33rd Newsletter of the ITN:

"NExt Generation of Tuneable LASers for optical coherence tomography"

(NETLAS)

led by University of Kent

MARCH 2023

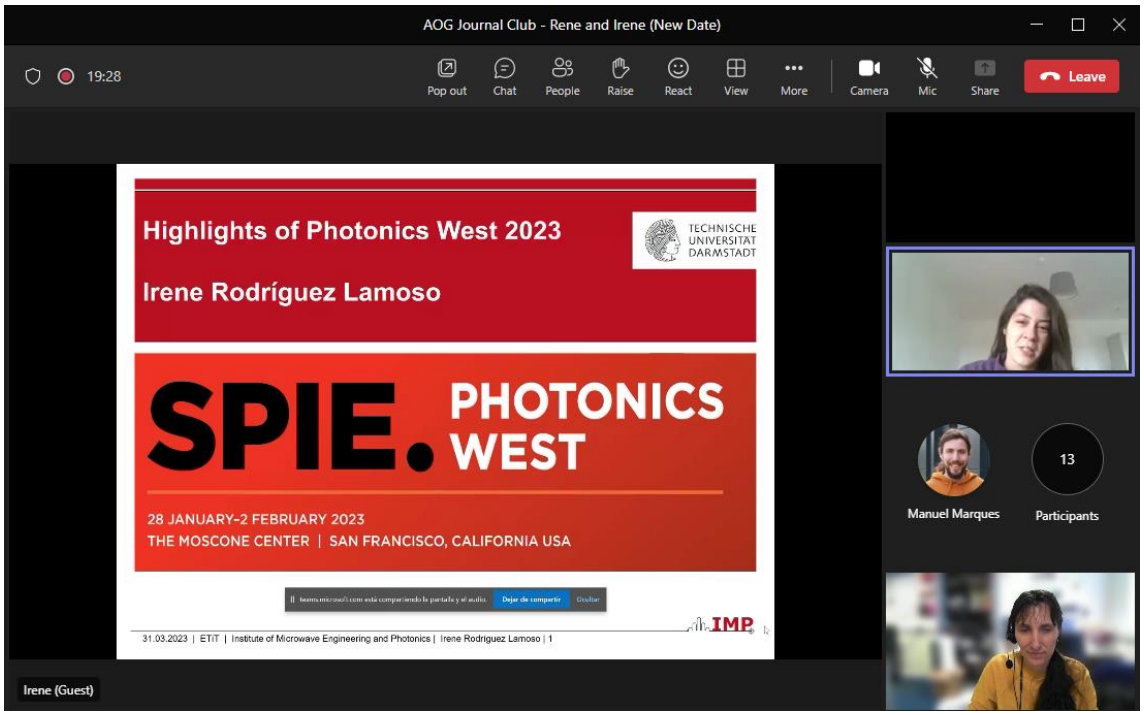
AOG Journal Club

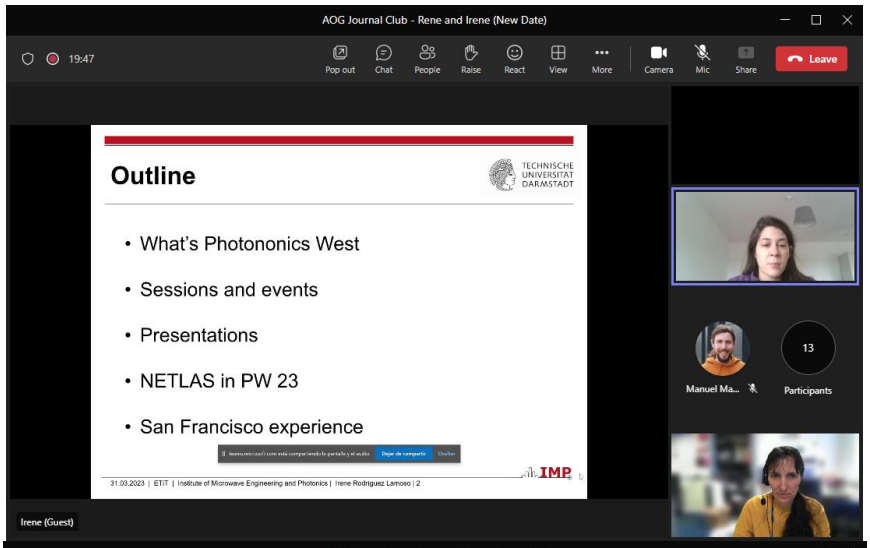
Feedback from the Photonics West 2023 conference in San Francisco (28 January - 2 February 2023)

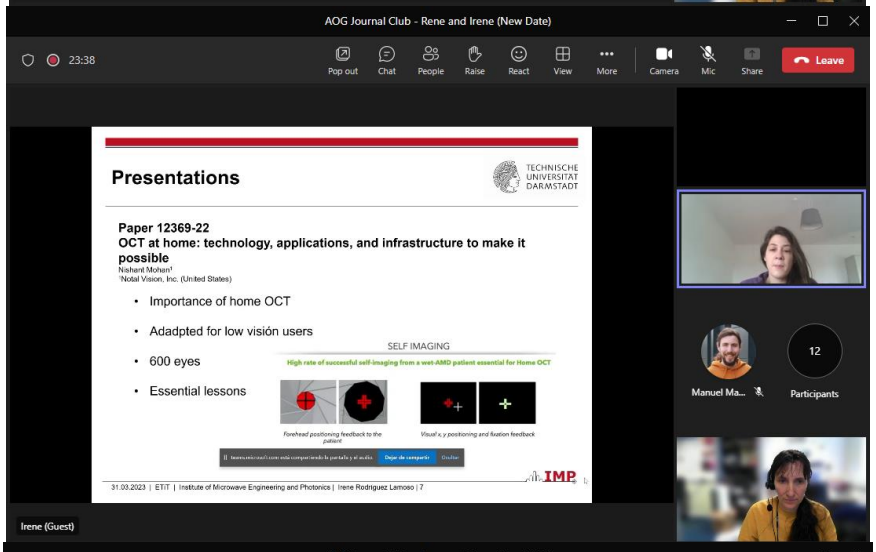
Presentation by NETLAS PhD Student Irene Lamoso

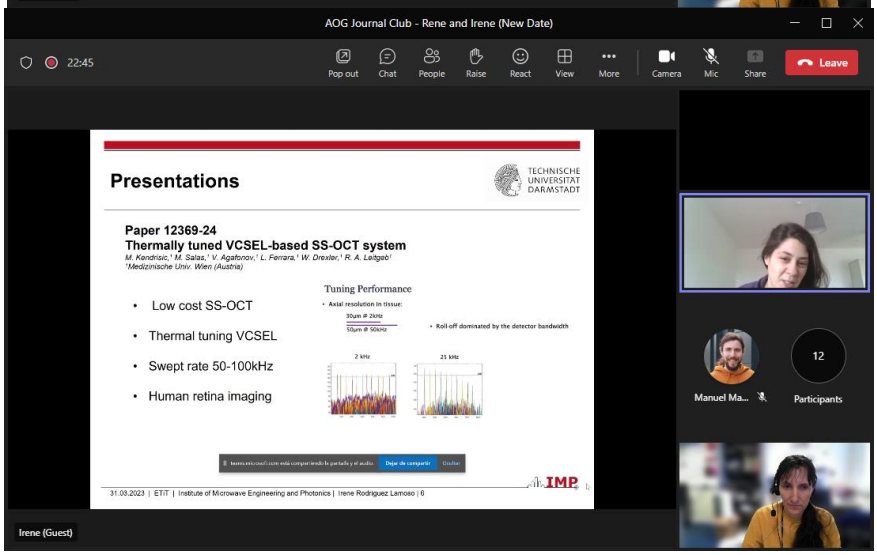
Friday 31/03/2023 at 12 pm

Irene presented some highlights from Photonics West 2023 in an hybrid event. The event was very well received by the AOG members and other NETLAS PhD Students. Slides from Irene's presentation are presented below.

