



NETLAS NEWSLETTER 5-2022

NETLAS PhD Student [Haris Ashraf's](#) experience during his secondment at [Superlum Diodes](#), Ireland

Host: [Technical University of Denmark](#) (DTU)

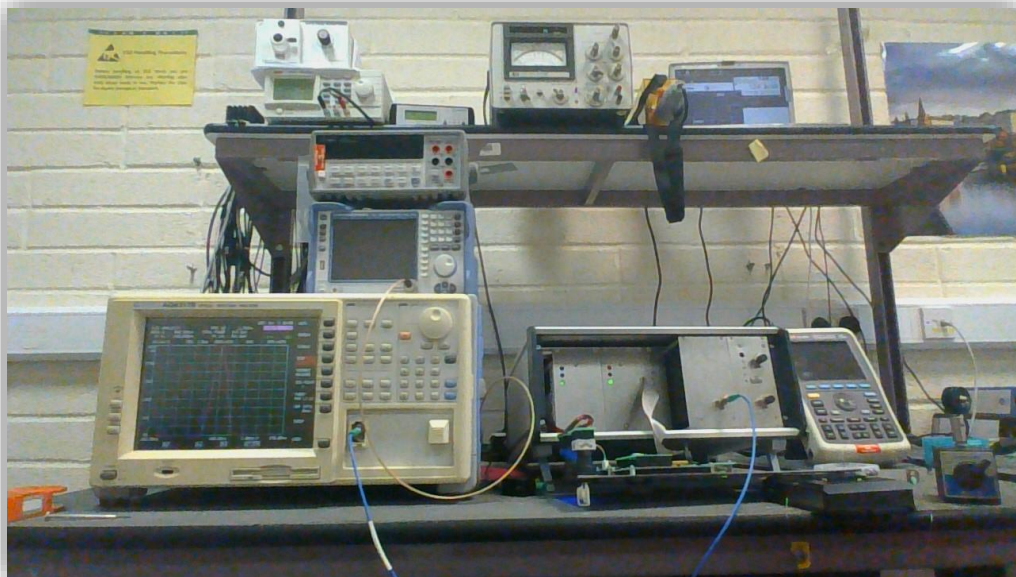
Secondment Period: 31st March 2022 – 15th April 2022

[PhD Project: Ultra-narrow linewidth swept sources at 850 nm based on acousto-optical tunable filter \(AOTF\) technology](#)

"The initial plan was to gain hands on experience working with AOTF Tunable Laser, understand the basic concepts and underlying challenges. [Superlum Diodes](#) is a leading company in manufacturing superluminescent diodes and modules and having an opportunity to get training directly from them was a wonderful experience.

It was a thorough training where I started from learning the basics of AOTF based Tunable Laser, its working principle, tuning mechanism, design parameters, and much more. During my stay there, I acquired the skills of testing and characterizing some important parameters of laser, for example, variation in tuning range as a function of SOA current, determining the instantaneous linewidth of laser (FWHM), mode spacing, side mode suppression ratio, static coherence length (CL), effect of intra-cavity SOA-current on FWHM and CL.

I would like to mention and thanks to Dr. Alexander Chamorovski who trained me during my entire stay at Superlum. He also showed me the internal structure of the laser and guided me how to assemble such a laser. Overall, it was an amazing experience. After this training, I will continue my research on this laser at DTU".



Superlum building and lab – photos @Haris Ashraf



Cork City - photos @Haris Ashraf



Prof Marinko's visit the Applied Optics Group!

Thursday 21st April 2022, Prof Marinko visited the AOG and gave a talk about his recent developments in the OCT field with a special interest in how to take advantage of Artificial Intelligence (AI) with OCT Angiography.



