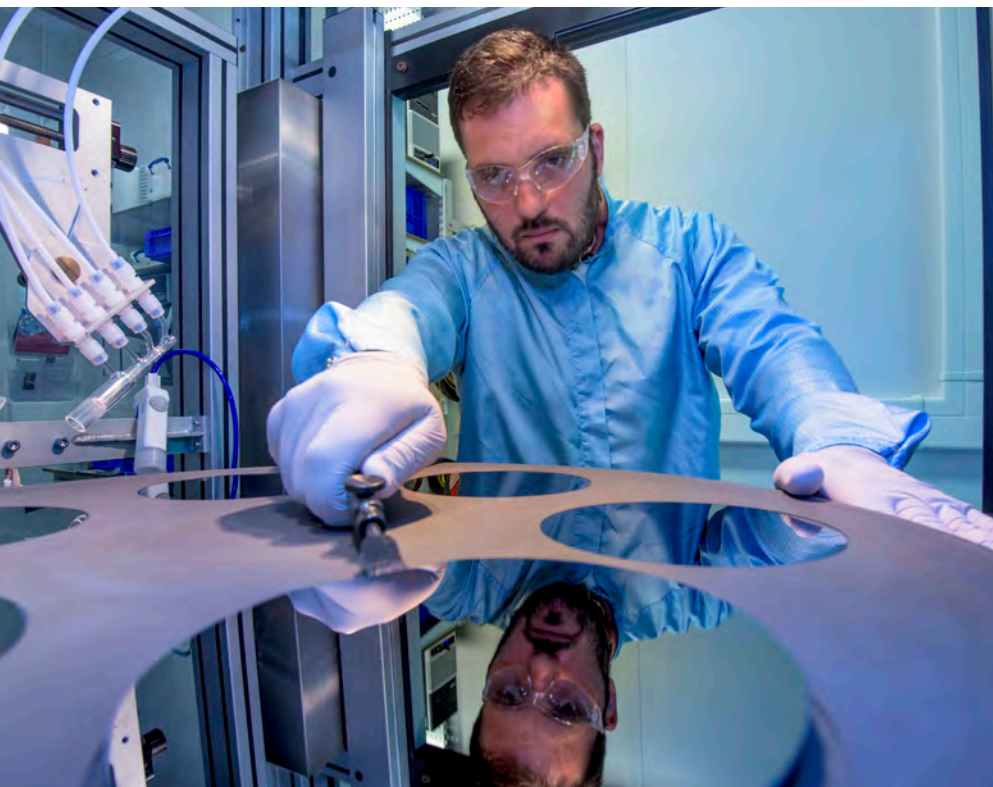
Follow-on survey

The Photonics Leadership Group (photonicsuk.org) has therefore launched a follow-on survey, to take a fresh check of the temperature of the sector, this time both in industry and academia. We are reporting the first results at this Photonex Digital Forum in the Industrial session on Tuesday 6th October (spie.org/px/special-events/Industry-Event).

In the last UK budget prior to the Covid-19 pandemic breaking out, the UK government made a clear commitment to increase research and development spending to 2.4% of GDP, a sum comprising public and private spending. Prescient questions were even asked in committee to verify that the target would not be reduced in absolute terms if the unthinkable happened and GDP declined. The good news is government remains committed to that target and have committed to double public R&D spending from £11 billion in 2020/21 to £22 billion by 2024/25 – a phenomenal 20%/ year annual increase.

Throughout the time of Covid-19 we have heard the repeated mantra “we will be guided by the science”. Indeed science and technology is, for the first time in many years, in the ascendance in policy thinking. In July the government published the first

continued page 7



Credit: University of Southampton

Pole of excellence: silicon photonics research at the ORC, University of Southampton.

High Speed Spectral Sensing



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These new modules offer high-speed measurement and are able to cover the wavelength ranges 1350-1650 nm, 1550-1850 nm and 1750-2150 nm. The MEMS FPI allows selection of the transmission wavelength by changing the applied control voltage.

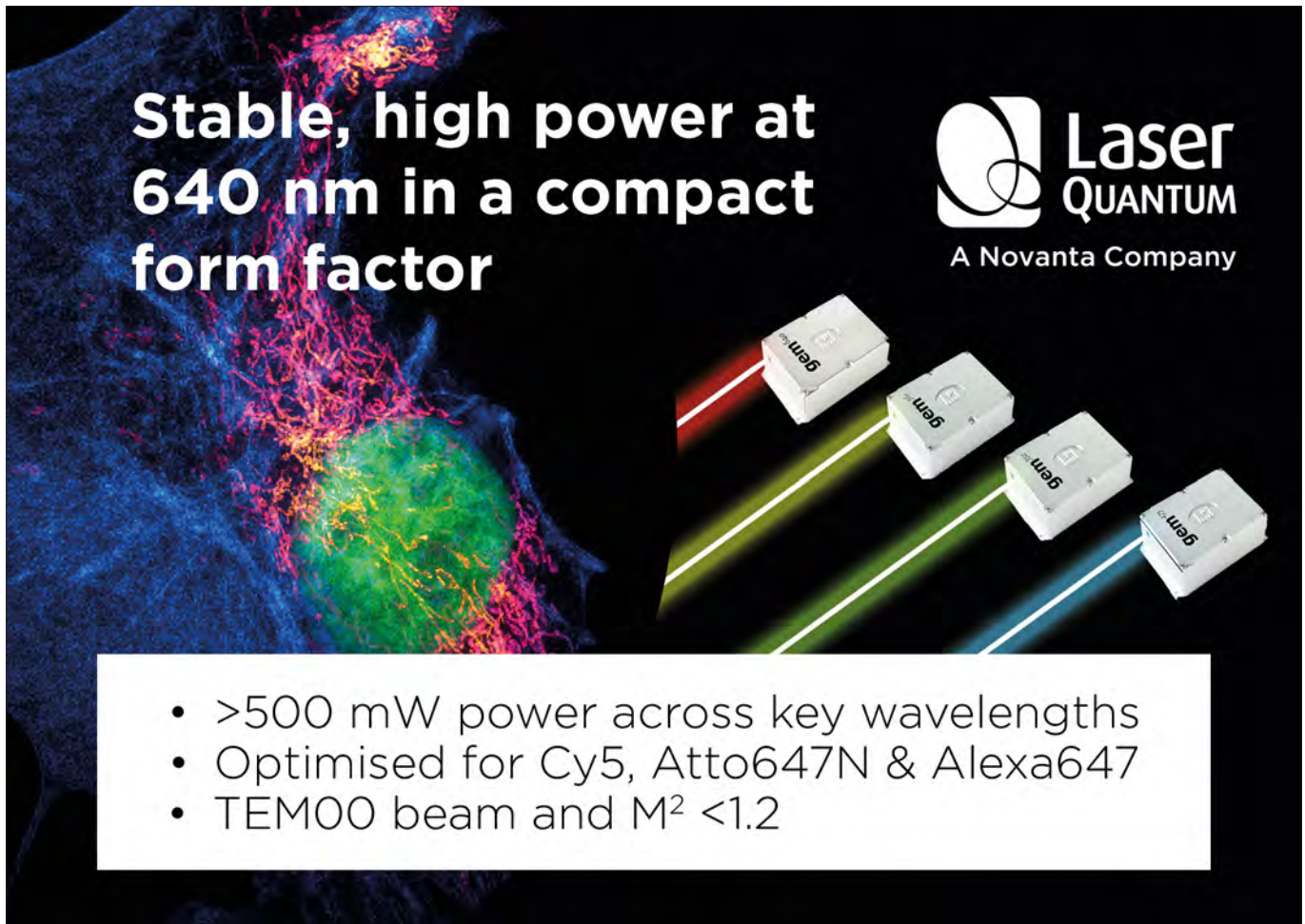
Ideal for various spectral sensing applications such as moisture detection, food and farm product inspection, plastic sensing, chemicals and fabric identification.



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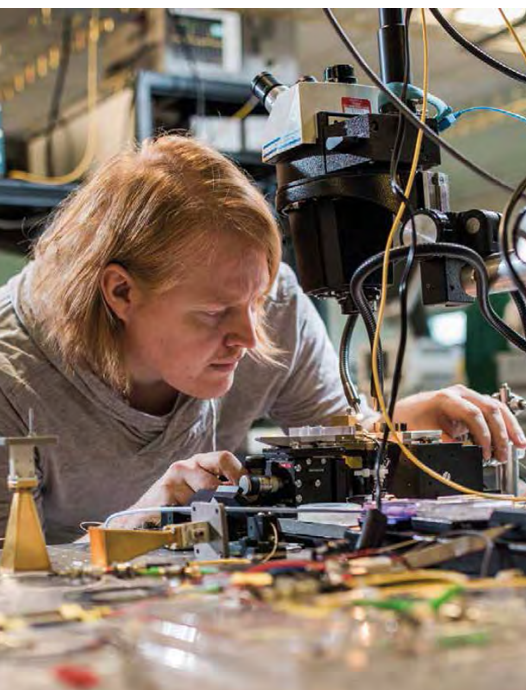
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Photonics 2020 and beyond

UK Research and Development Roadmap beginning to define the direction and that increase R&D support (www.gov.uk/government/publications/uk-research-and-development-roadmap/uk-research-and-development-roadmap).

Roadmap milestones

Compulsory reading for anyone in the UK innovation space, the roadmap has a heavy focus on decarbonisation – echoed in discussion of the “green recovery”; place – spreading the benefits of R&D investment through the UK’s regions; workforce diversity – championing opportunities for all; as well as recovery from the Covid-19 pandemic. Intriguingly, the roadmap notes the importance of supporting crosscutting technologies, which are, of course, exemplified by photonics.



Credit: University College London

Photonics research at University College London.

The PLG has invited the Department for Business Energy and Industry Strategy to introduce the roadmap at Photonex in the Tuesday industrial session alongside discussion of developments in the UK

innovation ecosystem. Markus Wilkens from Photonics21 will also be providing the latest update on developments to Horizon Europe and photonics funding in Europe, participation in which is clear goal in the UK R&D roadmap (spie.org/PX20/special-events/Industry).