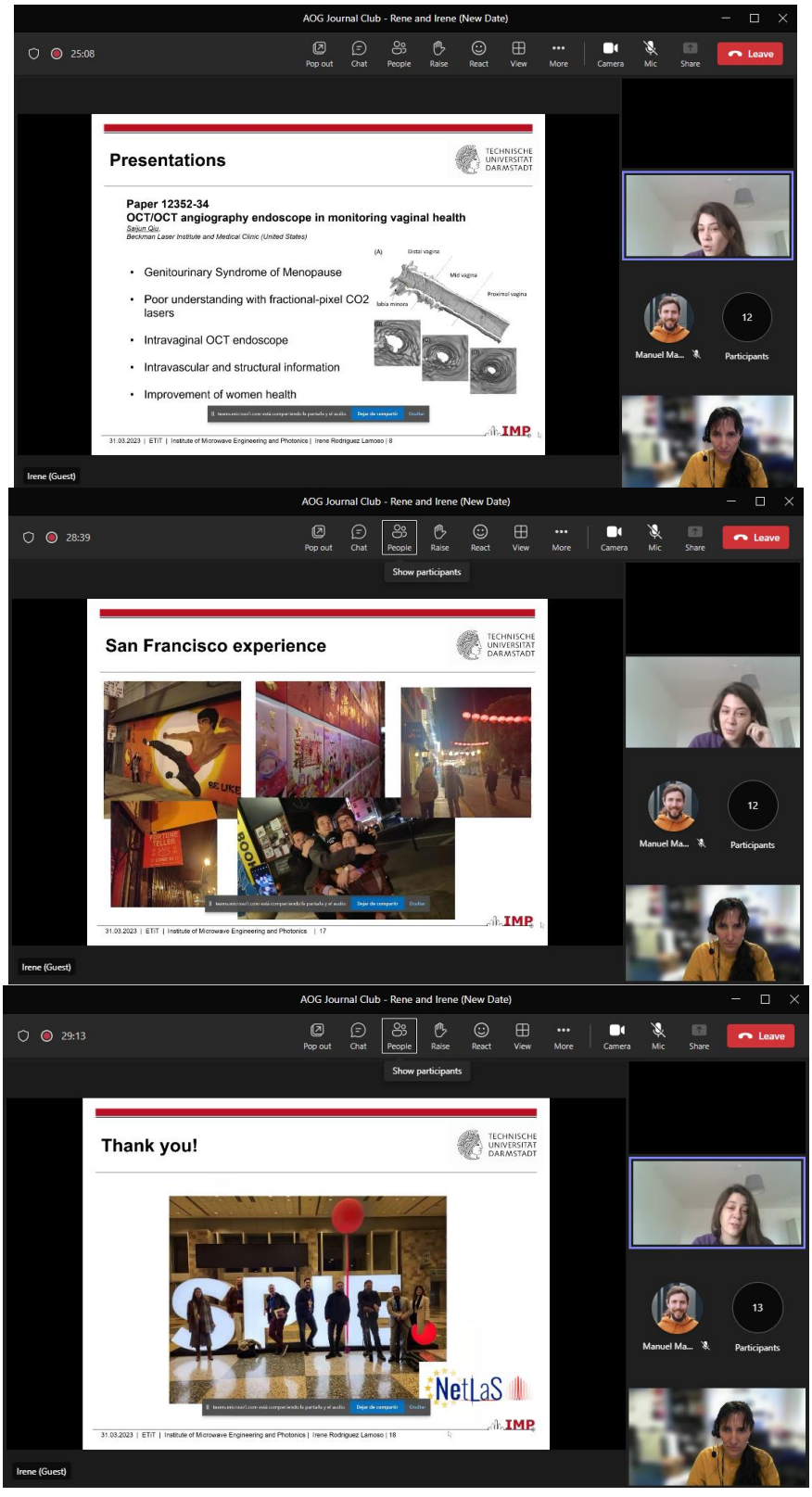








Slides from the [NETLAS PhD Student Irene Lamoso's] presentation



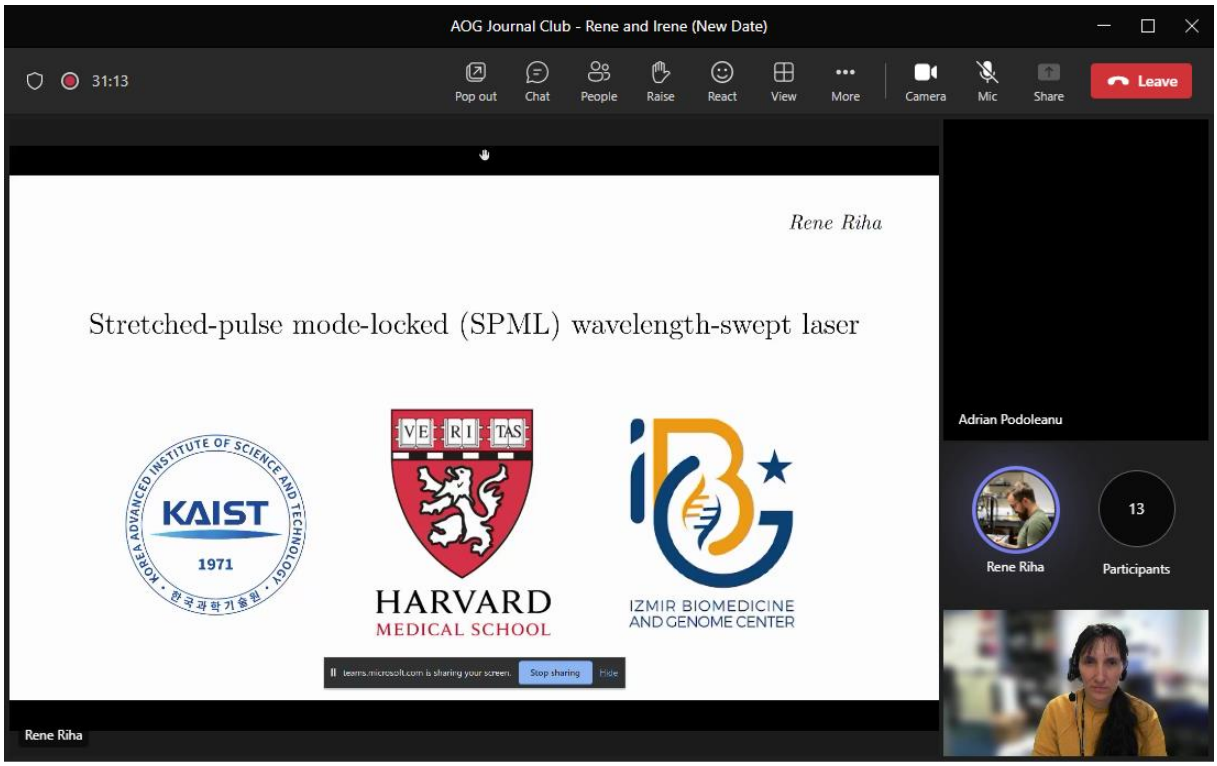
Slides from the [NETLAS PhD Student Irene Lamoso's] presentation

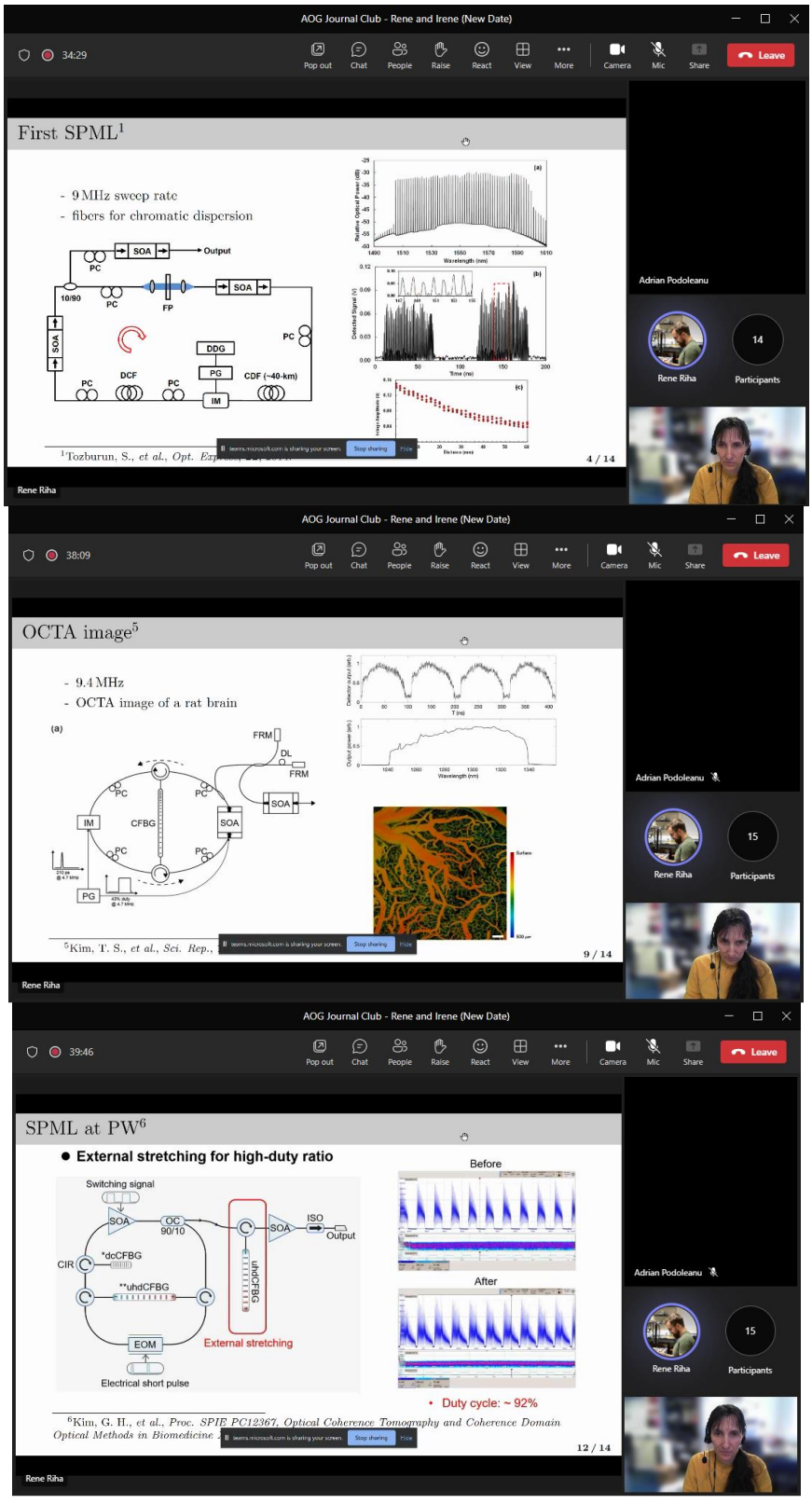
Feedback from the Photonics West 2023 conference in San Francisco
(28 January - 2 February 2023)

Presentation by NETLAS PhD Student Rene Riha

Friday 31/03/2023 at 12 pm

Rene presented a paper from Photonics West 2023 he found very interesting to share with the AOG members entitled "***Stretched pulse- mode-locked (SPML) wavelength-swept laser***".
A few slides from Rene's presentation are presented below.





Slides from the [NETLAS PhD Student Rene Riha's]presentation

SPS - Physics Research Project – Module PHYS7000 (PH700) - PH700 Students' presentations to the AOG's PhD Students and RAs

24th March 2023

University of Kent: Physics Research Projects Module PHYS7000 (PH700) has the aims **to provide an experience of open-ended research work**, **to begin to prepare students** for postgraduate work towards degrees by research or for careers in R&D in industrial or government/national laboratories, and **to deepen knowledge** in a specialised field and be able to communicate that knowledge orally and in writing. **The projects involve a combination of some or all of**: literature search and critique, laboratory work, theoretical work, computational physics and data reduction/analysis. The majority of the projects are directly related to the research conducted in the department and are undertaken within the various School of Physical Sciences (SPS) research teams.

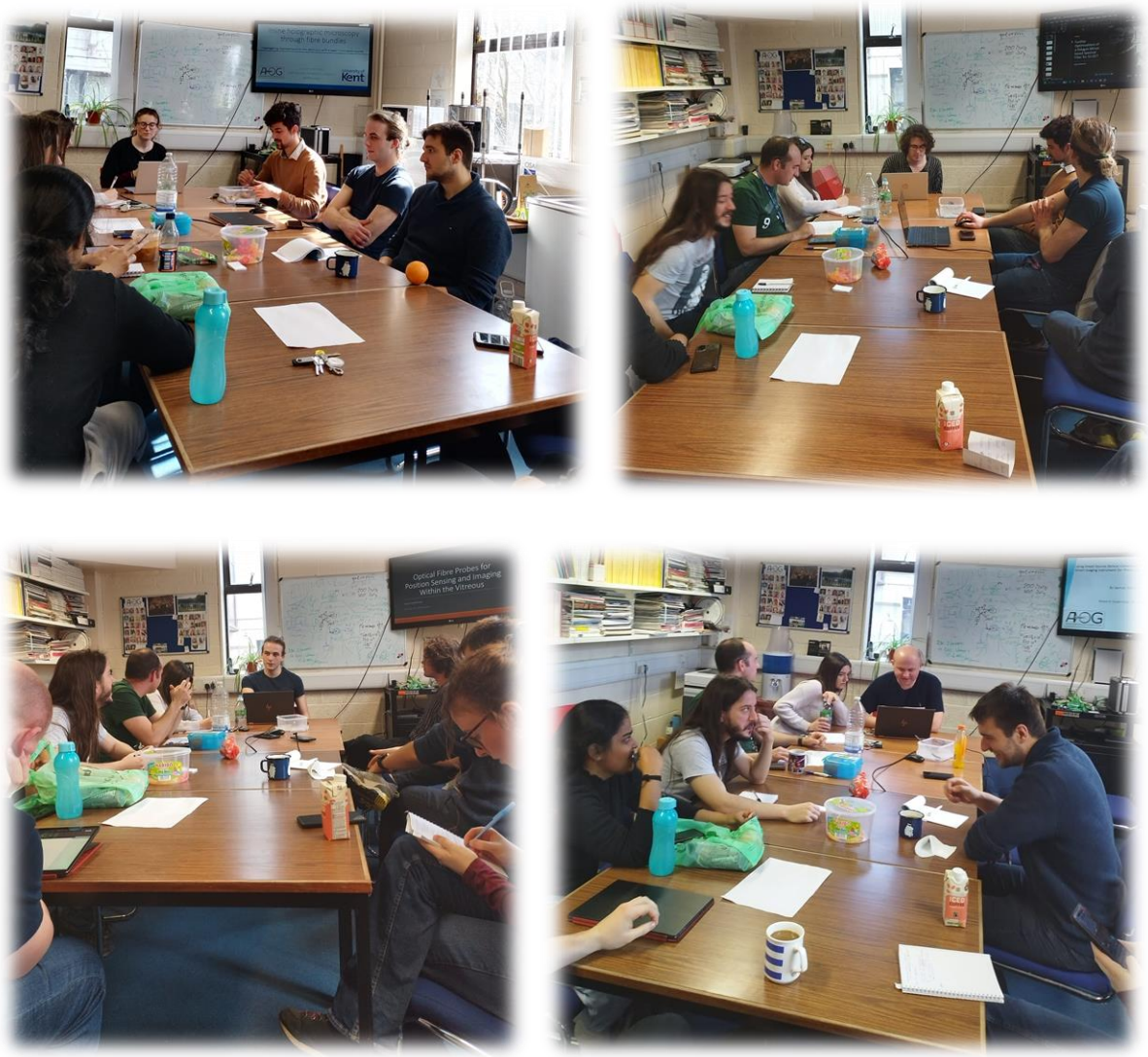
On **24th March 2023** the following PH700 Students from SPS, who **conducted their research project under the AOG's wing**, presented their results to the PhD Students and RAs from AOG, as a rehearsal preparation for their final presentation within SPS. NETLAS & AOG PhD Students were happy to participate and gave their feedback. A few photos from their presentations will follow.

