41st Newsletter of the ITN:

"NExt Generation of Tuneable LASers for optical coherence tomography"

(NETLAS)

led by University of Kent

December 2023

NETLAS COORDINATOR Prof. Adrian Podoleanu

As the 2023 year draws to a close, we can review it with some satisfaction. 2023 was a year full of events for the NETLAS community. We secured as closely advised by our Officer in charge in Brussels, Dr. Fabrizio Martone an extension of 10 months and replacement of 36 months made vacant with 3 positions of one year research. Thanks again to the sponsor for giving us an extra lifeline to NETLAS, where instead of planned one month within 2024, we will now have 11 months and instead of 15 ESRS, we will have taken care of 18 ESRs.

Numerous secondments have taken place and numerous other training events. Secondments meant reciprocal visits with transfer of equipment over the borders, something that was little contemplated by the time of submission for this grant application. ESRs have taken care not only of their Science, but have proven as grown into genuine administrators of expensive kits, custom declarations, packing and shipping. Travelled over the border with their kits in their luggages (Alejandro Martinez Jimenez/University of Kent, Irene Lamoso/University of Darmstatdt, Esteban Andres Proano Grijalva/DTU), or driven in their car (Marie Klufts/University of Luebeck) or organising large parcels (Sacha Grelet/NKT). By now all equipment made it back to the origin and research concluded.

Before the scientific and technological value of secondments we should praise the collaboration spirit and the enrichment brought about to the NETLAS community by the cultural exchanges triggered by the visits.

Several conferences have been attended. Dissemination of research was rich, at the main European Laser Congress in Munich and with a planned good attendance of Photonics West conference next year. The main networking event was diverted from Kent to Tampere. We thank colleagues there, Professor Mircea Guina and ESRs Philipp Tatar-Mathes and Ifte Bhuiyan for facilitating a truly international exchange by amalgamating our NETLAS with their traditional, highly international Markus Pessa Summer School. It was educative to see Photonics in its greatness in the labs and in the presentation of colleagues from Finland, where innovative ideas were nurtured by a strong bond between academia and industry.

Deliverables and Milestones have been continuously reported on the portal. One of the most important milestone is the conclusion of PhD training, with the first PhD not only submitted, but examined and awarded, hence congratulations to the beneficiary University of Tampere and the ESR, now PhD, Philip Tatar-Mathes.

In conclusion, we all deserve a relaxing respite.

Hence I am wishing you Happy Holidays, a Prosperous New Year and I hope you will enjoy the peace of the Season.

Adrian Podoleanu

We look forward to meeting again in 2023 and welcoming all those reading our Newsletters to our events next year.

Last newsletter of 2023

Student Theses -Optical Coherence Tomography News

Membrane-Based Broadband Semiconductor Light Sources for Optical Coherence Tomography

By NETLAS ESR Philipp Tatar-Mathes

Recruited by Tampere University, Finland

Secondment at AOG, University of Kent, UK

The scope of the thesis is to **advance OCT technology along two main avenues**: i) **more versatile membrane-based sources for visible wavelength range;** ii) **development of polarization sensitive OCT (PS-OCT) as an advanced technique providing information of birefringence.**

For the first path several membrane external-cavity surface-emitting lasers (MECSELs) were demonstrated targeting operation at difficult wavelength ranges, i.e., the red and near-infrared spectral range, and broad-band tuning, an essential feature for OCT.

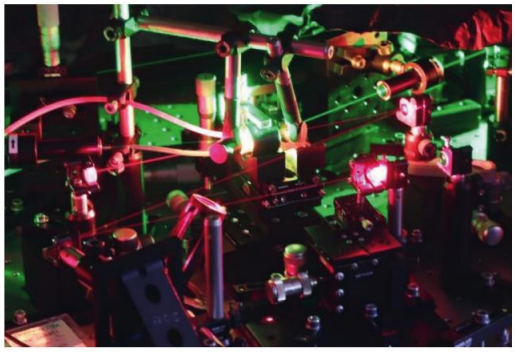


Figure 55 ***Picture of the z-cavity under operation with a birefringent filter and an airgap-etalon inside the cavity.***
Picture courtesy of Prabudeva Ramu

Main results including tunable emission were successfully demonstrated yet full scale implementation into OCT set-ups would require more advanced engineering to stabilize the operation for wavelength tuning. Broad-emitting MECSEL structures were presented based on novel design structures, including the incorporation of quantum dots in the gain region, as well as using two different quantum well types in the same active region. Also, **the characterization of a novel design criterion to mitigate undesired spectral effects inherent in MECSELs is presented**.

Read the entire thesis here

Highlight of the year, **FDML at shorter wavelength**, **collaboration of 4 NETLAS partners** led by University of Luebeck, Prof. Robert Huber (UzL), Superlum, Optores and UoKent

828 kHz retinal imaging with an 840 nm Fourier domain mode locked laser

Marie Klufts, Alejandro Martínez Jiménez, Simon Lotz, **Muhammad Asim Bashir,** Tom Pfeiffer, Alexander Mlynek, Wolfgang Wieser, Alexander Chamorovskiy, Adrian Bradu, Adrian Podoleanu, and Robert Huber

Biomedical Optics Express, Vol. 14, Issue 12, pp. 6493-6508, (2023)

https://doi.org/10.1364/BOE.504302

This paper presents a **Fourier domain mode locked (FDML) laser centered around 840 nm. It features a bidirectional sweep repetition rate of 828 kHz and a spectral bandwidth of 40 nm.** A**n axial resolution of ~9.9 µm in water and a 1.4 cm sensitivity roll-off are achieved.** Utilizing a complex master-slave (CMS) recalibration method and due to a sufficiently high sensitivity of 84.6 dB, **retinal layers of the human eye in-vivo can be resolved during optical coherence tomography (OCT) examination.** The developed FDML laser enables acquisition rates of 3D-volumes with a size of 200 × 100 × 256 voxels in under 100 milliseconds. Detailed information on the FDML implementation, its challenging design tasks, and OCT images obtained with the laser are presented in this paper.

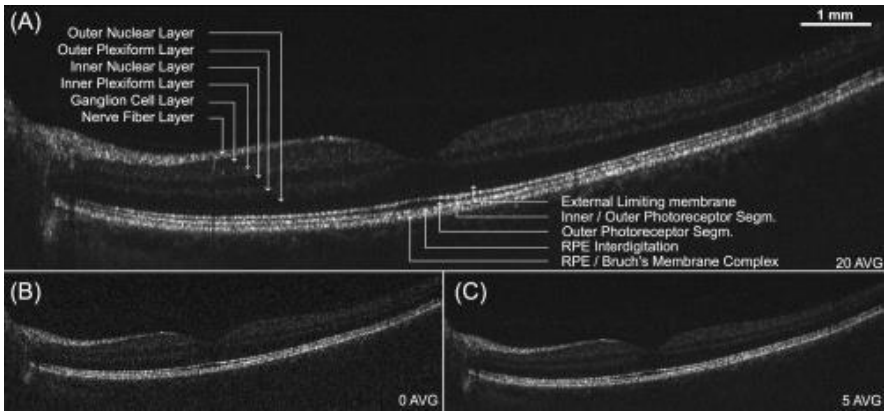


Fig. 9. Retinal OCT imaging focused on the macula. (A) is 20 times averaged, (B) is obtained without average, and (C) is 5 times averaged. RPE: retinal pigment epithelium.

AOG Visit

Alisia Maldon-Stanley's visit to the AOG

8th December 2023

On Friday 8th of December 2023, a talk which was hosted by Dr Adrian Bradu, took place on pathways into becoming a medical physicist within the NHS. The talk was given by former Kent student, Alisia Maldon-Stanley who graduated her Physics with Astrophysics (with foundation year) degree not so long ago.

Alisia currently works as a Radiation Protection Physicist in Queens Hospital, Romford. She completed the Scientific Training Programme (STP) prior to this, and gave details in her talk about the ways in which you can enter the programme as well as the different areas of medical physics you train in whilst completing the programme.