The R&D roadmap is being converted into a “comprehensive R&D plan”, to be delivered this autumn. We await news of how the ideas in the roadmap will have been refined and how they will feed into the UK’s comprehensive spending review (CSR) that is also ongoing. Setting departmental budget for several years, against a backdrop of recognition of the importance of science and technology and the role of cross-cutting technologies, the CSR represents very major opportunity for us all.

Vision required

To be ready to take advantage of that opportunity it is clear that we need a strong inspiration vision for the future of photonics. The laser may have been with us for 60 years, and whilst those of us close to the industry know there is much still to be discovered about light and how to harness its power we need to articulate that vision to inspire not only funders but also the next generation of research.

With that aim, the PLG convened 26 of the UK leading photonics researchers to look to the horizon and ask “What will be the focus of photonics research in 10+ years?”. 70 topics were identified in the “Future Horizons for Photonics Research: 2020 and beyond” report, jointly published in September 2020 with the All Party Parliamentary Group in Photonics and Quantum (available for free download at www.photonicsuk.org).

In what participants described as a “timely report which makes the case for photonics very well”, many report finding it a refreshing break to look into the future outside the constraints of the our many current day-to-day challenges. The results are mix for extensions of existing research foci where significant breakthroughs can be expect, such as beyond CMOS integrated photonics, and new area of interest such as biodegradable photonics. Who would not be intrigued by the concept and

implications of a mobile phone screen that we could compost!

Of course, horizons are always moving and thus this report also aims to simulate discussion of more future possibilities as well as providing a focus for checking the interests of industry and fit with policy. Further detail will be discussed in the Thursday lunchtime industrial session at Photonex with a presentation from all early career research team whose help was invaluable in compiling and inputting into the Horizon scanning process.

Nine challenges identified

Impact is and should never be far from our thoughts even if the pathway is not always clear. Within the horizon scanning exercise, we identified nine great challenges that photonics will address immediately and in the future, from healthy aging and mobility, to scaling manufacture, data, climate change, food production, pollution to defence.

Many of the sessions in the Photonex Digital Forum will present advances that help address these key challenges, including biophotonics & biomedical microscopy, emerging applications in silicon photonics, hyperspectral imaging and the latest advances in resilient photonics manufacturing, development in quantum technology, to name a few. These sessions provide the detail of where and how the cutting edge of photonics innovation is moving.

The online nature of this year’s Photonex, necessitated by Covid-19, provides everyone, especially those wishing to understand how and where photonics is impacting their world, as well as those already working in the field a unique opportunity to dip in and what photonics has to offer and the huge difference it makes to all our lives and plethora of end markets and industries.

One thing is certain, the breadth of this year’s event and exhibition means that there is something of interest for everybody, whatever your focus. We look forward to meeting you online.

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SPIE and University of Glasgow announce \$1 M quantum photonics program

The SPIE Early Career Researcher Accelerator Fund in Quantum Photonics will support collaborative early-career research.

SPIE, the international society for optics and photonics, and the University of Glasgow, UK, have announced the establishment of the SPIE Early Career Researcher Accelerator Fund in Quantum Photonics.

The \$500,000 gift from the SPIE Endowment Matching Program will be matched 100% by the university. The program will support a diverse group of graduate students working in the field of quantum photonics and will be managed by Professor Daniele Faccio, Royal Academy of Engineering Chair in Emerging Technologies, and Kelvin Chair of Natural Philosophy Professor Miles Padgett.

The fund will create two new programs at the university: an annual SPIE Early Career Researcher in Quantum Photonics Scholarship will be awarded to an outstanding Glasgow graduate student who is in the process of completing their studies.

In addition, the SPIE Global Early Career Research program will support outgoing and incoming placements at and from the university as part of its ongoing collaboration with leading quantum-photonics research groups across the globe. Each year, the program will pair several University early-career researchers with counterparts from outside laboratories for six-month-long shared projects.

'Transformative opportunities'

"We are delighted to be participating in these exciting endeavors with the University of Glasgow," said SPIE President John Greivenkamp. "The interactive placements will offer transformative opportunities the university's academic and industry-based researchers, and, together with the annual scholarship, will develop well-prepared, knowledgeable early-career researchers who will drive the future of the quantum industry."

"We're pleased and proud to be establishing the Early Career Researcher Accelerator Fund in Quantum Photonics thanks to SPIE's generous gift, which we're very happy to match with our own funding," said Professor Sir Anton Muscatelli, principal and vice-chancellor of the University of Glasgow,

"The University's quantum photonics



Daniele Faccio, center, working on laser system alignment and optimization with student Mihail Petev, left, and Niclas Westerberg, a Leverhulme fellow in the School of Physics and Astronomy.

expertise is world-leading, and our researchers have found ways to see through walls, capture images at a trillion frames per second, and take the very first pictures of quantum entanglement in action. This additional funding will help the University train a new generation of graduate students to make valuable contributions to academia and industry and inspire them to make their own amazing research breakthroughs," he added.

The SPIE Endowment Matching Program, established in 2019, is a \$2.5 million, five-year, educational-funding initiative designed to increase international capacity in the teaching and research of optics and photonics. SPIE supports optics and photonics education and the future of the industry by contributing a match of up to \$500,000 per award to college and university programs with optics and photonics degrees, or with other disciplines allied to the SPIE mission.

The initial SPIE contribution to the University of Arizona named a new endowed faculty chair, the SPIE Chair in Optical Sciences. Four more agreements announced earlier this year established the SPIE-Glebov Family Optics and Photonics Graduate Scholarship Fund and the Soileau Family-SPIE Optics and Photonics Undergraduate Scholarship Fund, both at the University of Central Florida's College of Optics and Photonics, the Baur-SPIE Endowed Chair in Optics and Photonics at JILA, and the SPIE@ICFO Chair for Diversity in Photonic Sciences.

About the Author

Daneet Steffens is Public Relations Manager, SPIE.



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Quantum-focused startups win IOP accolades

Four young UK companies developing optics-based products are tipped for success by the Institute of Physics.

The UK's Institute of Physics (IOP) has named four small companies developing photonics products for emerging applications among the winners of its latest "Business Start-up" awards.

Overall, the London-headquartered learned society identified seven physics-based startup firms as having the potential for business growth and significant societal impact.

They included ORCA Computing and Oxford HighQ, both spin-outs from the University of Oxford, alongside Edinburgh's Photon Force, and the University of Bristol affiliated QLM (Quantum Light Metrology) Technologies.

Other winners in the business startup category this year included Oxmet Technologies, which develops metal alloys and powders for 3D printing, the green energy firm FeTu, and muon imaging specialist Geoptic Infrastructure Investigations.

Entangled state storage

According to the firm's own citation, quantum optics experts at ORCA have established a completely new approach to quantum computing with their optical memory device.

Co-founded by Professor Ian Walmsley, director of the UK's quantum computing "hub" at the University of Oxford, ORCA says that its approach allows single photons and multiple entangled photon states to be stored and retrieved on demand within rubidium gas.

"Requiring far fewer components and free to operate within optical fiber rather than silicon, ORCA's approach offers a viable route to future high-performance, highly connected and scalable quantum computing," explains the firm.

Meanwhile Oxford HighQ has devised an optical microcavity analysis (OMCA) technique for sensing nanoparticles and chemicals. The company says that the first application of its devices enables real-time precision measurement of the quantity of pharmaceuticals loaded into drug delivery nanoparticles.

The micrometer-sized devices are said to provide a "step change" in sensitivity, capable of detecting just a handful of molecules. "Optical microcavity sensors for use with liquid samples will meet increasing demand for new tools in pharmaceutical and medical

research, food and water monitoring, and security and defense," predicts the firm.

Single-photon solutions

Active since 2016 and a spin-out from the University of Edinburgh, Photon Force has developed an ultrafast camera that is sensitive to individual photons. Its "PF32" product has been used in numerous applications.

As well as scaling up production, the company - an exhibitor at this year's Photonics West event - says it is now working on an architecture offering a 15-fold improvement in sensitivity and an order-of-magnitude reduction in noise.

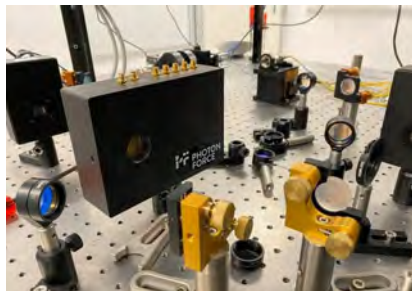


Photo: Photon Force.

A winner in the business startup category, Photon Force was one of four new companies developing photonics technology to be rewarded by the Institute of Physics in its latest set of awards.

Exploiting technology developed within the UK's quantum imaging hub, Bristol-based QLM is also working on a single-photon technique as a low-cost way to identify gas leaks and monitor methane emissions.

The company's lidar equipment is based around diode emitters and high-speed detectors developed initially for optical communications technology, providing long-range (more than 100 meters), continuous gas imaging in industrial environments.

QLM says it is actively engaged with the UK's National Physical Laboratory's emissions metrology group, as well as a number of gas companies, with a view to producing gas leak "security cameras" that are capable of monitoring carbon dioxide, ethylene, and carbon monoxide gas, as well as methane.