Victoria Bridges, supervised by Dr. Michael Hughes – with the project title "*Inline Holographic Microscopy through fibre bundles*"

Angus McPherson supervised by Dr. George Dobre – with the project title "*Further Optimisations of a Polygon Mirror based Spectral Filter for SS-OCT*"

Taylor Sanderson supervised by Prof. Adrian Podoleanu – with the project title "*Optical fibre probes for position sensing and imaging within the vitreous*"

Samuel Stockwell supervised by Dr Adrian Bradu – with the project title "*Using swept source OCT as a direct imaging instrument for photo acoustic remote sensing*".



A few photos from the PH700 students' rehearsal presentations

@ Photos by Dr. Ramona Cernat

AOG New Photos

On Wednesday 22nd March 2023 AOG organized a group photo to be taken, just in time before the PH700 Students finished their research projects and some of NETLAS PhD Students finishing their secondments at the University of Kent. It took about a month to fix the date and to have everybody available, also to find a sunny day for an outdoor photo (in the end we had the chance to be in a cold & cloudy day between showers ☹).

March 2023 AOG photos

@ Photos by AOG PhD Student Julien Camard

March 2023 AOG photos

having the Photonics Center building in the background

@ Photos by AOG PhD Student Julien Camard

PhD Students's Visit to the Institute of Ophthalmology, Moorfields Eye Hospital, and the Royal Free Hospital, London

23rd March 2023

@ Article written by NETLAS PhD Student Alejandro Martinez Jimenez on behalf of 6 researchers from the Applied Optics Group, University of Kent: **Lucy Abbott** (PhD in Kent on visible OCT), **Marie Klufts** (NETLAS PhD on fast FDML swept source at 850 nm, registered for PhD in University of Luebeck), **Alejandro Martines Jimenes** (NETLAS PhD on time stretched swept sources for OCT and ultra fast OCT), **Rene Riha** (NETLAS PhD on fast akinetic swept sources), **Philipp Tatar-Mathes** (NETLAS PhD on new active media for swept sources at short wavelength at the University of Tampere), and **Gopika Venugopal** (NETLAS PhD on low cost swept sources in visible).

Our visit to the Institute of Ophthalmology, Moorfields Eye Hospital, and the Royal Free Hospital left us feeling elated and inspired. The day was filled with a range of impressive demonstrations and presentations that showcased the cutting-edge technologies and exceptional talent of the teams we visited.

Many thanks for organizing this visit to Prof. Marinko Sarunic, Professor and Moorfields Eye Charity Chair in Advanced Ocular Imaging Institute of Ophthalmology, Medical Physics and Biomedical Engineering, University College London.

We started at the Institute of Ophthalmology, part of Marinko's team, consisting of Arman Athwal and Tom Smart, introduced us to their two advanced systems: LIVMAOS and AO VIS STIM. We were particularly impressed by the adaptability of their optical visual stimulator, which allowed the team to measure the human eye's response under varying conditions such as frequency and visibility. Furthermore, their mixed system that incorporated adaptive optics (AO) OCT images, fluorescence, and other

state-of-the-art technologies left us impressed. It was a pleasure to discuss the potential applications of these advanced systems learn from the team about their exciting research.

Our tour of the clinical research facilities at Moorfield Hospital, led by Vincent Rocco, proved equally enlightening. **We had the privilege to have a demonstration of the high-resolution OCT instruments, which were impressive in both their engineering quality and precision.** Angelos Kalitzeos also impressed us with his presentation of the AO-SLO system, which can resolve photoreceptors in the retina, showcasing the vast potential of adaptive optics. The story of how the system was built in just one week by the expert Alfredo Dubra, with Angelos maintaining it every day, left us very impressed.

After a short break for lunch, we met Marinko and headed to the Royal Free Hospital. **Aleksandra Goch and Marinko treated us with a remarkable experience, where we had the opportunity to witness the results of Aleksandra's PhD research first-hand.** Her innovative approach using intraoperative OCT (iOCT) to work alongside surgeons and understand their challenges was truly inspiring. **We were thrilled to join a live operation**, **where the surgeon operated the patient displaying at the same time iOCT.** Although this images help for diagnosis, is still unclear if they help to guide the surgeon, of course is a source of different information that could make the surgeon change his opinion in how to proceed, but it is still some work left for us to do. How can we give the information to the surgeon in a simpler and more digested way? What is the most important feature for a surgeon? Fast images, better quality, deeper penetration? All these questions are quite open and depend widely on the surgeon, there is not an easy answer.

Finally, our discussions with Marinko and Aleksandra towards the end of the day were uplifting, as **we reflected on our experiences and the incredible projects that each of us was pursuing.** We left the facilities feeling confident, admiring, and joyful about the advances and possibilities that lie ahead in ophthalmic research.

We appreciate the time and attention given by our hosts, thanks organisers and we invite you to come to Canterbury to see what we are doing for OCT in the eye. Please find below a few photos from our visit.

@ Article written by NETLAS PhD Student Alejandro Martinez Jimenez on behalf of 6 researchers from the Applied Optics Group, University of Kent

@Photos by **Prof. Marinko Sarunic** taken during the Visit to the Institute of Ophthalmology, Moorfields Eye Hospital, and the Royal Free Hospital, London

Mircea Guina receives the Innovation Professor of the Year 2023 award | Tampere University

Professor Mircea Guina from Tampere University has been selected as the **Innovation Professor of the Year 2023**

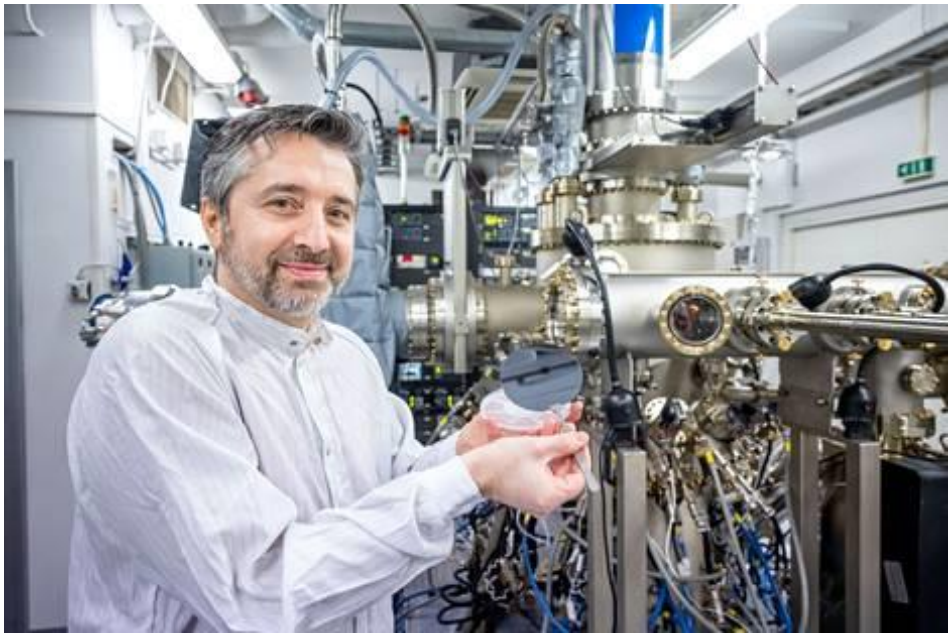
He is widely known for his innovative research and development work on semiconductor technology and optoelectronics. The CTO of the Year award was given to Juha Kytölä from Wärtsilä in the big companies' category, and Kuan Yen Tan from IQM Quantum in the SME category.

The awards were given by **Technology Industries of Finland** and innovation consulting company **Spinverse** on 21 March 2023 at the CTO Forum. The purpose of the awards is to highlight the importance of the work of chief technology officers, and the professors collaborating with companies, on the future competitiveness of Finnish industry. This year the event focused on leading companies and ecosystems and their impact both on business and on the societal level.

Read More on Mircea Guina receives the Innovation Professor of the Year 2023 award | Tampere universities (tuni.fi)

Science and technology: Tampere is planning to become a centre of excellence in the field of chips

The University of Tampere is currently coordinating the Soc Hub project, which aims to strengthen the competence in system circuit design and microelectronics in Finland. Finland aims to be a leading country in Europe's chip expertise. Chip competence centres and piloting environments are being planned both in Hervanta in Tampere and at Aalto University in Espoo.



Professor of Optoelectronics **Mircea Guina** holds a gallium arsenide disc in his hand. According to Pauli Kuosmanen, Director of Research and Innovation Services, **companies in the Tampere region have a great need for designers**. PHOTO: TIMO MARTTILA

Read the entire article on Microchips: A centre of excellence in the field is planned for Tampere - Science and Technology - Aamulehti

Congratulations to our Associated Partner Dr. Pearse Keane from Moorfields Biomedical Research Centre for being appointed as NIHR Senior Investigator - receiving the prestigious role as leader in people-based health research!

Senior Investigators are the most prominent and accomplished researchers within the NIHR community, taking the lead in people-based health research. They make up the NIHR College of Senior Investigators and are also members of the NIHR Academy.

Nationally, there are only around 200 NIHR Senior Investigators at any one time, with **only about 30 new appointments made every year**, so competition to join the group is fierce. We therefore commend all three professors for their successful applications this year, based on their outstanding careers as clinician researchers in ophthalmology.

Each Senior Investigator receives a **discretionary award of £20,000 a year for four years to fund activities that support research**. Their role is to guide the development of research capacity and to act as mentors, helping other NIHR researchers progress in their careers. Senior Investigator status can be awarded for up to two terms.

Professors Alastair Denniston and **Pearse Keane** and have been newly appointed as NIHR Senior Investigators, while Professor Jugnoo Rahi has been re-appointed for a second four-year term.

Prof. Alastair Denniston

Prof. Jugnoo Rahi

Prof. Pearse Keane

Read More on New NIHR Senior Investigators 2023

Optics at forefront of AI in healthcare

Attendees at the Optical Suppliers Association stand at 100% Optical were told how artificial intelligence (AI) was going 'from code to clinic' by **Professor Pearse Keane.**

The consultant ophthalmologist said optical coherence tomography (OCT) acquired more images per year than all other modalities combined with Moorfields Eye Hospital taking over 1,000 OCT scans a day.

'*We are drowning in the number of patients we need to see, but new technology can address some of these problems by applying deep learning to these images. Technology is really advancing ophthalmology and optometry which are at the forefront of AI in healthcare. The promise of AI is how we bring world-class expertise out of specialised hospitals and potentially into the community and homes of patients,*' Keane said.

Professor Pearse Keane at 100% OSA stand

Read the article on Optics at forefront of AI in healthcare - Optician (opticianonline.net)

H(eye) Definition

STOC-T: a new tomography device that changes the scope for retinal and choroidal imaging

Although Optical Coherence Tomography (OCT) scans are widely considered the best diagnostic technique for detecting eye conditions, the images they produce are far from perfect. Due to noise and/or limited axial range, OCT scans are unable to capture all the layers of the retina and choroid – resulting in poor quality images, and thus, poorer quality diagnoses.