The talk was open to both undergraduate and postgraduate students and offered a lot of insight, as well as raising a lot of curiosity into the career with plenty of questions being posed after the talk.

Prior to the event, Alisia came to the AOG labs to see some of the systems we develop as well as speaking to the respective researchers.

This was a very valuable experience for those involved and it would be lovely for such talks to continue in the future.

Photograph taken by Dr Gianni Nteroli

@Article written by AOG PhD Student Lucy Abbott

Meeting at the Institute of Physics: Optics for the Eye

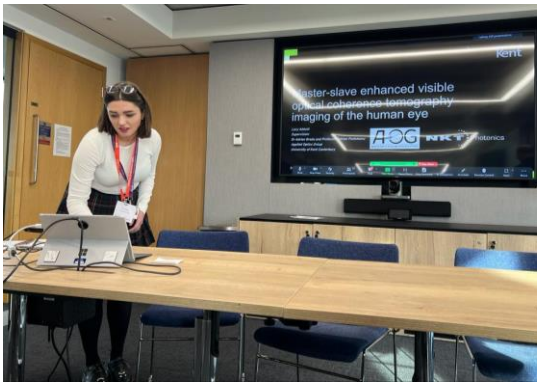
29th November 2023

On the 29th of November 2023, a meeting took place at the Institute of Physics, London, which hosted talks from both early career researchers and renowned academics around the theme of Optics for the Eye. AOG PhD students Lucy Abbott and Taylor Sanderson attended the event alongside Professor Adrian Podoleanu. The programme and abstracts for the event for those interested can be found using the following website: https://iop.eventsair.com/oe2023/programme

Both Professor Podoleanu and Lucy Abbott gave talks, titled '***Real time multiple en-face OCT imaging from different depths of the retina***' and '***Master-slave enhanced visible optical coherence tomography imaging of the human eye***', respectively. The talks were well received and piqued curiosity from other attendees who were very friendly and inquisitive in discussion both after the talks and throughout the lunch break.

An award was presented at the end of the event for the best early career researcher talk; the winner was Matthew Hellis who gave a great talk on '***High diffusion efficiency holographic diffusers for managing diplopia***.'

Despite being a relatively small meeting, it allowed for a good showcase of research ranging from more medical themes to developing devices, OCT to AO-SLO.



Lucy Abbott presenting. Photograph by Prof Adrian Podoleanu

The London's skyline on the morning of the event. Photograph by Lucy Abbott

@Article written by AOG PhD Student Lucy Abbott

OTHER PUBLICATIONS

Improved resolution in fiber bundle inline holographic microscopy using multiple illumination sources

MICHAEL R. HUGHES* and CALLUM MCCALL

Optica Open. Preprint.

https://doi.org/10.1364/opticaopen.24799212.v1

Recent work has shown that high-quality inline **holographic microscopy images can be captured through fiber imaging bundles.** Speckle patterns arising from modal interference within the bundle cores can be minimized by use of a partially-coherent optical source such as an LED delivered via a multimode fiber. This allows numerical refocusing of holograms from samples at working distances of up to approximately 1 mm from the fiber bundle before the finite coherence begins to degrade the lateral resolution. However, at short working distances the lateral resolution is limited not by coherence, but by sampling effects due to core-to-core spacing in the bundle. In this article **we demonstrate that multiple shifted holograms can be combined to improve the resolution by a factor of two.** The shifted holograms can be rapidly acquired by sequentially firing LEDs which are each coupled to their own, mutually offset, illumination fiber. Following a one-time calibration, real-time resolution-enhanced images are created in real-time at an equivalent net frame rate of up to 7.5 Hz. **The resolution improvement is demonstrated quantitatively using a resolution target and qualitatively using mounted biological slides.** At longer working distances, beyond 0.6 mm, the improvement is reduced as resolution becomes limited by the source spatial and temporal coherence.

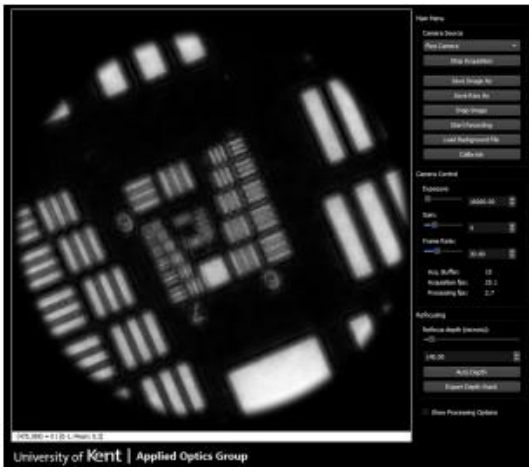


Fig. 9. Single frame from Visualisation 1 which demonstrates real-time resolution enhancement of a hologram of a USAF resolution target.

A Bilateral Craniectomy Technique for In Vivo Photoacoustic Brain Imaging

McGuire, L.S.; Zafar, M.; Manwar, R.; Charbel, F.T.; **Avanaki,**

Kamran Avanaki former PhD Student under Prof. Podoleanu's supervision, now Associate Professor of Bioengineering at the University of Illinois at Chicago (UIC)

Appl. Sci. **2023**, *13*, 12951.

https://doi.org/10.3390/app132312951

Due to the high possibility of mechanical damage to the underlying tissues attached to the rat skull during a craniectomy, previously described methods for visualization of the rat brain in vivo are limited to unilateral craniotomies and small cranial windows, often measuring 4–5 mm. Here, **we introduce a novel method for producing bilateral craniectomies that encompass frontal, parietal, and temporal bones via sequential thinning of the skull while preserving the dura.** This procedure requires the removal of a portion of the temporalis muscle bilaterally, which adds an additional 2–3 mm exposure within the cranial opening. Therefore, while this surgery can be performed in vivo, it is strictly non-survival. By creating large, bilateral craniectomies, this methodology carries several key advantages, such as the opportunity afforded to test innovate imaging modalities that require a larger field of view and also the use of the contralateral hemisphere as a control for neurophysiological studies.

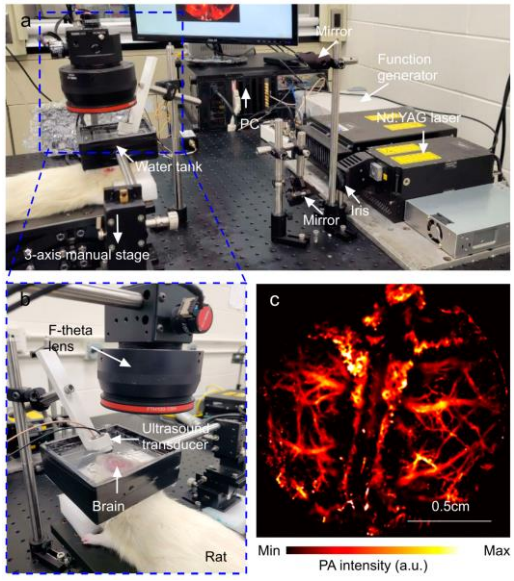


Figure 4. (**a**) Experimental setup of the laser scanning OR-PAM system for rat brain imaging. (**b**) Zoomed-in inset (different angle) enclosed by blue dashed box in (**a**). (**c**) Photoacoustic microscopy image of the rat brain when the scalp and skull are both removed

A New Method for Motion Artifact Suppression in Spectral-Domain Optical Coherence Tomography

S. Yu. Ksenofontov, P. A. Shilyagin, D. A. Terpelov, D. V. Shabanov, V. M. Gelikonov & **G. V. Gelikonov**

Grigory V. Gelikonov, former collaborator to Prof. A. Podoleanu and Dr M. Hughes on an ESPRC grant with Imperial College

Instrum Exp Tech **66**, 1037–1043 (2023). https://doi.org/10.1134/S0020441223050317

A new **method for processing spectral-domain optical coherence tomography signals**, which is designed to effectively suppress motion artifacts under conditions of large probing depths, is described. The features of this method made it possible to use it as part of an **otoscopic system of spectral-domain optical coherence tomography**, which ensured high quality of real-time imaging.