About the Author

Mike Hatcher, Business Editor, optics.org



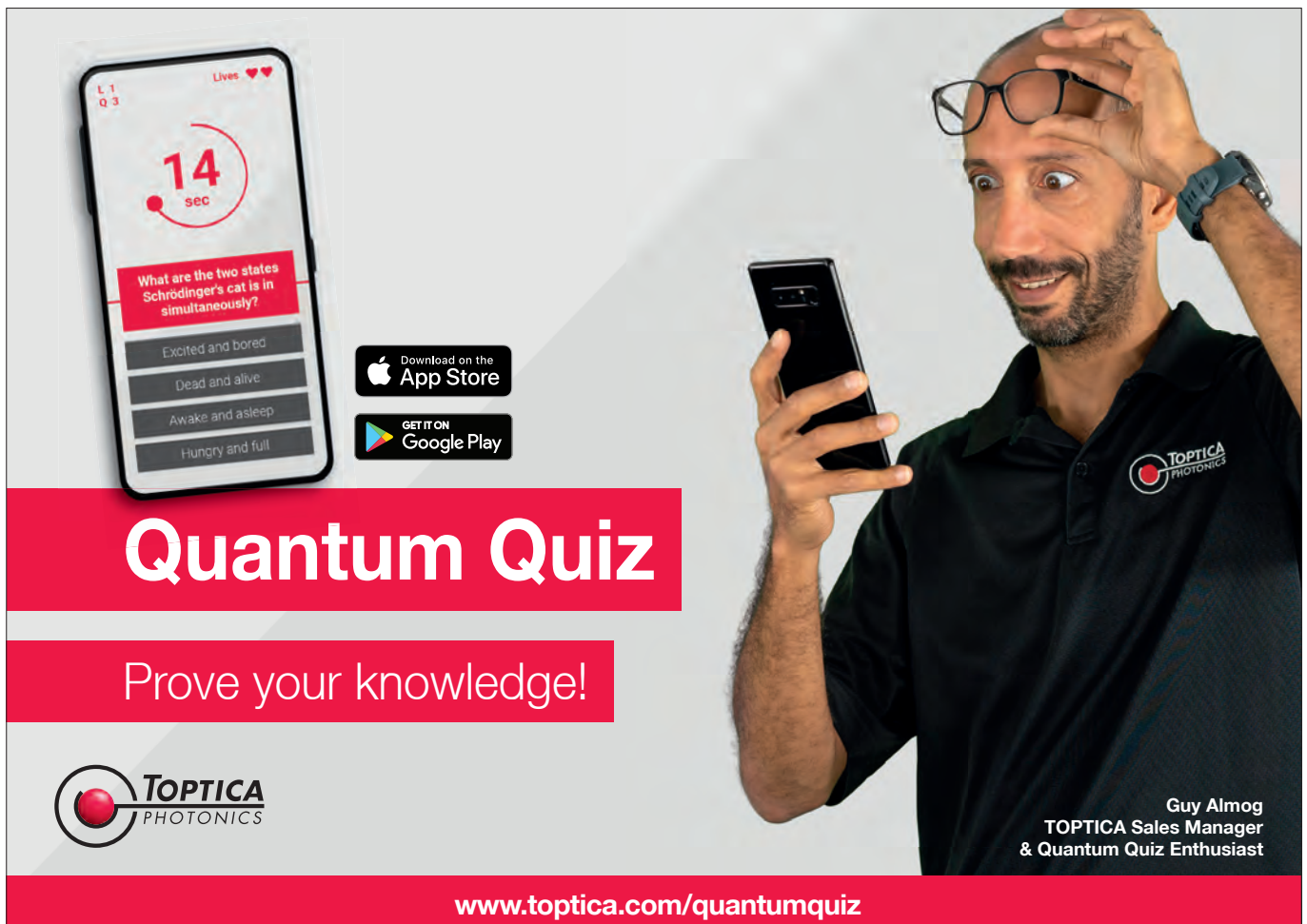
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14 sec

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Excited and bored

Dead and alive

Awake and asleep


Hungry and full

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CompoundTek and NTU working on compact tunable laser

Three-year venture between silicon photonics foundry and Singapore's NTU to develop new sources for comms and more.

CompoundTek, a foundry services provider of emerging silicon photonics solutions, is working with Nanyang Technological University, Singapore (NTU) on a three-year, joint project to develop "O, C, L-band silicon photonics tunable lasers for communications and other applications".

One of the primary objectives of the collaboration is to develop a high-performance tunable laser with a compact footprint, that is scalable, high-yield and suited for low-cost manufacturing.

By replacing the commonly-used array of single wavelength lasers with a single wavelength tunable laser, the simplified design architecture reduces existing complexities of wavelength division multiplexing (WDM) systems, and will additionally lower wavelength contention

and inventory costs for commercial products, say the researchers.

'Scalability and cost-effectiveness'

In their launch statement, the partners say, "Today's silicon photonics platform offers scalability, cost-effectiveness and manufacturability of the mature Si CMOS process. However, one of the key disadvantages of SiPh is the non-availability of highly-efficient silicon laser integrated with SiPh circuits.

"Hybrid SiPh, integrating SiPh devices with III-V compound semiconductor optical amplifier, offers the best of both worlds – enabling low propagation loss and high integration densities while providing efficient optical gain and flexibility for spectral engineering. This integration is one



Image credit: CompoundTek

K.S. Ang, COO of CompoundTek and Professor Wang, NTU, with a prototype of the packaged tunable laser.

of the key research areas at NTU's Photonics Institute."

Since its launch in 2017, CompoundTek says it has gained more than 20 global commercial customers in over nine countries and over 20 leading research institutes and universities in applications such as telecommunications, automotive LiDAR, data communications, bio-sensing and bio-medical, artificial intelligence, quantum computing and smart sensors.

About the Author

Matthew Peach, Editor-in-Chief, optics.org

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It's good to talk

Tuesday 6 October - Friday 9 October 2020

An ever-expanding feature of Photonex+Vacuum Expo is its conference programme, for which you can find the latest information on speakers and topics at spie.org/conferences-and-exhibitions/photonex-and-vacuum-expo/programme

This year's Digital Forum enables you to watch and take part in a number of sessions as live, real-time events with follow-up Q&A sessions into which you can post your questions.

Join fellow academics, scientists, and engineers sharing research in photonics, biophotonics, quantum technologies, lasers, optical technologies, nanotechnology, vacuum equipment and in-vacuum technologies. Attend exhibitor product demos, live plenary presentations and on-demand technical talks, and enjoy networking with exhibiting companies and colleagues through online events.

The PHOTONEX+VACUUM EXPO Digital Forum is a three-day programme comprising:

1. Biophotonics & Biomedical Microscopy
2. Emerging Applications in Silicon Photonics
3. HSI20iO: Hyperspectral Imaging and Applications
4. Industrial Programme and Photonics in Manufacturing
5. Thin Film and Coating Technologies, Science & Applications

Plus a Quantum Technology programme supporting the SPIE Photonex Promising Future of Quantum Technologies initiative.

6. Cold Atoms for Quantum Technologies
7. Quantum Photonics; enabling technologies

Highlights: Plenary Events

Quantum Photonics Plenary Session

Date: Tuesday 6 October 2020

Time: 9:30 AM - 10:30 AM BST

Welcome and Opening Remarks by David Armstrong, Fraunhofer UK Research Ltd. (United Kingdom)

Quantum technologies: feeding the ecosystem – growing the supply chain

Roger McKinlay, UK Research and Innovation (United Kingdom)

Roger McKinlay is the Challenge Director for the UK Quantum Technologies Challenge, led by UK Research and Innovation.



Biophotonics and Biomedical Microscopy Plenary Session

Date: Tuesday 6 October 2020

Time: 2:00 PM - 3:30 PM BST

Andrew R. Harvey, Univ. of Glasgow (United Kingdom)

Sumeet Mahajan, Univ. of Southampton (United Kingdom)

Computational phase microscopy

Laura Waller, Univ. of California Berkeley (United States)

Laura Waller is the Ted Van Duzer Associate Professor of Electrical Engineering and Computer Sciences (EECS) at UC Berkeley, a Senior Fellow at the Berkeley Institute of Data Science, and affiliated with the UCB/UCSF Bioengineering Graduate Group.



Translational biophotonics for clinical routine

Jürgen Popp, Leibniz Institute of Photonic Technology (Germany), Friedrich-Schiller University Jena (Germany), and InfectoGnostics (Germany)

Jürgen Popp holds a chair for Physical Chemistry at the Friedrich-Schiller University Jena and is also the scientific director of the Leibniz Institute of Photonic Technology, Jena.



Cold Atoms for Quantum Technologies Plenary Session I

Date: Wednesday 7 October 2020

Time: 3:00 PM - 4:00 PM BST

Welcome and Opening Remarks by Sonja Franke-Arnold, Univ. of Glasgow, UK.

Quantum gas flowing in a ring: the elementary atomtronic circuit

Hélène Perrin is a French physicist working on quantum gas at Laser Physics Laboratory of Université Sorbonne Paris Nord and CNRS, where she is a research director and leads the Bose-Einstein Condensate group.

Emerging Applications in Silicon Photonics Plenary Session

Date: Thursday 8 October 2020

Time: 9:00 AM - 10:30 AM BST

Welcome and Opening Remarks by: Callum G. Littlejohns, Univ. of Southampton, UK.

Applications of silicon photonics in life science and medicine

Roel Baets is full professor at Univ. Gent and is associated with IMEC. Since 1989 he has been a professor in the Faculty of Engineering and Architecture of UGent where he founded the Photonics Research Group.

Silicon nitride waveguides: towards a complete toolbox for nonlinear integrated photonics

Camille-Sophie Brès, Ecole Polytechnique Fédérale de Lausanne (Switzerland)



Cold Atoms for Quantum Technologies Plenary Session II and Panel Discussion

Date: Thursday 8 October 2020

Time: 2:00 PM - 4:00 PM BST

Welcome and Opening Remarks by Sonja Franke-Arnold, Univ. of Glasgow (United Kingdom)

The UK National Quantum Technologies Programme

Sir Peter Knight is a British physicist, professor of quantum optics and senior research investigator at Imperial College London, and principal of the Kavli Royal Society International Centre.

Panel Discussion: Realising our quantum ambitions - a super position to be in?

Join us in this panel discussion to explore the challenges and opportunities of converting global innovation initiatives into a thriving sector: are we in a super position to realise the full potential of quantum technology for all?