New research – from The International Centre for Translational Eye Research (ICTER) in Poland – has managed to find a way around these limitations through the development of Spatio-Temporal Optical Coherence Tomography (STOC-T). This new method makes it possible to view the retina and choroid with high resolution at distinct depths in the frontal section – something that has not been achieved previously.

Maciej Wojtkowski – the lead researcher from this study – **speaks about STOC-T's development, the limitations of OCT, and the future of retinal imaging.**

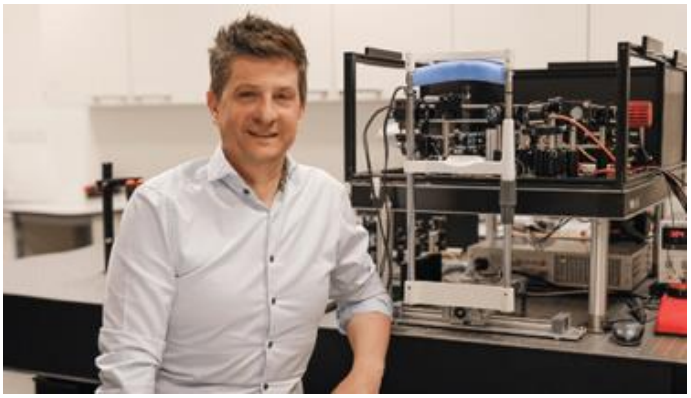


Image by Piotr Furman

What inspired the development of STOC-T? What are the limitations of OCT – recognized as it is as the current gold standard of clinical imaging? How does the new technology work to provide high quality images of the retina and choroid? What are the limitations for the clinical application of this new technology?

Find out these answers at A New Imaging Method Enables High Resolution Depictions of the Retina and Choroid at Distinct Depths (theophthalmologist.com)

PUBLICATIONS

Widely tunable 2 μm hybrid laser using GaSb semiconductor optical amplifiers and a Si3N4 photonics integrated reflector

Nouman Zia, Samu-Pekka Ojanen, **Jukka Viheriala,** Eero Koivusalo, Joonas Hilska, Heidi Tuorila, and **Mircea Guina**

Optics Letters, Vol. 48, Issue 5, pp. 1319-1322, (2023)

https://doi.org/10.1364/OL.480867

Tunable lasers emitting in the 2–3 μm wavelength range that are compatible with photonic integration platforms are of great interest for sensing applications. To this end, combining GaSb-based semiconductor gain chips with Si_3N_4 photonic integrated circuits offers an attractive platform. Herein, we utilize the low-loss features of Si_3N_4 waveguides and demonstrate a hybrid laser comprising a GaSb gain chip with an integrated tunable Si_3N_4 Vernier mirror. Read More

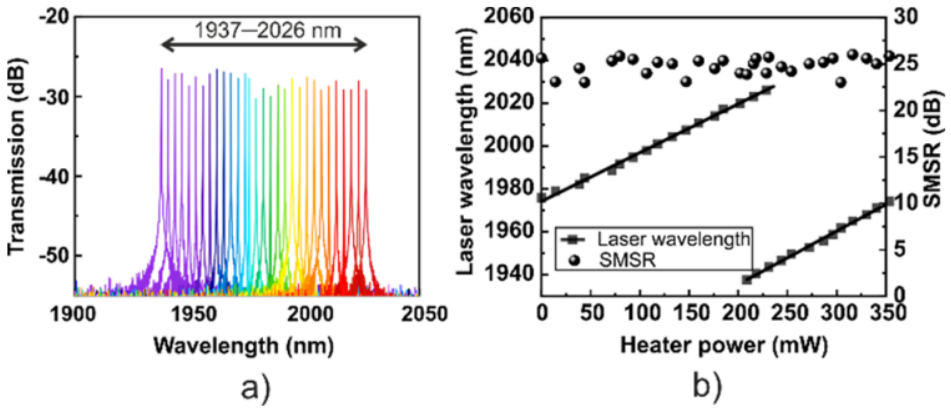


Fig. 7. (a) Superimposed emission spectra of the laser tuned by varying the RR heater power, and (b) wavelength tuning as a function of the heater power, and the SMSR across the entire tuning range.

High-power, high-repetition-rate tunable longwave mid-IR sources based on DFG in the OPA regime

Yang Liu, Jimin Zhao, Zhiyi Wei, Franz X. Kärtner, and Guoqing Chang

Optics Letters, Vol. 48, Issue 4, pp. 1052-1055, (2023)

https://doi.org/10.1364/OL.482461

We demonstrate high-power longwave mid-IR ultrafast sources based on a high-power Er-fiber laser system at 1.55 μm with a 32-MHz repetition rate. Compared with previous 1.03-μm-driven difference frequency generation (DFG), our current configuration allows tighter focusing in the GaSe crystal thanks to an increased damage threshold at 1.55 μm. Consequently, the 1.55-μm-driven DFG can operate in the regime of optical parametric amplification (OPA), in which the mid-IR power grows exponentially with respect to the square root of the pumping power. We experimentally demonstrate this operation regime and achieve broadband mid-IR pulses that are tunable in the 7.7–17.3 μm range with a maximum average power of 58.3 mW, which is also confirmed by our numerical simulation.

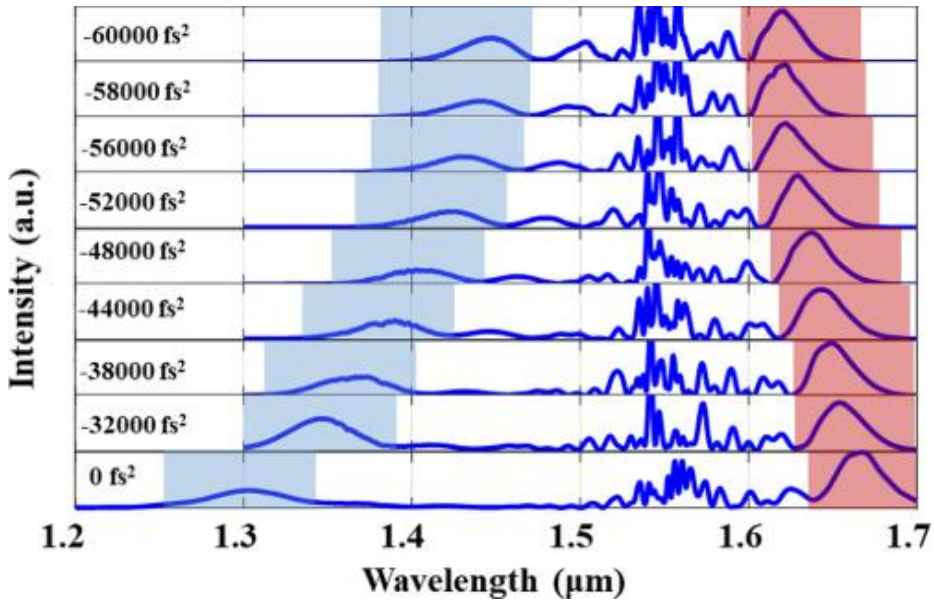


Fig. 6. Spectral broadening in a 9.6-cm DSF with different amounts of negative pre-chirping GDD added to the input pulse.

Novel Photodiode Cuts Excess Noise, Offers High Detection Efficiency

Researchers at the University of Sheffield **designed and developed an avalanche photodiode (APD) with significant potential for low photon detection.** The highly sensitive gallium arsenide antimonide/aluminum gallium arsenide antimonide (GaAsSb/AlGaAsSb) separate absorption and multiplication avalanche photodiode (SAM-APD), which the researchers believe signifies a milestone in the development of infrared (IR) APDs, demonstrates very little added noise to interfere with signal recognition.

The novel APD features a GaAsSb absorption region and an AlGaAsSb avalanche region. It **features low tunneling current** in addition to high usable avalanche gain and extremely low excess noise factors.

APDs are widely used in optical receivers for high-speed, optical fiber-based communication and **lidar** applications, which require extremely sensitive photodiodes that are capable of detecting very low levels of light intensity — in some cases, detection down to a few photons or single-photon level.

*Researcher Tarick Blain and team members designed an extremely low excess noise avalanche photodiode with a GaAsSb absorption region and an AlGaAsSb avalanche region. Core applications for the APD include lidar and **optical communications**. Courtesy of the University of Sheffield.*

Read More on Novel Photodiode Cuts Excess Noise, Offers High Detection Efficiency | Research & Technology | Feb 2023 | Photonics.com

Coherently averaged dual-comb spectroscopy with a low-noise and high-power free-running gigahertz dual-comb laser

C. R. Phillips, B. Willenberg, A. Nussbaum-Lapping, F. Callegari, S. L. Camenzind, J. Pupeikis, and U. Keller

Optics Express, Vol. 31, Issue 5, pp. 7103-7119, (2023)

https://doi.org/10.1364/OE.479356

We present a new type of dual optical frequency comb source capable of scaling applications to high measurement speeds while combining high average power, ultra-low noise operation, and a compact setup. Our approach is based on a diode-pumped solid-state laser cavity which includes an intracavity biprism operated at Brewster angle to generate two spatially-separated modes with highly correlated properties. The 15-cm-long cavity uses an Yb:CALGO crystal and a semiconductor saturable absorber mirror as an end mirror to generate more than 3 W average power per comb, below 80 fs pulse duration, a repetition rate of 1.03 GHz, and a continuously tunable repetition rate difference up to 27 kHz. Read More

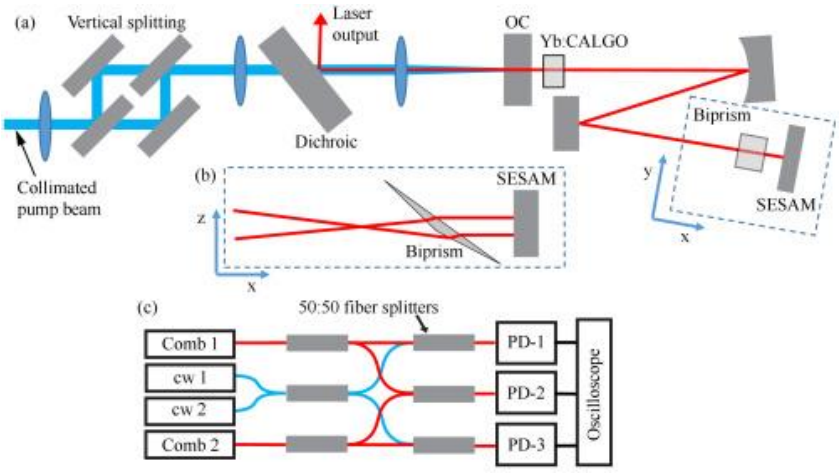
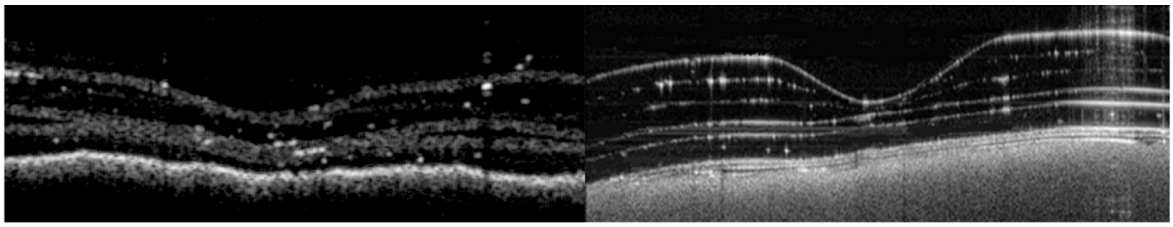


Fig. 1. Laser setup and diagnostics. (a) Top-down schematic of laser cavity and pump arrangement. The combs are multiplexed in the vertical, so from this view only one beam path is visible for the laser. A single pump diode is collimated and split into two parts to pump each comb separately as shown on the left of the figure. (b) Side-view schematic around the SESAM end of the cavity, showing how the combs are multiplexed at the Brewster-angled biprism. The combs are also separated vertically in the gain crystal. (c) Heterodyne measurement setup from [26]. Heterodyne measurements are generated between the two combs, and between the individual combs and the two cw lasers. Gigahertz-bandwidth photodiodes (PDs) are used for each signal.