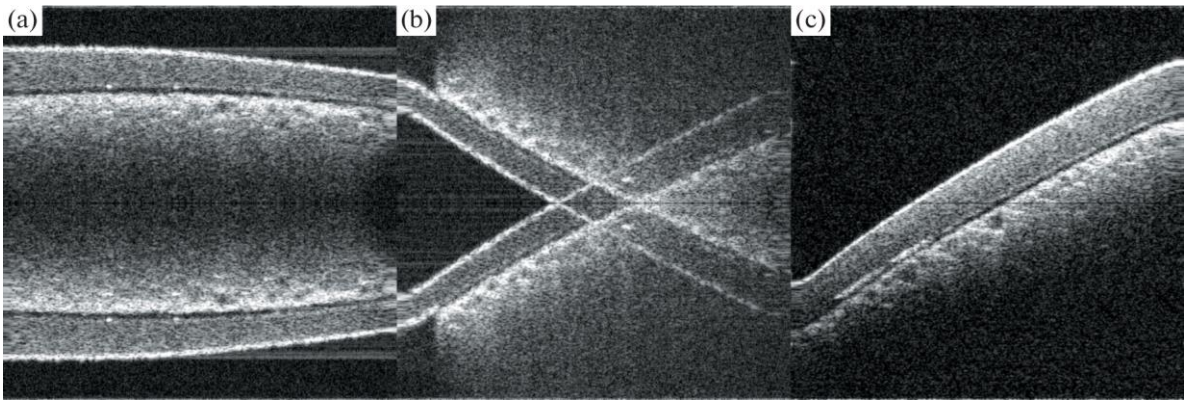


Fig 3. OCT image: (a) result of OCT image synthesis using transformation (4), (b) result of OCT image synthesis using transformation (4), when the surface of the test object is not orthogonal to the direction of the probing beam, (c) result of OCT image synthesis using the sequence of transformations (6)–(8).

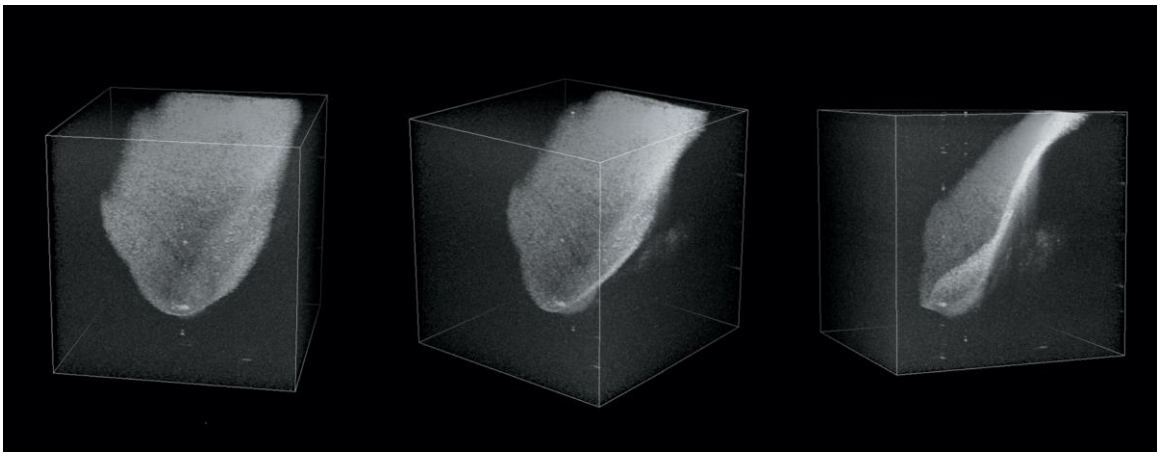
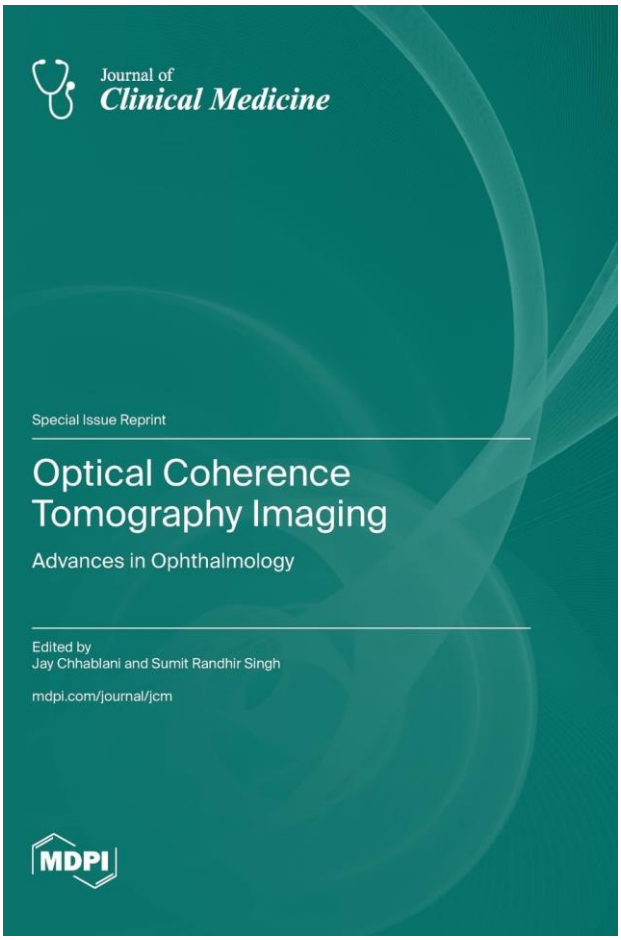


Fig.6 Three-dimensional image of a section of the human tympanic membrane obtained in vivo in real time

Books & Reviews

Optical Coherence Tomography Imaging: Advances in Ophthalmology

by Jay Chhablani (Editor), Sumit Randhir Singh (Editor)



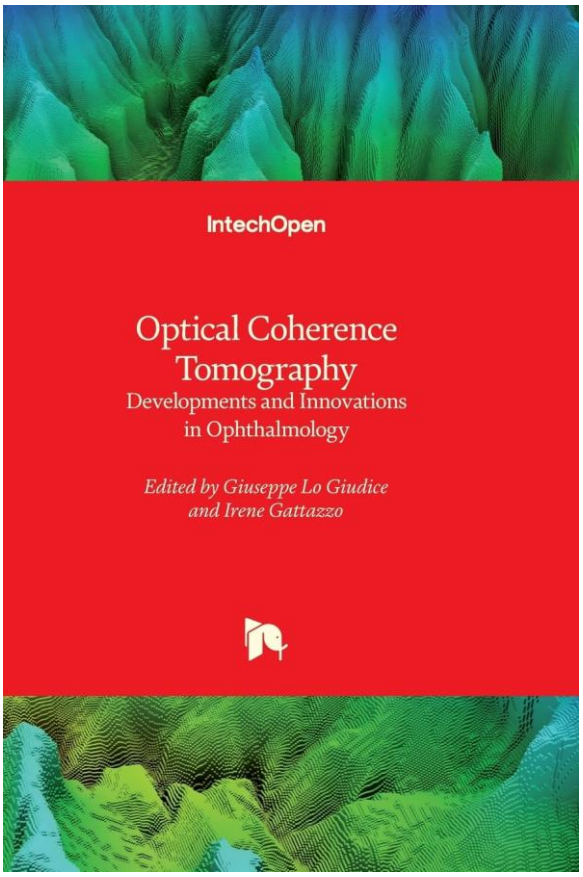
The advent of optical coherence tomography (OCT) has arrived in an era in which the in vivo, cross-sectional imaging of both the retina and choroid is possible. Infra-red rays of light are used to image the chorioretinal layers with an image resolution reaching 10-15 microns. During the last three decades, OCT technology has undergone several improvements, such as spectral domain OCT (SD-OCT), swept source OCT (SS-OCT), enhanced depth imaging (EDI-OCT), wide field OCT, intraoperative OCT, OCT angiography (OCTA), and adaptive optics OCT. **These enhancements help in both the qualitative and quantitative analysis of chorioretinal parameters in pathologies such as macular edema, neurosensory detachment, retinoschisis, macular holes, epiretinal membranes, and choroidal tumors.**
An **added advantage is the role of OCT in the evaluation of optic disc disorders, including optic neuritis and glaucoma, via the quantitative analysis of the retinal nerve fiber layer**.
Moreover, **OCT being non-invasive provides an opportunity for serial imaging during follow-up visits.**

Overall, OCT imaging provides tissue details, closely mimicking the histopathology, and is an invaluable asset in the armamentarium of retina physicians. This special issue includes applications of OCT in various chorioretinal disorders.