Panel Moderator:

Simon Andrews, Fraunhofer UK Research Ltd. (United Kingdom)

Panelists:

Sir Peter Knight, Imperial College London (United Kingdom)

Halina Rubinsztein-Dunlop, The University of Queensland (Australia)

Najwa Sidqi, Knowledge Transfer Network Ltd. (United Kingdom)

Mark Fromhold, The University of Nottingham (United Kingdom)

Ole Kock, Teledyne e2v UK Ltd. (United Kingdom)

Hyperspectral Imaging and Applications Plenary Session

Date: Friday 9 October 2020

Time: 9:00 AM - 10:30 AM BST

Welcome and Opening Remarks by Stephen Marshall, Hyperspectral Imaging Ctr., Univ. of Strathclyde (United Kingdom)

Looking for life on Mars with the Rosalind Franklin rover: the PanCam instrument

Andrew J. Coates, Mullard Space Science Lab. (United Kingdom)

Andrew Coates has been at UCL's Mullard Space Science Laboratory (MSSL) since 1982, with temporary guest positions at Max Planck Institute for Solar System Physics (Germany), Univ. of Delaware (USA) and the BBC World service (media fellowship). He is now Deputy Director (solar system) at UCL-MSSL.



Conference programme

Detailed information about the Photonex+Vacuum expo conference programme is available on spie.org/conferences-and-exhibitions/phonex-and-vacuum-expo/programme

You can also plan your viewing and attendance by downloading the SPIE Conference/Exhibition App for your phone or tablet.

Probing the mysteries of the solar atmosphere with high-resolution spectroscopy

Gabriel Muro, Aberystwyth University (United Kingdom)

Many aspects of the solar atmosphere remain poorly understood, including the mechanisms at work to heat the plasma to a million degrees. Spectroscopy is key to probing this extreme environment. After a brief introduction to the scientific questions, and the observational difficulties, I will present details of a high-resolution spectrometer designed and built at Aberystwyth with international collaborators. The spectrometer has been tested during the total solar eclipse of 2019 in Argentina, from which I will present preliminary results. Future developments, including the potential for additional channels, a hyperspectral imager, and the hope for a space-based instrument, will be discussed.



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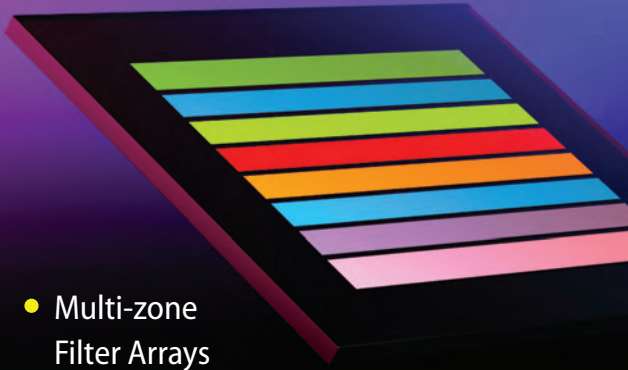
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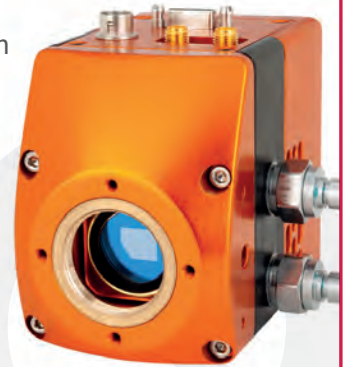
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JSC "NRI "Electron" awarded by CMS Gold Award of the European Organization for Nuclear Research (CERN) for its contribution to international research project as supplier for the Large Hadron Collider (2007).

JSC "NRI"Electron" now introduce hybrid photodetectors for the UV and near-IR range. This type of photodetectors compared to their solid-state counterparts has a number of advantages, such as a high dynamic range of operation and the ability to register weak signals. This achieves due to the ability to control the energy of photoelectrons recorded by the ECP. Hybrid devices have a spectral sensitivity ten times higher than solid-state ones.



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EU project touts 100 Gb/s silicon photonics transceiver module

Development under recently completed COSMICC effort said to meet both cost and power reduction demands.

Members of a European consortium developing silicon photonics technology say they have demonstrated a fully packaged transceiver module with a data transfer rate of 100 Gb/s.

(SiN) multiplexing components on silicon, integration of hybrid III-V/silicon lasers on the silicon/SiN platform, and a new high-count adiabatic fiber-coupling technique via SiN and polymer waveguides.

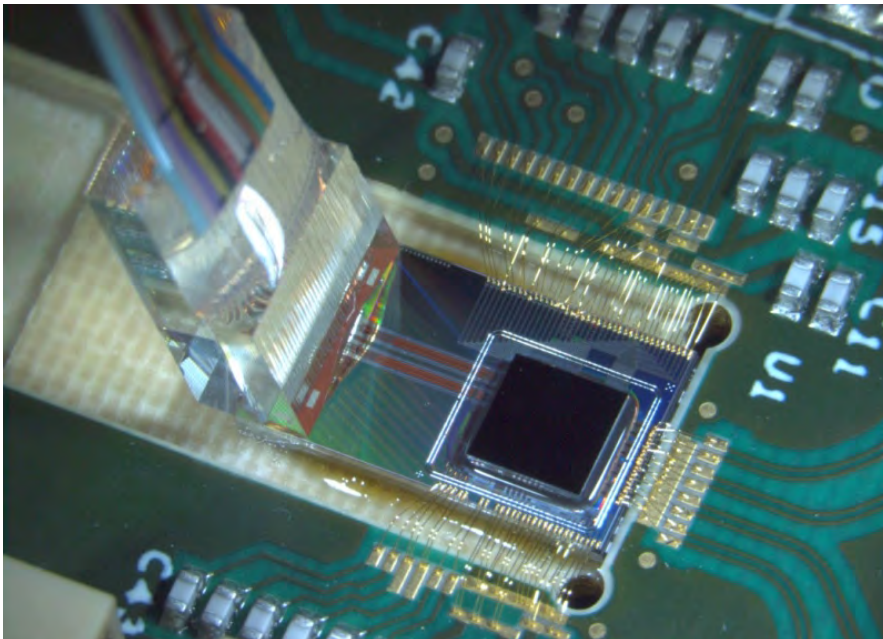


Photo: CEA-Leti.

The silicon photonics technology developed under the COSMICC project is expected to meet "tremendous market needs" with a target cost per bit that traditional multiplexed transceivers simply cannot achieve, say the project organizers.

Led by CEA-Leti in France, the COSMICC (CmOs Solutions for Mid-board Integrated transceivers with breakthrough Connectivity at ultra-low Cost) project team believes that the new optical hardware will meet the communications industry's demands for high-speed data modules - at a cost they say cannot be achieved with conventional approaches.

The COSMICC transceiver multiplexes two wavelengths at 50 Gb/s, and will be aimed initially at applications in data centers and supercomputers.

No cooling required

Following official completion of the €4 million Horizon 2020 project in late 2019, key breakthroughs were said to include the development of broadband and temperature-insensitive silicon nitride

According to CEA-Leti, the COSMICC team has in fact developed all the building blocks required to deliver faster transmission rates of 200 Gb/s and beyond, without any need for temperature control, by multiplexing four wavelengths and aggregating a large number of fibers

"This demonstration opens the way to technology that allows a reduction in the cost, power consumption, and packaging complexity - and opens the way to reaching a very high aggregated data rate beyond terabits per second," announced the research agency.

CEA-Leti scientist Ségolène Olivier, who coordinated the project, said that the critical breakthrough was the development of modulators and germanium photodetectors operating at 50 Gb/s, and their co-integration with control electronics.

"The new building blocks are essential for addressing the need for terabit-per-second transceivers at low cost and low energy consumption to sustain the exponential growth of data traffic in data centers and in high-performance computing systems," she explained, suggesting that the technology would "answer tremendous market needs" with a target cost-per-bit that cannot be met with standard optical transceivers.

Scintil spin-out

According to the COSMICC project's official summary report, although current optical transceivers based on VCSELs are able to meet cost demands, they suffer from limited speed and reach. On the other hand, modules with indium phosphide lasers are fast but expensive.

Aside from developing the two-channel 100 Gb/s transceiver module, the consortium created a new low-cost optical packaging scheme based on single-mode Si/SiN/polymer waveguide coupling that is able to combine up to 24 optical fibers, providing aggregate speeds in the terabit-per-second realm.

"The implemented adiabatic coupling scheme will enable a reduction of the energy per bit of 40 per cent at 50 Gb/s compared to the grating coupler scheme," states the project summary, adding that the team has set up a pilot line for single-mode polymer packaging substrates.

CEA Leti says that the new approach consumes only 5.7 picojoules per bit for each channel operating at 50 Gb/s.

As well as the obvious utility in optical communications, the transceivers may help to usher in a host of new applications for silicon photonics. Those could include sensing and lidar, with the potential for use in future autonomous vehicles.

The CEA-Leti spin-out firm Scintil Photonics, which last year raised €4 million equity funding, is aiming to develop 800 Gb/s transceiver circuits based on the COSMICC approach.

• Aside from CEA-Leti, the COSMICC consortium included industry partners STMicroelectronics, Vario-Optics, Seagate, and Finisar (now part of II-VI). Academic expertise was provided by Université Paris Sud, Università di Pavia, the University of Southampton's Optical Research Centre, the University of Saint Andrews, and Cork Institute of Technology.