Siloton Obtains Ground-breaking Optical Coherence Tomography Image With First-generation “Akepa” Photonic Chip

Siloton Limited, a trailblazing UK start-up, has acquired a sub-surface image of the retina in a synthetic eye, using its revolutionary photonic chip technology. The synthetic eye, more commonly known as a retinal phantom, is anatomically analogous to a real eye and is used to calibrate clinical devices.

- Siloton Limited has acquired a sub-surface image of the retina in a synthetic eye, using its revolutionary photonic chip technology.
- The synthetic eye, more commonly known as a retinal phantom, is anatomically analogous to a real eye and is used to calibrate clinical devices.
- The image was taken with Siloton’s first-generation optical coherence tomography (OCT) chip, *Akepa*.



Left: Siloton’s first OCT image of a Rowe Technical Design OCT Model Eye retina tissue phantom, acquired using a photonic chip.

Right: Reference image of a Rowe Technical Design OCT Model Eye retina tissue phantom, taken with a traditional OCT system by UC Davis Depart. Of Ophthalmology Advanced Retina Imaging Laboratory. Reproduced here by permission of Rowe Technical Design, Inc.

About *Akepa:* *Akepa* is Siloton’s first-generation OCT chip, designed using *Redfield, a* proprietary, in-house component library. The core circuit comprises over 300 optical and electronic elements, with a further 200 elements integrated alongside this as part of a series of test structures. With approximately 70% of the OCT system on-chip, this is already at the same level of integration as will be required in the final product. *Akepa* was fabricated in a commercial foundry, providing a clear route to high-volume manufacture at the scales required for widespread monitoring and treatment of retinal disease.

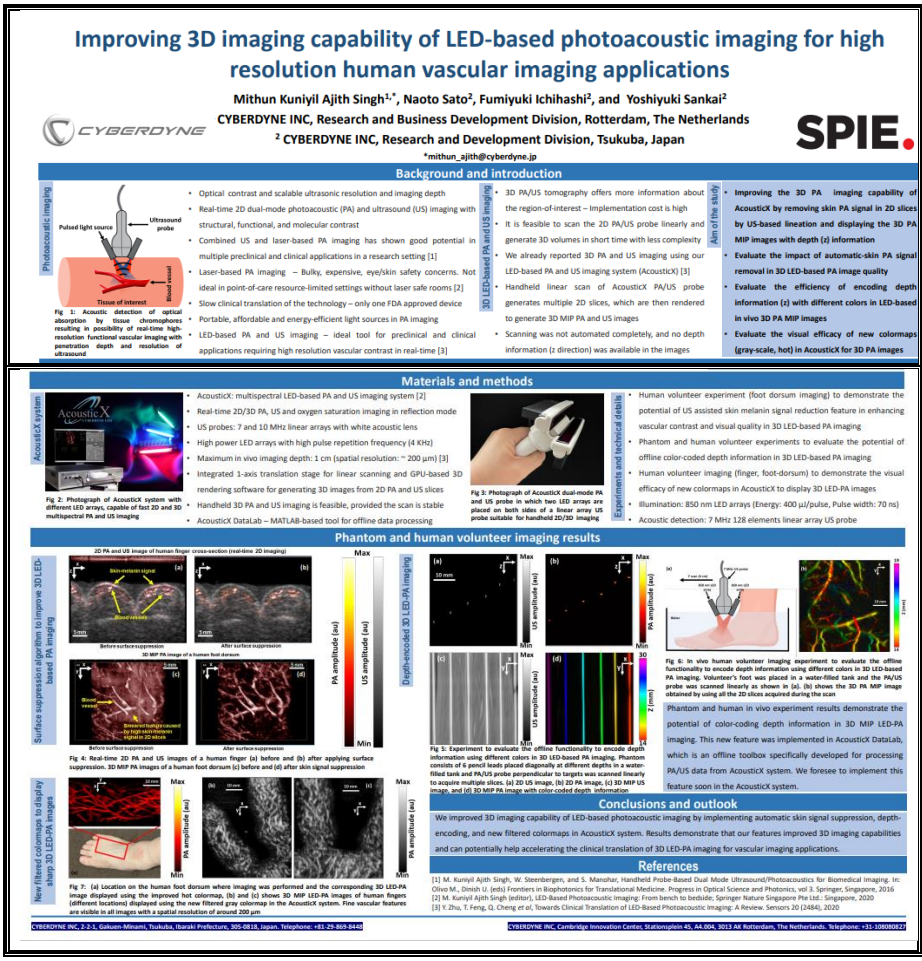
Read More on Siloton Obtains Ground-breaking Optical Coherence Tomography Image With First-generation “Akepa” Photonic Chip (thequantuminsider.com)

Improving 3D imaging capability of LED-based photoacoustic imaging for high resolution human vascular imaging applications

Conference Poster

Mithun Kuniyil Ajith Singh, Naoto Sato, Fumiyuki Ichihashi, Yoshiyuki Sankai

Proceedings Volume 12379, Photons Plus Ultrasound: Imaging and Sensing 2023; 123790R (2023) https://doi.org/10.1117/12.2651193
Event: SPIE BiOS, 2023, San Francisco, California, United States



Visualizing blood vessel networks in 3D is helpful in many superficial vascular imaging applications. We previously reported the feasibility of LED-based photoacoustic imaging in visualizing human vasculature in 3D by linear translation of combined photoacoustic/ultrasound imaging probe. In this work, we improved this 3D imaging functionality by **1)** automatic removal of skin PA signal in different 2D slices by ultrasound-based lineation , **2)** encoding depth information with different colors and **3)**improving the grayscale and hot color maps. All these new features were implemented in the system software and we validated these using phantom and human in vivo imaging experiments.

Results demonstrate that the newly implemented features significantly improved the 3D imaging capability in our LED-based photoacoustic and ultrasound imaging system. We believe that the improved 3D imaging functionality in the system will be potentially useful for multiple preclinical and clinical applications in which the visualization of vasculature in 3D is a prerequisite.

An optical design enabling lightweight and large field-of-view head-mounted microscopes

Scherrer, J.R., Lynch, G.F., Zhang, J.J. *et al.*

Nature Methods (2023). https://doi.org/10.1038/s41592-023-01806-1

Here we present a fluorescence microscope light path that enables imaging, during free behavior, of thousands of neurons in mice and hundreds of neurons in juvenile songbirds. The light path eliminates traditional illumination optics, allowing for head-mounted microscopes that have both a lower weight and a larger field of view (FOV) than previously possible. Using this light path, we designed two microscopes: one optimized for FOV (~4 mm FOV; 1.4 g), and the other optimized for weight (1.0 mm FOV; 1.0 g).

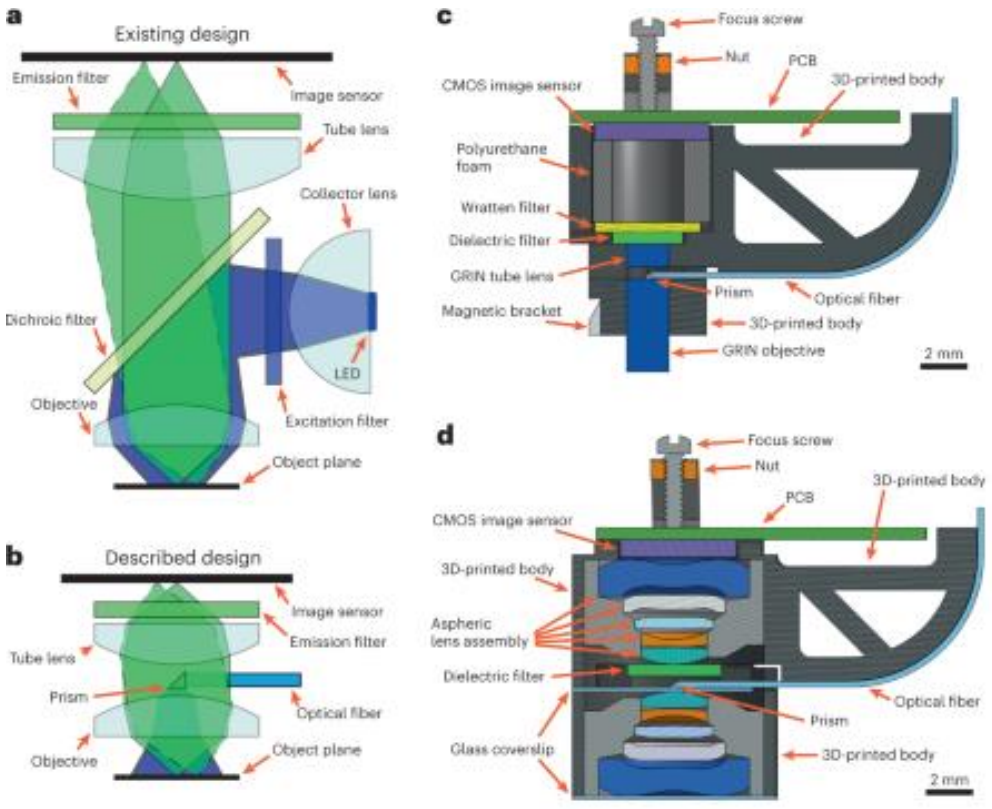
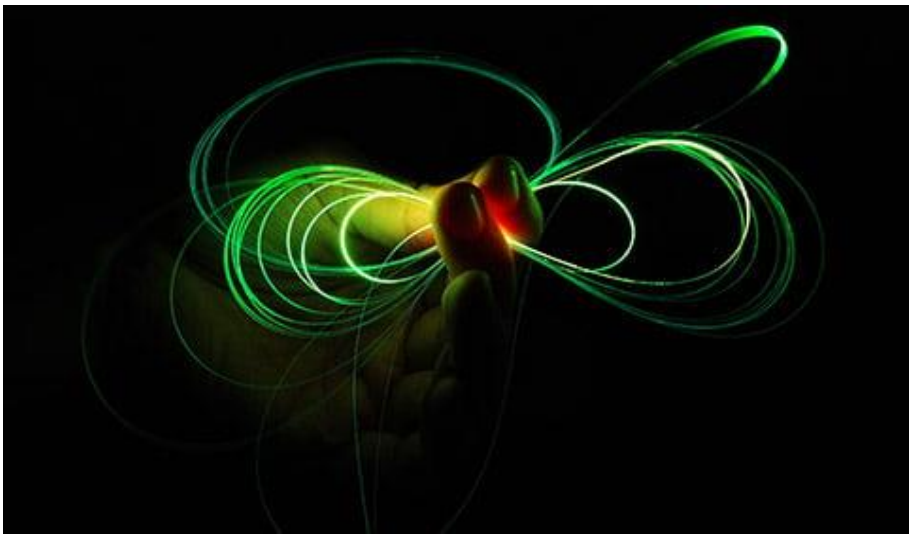


Fig. 1 a,**b**, Schematic representation of optical path for standard head-mounted microscopes (**a**) and for the microscopes in this paper (**b**). Ray traces are the excitation light path (blue) and emission light paths for points on-axis (solid green) and off-axis (dashed green). **c**, Cross-section diagram for the Featherscope. **d**, Cross-section diagram for the Kiloscope.