Order the book here

Optical Coherence Tomography - Developments and Innovations in Ophthalmology

By Giuseppe Lo Giudice (Editor), Irene Gatazzo (Editor)



Optical coherence tomography (OCT) has dramatically revolutionized ophthalmology in the clinical setting. **It has become an indispensable tool for ophthalmologists, enabling them to visualize and diagnose several different ocular diseases.**

With the advent of OCT, the diagnosis and management of ocular diseases have become even more accurate, efficient, and patient friendly. A new generation of OCT technology with increased resolution and speed has been developed, achieving in vivo optical biopsy (i.e., visualization of tissue architectural morphology in situ and in real-time). Functional extensions of OCT technology enable noninvasive, depth-resolved functional assessment and tissue imaging.

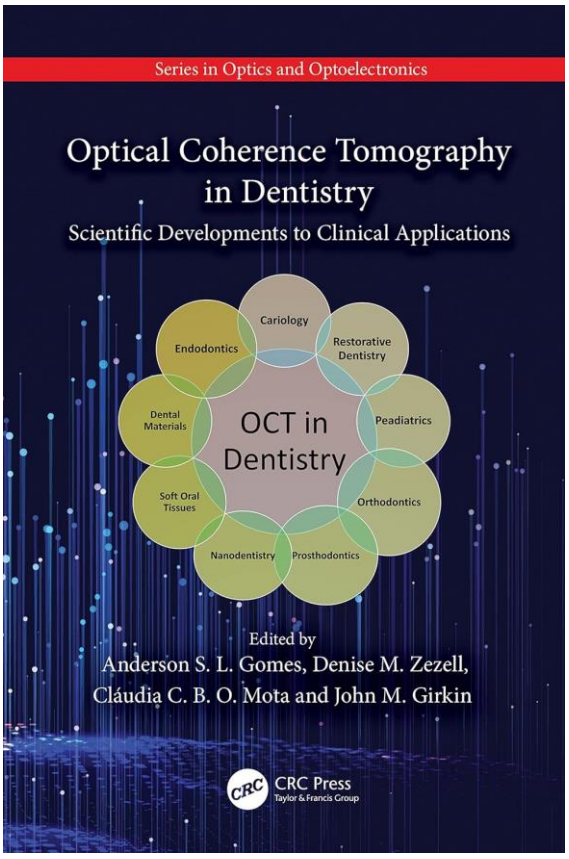
This comprehensive and richly illustrated guide enables the reader to identify the anatomy and ophthalmic pathologies illustrated by OCT. It is the most up-to-date book on OCT.

All the **major pathological areas of ophthalmology are covered, including macular degeneration, uveitis, glaucoma, vascular diseases, and glaucoma abnormalities, as well as other hot topics.**

Order the book here

Optical Coherence Tomography in Dentistry: Scientific Developments to Clinical Applications (Series in Optics and Optoelectronics)

by Anderson S. L. Gomes (Editor), Denise M. Zezell (Editor), Cláudia C. B. O. Mota (Editor), John M. Girkin (Editor)



Optical Coherence Tomography (OCT), a method to "see inside of things" without destroying them, has been applied to subjects ranging from materials science to medicine. **This book focuses on the biomedical application of OCT in dentistry, covering topics from dental materials to clinical practice.**

Since the introduction of the OCT method in ophthalmology in 1991, and then dentistry in 1998, developments in OCT methods, particularly in biomedical areas, have led to its dissemination worldwide. **The chapters of this book cover the basics and recent global advances of OCT in dentistry, including an overview of the method and its use in cariology, restorative dentistry, dental materials, endodontics, pediatric dentistry, orthodontics, prosthodontics, soft oral tissues and nanodentistry.**

This book will be of interest to both newcomers in the field as well as those already working in OCT, either in research and/or the clinic. It will be of great use in courses on optical imaging applied to biomedical areas, particularly where it can provide real-life examples of the application of OCT.

Order the book here

CONFERENCES

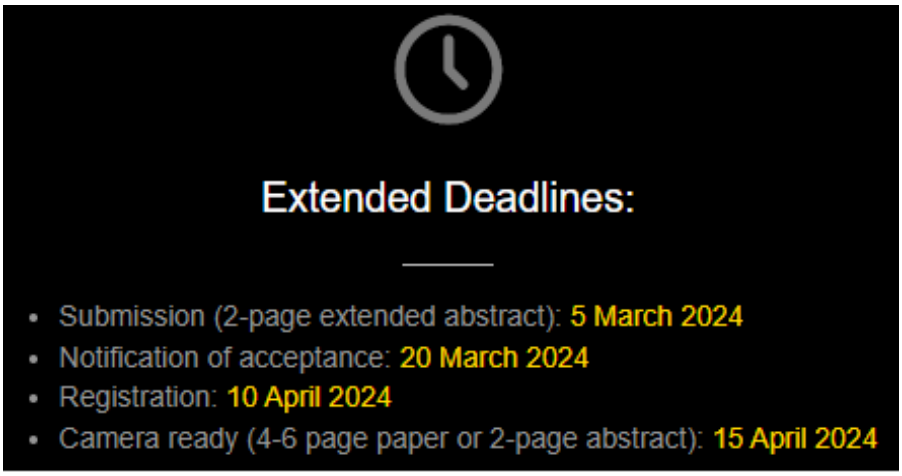
7th International Conference

on Optics, Photonics and Lasers (OPAL' 2024)

15-17 MAY 2024

PALMA DE MALLORCA (BALEARIC ISLANDS), SPAIN

The conference is focusing any significant breakthrough and innovation in optics, photonics, lasers and its applications: read more here



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.

New PhD Position in KENT

PhD Optical Tomography (OCT) and Deep Learning for Breast Cancer

About the Project

We are recruiting for a fully funded PhD Studentships in Optics/Photonics/Physics/Artificial Intelligence for a period of 36 months within the Applied Optics Group (AOG), Division of Natural Sciences, University of Kent. The position is supported by the University of Kent and is associated with the MRC grant: **Quantitative OCT-Raman spectral imaging for intra-operative detection of positive margins in breast conserving surgery**, ***a collaboration with University of Nottingham.***

OCT, due to its non invasive and high resolution capabilities of imaging the tissue has evolved into a versatile, highly professional diagnostic method. Research will focus on innovative solutions for multi view imaging of biopsies and combination of OCT imaging with Raman investigation.

About half of the PhD work will consist of **developing deep learning techniques for the interpretation of breast cancer images.** We will look at the most efficient preparation and pre-processing of the images. This will be followed by a meta-analysis of existing classifiers of breast cancer images. Finally, **we will take a data-centric approach to automate interpretation of the images.** The systems assembled will generate data that will enable health care providers to supply cost-effective, targeted treatment, not currently possible with conventional technology. Read More

Criteria

The applicant must have a good background in theoretical and experimental optics and expected to have graduated Physics (Optics) or Electrical and Electronic Engineering. We are looking for a highly imaginative and self-motivated individual with expertise in optics, digital signal processing and programming languages such as LabVIEW, MatLab or C++. Knowledge of Python and TensorFlow is essential.