About the Author

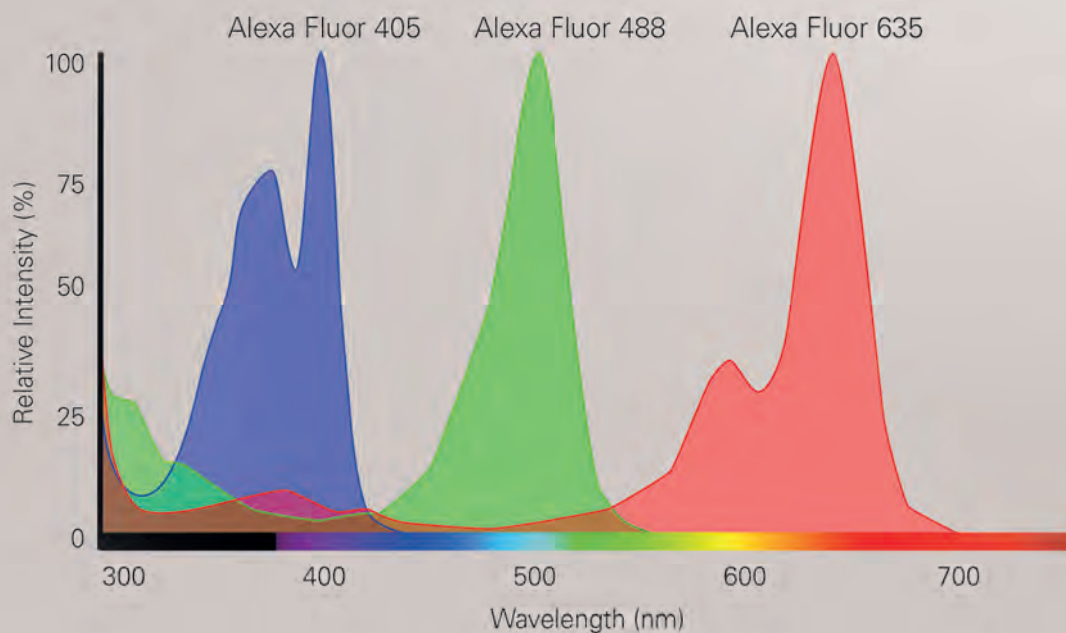
Mike Hatcher, Business Editor, optics.org

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Teledyne e2v sensors to fly on future Sentinel satellites

European Copernicus program will study cloud structures and carbon dioxide emissions.

The European Union's Copernicus Earth observation project continues to develop and schedule satellite missions under the Sentinel program, with several Sentinel satellites already in orbit.

Teledyne e2v has announced that its image sensors have been selected by the program for intended inclusion in two forthcoming Sentinel-based missions currently under development, termed CHIME and CO2M.

Both missions are among the High Priority Candidate projects being readied for inclusion in the second-generation "Copernicus2.0" program, to "address EU Policy and gaps in Copernicus user needs, and to increase the current capabilities of the Copernicus Space Component," according to the project.

The last element of the initial set of Sentinel missions, Sentinel-6B, is due for launch in 2026, with Copernicus2.0 then proceeding with missions 7 through 12.

CHIME, for Copernicus Hyperspectral Imaging Mission, will provide complementary hyperspectral observations to those already being delivered by the Sentinel-2 satellite pair since their launch in 2015 and 2017. The prime contractor for CHIME is Thales Alenia Space, with the instrument scheduled for Sentinel-10.

"Compared to currently flying multi-spectral missions, CHIME will have an increased number of narrow spectral bands in the visible-to-shortwave infrared range, which will allow for a more accurate determination of biochemical and biophysical variables," according to science advocacy group Future Earth in its study of the Copernicus2.0 program.

The CHIME mission will provide hyperspectral observations at a spatial resolution of 20 to 30 meters, allowing users to distinguish opaque clouds, thin clouds, cloud shadows and vegetation. Its data should be of value in agriculture, food security, biodiversity and forestry, among other sectors.

"This is excellent news in two respects for

the CHIME mission," said Miles Adcock of Teledyne e2v. "First, the UK facility has been able to continue the long-standing supply of imaging sensor technology to the Copernicus Sentinels. Second, we have developed a UK infrared detector design and manufacturing capability that utilises the world's best base detector substrate materials from within the Teledyne Imaging group."



Sentinel-6, last mission of the original Copernicus program, sits in its clean room. More satellites will continue the project as Copernicus2.0.

Measuring carbon dioxide from space

CO2M, or Copernicus Anthropogenic Carbon Dioxide Monitoring, is due to fly on Sentinel-7, with Germany's OHB System the prime contractor and Thales Alenia Space responsible for the CO2M payload.

Sentinel-7 is itself due to consist of three separate vehicles, detecting the spectral absorption signals of carbon dioxide in infrared sunlight reflected off Earth's surface and measuring concentrations to a precision of 0.7 ppm. The satellites will also be given additional instruments for detection of nitrogen dioxides emitted from burning fossil fuels at high temperature. The goal is to help

locate carbon dioxide plumes produced by humans and distinguish them from carbon dioxide coming from natural sources.

"The high spatial and temporal resolution planned for this mission represents a step-change in what is currently available for measuring carbon dioxide from space," Future Earth commented. "ESA aims to launch CO2M by the end of 2025, and it is expected to provide data from 2026 to support the second global stocktake of greenhouse gas emissions, to be concluded in 2028 by countries participating in the Paris Agreement."

According to Teledyne e2v, its products due for inclusion in CO2M include sensors from the company's Capella range of CMOS products as primary visual sensors for CO2 and NO2, and also for use as visible and near-

infrared (VNIR) detectors in a multi-angle polarimeter instrument.

A Cloud Imager (CLIM) instrument onboard the same mission will also employ a Capella CMOS digital image sensors, a product specified as having a 2048 by 2048 resolution of 10-micron pixels.

"We have a proud heritage of supplying the Sentinels with CCD and CMOS detectors," commented Christophe Tatard from Teledyne e2v. "With this extension of the programme we are very excited to now be providing a short-wave infrared detector as well as the VNIR detectors."

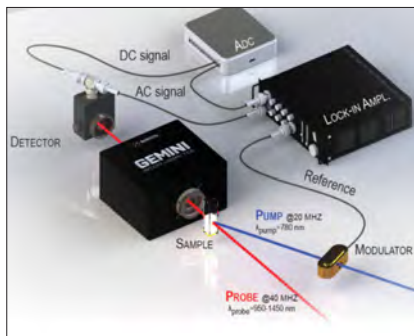
About the Author

Tim Hayes, Contributing Editor, optics.org

Broadband pump-probe spectroscopy at MHz modulation frequency

NIREOS' GEMINI interferometer enables an innovative approach to broadband pump-probe spectroscopy. Thanks to the employed time-domain Fourier Transform (FT) detection system, this configuration allows you to measure the broadband pump-probe signal with a single-pixel detector and a single-channel lock-in amplifier. In this way, it is possible to combine an ultra-broad spectral coverage with an extremely high sensitivity, due to high frequency modulation (in the MHz regime) and detection.

The great advantage of this detection



Here is the example set up:

scheme is working at high modulation frequencies, where the lasers relative intensity noise is typically at its lowest, thus allowing one to achieve an excellent signal-to-noise ratio in a short time. This is clear by taking a closer look at the dynamics at negative delays. The RMS noise is 2.7×10^{-6} employing 1.5-second integration time. Moreover, being based on a single detector and lock-in amplifier, this system is less expensive and complex than other implementations using a detector array connected to a multichannel lock-in.

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2020 new products and exhibitor news

In the following pages we present some recent launches and applications by companies appearing at this year's Photonex Virtual Exhibition. Visit spie.org for access.

By Matthew Peach, Editor in Chief, *optics.org*.

Allectra offers high vacuum and UHV components

Allectra is a leading manufacturer of High Vacuum and UHV components including custom items. In the past eighteen years the company has seen widespread adoption of its proprietary technologies across multiple scientific disciplines. Its electrical feedthrough range includes Sub-D and Co-axial types alongside cables and accessories, also viewports and hardware. It has three facilities with scientific and engineering capabilities, one in the UK and two in Germany.

The company states, "Vacuum processing has evolved significantly in recent decades. Just sixty years ago, high-vacuum (HV) conditions were considered a costly scientific novelty that was confined to academic research. Furthermore, scientists were yet to replicate pressures below 10⁻⁹ mbar; characteristic of ultra-high vacuum (UHV). This largely resulted from the limitations of vacuum components, such as adapters, pumps, and valves.



Image: Allectra

Allectra is a manufacturer of SMA feedthrough connectors for high and ultra high vacuum applications.

"The progressive development of vacuum components has helped unlock the UHV pressure regime, while broader more recent industrial trends and technological innovations have made vacuum processing available to non-academic professionals.

"High and ultra-high vacuum conditions are now routinely generated at industrial scales for processing methods as varied as chemical-vapour deposition, ion beam etching, pulsed laser deposition, sputtering, surface analysis, and much more."

Each of these high-technology processes relies on a series of vacuum components and this importance is reflected by their market value. In 2017, the semiconductor industry alone consumed \$2.5 billion worth of vacuum components; the single largest material expense for semiconductor OEMs. This includes adapters, fittings, flanges, feedthroughs, in-vacuum cabling, etc. With increasing intensity in worldwide vacuum processing, the market for vacuum components is expected to top \$3.1 billion by 2023.

The company adds, "The current value of the vacuum components market is a testament to the innovation that has driven vacuum engineering. This is also reflected by new capabilities in vacuum component engineering for custom designs and proprietary applications."

Allectra supplies both CF and KF flanges in 304L or 316L stainless steel, enabling manufacturers to interchange fitting types from other HV/UHV applications. We also offer an extensive range of electrical feedthroughs including , Sub-D, Coaxial and the new Triaxial, with air and vacuum connectors, for low/high current, high-frequency, or voltage measurements. These ensure highest sensitivity for electrical signals for the in-vacuum process.

www.allectra.com

Alrad Imaging announces new USB-to-HDMI converter from Imaging Source

Typical machine vision applications use dedicated computers to perform image processing and analysis. Some simple monitoring and visualization tasks do not, however, require these levels of image processing. Such tasks are most efficiently solved by delivering images directly from camera to monitor, eliminating the need for and associated costs of dedicated computer hardware.

Specially designed for this purpose, the new

USB-to-HDMI converter generates an HDMI signal from The Imaging Source's USB3 camera image data. Camera settings like exposure and gain can be configured via an on-screen menu and are automatically restored on startup.



Credit: Alrad Imaging

USB-to-HDMI converter from Imaging Source, distributed by Alrad.

The converter supports all 33U and 37U-series cameras from The Imaging Source with native display resolution up to 4K. There are easy-to-use on-screen menus for camera and display settings via USB keyboard.

Distributor and supplier Alrad Instruments has been providing high quality components and scientific equipment to the OEM market, industry and research for the past 50 years. Our product areas cover imaging and machine vision components, image sensors, photonics components including laser products, embedded AI and deep learning systems and IOT products including RFID components and systems.