From left to right: Rasmus Eilkaer (Technical University of Denmark- DTU), Julien Camard, Rene Riha (NETLAS PhD Student), Adrian Fernandez, Dr George Dobre, Alejandro Martinez (NETLAS PhD Student), Prof Adrian Podoleanu, Esteban Proano (NETLAS PhD Student), Prof Marinko, Dr Manuel Marques, Irene Rodriguez (NETLAS PhD Student), Giannis Nteroli, Gopika Venugopal (NETLAS PhD Student), and Dr Adrian Bradu

Title: OCT Angiography and AI for Diabetic Retinopathy

Abstract: Diabetic Retinopathy (DR) is one of the leading causes of vision loss in working age adults. The pathological changes to the retina, the light sensitive tissue at the back of the eye, due to DR can be imaged with optical coherence tomography (OCT), and the microvasculature visualized with OCT Angiography (OCTA). Artificial intelligence (AI) tools to analyse the OCT intensity and OCTA flow contrast image data may assist with the classification of DR and has potential to identify early changes that may be predictive of disease severity. [Read More](#)



AWARD for University of Kent and NETLAS Associated Partner Moorfields Eye Hospital, London: NIHR i4i award received for first-time retinal surgery robot

Researchers from the School of Biomedical Engineering & Imaging Sciences, in collaboration with **University of Kent and Moorfields Eye Hospital**, have received a £1.5M award from the National Institute for Health Research (NIHR), the research partner of the NHS, public health and social care, for their robotic system designed to deliver regenerative therapies to the human retina.

“ *An exciting collaboration engaging UK expertise straddling physics, biomedical engineering, robotics, ophthalmology and surgery will be supported by the NIHR. Led by King’s College London, this consortium aims to address one of the major limitations of regenerative therapy in delivery of drugs and cells to exact locations in the retina.*

– Co-Investigator, Professor Adrian Podoleanu, University of Kent

“ *Success has already been demonstrated for certain types of stem cell therapies, including based on a seminal clinical study by our team at Moorfields. There is now evidence that degenerative eye diseases may be reversible with new therapies. However, these must be precisely delivered. With our proposed robotic system the success of novel therapies will not be held back by limitations in conventional retinal surgery techniques.*

– Prof Lyndon da Cruz from Moorfields Eye Hospital, Project clinical co-lead

The proposed snake-like robotic system will be equipped with force sensing and imaging capabilities to boost the performance of surgeons and fulfil the most challenging precision requirements. [Read More](#)



AOG Journal Club

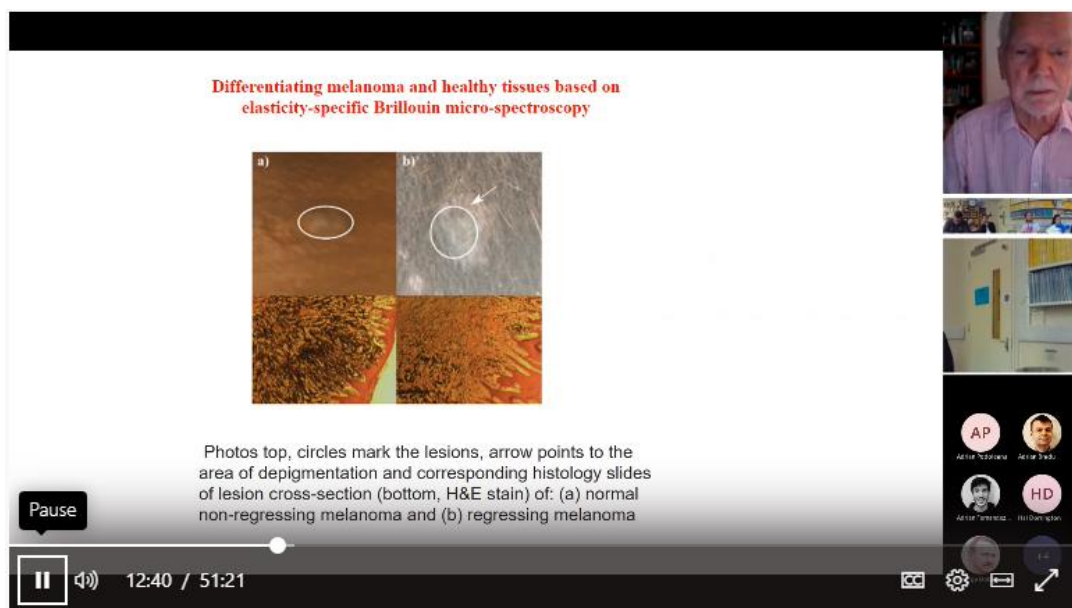
**Presentation by Prof. David A Jackson,
FInstP, FOSA
Emeritus Professor of Applied Optics**