For more information you may contact Professor Adrian Podoleanu
at A.G.H.Podoleanu@kent.ac.uk, School of Physics and Astronomy or Professor Philippe de Wilde at P.Dewilde@kent.ac.uk, Division of Natural Sciences, University of Kent.

How to apply
For further information and details on how to apply, please visit

https://www.kent.ac.uk/scholarships/search/FNADAOGOCT01

Deadline

Applications must be received by 29 February 2024, 23:59 GMT

For more information click: https://www.findaphd.com/phds/project/phd-optical-tomography-oct-and-deep-learning-for-breast-cancer/?p166666

China Scholarship Council (CSC)-Kent PhD Scholarships

Scholarship value

Full tuition fees at overseas rate, living stipend, a return airfare from China to the UK, medical insurance and a one-off reimbursement for UK visa costs.

Deadline

Sunday 28 January 2024, 23:59 GMT

Further details

The University of Kent and the China Scholarship Council are jointly **providing up to 20 fully funded PhD scholarships per annum for Chinese students to study at University of Kent's UK campuses.**

If you have any questions, please contact the International Marketing and Recruitment Team at china@kent.ac.uk.

Please do not use this email address to submit your application. The correct email address for applications is specified below.

How to apply

Vice Chancellor's Cup highlights 2023

The Vice-Chancellor's Cup (VC's Cup) is an inter-departmental tournament for all University of Kent staff. From November 2023 to September 2024 staff departments across the University compete in a series of activities!
All departments and abilities are welcome.

For the first event of the Vice Chancellor's Cup 2023/24 edition, 15 excited VC's Cup teams were tasked with eight challenges over two lunchtimes, each under a time limit of three minutes. ***Some members of the AOG joined the team called DONATS and are thrilled to announce the successful conclusion of their recent event,*** "**It's a Knockout**". This engaging gathering featured a series of mini-games designed to test and enhance essential skills such as communication, trust, and teamwork.

The inaugural challenge, the **Hula Hoop Shuffle**, required teams to transport hula hoops using two ropes from point A to point B while maintaining equilibrium and synchrony. This activity emphasized the **importance of coordination and collaboration** within each team. Following that, the **Blindfolded Ball Pickup Challenge** presented participants with the **unique task of retrieving balls from the floor while blindfolded.** Guided by a team captain connected through a rope, **this exercise underscored the significance of trust and effective communication.**

A snapshot of what they had to do to win the round

The Rugby Game showcased players' precision in passing, agility, and collaborative effort. **The Pairs Match,** a closely contested event, saw Marlowe's Marauders emerge victorious, demonstrating exceptional speed and memory.

The grand finale, the **Target Practice challenge**, focused on **accuracy and agility**. Teams skilfully maneuvered tennis balls through a challenging slalom course using hockey sticks before strategically knocking down various targets.

It is with great pleasure that we announce Team DONATS as the overall champions of this year's "It's a Knockout." Led by **Julien Comard and Carla Canedo Da Costa Ribeiro**, and comprised of outstanding members **Radu Stancu, Alejandro Martinez**, and **Rafaella Siagkri**, Team DONATS highlighted exemplary performance across all mini-games.

@Article by NETLAS ESR **Alejandro Martinez**

AOG Christmas celebration 2023

AOG is keeping the tradition of gathering every year to celebrate Christmas. To host the celebration, this year AOG decided to retain the same venue used last year - a familiar and easy access location to everyone: Ye Olde Beverlie Pub. For the 2nd time ever within AOG, all PhD Students prepared the Secret Santa. The celebration ended with the **traditional speech of the head of the group**, **Prof. Adrian Podoleanu**, who highlighted the **achievements of the year 2023**.

AOG had the privilege to welcome to the celebration Dr Konstantin Morozov from Innolume, Germany, NETLAS's Beneficiary, who was visiting AOG at that time. A selection of photos will follow.

@Photos by AOG members

@Photos by AOG members

@Photos by AOG members

Merry Christmas from AOG!

OTHER NEWS OF INTEREST TO THE NETLAS COMMUNITY

PUBLICATIONS

Photoacoustic vector tomography for deep haemodynamic imaging

Yang Zhang, Joshua Olick-Gibson, Anjul Khadria & Lihong V. Wang

Nat. Biomed. Eng (2023)

https://doi.org/10.1038/s41551-023-01148-5

Imaging deep haemodynamics non-invasively remains a quest. Although optical imaging techniques can be used to measure blood flow, they are generally limited to imaging within ~1 mm below the skin's surface. Here we show that such optical diffusion limit can be broken through by leveraging the spatial heterogeneity of blood and its photoacoustic contrast. Specifically, successive single-shot wide-field photoacoustic images of blood vessels can be used to visualize the frame-to-frame propagation of blood and to estimate blood flow speed and direction pixel-wise. The method, which we named **photoacoustic vector tomography (PAVT**), **allows for the quantification of haemodynamics in veins more than 5 mm deep, as we show for regions in the hands and arms of healthy volunteers**. PAVT may offer **advantages for the diagnosis and monitoring of vascular diseases** and for the mapping of the function of the circulatory system. Read More

A great number of health problems, and consequently the medical treatments for them, involve how blood flows through the body. Heart attacks are caused by restricted blood flow to the heart muscle. Many symptoms of diabetes are the result of damaged blood vessels. Tumors, meanwhile, often promote the growth of new vessels that deliver blood specifically to them. And blood flow is a crucial physiological parameter for measuring brain function.

Because of this, **medical professionals want to be able to examine blood vessels and assess their condition, but with many of those vessels buried quite deeply in the body, such an examination can be difficult without exploratory surgery**.

Seeing Deep Blood Flow With Sound and Laser Light

Intracoronary optical coherence tomography: state of the art and future directions

Ziad A. Ali[1,2], MD, DPhil; Keyvan Karimi Galougahi[2], MD, PhD; Gary S. Mintz[2], MD; Akiko Maehara[2,3], MD; Richard A. Shlofmitz[1], MD; Alessio Mattesini[4], MD

Abstract

Optical coherence tomography (OCT) has been increasingly utilised to guide percutaneous coronary intervention (PCI). Despite the diagnostic utility of OCT, facilitated by its high resolution, the impact of intracoronary OCT on clinical practice has thus far been limited. Difficulty in transitioning from intravascular ultrasound (IVUS), complex image interpretation, lack of a standardised algorithm for PCI guidance, and paucity of data from prospective clinical trials have contributed to the modest adoption. Herein, we provide a comprehensive up-do-date overview on the utility of OCT in coronary artery disease, including technical details, device set-up, simplified OCT image interpretation, recognition of the imaging artefacts, and an algorithmic approach for using OCT in PCI guidance. We discuss the utility of OCT in acute coronary syndromes, provide a summary of the clinical trial data, list the work in progress, and discuss the future directions. Read More

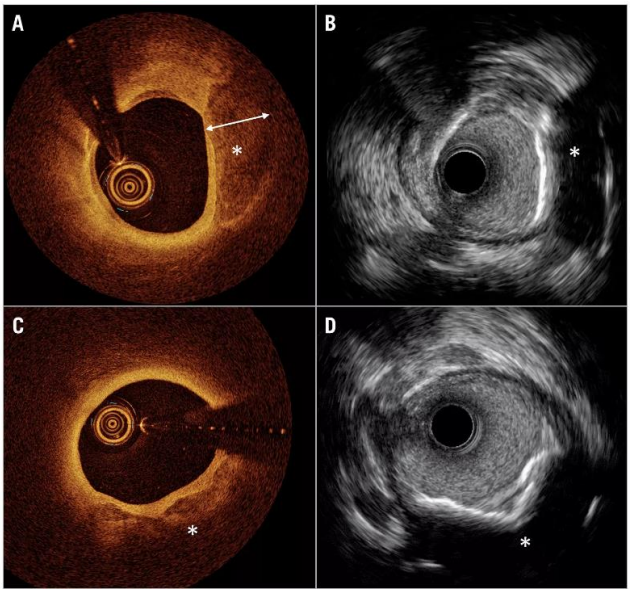


Figure 2. Comparison of coronary calcium imaging by optical coherence tomography and high-definition intravascular ultrasound. A) Optical coherence tomography (OCT) shows superficial calcium extending to the medial layer (*). The calcium (*), where thickness can be measured due to the optical properties of light penetration through the calcium crystal. B) Co-registered image on high-definition intravascular ultrasound (HD-IVUS) does not allow measurement of calcium thickness. C) OCT shows superficial calcium extending to the medial layer (*), where thickness cannot be measured due to the limited penetration depth of light. D) Co-registered image on HD-IVUS does not allow measurement of calcium thickness.