<https://alrad.com>

CPI partners with Perceptive Engineering and FUJIFILM Diosynth Biotechnologies

Independent technology innovation centre CPI, which operates from a range of locations across the UK (www.uk-cpi.com/contact), has announced a partnership with Perceptive Engineering and FujiFilm Diosynth Biotechnologies. The companies will develop a "data-driven solution to improve efficiencies during downstream biologics processing", with the aim of reducing the cost of manufacturing new, life-saving therapies.

Biologics offer promising treatment options for disease areas with unmet clinical needs, and now represent seven of the top ten grossing drugs globally. Although advances in continuous biomanufacturing processes

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Photonex 2020 new products and exhibitor news

have made the production of biologics more efficient, the high failure rate of expensive purification resins means that manufacturing costs remain high.

As part of the Digital Integrated and Intelligent Continuous (bio)Manufacturing (DIICbM) project, CPI and its partners will develop new tools to accelerate workflows and integrate process analytical technology into CPI's existing automated platform for continuous downstream bioprocessing.



Image: CPI

Research at CPI.

Utilising Perceptive Engineering's PharmaMV software, the partners will collect and analyse data from CPI's automated platform to build a model that can identify and predict the degradation and failure of purification resins. Additional data to refine the model will be provided by Diosynth.

The resins used in the manufacture of biologics are extremely expensive, and failure not only means they must be replaced, but also leads to batches of drugs that do not meet quality standards. The model being developed will enable a much greater understanding of resin failure, and the partners are working to integrate it into CPI's automated platform to provide real-time insights. This will enable early interventions, while promoting the development of better processes that avoid resin failure altogether.

CPI was instrumental in identifying the funding streams available for the project and writing the initial proposal. Once a working model is developed, CPI will demonstrate proof-of-concept at its National Biologics Manufacturing Centre in Darlington, UK, and it

will also investigate the model's transferability to other platforms.

David Lovett, Managing Director at Perceptive Engineering, said, "By using advances in at-line process analytical technology, the DIICbM project will help to optimise end-to-end manufacturing processes at CPI's National Biologics Manufacturing Centre. With strategic guidance from world-leading partner FUJIFILM Diosynth Biotechnologies, we are hugely excited by this project."

Jonathan Haigh, Vice President, Process Development at Diosynth, said, "We are delighted to contribute to this exciting project with our technical expertise in biologics manufacturing. By increasing the efficiency of manufacturing processes, we can help to improve the accessibility of these valuable therapies to patients."

Lucy Foley, Biologics Business Unit Director at CPI, commented, "Fully optimising and automating continuous downstream processes is a vital part of streamlining biologics manufacture. Our facilities have the ideal combination of expertise and instrumentation to test and prove the innovative new technology that can achieve this."

www.uk-cpi.com

Edmund Optics and Schott expand their partnership

In mid-2020, it was announced that Edmund Optics and Schott have formed a strategic partnership to enable customers to access "the highest of quality polished optical glass filters from Schott, with the customer service and fast shipping of Edmund Optics."

"We are now working even closer together," Marcus Knöbel, Executive VP of Schott's Business Unit Advanced Optics and Samuel Sadoulet, President and COO of Edmund Optics, jointly stated. "This enhanced partnership enables both brands to provide many additional benefits to customers."

Enquiries for Schott's portfolio of optical filters can now be more easily processed through Edmund Optics. This expansion will also significantly increase the service profile of Edmund Optics' German manufacturing facility, known as ITOS, which has had a long-term partnership with Schott.



Image: Edmund Optics

Edmund Optics has announced that its TECHSPEC CA Series Fixed Focal Length Lenses were awarded a Silver-Level 2020 VSD Innovators Award in the lighting, lenses and optics category.

"This partnership will drive fast and easy access to components using Schott materials in Europe and in a next step in China for both standard products and custom designs for prototype and small volume quantities, as well as high volumes," added Knöbel. Sadoulet said, "We will now be able to offer additional flexible solutions to our customers by applying our leading customer service to an even larger product range."

Edmund Optics has been a leading global manufacturer and supplier of optics, imaging, and photonics technology that has served a variety of markets including life sciences, biomedical, industrial inspection, semiconductor, R&D, and safety and security since 1942.



Image: Edmund Optics

Virtual handshake: Marcus Knöbel, Executive Vice President of Schott's Business Unit Advanced Optics and Samuel Sadoulet, President and COO of Edmund Optics.

The company designs and manufactures a wide selection of optical components, multi-element lenses, imaging systems, and optomechanical equipment, while supporting OEM applications with volume production of stock and custom products. The company employs over 1,000 employees in more than nine countries across the globe and continues to expand.

EO helps customers from prototype to volume production, and specializes in creating cost-effective solutions that meet our customer's specifications, timelines, and budgets. Whether requirements include stock optics,

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Photonex 2020 new products and exhibitor news

a build-to-print custom optical component, expert application engineering to optimize the design, or a completely custom design to customer-supplied requirements, the company's engineers can create solutions for optical challenges.

www.edmundoptics.com

EKSMA announces new research and development project

EKSMA Optics has started a new R&D project with an objective to develop two new innovative products. Considering current and forecasted market demand, laser attenuators with a high laser damage threshold and dichroic cube beamsplitters are the twin focuses of the work, to be part funded by



Image: EKSMA Optics

EKSMA is developing new laser attenuators and dichroic cube beamsplitters.

European Regional Development Fund (ERDF).

The company stated that these new products will be developed "by employing the company's technical capabilities and introducing new production technologies. The devices will offer technological and functional advantages to the market"

It added, "Successful completion of this 3.5 million euro total-value project will allow EKSMA to increase the company's innovative potential, while the commercialization of new products will ultimately increase turnover and competitiveness." The development project funded by the ERDF – EKSMA will 1.4 million euro – runs through to May, 2023.

www.eksmaoptics.com

Hamamatsu launches 'stay healthy' 3D time-of-flight image sensors

Touchless operation of machinery for hygiene management, measurement tools for ensuring social distance and labour-saving autonomous robots are becoming more common in everyday life. So says photonics systems giant Hamamatsu, which has launched a range of 3D time-of-flight image sensors.

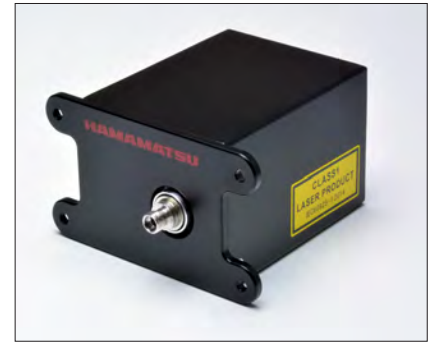


Image: Hamamatsu

A new Hamamatsu 3D time-of-flight image sensor.

Craig Palmer, General Sales Manager, commented, "Today, distance sensors are

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Photonex 2020 new products and exhibitor news

playing an increasingly important role as a key enabling component in the development of such technologies. Distance Image sensors measure the distance to an object per pixel, using an indirect time-of-flight method. It is the optimum sensor for people and object detection, and shape recognition for applications where touchless or labour-saving technology is required."

To meet the needs of these applications, Hamamatsu Photonics has introduced a new range of 3D time-of-flight back-thinned image sensors. Through back-thinning, these new sensors deliver high sensitivity in the near-infrared region. An integrated active circuitry improves the tolerance to background light and makes this new range of distance sensors ideal for measurement applications including hygiene management, measurement for social distancing and remote operations. They are also available in a compact wafer-level package.

Hamamatsu can offer evaluation kits to aid development, and customised solutions to meet customers' specific application needs.

www.hamamatsu.com

Hübner Photonics introduces Cobolt Rogue 640 nm laser

Hübner Photonics has introduced the Cobolt Rogue 640 nm laser. The Cobolt Rogue Series lasers are continuous-wave diode pumped lasers (DPL) and are multi-mode, high power complements to the established Cobolt 05-01 Series of single frequency lasers. The Cobolt Rogue 640 nm is multi-longitudinal mode in a perfect TEM₀₀ beam with 1 W output power, ideally suited for super resolution microscopy.

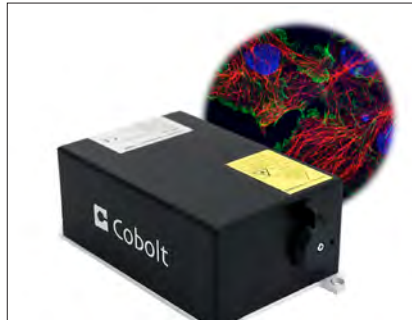


Image: Hübner Photonics

The Cobolt Rogue 640 nm laser from Hübner Photonics.

All Cobolt lasers are manufactured using proprietary HTCure technology and the resulting compact hermetically sealed package, which provides a high level of immunity to varying environmental conditions along with exceptional reliability. With demonstrated lifetime capability and several thousand units installed in the field, Cobolt lasers have proven to deliver unmatched reliability and performance both in laboratory and industrial environments.

Hübner Photonics offers a full range of high performance Cobolt lasers: the CW tunable laser C-Wave along and a full selection of C-Flex laser combiners. Through continuous technology development, customer orientation and an ISO certified quality management system, the company has become a preferred supplier of lasers for applications in fluorescence microscopy, flow cytometry, Raman spectroscopy, metrology, holography, nanophotonics and quantum research. Hübner has manufacturing sites in Kassel, Germany and Stockholm, Sweden with direct sales and service offices in USA and UK.

www.hubner-photonics.com

Ibsen launches compact spectrometers with broad wavelength range

Ibsen has developed an extreme broadband grating technology and offers a series of ultra-compact, broadband spectrometers based on these – the Freedom UV-NIR (190-1100 nm) and the Freedom UV-VIS (190-850 nm) meters, which it says "are ideal for high performance portable solutions."