Friday 06/05/2022 at 12 pm

Potential optical techniques that could be useful for medical and other applications

- 1 Polarization azimuth control based on High-bi fibre
- 2 Optical spectrum analyser
- 3 Optical frequency oscillator
- 4 Brillouin micro-spectroscopy
- 5 Raman and SERs for cancer studies
- 6 Dynamic light scattering

A few slides from Prof. Jackson's presentation are presented below



Typical results using SER on samples

A

B

21:43 / 51:21

Dynamic Light Scattering Particle Size Distribution Analysis

Particle size can be determined by measuring the random changes in the intensity of light scattered from a suspension or solution, known as dynamic light scattering (DLS), but is also photon correlation spectroscopy (PCS)

Particles can be dispersed in a variety of liquids. Only liquid refractive index and viscosity needs to be known for interpreting the measurement results

37:54 / 51:21

Spectrometer when illuminated by 2 lasers at different frequencies

Fig (a) show laser frequencies are superimposed
(b) laser frequencies just resolved, frequency difference 25kHz
© laser frequency difference increased

40:12 / 51:21

A few slides from Prof. Jackson's presentation



AOG Journal Club

Presentation by NETLAS PhD Student
[Alejandro Martinez Jimenez](#)

Friday 13/05/2022 at 1 pm

Paper presented:

Relationship between axial resolution and signal-to-noise ratio in optical coherence tomography

<https://opg.optica.org/ol/abstract.cfm?uri=ol-47-6-1517>

A few slides from Alejandro's presentation are presented below.

ADG Journal Club - Alejandro

18:39

Recording and transcription have started. By attending this meeting, you consent to being included. [Privacy policy](#)

Request control

People Chat Reactions More

Camera Mic Stage Leave

Dismiss

AP AJ
Adrian Podolski... Alejandro Marti...

MJ
Michael Hu... Muhamma...

EG HD
Esteban An... Hal Doring...

RR
Adrian Brado... Rene Riba...

R +2
Ramas Egu...

RC

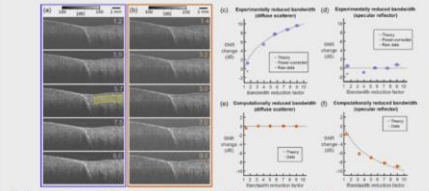


Fig. 3. Measurements of the SNR dependence on optical bandwidth. (a) Images of a diffuse tissue (chickens breast) with different experimental optical bandwidth reduction factors. (b) SNR as a function of experimental bandwidth reduction factor for the diffuse scattering area indicated by the yellow box in panel (a). (c) SNR as a function of experimental bandwidth reduction factor for a mirror signal (OCT image not shown). (d) SNR as a function of computational bandwidth reduction factor for the diffuse scattering area indicated by the yellow box in panel (a). (e) SNR as a function of computational bandwidth reduction factor for a mirror signal (OCT image not shown). Note that the SNR of the diffuse scattering region [panels (c) and (e)] was calculated as the ratio of the mean signal power within the yellow box to the mean noise power measured above the tissue.

sensitivity must be used carefully as a predictor of the imaging SNR. Figure 3(e) shows that the SNR in diffuse regions remains largely unchanged when the optical bandwidth is computationally reduced. This is interesting because it is representative of spectral windowing processing approaches wherein a narrow portion of the acquired fringe is processed, causing the optical bandwidth and the effective A-line duration to decrease. These two effects (more photons within the coherence gate due to resolution degradation and fewer detected photons due to reduction of measurement duration) have opposing effects on the SNR. For a constant spectral envelope, these effects cancel exactly and the SNR is not affected. While it has never been explicitly stated, this is in fact why these approaches can be used in split-spectrum

ADG Journal Club - Alejandro

40:18

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Adrian Podolski... Alejandro Marti...