AI: The Future No Longer

“How will AI impact ophthalmology?” There’s no time left to answer.

Credit: Shutterstock.com

Artificial intelligence (AI) is not just something out of a science fiction movie… It’s a technology of today that surrounds us wherever we go.” So wrote Rahul N. Khurana on the American Academy of Ophthalmology (AAO) website in July 2018 (1).

Khurana went on to **identify two ways AI is changing the practice of ophthalmology.** The first **– improving screening and access to care** – saw ophthalmologists “using AI to screen fundus images automatically for conditions like diabetic retinopathy and glaucoma,” wrote Khurana. The second, **augmenting intelligence**, addressed the information/data “flood” facing the modern-day ophthalmologist. “AI will be the backbone to help us manage this information overload and deliver the optimal care for our patients.”

Of course, the subject of AI in ophthalmology – and, certainly, in healthcare more broadly – has been a popular thread at conferences for a decade or more. Perhaps what is more concerning is the question – “What is the future of AI in ophthalmology?” – remains ubiquitous. Given the advances made in the last five years since Khurana’s prediction alone – maybe we should be asking, “How do we use AI now?”

Read More: How Do We Best Employ Artificial Intelligence in Ophthalmology Today? (theophthalmologist.com)

Did you know?

Prof. Eric SOUIED:

delighted to introduce you his brand-new website dedicated to ophthalmology

Home - Ophtalmologiste - CRETEIL - Pr Eric Souied English version - CRETEIL, 94000 - Ophtalmologiste (pr-eric-souied.com)

On this website, you will find:

Research Topics: articles and studies on various retina research subjects. **Informative Videos** : a video section where are centralized explanations, interviews, and practical demonstrations. These videos enable you to visualize complex concepts in a clear and accessible manner. **Monthly Updates:** Stay up-to-date with the latest advancements in ophthalmology by checking out my news section. **Each month**, Prof. Souied will share informational topics, important news, and recent discoveries in the field. You have the option **to subscribe to his newsletter directly on the website**. Prof. Souied is committed to share his expertise and contribution to the progress of ophthalmology.

Feel free to explore the various sections, engage with his community on LinkedIn or Facebook, and share these resources with those who may benefit.

Anti-VEGF Pioneer - 17 Years of Excellence

Prof. Souied was the first ophthalmologist authorized to perform an anti-VEGF injection in France on August 30, 2006.

Since then, this technique has proven its effectiveness in treating exudative AMD (Age-Related Macular Degeneration) and other retinal diseases such as macular edema in diabetic individuals and retinal vein occlusions.

Seventeen Years Since the First Anti-VEGF Injection in France @

Did you know?

Photonic chip that 'fits together like Lego' opens door to local industry

Scientists from Sydney Nano, University of Sydney are advancing chip technology for the trillion-dollar industry, inspired by Lego.

They've developed a **compact silicon semiconductor chip integrating electronic and photonic components, expanding radio-frequency (RF) and accurate information flow**. The chip's modular construction, similar to Lego blocks, involves advanced packaging with electronic 'chiplets,' allowing attachment to pre-made wafers.

Dr Alvaro Casas Bedoya holding a silicon wafer used in chip manufacturing.

New semiconductor architecture integrates traditional electronics with photonic, or light, components.

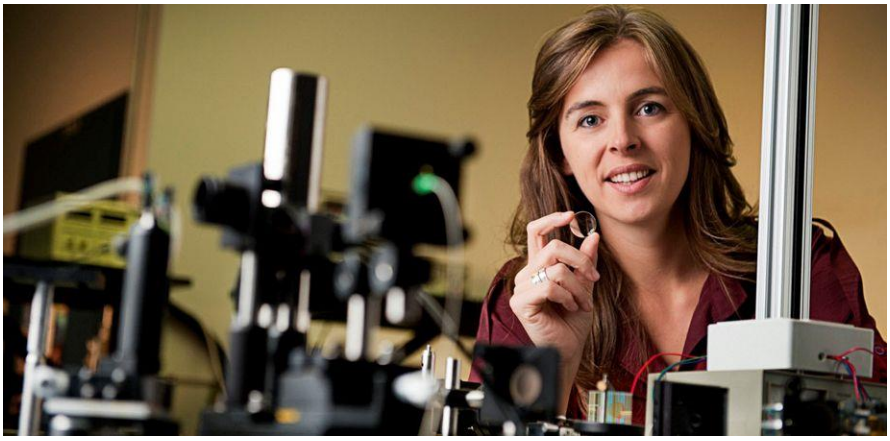
Designed by Dr Alvaro Casas Bedoya in the School of Physics, the chip could have application in advanced radar, satellites, wireless networks and 6G telecommunications.

Read More

Photonic semiconductor that 'fits together like Lego' opens door to local chip industry - The University of Sydney

Did you know?

Professor Caroline Boudoux's lab at Polytechnique Montréal **developed a new version of a popular medical imaging technology for optical coherence tomography based on an optical fiber device called a "photonic lantern".** 🏮



It will have a variety of medical and other applications, which Boudoux spelled out in detail at the BiOS Hot Topics in her presentation at SPIE Photonics West in January 2023.

She works with a particular type of hardware called modally specific **photonic lanterns, which act as (de-)multiplexers of spatial modes in fiber optics.**

Boudoux said her team, in collaboration with colleague Nicolas Godbout, has developed a **new way to model and manufacture the lantern "with better specifications and using a technique compatible with largescale manufacturing, to allow rapid translation outside the lab**."

What makes the new version particularly useful is the lantern's application as an imaging system for OCT. "**The lantern lets us create images with more photons, and that makes possible better contrast**," Boudoux said.

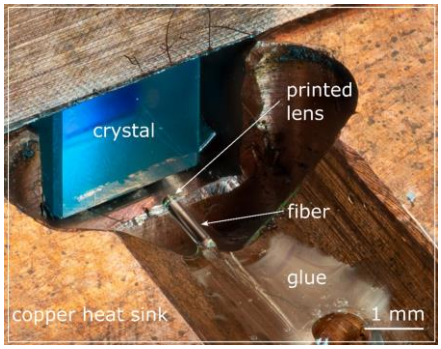
Novel 'few mode' innovation reboots and expands OCT (spie.org)

Did you know?

A University of Stuttgart research team significantly reduced the size of a laser by 3D printing micro-optics onto fibers, letting them combine fibers and laser crystals inside a single laser oscillator

WASHINGTON — For the first time, researchers have shown that 3D-printed polymer-based micro-optics can withstand the heat and power levels that occur inside a laser. The advance enables inexpensive compact and stable laser sources that would be useful in a variety of applications, including the lidar systems used for autonomous vehicles.

"We significantly reduced the size of a laser by using 3D printing to fabricate high-quality micro-optics directly on glass fibers used inside of lasers," said research team leader Simon Angstenberger from the 4th Physics Institute at University of Stuttgart in Germany. "This is the first implementation of such 3D-printed optics in a real-world laser, highlighting their high damage threshold and stability."



Caption: Researchers printed microscale lenses directly onto optical fibers, allowing them to compactly combine fibers and laser crystals inside a single laser oscillator.