Then Ibsen's Fused Silica Transmission Gratings enable high resolution, high efficiency gratings that are suited to compact spectrometers. The company offers a range of spectrometer gratings spanning from

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Photonic Solutions Ltd

GEMINI Interferometer - discover the advantages of Fourier-Transform techniques

Learn the magic of Fourier-Transform techniques and how with the GEMINI interferometer you need no longer compromise on spectral resolution and sensitivity.

Accurate control of the temporal delay between the two replicas of the input light, allows unrivalled accuracy and reproducibility over an ultra-broadband spectral range 250nm-4200nm, with 0.7nm spectral resolution and high throughput from a 10mm clear aperture.



Contact Details

Photonic Solutions Ltd.
Unit 2.2 Quantum Court
Heriot-Watt University Research Park
Edinburgh, EH14 4AP
www.photonicsolutions.co.uk
sales@photonicsolutions.co.uk
Tel: +44 (0)131 664 8122

NKT Photonics Ltd

The World's leading supercontinuum source just got even better!

NKT Photonics' next generation supercontinuum source, the SuperK FIANIUM, is the "future-proof" choice for bio-imaging offering improved functional imaging thanks to the unique combination of picosecond pulsed operation and broad tunability from 390-2400 nm.

Available in three versions, with up to 2W visible and 6.5W total power, and with option for variable repetition rate down to 150kHz as standard.



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Photonic Solutions Ltd.
Unit 2.2 Quantum Court
Heriot-Watt University Research Park
Edinburgh, EH14 4AP
www.photonicsolutions.co.uk
sales@photonicsolutions.co.uk
Tel: +44 (0)131 664 8122

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UV bandwidths over VIS to NIR bandwidths, and also offers custom design of gratings for diverse OEM applications.

The Freedom broadband spectrometers combine compact size, cost efficiency, and high performance with flexibility in the choice of detector system and electronics. These features make the Freedom spectrometers especially well-suited for integration into portable and handheld instruments.

The key features of the Freedom UV-VIS-NIR system are: high efficiency across the complete 190 – 1100 nm range, ultra compact size of 48 x 54 x 16 mm, robust and athermal performance, and flexibility in choice of detector and electronics.

The high broadband efficiency is obtained with an innovative transmission grating,

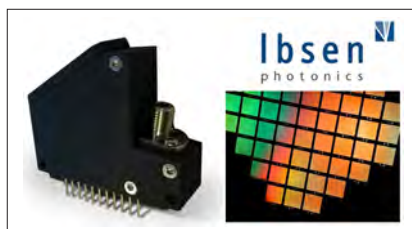


Image: Ibsen Photonics

Ibsen Photonics' Freedom spectrometer UV-VIS or VIS-NIR (left) and spectrometer grating for 200-1100nm (right).

developed and manufactured by Ibsen Photonics. In contrast to typical blazed gratings, this new grating provides nearly constant diffraction efficiency over the 190 – 1100 nm range for both polarizations.

The Freedom is available in three standard variants with either a cost-efficient CMOS detector, front-illuminated CCD or a low noise back-thinned CCD. More detector options are available upon request. These UV-VIS spectrometers are, as an example, ideal as a UV detector in a High Pressure Liquid Chromatography (HPLC) system.

www.ibsen.com

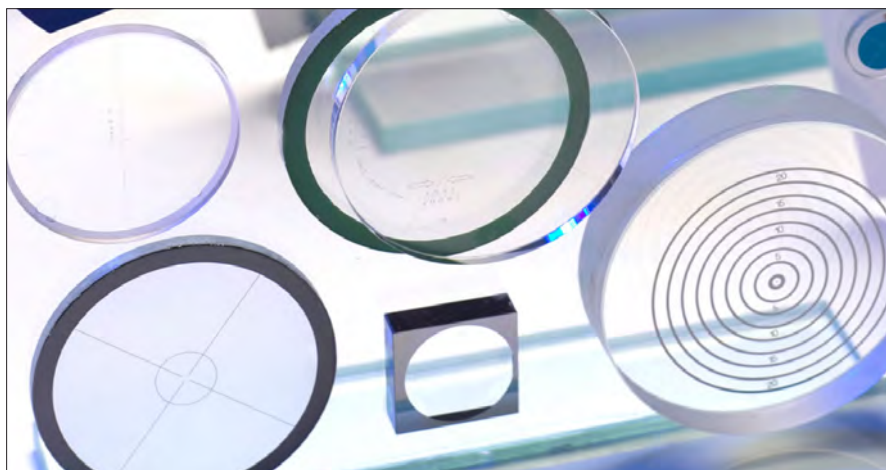
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Product Announcements

Custom made Reticles and Apertures from Graticules Optics

Graticules Optics has over 70 years' experience in exacting quality micro-structure products and developing specialised processes to manufacture complex reticles/custom optics to customer's own requirements.

As a Custom Reticle and Aperture maker we have facilities and the expertise to manufacture bespoke products to different applications from Microscopy and Spectroscopy to Military, simple



crosslines, pinholes and slits to complex sighting patterns, from chrome deposited images techniques (positive and negative patterns) to etch and fill doublet assemblies, and electroplated foil.

To discuss your custom design, email Graticules directly at sales@graticulesoptics.com or call our team on +44 (0)1732 360460.

New Raman Spectrometer Offers High Sensitivity, Wide Range

Ocean Insight introduces the QE Pro-Raman+ spectrometer for 785 nm Raman excitation applications. The QE Pro-Raman+ provides 3x sensitivity improvement compared with similar spectrometers and unlocks more Raman signature data with its expanded spectral range (150 cm⁻¹ to 3000 cm⁻¹).

The ability to distinguish sharp peaks from weak Raman spectral signatures

makes QE Pro Raman+ an excellent choice for analysis of chemicals, pharmaceuticals, illicit drugs, pesticides and organic materials. When combined with Ocean Insight's SERS substrates and Ocean Intelligence machine learning, it can perform trace level material identification and even determine quantitative concentration levels.



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Laser Components presents research at SPIE Laser Damage conference

Laser Components has presented the results of the joint research project PLUTO+ at the SPIE Laser Damage Online Forum (between September 15-18). Together with partners such as Ruhr-University Bochum, Laser Centre Hannover (LZH) and Leibniz Institute for Plasma Research and Technology in Greifswald, the company spent four years investigating new methods for optimising plasma-based coating processes.



Image: Laser Components

Dr. Sina Malobabic, responsible for coordinating the project at Laser Components and making all the measurements.

A new multipole resonance probe (MRP) was used to prove that drifts and fluctuations in the plasma source can occur even if all other operating parameters are identical. Such fluctuations can be corrected within the framework of an in-situ control, which might have a considerable effect on the laser damage threshold.

"In plasma-assisted coating processes, the mechanical and optical properties of the dielectric layers are highly dependent on the energy input of the plasma," said Dr. Sina Malobabic, who was responsible for coordinating the project at Laser Components and carried out all the measurements. "The MRP developed by Ruhr-Uni Bochum monitors the electron density directly inside the plasma. For the first time we can monitor and correct irregularities during the coating process, opening up new possibilities for process optimisation."

Laser Components specializes in the development, manufacture, and sale of components and services in the laser and

optoelectronics industry. The company has been serving customers since 1982 with sales branches in five different countries. It has been producing products in house since 1986 with production facilities in Germany, Canada, and the United States. In-house production makes up approximately half of all sales revenue.

www.lasercomponents.com

Thorlabs introduces configurable 6-colour light source for microscopy

Thorlabs has announced the release of its 6-Color Light Engine, intended for fluorescence excitation applications. The configurable Chrolis design combines the light from 6 customer-chosen high-power LEDs into a single Ø3 mm liquid light guide. Users can select from 11 different wavelength options with outputs ranging from 365 nm to 780 nm, covering all known fluorophores.

Each LED's intensity can be individually controlled via an easy-to-use graphical user interface, which also offers extensive pulse capabilities. Light pulses are generated internally. For each LED, the pulse parameters can be set separately. The pulses are optimized for fast rise/fall times and offer best-in-class waveforms. Via a BNC breakout box, it is also possible to trigger the LEDs from external signals. Alternatively, the pulses generated internally can be used to trigger external devices, such as cameras.

"We are excited to introduce this new high-



Image: Thorlabs

Configurable Chrolis design combines the light from 6 LEDs into a single liquid light guide.

end LED source, which is designed, developed, and produced by Thorlabs' Munich-based team," noted Bruno Gross, General Manager of Thorlabs GmbH. "Over the next year, we are planning to expand this product line with additional optical, electronic, and software features."

Ultra-Low-Noise Semiconductor Lasers

Thorlabs this year also launched its ultra-low-noise semiconductor laser product line, which

offers a combination of high output power (greater than 100 mW), narrow linewidth (less than 100 Hz), and ultra-low relative intensity noise (RIN less than -165 dB/Hz). Based on a patented Fiber Bragg Grating (FBG) external cavity design, these lasers provide output centered at 1550 nm.

"These ultra-low-noise lasers build on Thorlabs' class-leading semiconductor gain chip to offer a unique combination of high output power, low phase noise, and low RIN for demanding applications in remote sensing, optical comb generation, and RF/microwave photonics," said Jian Wei, Director of Semiconductor Components at Thorlabs' Quantum Electronics facility in Jessup, MD.

Commercialized in collaboration with Morton Photonics, Inc., each laser is packaged in an extended 14-pin butterfly housing featuring two thermoelectric cooler elements for precise laser and FBG control and stabilization. Offered in both polarization maintaining and single mode fiber variants, these lasers can be optimized for wavelength tuning by temperature or current depending on the application.

www.thorlabs.com

VAT Vacuum Products expects 2020 sales, earnings 'substantially above' 2019 figures

VAT Vacuum Products, headquartered in Haag, Switzerland, and with a UK office in Leamington Spa, is a provider of leading-edge vacuum valve technology for all high vacuum demanding applications such as high energy physics, semiconductor production, solar and flat panel display production as well as numerous other science and industry applications. The company says it is investing at above industry average levels in R&D, both in its own research as well as in numerous cooperative arrangements with institutes and organizations requiring vacuum science solutions worldwide.