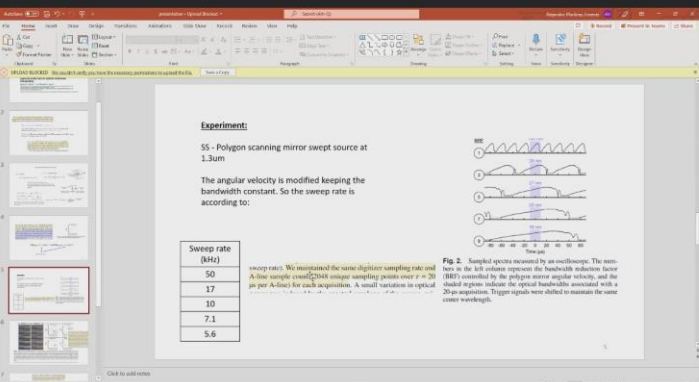
MJ
Michael Hu... Muhamma...

EG HD
Esteban An... Hal Doring...

RR
Adrian Brado... Rene Riba...

R +2
Ramas Egu...

RC



Experiment:

55 - Polygon scanning mirror sweep source at 1.3um

The angular velocity is modified keeping the bandwidth constant. So the sweep rate is according to:

Sweep rate (kHz)
50
17
10
7.1
5.6

Fig. 2. Sampled spectra measured by an oscilloscope. The numbers in the left column represent the bandwidth reduction factor (BFR) controlled by the polygon mirror angular velocity, and the shaded regions indicate the optical bandwidth associated with a 20-nm exposure. Trigger signals were added to maintain the same center wavelengths.

ADG Journal Club - Alejandro

21:55

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AP AJ
Adrian Podolski... Alejandro Marti...

MJ
Michael Hu... Muhamma...

EG HD
Esteban An... Hal Doring...

RR
Adrian Brado... Rene Riba...

R +4
Ramas Egu...

RC

Take-home messages

those on lower resolution systems on a like-for-like basis. Many systems which report axial resolutions of the order of 1 μm are based on supercontinuum light sources which are widely accepted to be noisy. Even though such systems are approaching shot-noise limited sensitivity [14], this work outlines that they will continue to produce images with a lower image SNR than their more limited optical bandwidth counterparts.

(a)

Finally, it is tempting to conclude from this work that an uncorrected dispersion imbalance in the interferometer or chirped fringe, both of which degrade the axial resolution, would result in an improved SNR. However, this neglects the attenuation of the point spread function that accompanies a dispersion/chirp-induced PSF broadening. Because of this attenuation, dispersion/chirp does not increase the number of photons within a single coherence gate, and therefore does not improve the SNR.

(c)

As the axial resolution approaches the size of the sample structure under investigation, the distributed scatterer approximation no longer holds, and the entire structure then falls into the surface boundary regime wherein the SNR is independent of optical bandwidth/axial resolution.

(b)

In a few words:

As light axial resolution approaches the size of the sample structure under investigation, the distributed scatterer approximation no longer holds, and the entire structure then falls into the surface boundary regime wherein the SNR is independent of optical bandwidth/axial resolution.

In this work, we have shown that a high axial resolution can also result in a lower SNR. It may be advantageous therefore to image with deliberately reduced axial resolution in some applications.