Credit: Moritz Floess and Simon Angstenberger, 4th Physics Institute at University of Stuttgart in Germany

In the Optica Publishing Group journal *Optics Letters*, the researchers describe how they 3D printed microscale optics directly onto optical fibers to combine fibers and laser crystals inside a single laser oscillator in a compact way. **The resulting hybrid laser exhibited stable operation at output powers of over 20 mW at 1063.4 nm and had a maximum output power of 37 mW.**

The new laser combines the compactness, robustness and low cost of fiber-based lasers with the advantages of crystal-based solid-state lasers, which can have a broad range of properties such as different powers and colors. "Until now, 3D-printed optics have primarily been used for low power applications such as endoscopy," said Angstenberger. "The ability to use them with high power applications could be useful for lithography and laser marking, for example. We showed that these 3D micro-optics printed onto fibers can be used to focus large amounts of light down to a single point, which could be useful for medical applications such as precisely destroying cancerous tissue." Read More at:

Researchers create stable hybrid laser by 3D printing micro-optics onto fibers | Optica

Did you know?

Lithuanian Altechna, leading laser optics company, acquires Alpine Research Optics, expanding quality laser optical solutions offering

Established in 1991, Alpine Research Optics has distinguished itself as a leader in **providing laser optics to the laser, semiconductor, medical, and scientific research markets.** ARO fabricates ultra precision optics and has **in-house coating capabilities starting at the 193 nm wavelength**. Production quantities range from prototype to mid-level volumes for **windows, mirrors, polarizers, prisms, beam splitters, filters, spherical and cylindrical lenses. Specialties include high laser damage threshold optics and optics optimized for ultrafast applications.** Check their products here.

Altechna, a **provider of laser optics and optomechanical assemblies** from Vilnius, Lithuania has acquired Alpine Research Optics (ARO), situated in a hub of photonics research and technology – Boulder, Colorado. Both companies plan to triple their income in five years while maintaining ARO's management. **This union will strengthen the companies' position in the global laser technology market while focusing on medical and semiconductor production.** Check Altechna's products here.

(1) Lithuanian Altechna, leading laser optics company, acquires Colorado's Alpine Research Optics, expanding quality laser optical solutions offering | LinkedIn

Did you know?

Globally, 2023 will be the warmest year on record. Since the start of observations, Antarctic sea ice extent has never been so low; Canadian wildfires spread over areas much larger than normal; and extreme events, such as droughts, floods, and heat waves, have affected numerous people around the world.

In July, a heat wave over the Mediterranean caused daily temperatures to be 12°C above average in certain locations. Simultaneously, large areas in the world experienced higher than normal temperatures.

If warming continues at the same rate, we expect that 75% of all days will see extreme heat events by 2050. Half of the Northern Hemisphere will experience a heat wave at least once in the decade 2050-2059.

In the following paper, the authors contrast the local and hemispheric perspective of heat waves, and confirm that global warming is the main driver of the increase in occurrence of extreme heat.

Comparing Local Versus Hemispheric Perspectives of Extreme Heat Events - Van Loon - 2023 - Geophysical Research Letters - Wiley Online Library

Importantly, they note that temperature is not well-approximated by normal statistics. To be able to accurately forecast the next heat wave, this is crucial information when combining model predictions and observations (a process called data assimilation, see this link for a layman's intro).

This framework was generalized to handle a much broader scope of statistics. This method allows forecasts to be more accurate, as it removes implicit biases introduced by assuming incorrect probability distributions.

Read More at Foundations for Universal Non-Gaussian Data Assimilation - Van Loon - 2023 - Geophysical Research Letters - Wiley Online Library

OPTICS & PHOTONICS NEWS

Optics & Photonics News Magazine
December 2023 Issue

- Optics in 2023
- 2023 Photo Contest Winners

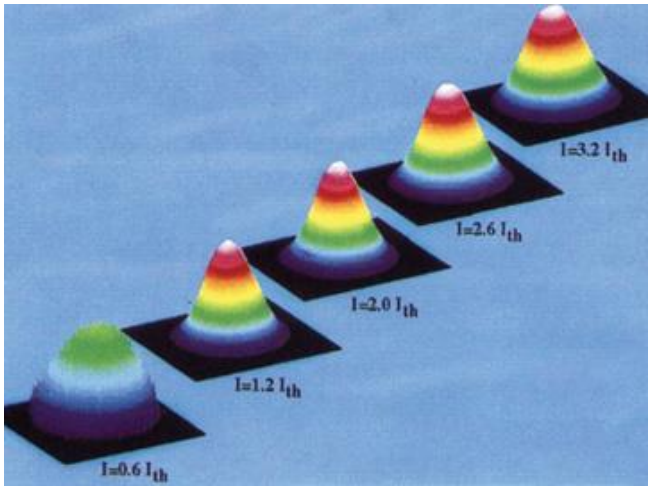
Browse all Issues

OPTICS & PHOTONICS NEWS

30, 20, and 10 Years Ago in OPN

VCSELs; micro-optics and quantum optics; rewriteable digital laser

"**Vertical cavity surface emitting lasers (VCSEL) are promising for optical interconnects, communications and signal processing.** The most promising aspect lies in the prospect of ***eliminating low-yield and high-cost laser fabrication steps such as wafer lapping, cleaving, dicing, and facet coatings*** … [W]e have demonstrated a novel [passive antiguide region] design that results in excellent mode selection for large-aperture VCSELs without compromising other laser properties. This structure is expected to be useful also for obtaining high power and single mode from large aperture edge emitting lasers."



1993 [C.J. Chang-Hasnain et al.]

*Optics in 1993: "*Single-mode large-aperture vertical cavity surface emitting laser," C.J. Chang-Hasnain et al., Optics & Photonics News, December 1993, p. 26

Optics & Photonics News - 30, 20, and 10 Years Ago in OPN (optica-opn.org)

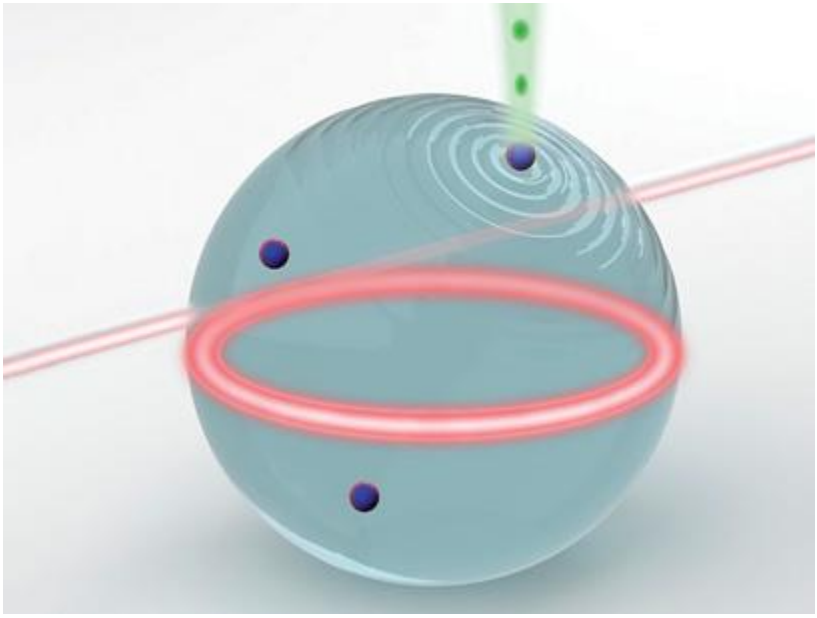
NetLaS

OPTICS & PHOTONICS NEWS

Optics in 2023

The special issue of ***Optics & Photonics News*** highlights exciting peer-reviewed optics research that has emerged over the past year.