Researchers Shrink Dimensions in Which Light Can Be Confined

The degree to which light can be confined determines the intensity and precision of light-based devices. It also sets the limits within which nanoparticles can be observed. For these reasons, finding ways to confine and control light in ever smaller volumes is an ongoing challenge for the photonics community. Scientists from the University of Southampton, in collaboration with colleagues at the Technical University of Dortmund and the University of Regensburg, **have demonstrated that a light beam can be confined to a spot that is 50× smaller than its own wavelength**. In a first-of-its-kind demonstration, the researchers said, the team further showed that the spot can be moved by miniscule amounts at the point where the light is confined.



Researchers believe that the demonstrated approach for the active control of confined electromagnetic fields could influence multiple nanophotonic applications. Courtesy of the University of Southampton.

Read More on Researchers Shrink Dimensions in Which Light Can Be Confined | Research & Technology | Mar 2023 | Photonics.com

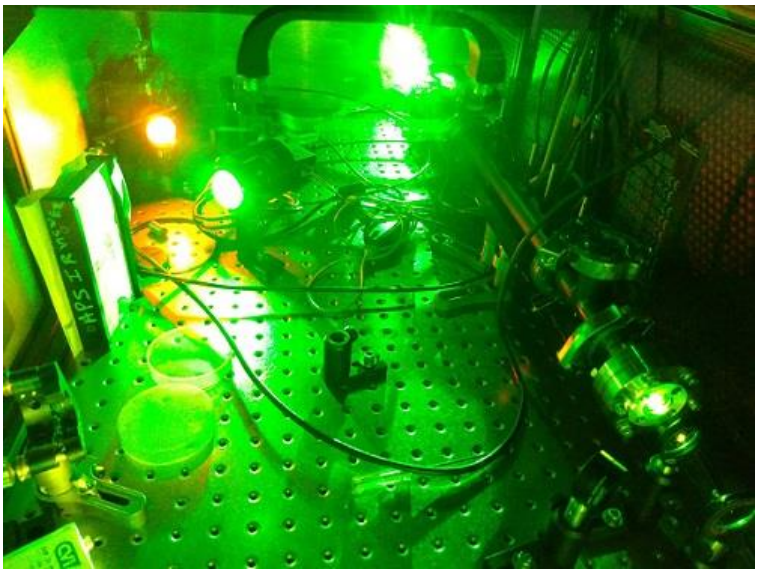
The research was published in *Optica* (www.doi.org/10.1364/OPTICA.473085).

Simple Approach to Laser Color Conversion Uses SRS in Ionic Liquids

Scientists from Brookhaven National Laboratory showed that ionic liquids provide an efficient means to convert one color of laser light into another. **The discovery could lead to a way to create lasers** with desired colors for a range of medical, scientific, and technological applications.

The method is based on the interaction between the laser and different types of ionic liquids (also known as liquid salts). The vibrational energy in the chemical bonds in the ionic liquid cause the laser's energy to shift and change color.

"*By adding a certain ion that has a particular vibrational frequency, we can design a liquid that shifts the laser light by that vibrational frequency*," chemist James Wishart said. "*And if we want a different color, then we can switch out one ion and put in another that has a different vibrational frequency. The component ions can be mixed and matched to shift laser colors by different degrees as needed*."



Shooting a green laser through a tube filled with a particular ionic liquid (right side of photo) can easily convert the green laser light to orange (upper left) — a long-sought color for medical applications. The method can be tailored for different color shifts by choosing different ionic liquids. Courtesy of Brookhaven National Laboratory.

Read More at https://www.photonics.com/

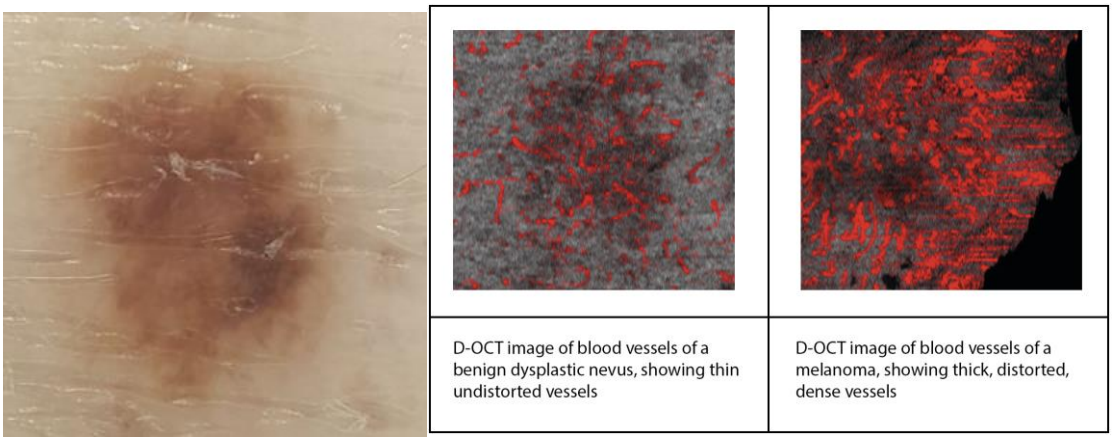
Study finds Dynamic OCT can distinguish nevi and melanomas based on blood vessel morphology

The study, published in *Cancers* clinical journal, showed that VivoSight's powerful Dynamic OCT (D-OCT) capability for detecting and imaging blood vessels in skin has the potential to help dermatologists non-invasively distinguish melanomas from suspicious nevi in unclear cases.

According to the paper authors, adding D-OCT imaging to clinic-dermoscopic examination may:

- improve diagnostic approach to unclear melanocytic lesions
- limit unnecessary biopsies
- accelerate and individualise the treatment plan

Magnified visual view of a suspicious nevus



D-OCT image of blood vessels of a benign dysplastic nevus, showing thin undistorted vessels

D-OCT image of blood vessels of a melanoma, showing thick, distorted, dense vessels

Perwein MK, Welzel J, De Carvalho N, Pellacani G, Schuh S. Dynamic Optical Coherence Tomography: **A Non-Invasive Imaging Tool for the Distinction of Nevi and Melanomas**. Cancers. 2022 Dec 20;15(1):20.

https://www.mdpi.com/2072-6694/15/1/20

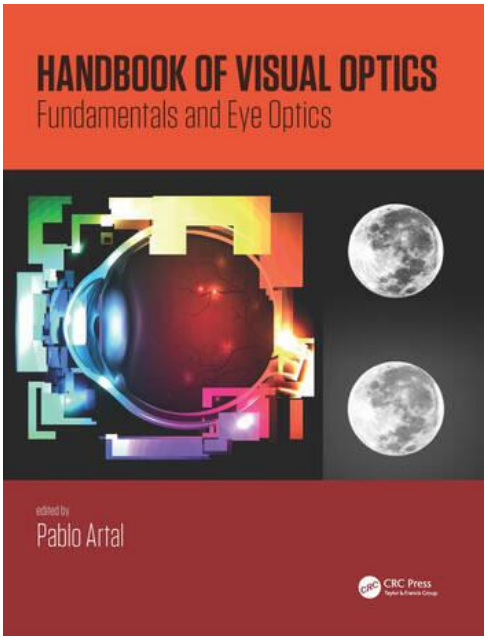
For more information visit **https://us.vivosight.com/skin-vasculature-blood-flow/**

Handbook of Visual Optics

Two-Volume Set

*Edited by **Pablo Artal***

Handbook of Visual Optics offers an authoritative overview of encyclopedic knowledge in the field of physiological optics. It builds from fundamental concepts to the science and technology of instruments and practical procedures of vision correction, integrating expert knowledge from physics, medicine, biology, psychology, and engineering. The chapters comprehensively cover all aspects of modern study and practice, from optical principles and optics of the eye and retina to novel ophthalmic tools for imaging and visual testing, devices and techniques for visual correction, and the relationship between ocular optics and visual perception.



Volume One:

Fundamentals and Eye Optics. Fundamentals/Background. Optical properties of the eye.

Volume Two:

Instrumentation and Vision Correction. Ophthalmic instrumentation. Vision correction. Impact of eye's optics in vision.

ISBN 9780367777982
Published May 26, 2021 by CRC Press
832 Pages

Order the book here or from Amazon vol 1 and vol 2

Hear from Dr. Artal at this Q&A session: http://ow.ly/wudA30fLW84

Classic Physics Papers

A collection of classic physics papers, with brief commentary. **This is supposed to become a collection for students,** to be displayed in the lounge of **Max Planck Institute for the Science of Light** - that means the topics skew towards optics and quantum (not high energy physics or astro). This is an evolving list, compiled and with commentaries written by Florian Marquardt.

Read More on Classic Physics Papers - HedgeDoc (gwdg.de)

CONFERENCES

International Summer School New frontiers in Optical Technologies 11th edition
August 8-11, Tampere, Finland
in conjunction with the
NETLAS International Conference

Tutorial type of lectures covering laser technologies, imaging (including bio-imaging technology), quantum technology, photonic integration, transferable skills.

More information and registration open at the end of March. All NETLAS ESRs are expected to present orally.

Two speakers confirmed:
Prof. Ursula Keller (ETH)
Dr. Mark Kuznetsov (Axsun Technologies).

More information will follow in the next Newsletter.

Student Theses -Optical Coherence Tomography News

Polarization-Sensitive Optical Coherence Tomography to Study Diffusion of Plasmonic Gold Nanorods— a Novel Tool for Optical Bioimaging

By **Raghav K. Chhetri**

University of North Carolina at Chapel Hill

USA

Aims of this thesis: Optical Coherence Tomography (OCT) is an imaging tool that performs micron resolution, non-invasive, cross-sectional imaging by measuring the echoes of backscattered light. In this thesis, a custom-designed polarization-sensitive OCT (PS-OCT) system is discussed, which is implemented in using plasmonic gold nanorods (GNRs) as diffusion probes. PS-OCT imaging is undertaken in Newtonian fluids and validation of rotational and translational diffusion of GNRs with the Stokes-Einstein relation is presented via analysis of the autocorrelations of the OCT signals. Diffusion of GNRs in non-Newtonian fluids is also studied and the frequency-dependent viscoelasticity is also explored using generalized Stokes-Einstein relation. Furthermore, diffusion of GNRs in the "correlation length ≥ probe" regime is discussed in low concentration polymer solutions. Biological samples such as porous extracellular matrix (ECM) and in vitro mucus are explored using PEGylated GNRs as diffusion probes with PS-OCT imaging. The diffusion of GNRs was found to be sensitive to changes in the ECM induced either by ECM-remodeling fibroblasts or by changes in the ECM concentration. ------- This thesis presents a platform for extending the reach of OCT imaging to the exciting fields of microrheology and bio-rheology, which holds tremendous promise in the assessment of micro- and nano- scale viscoelasticity of biological samples using GNRs as probes.

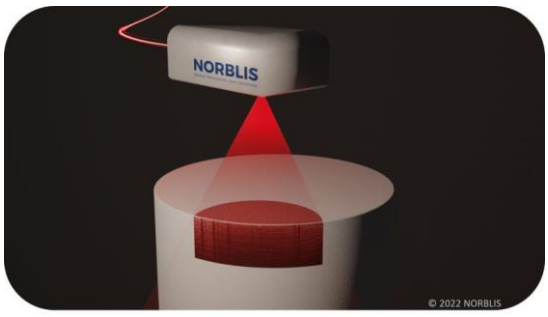
Read More

Did you hear about NORBLIS new project ?