The key objective of this research is to further reduce outgassing and cross contamination issues as well as particle emission and activation by vacuum valve technology. Furthermore, VAT is working to integrate valve technology in ways that the implemented technology can support process parameters beyond the prime valve functionality.

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Photonex 2020 new products and exhibitor news

Positive results

In mid 2020, the company reported positive trading results for the latest quarter's and half year's trading, achieving "higher Q2 orders and sales driven by steady growth in semiconductors; and a H1 pre-tax earnings margin near 30% as operational improvements continued."



Image: VAT Vacuum Products

VAT Vacuum Products develops leading-edge technologies for all high vacuum demanding applications.

Q2 2020 highlights included: group net sales up 28% vs Q2 2019, with technology innovation key as customers invested in next-generation chip fabrication. Of the Covid-19 pandemic, the company stated, "we experienced fewer supply chain disruptions than expected; our global footprint has supported production continuity."

Half-year 2020 highlights included: "continued market recovery driving 37% higher orders, with 21% net sales growth vs H1 2019; group pre-tax margin up 460 basis points on higher volumes and strong productivity and cost focus."

VAT's forecast for the remainder of 2020: "The semiconductor outlook remains positive; the strength of recovery depends on macro impact of the pandemic. Assuming there is no substantial demand deterioration vs. H1, VAT expects FY 2020 net sales¹, pre-tax earnings and margin, and net income to be substantially above 2019." Net sales in the financial year 2019 amounted to CHF 570 million.

www.vatvalve.com

Passive digital night vision now possible with Raptor's Owl 640 N

Using next-generation technology, Raptor has launched one of the lowest noise VIS-SWIR cameras on the market, perfect for imaging in low light conditions. Using a 640 x 512 InGaAs sensor, and the sensor stabilised to 15°C, the Owl 640 N offers a visible response from 0.6µm to 1.7µm to enable a high sensitivity.



Image: Raptor

The Owl 640 N is first advanced SWIR camera with digital night vision capability.

The camera also offers the lowest readout noise on the market with a typical value of 18 electrons. The camera has a high intra-scene dynamic range of typically 73dB, enabling simultaneous capture of bright and dark portions of a scene.

Available with a 14 bit base Camera Link output, the Owl 640 N will run at frame rates up to 120Hz. The camera features an on-board Automated Gain Control, which enables the best contrast imaging from low to bright light as well as an on-board intelligent 3 point Non-Uniform Correction, providing the highest quality images. As with all Raptor cameras, the Owl 640 N is compact and rugged.

Quantum Design UK & Ireland is a leading distributor of high-tech instrumentation and consumables for scientific, academic and industrial research. The company is part of the QDI Group. QDUKI's success in distributing scientific products comes from more than 30 years' experience in manufacturing and distributing its own industry-leading materials characterisation systems.

www.qd-uki.co.uk

Edwards launches compact dry vacuum pump

Pump technology developer Edwards, based in Burgess Hill, UK, has launched its nXRi high-performance compact dry pump, with lower input power and zero maintenance, offering

operational improvements and cost benefits across a range of applications. Initial variants will provide pumping speeds of either 60 and 90 m3h⁻¹, four times more pumping speed than a similar sized dry pump.

The pump is described as "the perfect vacuum solution across a spectrum of applications due to its compact size and low power, reliable performance and reduced costs."

"Performance is at the core of our new nXRi dry pump," said Dave Goodwin, Product Manager, Scientific Vacuum, Edwards. "The nXRi delivers four times more pumping speed than similar-sized dry pumps, and with low ultimate and high reliability customers are assured a consistent and stable vacuum for years to come."



Image: Edwards

Edwards product development at the company's HQ in Burgess Hill, UK.

Designed with size in mind, the compact footprint and height allow the nXRi dry pump to fit easily under a benchtop saving valuable space in the laboratory; and at under 30kg offers a highly mobile vacuum pump for changing work flows and environments. The pump is maintenance free for up to five years, with no tip-seal or oil change, for maximum uptime and reduced maintenance costs.



Image: Edwards

Edwards nXRi high-performance compact dry pump.

The nXRi's 40% smaller footprint, compared to alternative dry pumps, assures seamless integration into analytical instruments and vacuum systems for a ready to go vacuum solution, perfect for mass spectrometry, electron microscopy and leak detection. R&D and industrial customers will enjoy the design flexibility, oil-free and low maintenance features.

www.edwardsvacuum.com

How to overcome the Abbe diffraction limit with single-molecule localisation microscopy (SMLM)?

The background

The ground-breaking techniques of super-resolution optical fluorescence imaging was awarded the 2014 Nobel Prize in Chemistry to Eric Betzig, Stefan Hell and W. E. Moerner. These techniques overcome the Abbe diffraction barrier, which fundamentally restricted the lateral optical resolution to 200 – 300 nm until the early 1990s.

There are two different techniques commonly used: deterministic super-resolution called stimulated emission depletion (STED) microscopy; or a stochastic technique called photoactivated localisation microscopy (PALM).

How does SMLM work?

The fundamental principle of SMLM is the random photoactivation and subsequent localisation of individual fluorescence emitters by detecting their photon emission at a certain position and time in the complete absence of emission from neighbouring emitters. The centroid of the diffraction-limited distribution of photons is a measure of the location of the emitter and is far better defined than the photon distribution itself. A super-resolved SMLM image is a map of individual locations that can yield lateral resolutions down to 5 nm.

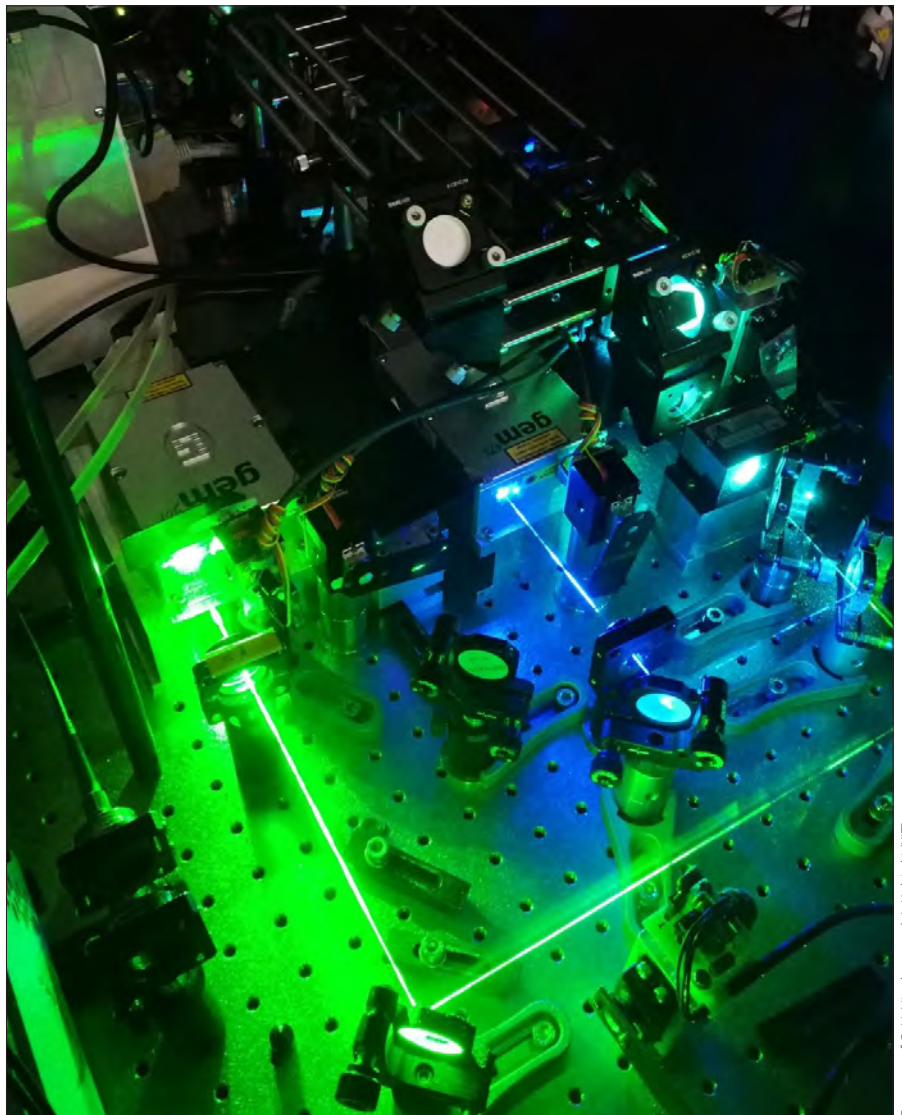
How can you ensure individual localisation?

PALM exploits specific properties of fluorophores that spontaneously form in photoactivatable fluorescent proteins (paFPs) of the green fluorescent protein (GFP) family. GFP-like proteins are genetically encodable, enabling markers to be produced with no further staining procedures. Typically, weak 405 nm laser light photoconverts a few paFPs from green- to red-fluorescent emitters during acquisition of a single camera frame. Red fluorescence is typically excited by a 561 nm laser. The red emission appears as a small number of isolated, diffraction-limited

spots in the red channel during each camera frame. Photobleaching quickly removes the red-converted paFPs, new emitters are then activated and detected in the next camera frame. Careful adjustment of the experimental

SMLM laser requirements

For fluorescence excitation of paFPs, high laser powers in the range of 500 mW are beneficial and lasers emitting at suitable wavelengths in order to excite the fluorescent molecules employed for visualisation. The gem lasers from Laser Quantum offer high powers across numerous wavelengths (473, 532, 561, 640 and 671 nm) with near perfect beam quality in a compact, cost-efficient platform. The high



Photograph of the laser compartment of a widefield microscope for SMLM with the beam paths of the gem 473 (blue) and gem 561 (green).

parameters (laser powers, camera dwell times) reduces the probability of detecting two fluorophores spatially overlapping to almost zero.

powers also allow advanced beam shaping techniques since power is not the limiting factor as with diode lasers.

Courtesy of G. U. Nienhaus and A. Kobitski (KIT)



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