A few slides from the NETLAS PhD Student Alejandro Martinez Jimenez's presentation



AOG Seminar

Presentation by NETLAS PhD Student [Rene Riha](#)

Friday 20/05/2022 at 12 pm

Presentation Title: **Dispersive cavity swept sources and dual resonance sweeping mechanism**

Summary: Principles of dispersive cavity akinetic swept sources for OCT were explained to AOG staff at Kent. State of art in research on this type of swept source was presented and a dual resonance sweeping mechanism developed at Kent introduced. A paper was recently submitted to Optics Letters employing this mechanism in the 1550 nm range. Recent results in the 1060 nm setup were also shown with a wavelength tuning range of 40 nm at 1.7 MHz sweep rate.

A few slides from Rene's presentation are presented below.



AOG Seminar - Rene

13:47

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Optical modes in a dispersive cavity

- longitudinal modes condition

$$\Delta\nu(\nu) = \frac{c}{2Ln(\nu)} \left(1 + \frac{\nu}{n(\nu)} \frac{dn(\nu)}{d\nu} \right)^{-1}$$

\Rightarrow modes separation changes with ν !

- modulation frequency $f_m = p\Delta\nu(\nu)$

Optical modes in dispersive laser cavity.

5 / 22

Rene Riha

David Jackson

RR +6 RC

AOG Seminar - Rene

22:10

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Dual resonance sweeping mechanism

- sweeping over large Δf_m at $f_s \approx T_p$
- RF comb applied to the modulator

$$f_m(\lambda) = f_{m0} + p f_s = p_0 f_r(\lambda_0) + p f_r(\lambda_0) + \delta f_s$$

δf_s - frequency detuning from $f_r(\lambda_0)$

p going through $\dots, -1, 0, 1, \dots$

Numerical model for the RF comb.

Recorded RF comb for $f_s = 912$ kHz and $\Delta f_m \approx 200$ MHz.

13 / 22

Rene Riha

David Jackson

RR +6 RC

AOG Seminar - Rene

31:14

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Conclusion and plans

- dual resonance mechanism employing intensity modulator for the first time (1550 nm setup): $f_s \approx 900$ kHz, $\Delta\lambda \approx 25$ nm, $OPD_{dB} \approx 2.6$ mm
- continue with characterization of the dual resonance 1060 nm setup
- dual resonance at 850 nm?
- linear-in-wavenumber AKKS[®]? (more in the journal club)

AlnairLabs 50 ps pulsewidth pulse generator

³H. W. Lee et al. "Linear-in-wavenumber actively-mode-locked wavelength-swept laser". *Opt. Lett.*, 2020, 45(19).

22 / 22

Rene Riha

David Jackson

RR +6 RC

A few slides from the NETLAS PhD Student Rene Riha's presentation



International Day of Light – 16th May 2022 at Kent University

International Day of Light is celebrated on May 16th each year, the anniversary of the first successful operation of the laser in 1960 by physicist and engineer Theodore Maiman. The International Day of Light was proclaimed at the General Conference of UNESCO in November 2017.

According to laserfest.org, Theodore Maiman developed the first working laser at Hughes Research Lab in 1960, and his paper describing the operation of the first laser was published in “Nature” magazine three months later.

With the occasion of the International Day of Light, NETLAS PhD Students from Kent University **Applied Optics Group (AOG)** [Alejandro Martinez Jimerez](#), [Gopika Venugopal](#), [Rene Riha](#), together with NETLAS PhD Students [Esteban Andres Proano Grijalva](#) (**Technical University of Denmark**) and [Irene Rodriguez Lamoso](#) (**Technical University of Darmstadt**, Germany), students currently during their secondments at Kent University, and [Sacha Grelet](#) (**NKT Photonics** Denmark), have initiated a poster session, collaborated and prepared together a poster entitled “Swept Source Technologies at Kent”. They displayed the poster in the foyer area of Ingram building together with other scientific posters.

In addition, [Alejandro Martinez Jimerez](#) (President of [Optica student chapter](#) at Kent University) and AOG PhD Students [Adrian Fernández Uceda](#) and [Julien Camard](#) made and displayed another poster entitled “Optica chapter at the University of Kent”. Different students have prepared posters with little concepts on light and its deep application, all related to their research topics.