Have a look at what mid-infrared supercontinuum sources can accomplish when used in an OCT system:
non-contact, non-destructive in-line inspection of ceramic multi-layer stacks - providing eyes at mm depth into ceramic

With the 11M€ and 29-partner Horizon Europe project ZDZW project well under way we can now reveal more about what it's all about and what our role is. ZDZW, including endusers Siemens, Lithoz GmbH, GLN and illycaffè will develop digitally enhanced zero defect, zero waste manufacturing for a wide range of industries. NORBLIS will contribute to the project by employing our unique mid-infrared Optical Coherence Tomography scanner for non-destructive inspection. Specifically we join forces with Austrian company Lithoz GmbH and German company airCode to develop cost-effective in-line quality inspection of ceramic antenna modules used for in-vivo medical applications.

If you need cutting-edge technology for non-destructive testing of highly scattering media such as ceramics, paints and coatings, just let us know at contact@norblis.com



Post | Feed | LinkedIn

This imaging platform will significantly increase the quality of the diagnosis, reduce the burden on patients and reduce the costs for the healthcare system.

Scinvivo first focusses on the medical needs in bladder cancer. Scinvivo's forward-looking OCT-catheter provides the answer by giving urologists real time ultra high resolution (a few micrometers) insight in the anatomical structure during diagnosis (cystoscopy).

During cystoscopy, only the surface of the bladder wall is visible. Getting insight into the anatomical structure is crucial for a fast and better diagnosis. Using Scinvivo's OCT catheter addresses directly the unmet needs in bladder cancer diagnosis & care:

1. differentiating between non-invasive (TIS - T1) and muscle-invasive bladder cancer(T2 - T4) as early as possible in the diagnostic process (a faster diagnosis increases the survival chances up to 30%),

2. the follow-up monitoring of BC patients to reduce the number of unnecessary surgeries caused by false positives (up to 50% of the surgeries).

Their product offering consists of a single use catheter and a base station. All individual catheter parts are tested and now combined into a catheter with an outer diameter of 2.5 mm (7.5 Fr). The forward looking OCT catheter allows the medical professional; to capture a cross section of the tissue with a field of view of 5 mm and a depth of 2-3 mm. The working distance from the tip of the catheter to the tissue is ~10 mm. Artifacts in the image due to body movements are reduced to an absolute minimum by means of a refresh rate >>60Hz. Furthermore, the catheter is single use preventing cross patient infections.

News from Scinvivo can be found on their webpage

TECHNICAL UNIVERSITY OF DENMARK (DTU) – NETLAS BENEFICIARY – RANKS THIRD AFTER STANFORD AND MIT

The Technical University of Denmark (DTU) now ranks third among the best 'Engineering and Technology' universities in the world, just after Massachusetts Institute of Technology **(MIT)** and **Stanford University**. This ranking is published by Research.com, a leading academic research portal, based on data collected from Microsoft Academic Graph.

The Technical University of Denmark (DTU) was founded in 1829 by Hans Christian Ørsted, the prominent Danish physicist and chemist. Today, it is a public university located in Copenhagen and organized into **27 departments**, by which its **top three research fields are biology, physics, and computer science.** DTU has 11,031 students enrolled, 7,197 of whom are undergraduates, 3,834 postgraduates, and 1,330 PhD students.

DTU also exemplifies Denmark's usage of the triple helix model of innovation, as the university has strong collaborative ties with both the government and private companies. In particular, DTU's capabilities prove to be very valuable to private companies.

Read More at https://investindk.com/insights

Open PhD position at DTU, Denmark

Do you know anyone, who would be interested in a PhD Fellowship in Effects of Higher Order Modes on Optical Fiber Amplifiers and Lasers?

The PhD project is part of EU-funded Doctoral Network and will be in collaboration with the fiber manufacturer OFS-Denmark.

The position is mostly interesting for non-Danes as the candidate must not have lived in Denmark for more than 12 months in the 36 months immediately before your recruitment date.

For more information and application:

https://lnkd.in/eDUt2xiF

The latest official VDI Guideline 5565 on the use of **OCT (Optical Coherence Tomography)** for predominantly technical applications has been published by NETLAS Associated Partner RECENDT.

Dr. Bettina Heise (RECENDT, Head of OCT) was actively involved in the expert committee of the VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik (GMA) and contributed the requirements of industry and users.

Companies and research institutions with a focus on industrial metrology and medical technology work together in the VDI/VDE-Gesellschaft Mess- und Automatisierungstechnik (GMA) in an expert committee on OCT and have now published a first draft guideline with standardised process descriptions.

The aim of the guideline is to advise users of OCT systems on important physical and technical parameters and procedures for system selection and on the basic applicability of OCT.

The guideline VDI/VDE 5565 part 1 can be obtained here: **VDI/VDE 5565 Part 1 - Optical Coherence Tomography (OCT) - Process descriptions**.

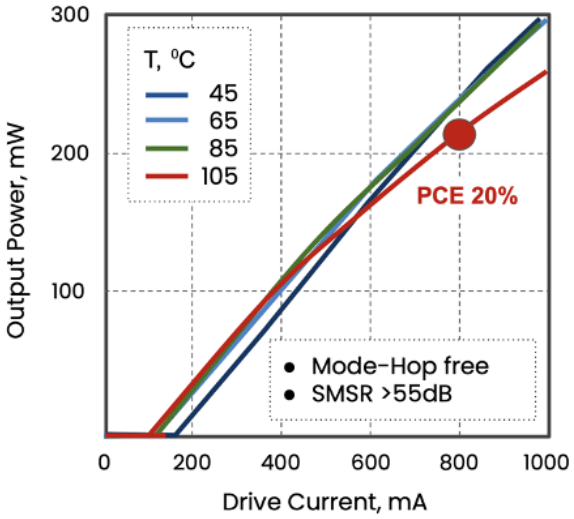
The next document of this guideline is in progress: VDI/VDE 5565 Sheet 2 - Optical Coherence Tomography (OCT) - Signal Processing and Data Evaluation.

Read More on New VDI guideline 5565 on the use of OCT - RECENDT | Research Center for Non-Destructive Testing GmbH

Alfalume Inc. in partnership with **NETLAS Beneficiary Innolume GmbH** announces sample availability of its O-band high power InAs/GaAs Quantum Dot DFB lasers which offers best-in-class output power, wall plug efficiency, temperature range as well as fundamentally better reliability of QD lasers compared to QW counterparts.

The Aflalume QD **lasers provide significant benefits for high speed datacom transceivers, including record high power and conversion efficiency at temperatures above 85°C without requiring thermoelectric coolers, optical isolator free operation, and lower cost due to significantly reduced component costs and better assembly yields.**

"***Our QD laser technology matches the operation temperature of photonics to the highest operating temperature of modern electronics. There is no other technology today which can provide the power level of O-band DFB lasers above 200mW with power efficiency of 20% at 1050C with the ability to operate efficiently up to 1500C"*** said Alexey Kovsh, Alfalume CEO. "***Our uncooled lasers are ideal for pluggable transceivers offering the highest efficiency at high temperatures***".



QD DFB lasers offer the following performance characteristics:

- **250mW @85°C, which can be split into 4 or 8 channels for 800G and 1600G DR8 Modules**
- **20% Power Conversion Efficiency at 105°C**

Read More at Our partner Alfalume announces availability of 1.3 µm high power uncooled QD Lasers - Innolume

Near-IR femtosecond light pulses for neuroscience using NKT Photonics products

Meadowlark Optics has developed a Spatial Light Modulator to activate neurons in the brain. They used NKT Photonics near-IR femtosecond light pulses from the aeroPULSE FS50.

In optogenetics, light induces neural activity in defined cell types expressing photo-sensitive microbial opsins that either generate or suppress neuronal activity.

To target neurons in the brain, Spatial Light Modulators (SLMs) are used to generate 3D holographic patterns of nearly diffraction-limited or soma-sized spots. To further understand perception, neuroscientists aim to replicate naturalistic patterns of neural activity, and **Meadowlark Optics recently developed an SLM that allows for fast switching as well as a larger field of view.**

The question was if the new SLM could withstand the high peak intensities from near-IR femtosecond lasers needed to stimulate a larger population of neurons. In this case study, Meadowlark stress-tested their new SLM using near-IR femtosecond light pulses from the aeroPULSE FS50.

Read More on Near-IR femtosecond light pulses for neuroscience - NKT Photonics

OPTICS & PHOTONICS NEWS

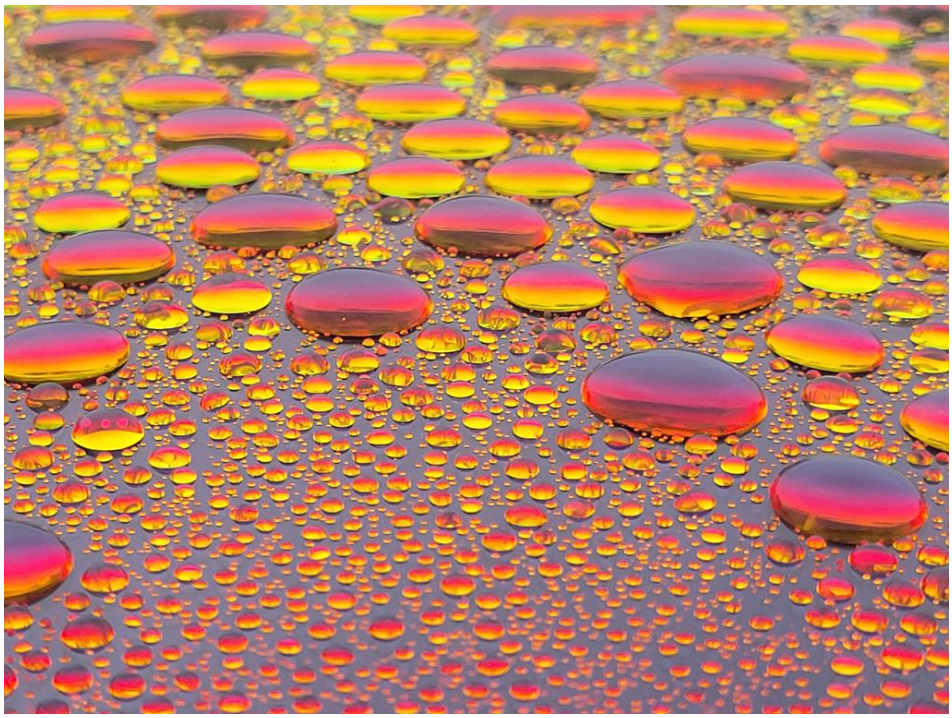
Optics & Photonics News Magazine
March 2023 Issue

- Subsea Fiber: Into the Deep
- Topology: Photonics on the Edge
- François Arago and the Birth of Interferometry

Browse all Issues

Image of the Week

Striking images of optics and photonics, contributed by OPN readers



Glowing Raindrops

Droplets from a rainstorm collect on the panoramic glass roof of an early Tesla Model 3.

The unique color is indicative of a multi-layer dichroic coating—presumably for both UV and IR blocking, since the car stays quite cool in the Arizona sun. Image captured with a Galaxy S21+.

—Katie Schwertz, Edmund Optics, Tucson, AZ, USA

Webinars

We recommend our NETLAS PhD students to attend these upcoming webinars (part of the free Thorlabs webinar series). Thorlabs' Digital Webinars are covering a variety of topics, each with a dedicated live Q&A session, and have a common goal of providing educational, engaging, and valuable content.

Thorlabs Previously Recorded Webinars

Thorlabs' Digital Webinar series began in mid-2020. Each webinar and Q&A session is recorded and added to the archive on Thorlab's web page.

Coming Soon!

Thorlabs' Strategy for Sustainable Work Force Development

The photonics manufacturing industry requires a highly skilled workforce to design, manufacture, and assemble the precise instruments and equipment necessary for advanced research and development in the medical, telecommunications, and defense industries. Join Thorlabs' Business Development Manager, Navid Entezarian, as he outlines the approach Thorlabs is taking to solve the trained workforce shortage.