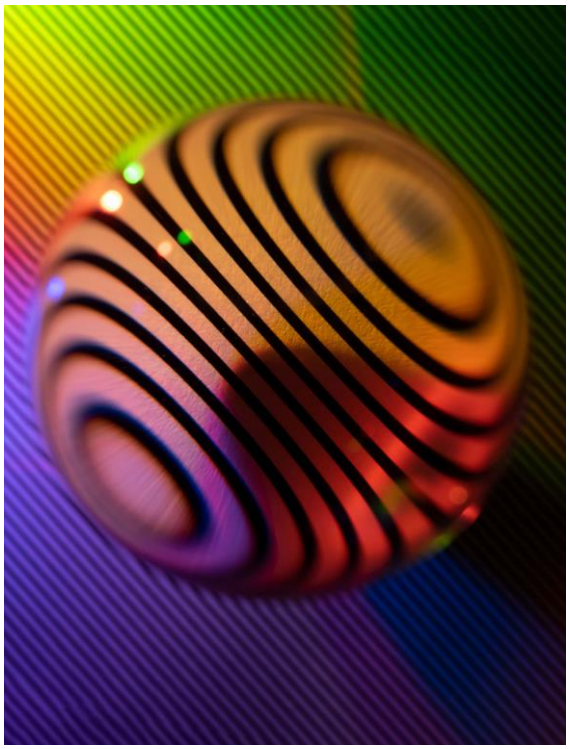
Their **panel of editors reviewed 115 summaries of work by researchers from around the world. They selected for publication 30 stories that they felt communicated breakthroughs of particular interest to the broad optics community.** Read them here.



Optics & Photonics News - Optics in 2023 (optica-opn.org)

Image of the Week

Striking images of optics and photonics, contributed by OPN readers



Glass Sphere

A glass sphere is the geometrically simplest form of lens. In this photo, one can clearly see how the lens magnifies the lines in the background. The spherical aberrations toward the edges are visible, as well as another fascinating effect: the straight lines gradually become distorted into closed curves when looking toward the edges perpendicular to the lines in the background. [OPN 2023 Photo Contest Winner]

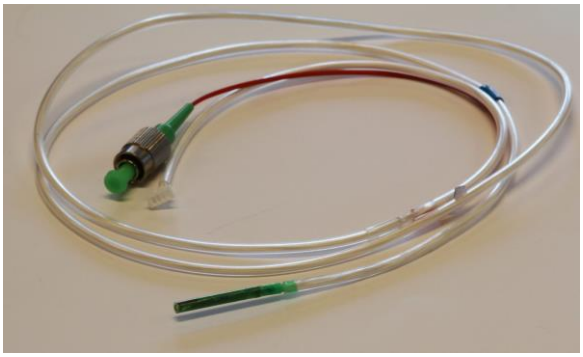
—Susanne Viezens, Max Planck Institute for the Science of Light, Erlangen, Germany

Scinvivo

Scinvivo - an SME based in Eindhoven, Netherlands - aims to **revolutionize cancer diagnostics and care** by providing medical professionals with the next gen **minimal invasive imaging platform based on Optical Coherence Tomography.**

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 professionals 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.

Check their website here:
https://www.scinvivo.com/

The Lions Eye Institute is an Australian medical research institute affiliated with the University of Western Australia.

In 2023, the Lions Eye Institute celebrates 40 years of preventing and curing blindness and eye disease.

The Institute was **established in 1983 by Professor Ian Constable AO**. A number of significant discoveries and inventions have helped to elevate the Institute's global reputation, and proved the genesis for significant collaborations with leading national and international organisations. These include the **world's first artificial cornea**, the Barrett Universal II Formula, XEN® Gel Stent, the central retinal vein occlusion bypass laser surgery procedure and the excimer laser surgical system.

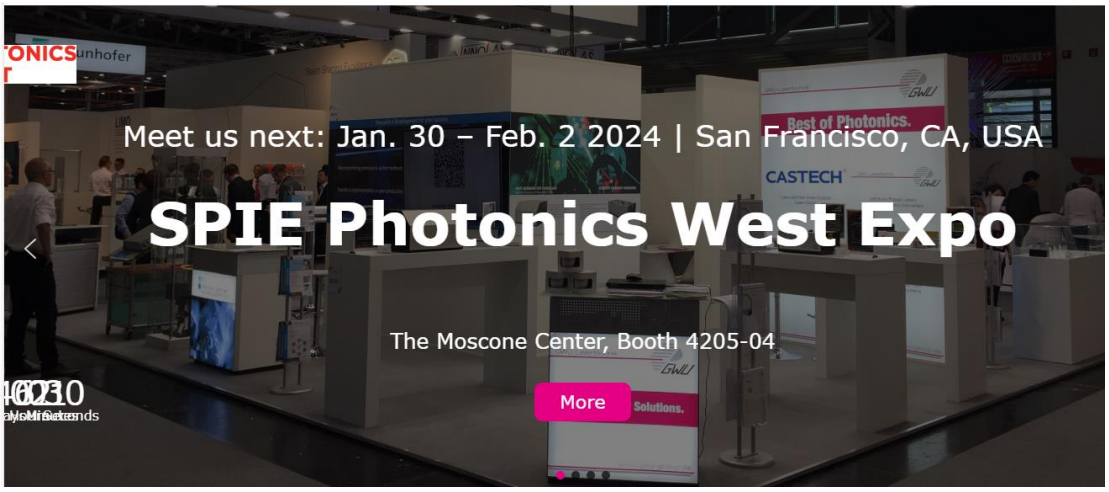
Read their 40 Years of Impact report

Find research publications and data generated through their research here.

In December 1988 GWU-Lasertechnik was officially registered at their local commercial court.

Since more than 30 years GWU-Lasertechnik are well known experts for **crystals**, **optics** and **non-linear frequency conversion**. Due to its **competence and superior service**, GWU has established a broad base of satisfied customers in the **industrial branch** as well as in **scientific research facilities** worldwide. GWU offers laser **crystals** and optical non-linear crystals, **optics** and **laser components** with a broad variety of specifications.

Laser Products - GWU-Lasertechnik



Happy Birthday to RICHARD E. SHOPE (25th December 1901-1966)

In 1918 and 1919, an influenza pandemic killed between 20 and 50 million people worldwide; in the United States, 28 percent of all citizens came down with the disease, which claimed 10 times as many American lives as World War I. Meanwhile, pigs in the Midwestern U.S. were dying of a similar illness.

Richard E. Shope, a pathologist employed by the Rockefeller Institute for Medical Research, suspected the two outbreaks were related. So in 1928, Shope visited Iowa—where he had been born on Christmas Day in 1901—to investigate a possible link between the two illnesses.

For this and other fundamental discoveries of the workings of viruses, Dr. Shope was awarded the 1957 Albert Lasker Clinical Medical Research Award.

At the time, scientists believed that influenza was caused by a bacteria of some kind—so when he arrived in Iowa, Shope began searching infected swine for microscopic suspects. He managed to identify a bacteria species that was present in most of the runny-nosed pigs he examined. However, when he injected this one-celled organism into healthy pigs, they failed to contract the disease.

Starting again, Shope looked for other potential disease-carriers within the sick pigs' mucus. In 1931, he filtered the samples to remove any bacteria and introduced this new filtrate to some non-infected swine. Soon, the control pigs came down with a mild case of porcine influenza, proving that the flu was caused by a "filter-passing agent"—in this case, a virus. When Shope combined the virus with the bacteria, the test animals came down with more severe symptoms. Encouraged by his results, American and British scientists conducted a series of tests, which showed that human and pig influenza were indeed close relatives. **Building off of Shope's research, a British team went on to isolate the human influenza virus for the very first time in 1933.** If it hadn't been for this breakthrough, flu vaccines might not exist today.

Read More about the 7 Great Scientists Who Were Born on Christmas Day - myRepublica - The New York Times Partner, Latest news of Nepal in English, Latest News Articles (nagariknetwork.com)

Adrian Podoleanu wishes all readers of the Newsletter,
A **Happy New Year** with a recent photo (20 Dec. 2023)
from his College in Comanesti, Moldova Romania where
the School Festival ended with the Bear Dancing.
The College Club "was invaded" by the bears.

Ursul, The Bear Dance Festival, is a ritual that symbolizes the death and rebirth of time. A tradition, preserved since ancient times that is still kept alive today (Comanesti, Moldova Romania).

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