Introduction

Swept-source (SS) is a type of laser source in which the output is periodically tuned over the bandwidth $\Delta\lambda$. The laser is usually centered on a particular wavelength and is "swept" over its tuning bandwidth.

The Applied Optics Group in the University of Kent together with its partners in the NETLAS ITN are developing novel swept-source lasers, based on different technologies:

- MEMS, MEMS-VCSEL...
- Mirror based swept-source
- Active and passive mode-locking lasers
- Supercontinuum

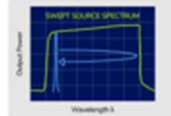


Fig. 1: Swept source operates principle in wavelength

Applications

SS optical coherence tomography (OCT) employs a swept-source, a high-speed photodetector, and a digitizer to acquire the interferograms produced with a Michelson interferometer. SS has been increasing in popularity due to its technical advantages over previous technologies for OCT by such longer axial range, increasing speed, and higher signal-to-noise ratio.

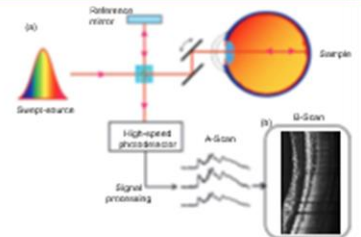


Fig. 2: (a) OCT Setup. (b) B-scan image of the retina. OCT image was obtained in the AOG lab.

know-how

MEMS & MEMS-VCSEL

1) THE MIRRORS

DBR: Distributed Bragg reflector. The periodic contrast in refractive index leads to partial reflections interfere constructively. DBR reflectivity and stopband depends on the number of layer pairs and



2) MICRO ELECTROMECHANICAL DESIGNS

Fig. 5: Electrothermo MEMS actuation. (a) FP-DBR on a substrate with a layer of heater. (b) Cross-section of a P-MEMS. (c) Schematic cross-section image of FP-DBR.



3) MEMS-SS WORK PRINCIPLE

The cavity length determines the resonant wavelength, i.e. the emission wavelength. By changing this length the emission wavelength varies accordingly ($\lambda_{\text{res}} = mc/2$).

3.1) FP-Filter

Source: out of this

3.2) MEMS-VCSEL

Source: beside this

OPTICA

Student Chapter

at the University of Kent Canterbury, UK

Scan me!

At the source: OPTICA

Lead editor in the field of **optics and photonics**, **OPTICA** (formerly OSA) has dozens of local **Student Chapters** in Universities around the globe...

Collimated funding

OPTICA provides **funding** to our Chapter to run a **variety of activities**. In return, we submit a **report** at the end of the year.

The **Applied Optics Group** (AOG) at Kent develops **advanced optical systems** for **imaging and sensing** with applications in

Top part of the posters made by NETLAS and AOG Students displayed in Ingram building with the occasion of the International Day of Light – 16th May 2022



In the photo, from left to right: **Manuel Marques, Marie Klufts, Julien Camard, Adrian Fernandez, Irene Lamoso, Prof. Adrian Podoleanu, Rasmus Eilkaer Hanse, Esteban Andres Proano, Alejandro Martinez, Rene Riha, Gopika Venugopal and Ramona Cernat.**

If you want to zoom in and have a close look on the posters, please see them attached just below:

[Optica Student Chapter - Who are we?](#) [Download](#)

[Diffraction Slide by Andy Thrapp](#) [Download](#)

[LASER by Matej Spacek](#) [Download](#)

[Microneedles by Rachel Sully](#) [Download](#)

With this [initiative](#), Optica Student Chapter administration intended to make the student chapter known to the other students at the University of Kent: they are more than welcome to visit us and join our activities.



International Day of Light – 16th May

International video production:
Light – a spectrum of opportunities



Dr. Danuta Sampson: Senior Research Fellow at the UCL and Surrey University, United Kingdom.