Presented by Navid Entezarian,

Business Development Manager, Thorlabs

Navid Entezarian began his career at Thorlabs in 2013 as a production engineer, and has worked his way through the optics department to his current role as Business Development Manger. In this role, he focuses on growing the optics and mechanics unit here at Thorlabs. Navid graduated from New Jersey Institute of Technology with a degree in Physics and has since then been involved in the photonics industry to become a seasoned specialist in the optics field.

Click to Register!

Browse All Job Openings
on their Careers Page

Kent Academic Repository celebrates its 16th birthday & 100,000th record

Colleagues from across the university celebrated 16 years of the Kent Academic Repository (KAR), and it's 100,000th record, at the KAR Party.

Colleagues who have all been part of the Kent Academic Repository's story they warmly welcomed to celebrate with cake and to catch-up with colleagues from across the university.

Professor Shane Weller, Deputy Vice Chancellor for Research and Innovation, opened the event by sharing stories about KARs origins, its development over the last 16 years, and acknowledged the many staff who have been part of its story.

Find out more about why they are celebrating the 16th Birthday of the Kent Academic Repository, including where it all began and their plans for the future. Event slides and photographs can also be accessed on the Kent Academic Repository.

Shane Weller cuts the celebratory cake with the IS Research & Scholarly Communications Support team

University of Kent offers emergency food packages to student struggling with cost of living

A university has opened a foodbank for students to help combat the cost of living crisis. The University of Kent, which has campuses in Canterbury and Medway, is offering food packages for those who need it.

The University of Kent has joined The Food Foundation in launching the Right to Food University scheme© Kent Online

It has joined The Food Foundation in launching the Right to Food University scheme which aims to provide people with the "basic human right" of food. Canterbury Christ Church University and Greenwich University are also part of the project.

Students are being asked to fill out an online form with their student ID, which university they attend, and any dietary restrictions, including vegan, vegetarian, halal, kosher and gluten-free, as well as what time and where they can pick up the package. Read More here and here.

Browse Guide pages - Help - University of Kent

Did you know the March 2023 Events Celebrations & Special Days ?

In the following, please find fun events happening this March in England, Scotland, Wales and Northern Ireland as well as around the world.

Fairtrade Fortnight: 27th Feb to 12th Mar 2023

Fairtrade farmers, workers and campaigners up and down the country highlight the difference fair trade can make to lives and communities. Check the website

St. David's Day: 1st Mar 2023

St. David is the patron saint of Wales, and celebrations include wearing daffodils and leeks, eating traditional Welsh food and wearing Welsh national costume.

World Book Day: 2nd Mar 2023

Annual celebration of books and reading celebrated by reading, book related activities and dressing up as characters from books. World Book Day 2023

World Wildlife Day: 3rd Mar 2023

World Wildlife Day is an opportunity to celebrate the many beautiful and varied forms of wild fauna and flora and to raise awareness of the multitude of benefits that conservation provides to people. World Wildlife Day | Official website of UN World Wildlife Day

National Day of Unplugging: 3rd Mar to 4th Mar 2023

Have a 24-hour respite from technology, to inspire you to have a more healthy life/tech balance. Take an hour or a full day away from technology. Unplug Collaborative

Food Waste Action Week: 6th Mar to 12th Mar 2023

A whole week of action to raising awareness of the environmental consequences of wasting food, and promoting activities that help to reduce the amount of food we waste. Food Waste Action Week | WRAP

International Women's Day: 8th Mar 2023
A worldwide celebration of women's rights and celebrating the social, economic, cultural and political achievements of women.
International Women's Day 2023 (internationalwomensday.com)

British Science Week: 10th Mar to 19th Mar 2023
British Science Week is a ten-day celebration of science, technology, engineering and maths. The week aims to to raise awareness, spark enthusiasm and celebrate science, engineering, technology and maths with people of all ages and from all walks of life.
Homepage - British Science Week

Pi Day: 14th Mar 2023
A day for celebrating the wonder of mathematics. The 14th March was chosen because the value of Pi is often taken as 3.14.
Pi Day 14th March (eparenting.co.uk)

Red Nose Day: 17th Mar 2023
The day when people across the land join forces to raise money for brilliant causes in the UK and around the world, by having a good laugh!
Red Nose Day | Comic Relief

St. Patrick's Day: 17th Mar 2023
Ireland's national day is celebrates the Irish patron saint Patrick. The day is celebrated all around the world with Guinness and shamrock decorations.
St. Patrick's Day: Parade, Facts & Traditions - HISTORY - HISTORY

Global Recycling Day: 18th Mar 2023
A day to recognize, and celebrate, the importance recycling plays in preserving our precious primary resources and securing the future of our planet. It is a day for the world to come together and put the planet first.

Home – Global Recycling Day

Robot Day: 18th Mar 2023
Robot Day has been created by the Institution of Engineering and Technology to inspire and educate young people and those who are influential in their lives about STEAM careers.
Home | Robot Day UK Website

Mother's Day (UK): 19th Mar 2023
Also known as Mothering Sunday, this is the day where we show Mum just how much we love her in the UK. Mothering Sunday was traditionally the day when you returned to the "Mother Church" where you were baptised.
Mother's Day in the United Kingdom (timeanddate.com)

World Sleep Day: 19th Mar 2023
A celebration of sleep and a call to action on important issues related to sleep, including medicine, education, social aspects and driving.

World Sleep Day March 18, 2022

Shakespeare Week: 21st Mar to 27th Mar 2023
Shakespeare Week is a national annual celebration giving primary school aged children opportunities for enriching and enjoyable early encounters with Shakespeare.
SHAKESPEARE WEEK - March 21-27, 2023 - National Today

Spring Begins: 20th Mar 2023
Today is the first day of spring in the northern hemisphere, and the first day of autumn in the southern hemisphere.
SPRING EQUINOX - March 20, 2023 - National Today

World Poetry Day: 21st Mar 2023
A UNESCO day to promote the reading, writing, publishing and teaching of poetry throughout the world.
World Poetry Day | UNESCO

Piano Day: 29th Mar 2023
A day for piano players and lovers to share the joy of the piano. It takes place on the 88th day of the year, for the number of keys on a piano.
Piano Day 2023 - Welcome

Wear A Hat Day: 31st Mar 2023
This fundraising day is in aid of Brain Tumour Research. Wear A Hat Day arrives as the culmination of weeks of awareness and campaigning as part of Brain Tumour Awareness Month.
Wear A Hat Day Events| Brain Tumour Research

Romanian Mărțișor –the Celebration of Spring

Mărțișor is an old tradition celebrated all over Romania every year, on **March 1st**. The name **Mărțișor** is a diminutive of March (*Martie* in Romanian).

It is believed that the person who wears the red and white string would enjoy a prosperous and healthy year. Not long ago, in the countryside, people used to celebrate the Martisor by hanging a red and white string at their the gate, window, cattle's horn and shed to protect against evil spirits and to invoke nature's regenerative power.

In eastern Romania (*Moldova* and *Bucovina)*, the red and white string was complemented with a small - gold or silver - coin. After wearing the coin for twelve days, the women would buy fresh cheese with it hopping that their skin would be healthy and beautiful the entire year. According to archaeological research, the Mărțișor traces its history more than 8,000 years ago.

In the old times, Mărțișor were made of small river pebbles, coloured in white and red, stringed on a thread and worn around the neck. They were worn, to bring good luck and good weather, from March 1 until the first trees would bloom. When the first trees were flowering the Mărțișor were hanged on tree branches. Nowadays, on March 1, Romanians buy silky red-white threads *(șnur)* tied into a bow to which a small trinket is attached and offer them to their (female) family members, friends and colleagues to show friendship, respect or admiration.

AOG female members had the privilege to receive Mărțișor from the head of the group Prof. Adrian Podoleanu!

Romanian Spring Traditions - Martisor (romaniatourism.com)

International Women's Day
8 March 2023

Why is International Women's Day celebrated?

It's extremely important to celebrate International Women's Day to honour and appreciate the different achievements that women have accomplished around the world, including successes in society, economy, politics and culture.
It's also a time to remember those who continue to go unheard and are prevented from reaching their full potential, as basic rights like health and education are still not recognised for some women around the world.

International Women's Day (IWD) 2023 campaign theme:#EmbraceEquity

The aim of the IWD 2023 **#EmbraceEquity** campaign theme is to get the world talking about *Why equal opportunities aren't enough*. People start from different places, so true inclusion and belonging require equitable action. Read more about this **here**.

International Women's Day: Women & Technology (internationalwomensday.com)

There are lots of brilliant women to introduce on International Women's Day, from writers, to activists and politicians. Here are just a few:

- Jane Austen - was a writer born in 1775. She was a successful author during a time when people didn't believe women should work. Her work is still read and celebrated today.
- Marie Curie - did ground-breaking research on radioactivity that led to the treatment of many illnesses. She was the first person ever to be awarded two Nobel Prizes.
- Malala Yousafzai - was a little girl when she was hurt because some people thought that girls should not go to school. Malala believed that girls had a right to education and spoke out about her beliefs. She became the youngest person ever to be awarded the Nobel Peace Prize.

Other influential women throughout history, as well as female figures in the field of sport, science, politics, art, including Jane Goodall, Rosa Parks, Dorothy Vaughan, Ada Lovelace, Elizabeth II, and Nicola Adams.

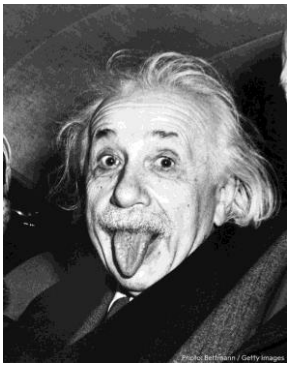
International Women's Day 2023 - University of Kent

Read more about Who Are The Famous Women From History Who Changed The World? | HistoryExtra

Did you know?

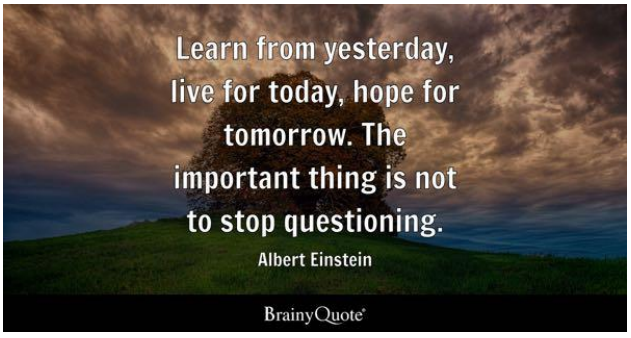
Genius Day is celebrated on 14th March 2023!

When the photographer Arthur Sasse asked physicist and scientist Albert Einstein (14 March 1879 – 18 April 1955) to smile for the camera on his 72nd birthday on 14 March 1951 – this is the image that was taken (see below). Einstein was tired of smiling for all the photographers and instead decided to stick out his tongue. Einstein himself later used the image on greetings cards that he sent to friends. Read Albert Einstein's biography here.



This image has become one of the most famous and iconic images ever taken of laureate Albert Einstein, who was awarded the Nobel Prize in Physics 30 years before the photograph was taken.

Read More about Albert Einstein: His life, theories and impact on science here



Albert Einstein Quotes

This month **we celebrate 144 years since Albert Einstein was born**! Read More about the history of the Genius Day, Genius day activities and important facts about Albert Einstein here.

Happy Birthday Albert Einstein!!

NETWORK EVENTS

We invite all partners to communicate events and ideas to place in our newsletter

Please send any piece of news, on NETLAS activities or anything else happening that may be of interest to the NETLAS community, to Ramona Cernat: R.Cernat@kent.ac.uk and to Adrian Podoleanu: ap11@kent.ac.uk