“Please find below the link to our international video production: **Light – a spectrum of opportunities**. The video will go public at 10 am on 16th May (UK time)”.

<https://youtu.be/XxHYR-A68FA>

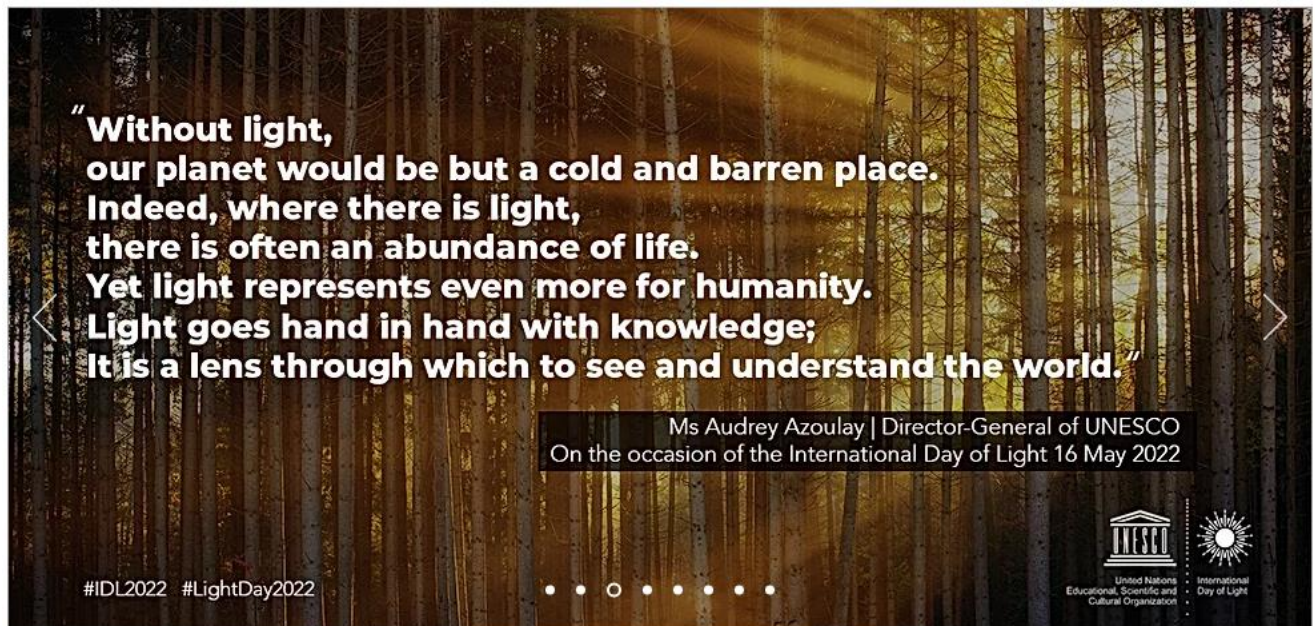
“Light is everywhere. Light, optics, and photonics impact almost every aspect of our lives; from entertainment to medicine, communications, energy, agriculture, art, and culture. In this short video, we summarize it. We hope you will like it and become inspired by Light; its beauty and its endless presence in our lives”.



OPTICS & PHOTONICS NEWS

Celebrating LightDay 2022

The [International Day of Light](#), observed annually on 16 May, is a unique opportunity to celebrate the incredible ways that light science impacts people's lives. To commemorate this important day, [Optics and Photonics News has put together several stories from this year](#) that showcase how light science is driving advances across applications in sustainable development, clean energy, health care, communications infrastructure, astronomy, cultural preservation and more.

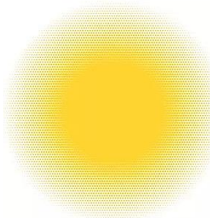


[International Day of Light \(lightday.org\)](https://lightday.org)

For interest, you can find [here](#) some of the laser history, but note that the International Day of Light is not just about lasers and science. It also includes aspects of art, culture, entertainment – everywhere light is present in fact!



The 2022 Daylight Award



THE DAYLIGHT AWARD

**The Daylight Award
honors and supports
daylight research and
daylight in architecture.**

It acknowledges and encourages scientific knowledge and practical application of daylight, which interlink disciplines that are usually addressed in separated, monocultural spheres, professional circles, or practices. The Daylight Award strives to raise a holistic understanding of daylight and increase its positive impact on life.

The 2022 laureates were announced on the UNESCO International Day of Light, 16 May 2022.

[Laureates - The Daylight Award](#)



**THE DAYLIGHT AWARD 2022 —
DAYLIGHT IN ARCHITECTURE**

[YVONNE FARRELL and](#)

[SHELLEY MCNAMARA](#)



**THE DAYLIGHT AWARD 2022 —
DAYLIGHT RESEARCH**

[ANNA WIRZ-JUSTICE](#)



AOG University of Kent – Company visit: [CAIRN Research](#) in action

Amongst the many activities of the OPTICA Student Chapter at the University of Kent, company visits are important educative events. Hence, it is always a great opportunity to pay a visit to one of the closest companies to Canterbury, such as the [CAIRN Research](#).

The company chairman, Dr Martin Thomas, recently visited the AOG labs, and following our conversation, the PhD Students [initiated a visit to his company](#).

On 23rd May 2022 NETLAS and AOG PhD Students organized themselves and split in small groups to fit in three cars and went to the company located in Faversham Kent.



In the photo, from left to right: Irene Lamoso, Rasmus Eilkaer Hanse, Manuel Marques, Alejandro Martinez, Hal Darrington, Rene Riha, Marie Klufts, Adrian Fernandez, Esteban Andres Proano Grijalva, Gopika Venugopal, Julien Camard and the company director Dr Martin Thomas

Dr Martin Thomas guided the group into his labs, presenting us how the company settled in Kent and how they adapted to the fast evolving demands of the industry.



Jez Graham, CEO of Cairn Research, showed us some of the products that they developed for their customers. Completely customized products for their customers. Focus was set on two sets of products:

***Specialised microscopes.** Through interaction with the customer base the company realised that many advanced microscope modalities are simply too versatile. Customers might only need 1 or 2 features of a microscope that offer a wide range of applications. As a result, Cairn Research has started offering microscopes that only do exactly what the specific customer needs, which means they are better at these specific tasks while being much more user friendly.

***Rotating filter wheels.** In some multispectral applications, the ability to shift between colours quickly and reliably is important. For this Cairn has developed co-rotating filter wheels. The co-rotating filter wheels offer two great advantages over a single filter wheel; by leaving a single hole empty in both wheels more colours can be used simultaneously, and the co-rotating property means that the instrument can balance its own torque.

It is encouraging for the PhD students that such interesting industrial research takes place so close to the university. It seems like it was a great adventure!



CAIRN Research [twit on](#)
[23rd May 2022](#)

We really had a great experience during the visits, fascinating tools are the ones that they have. We wish them all prosperity and success in the following years! Hope that we can collaborate more in the future and see more of our PhD Students working in your company!



Professor Adrian Podoleanu Career Celebration conference Canterbury 26-27 May 2022

We are delighted to announce that an event took place in Canterbury, UK, on Thursday 26 (afternoon) and Friday 27 May (all day), to celebrate Prof Adrian Podoleanu's career achievements to date.

Program of the event and other information can be found here

[**http://cc22.aogkent.uk/**](http://cc22.aogkent.uk/)

The event started with a recorded video by the Vice-Chancellor of University of Kent [**Prof. Karen Cox**](#), followed by [**Prof David Jackson's**](#) summary of the early days of AOG [FInstP, FOSA, Emeritus Professor of Applied Optics, former head of AOG (1965-2005)] and [**Prof Philippe de Wilde**](#), professor of artificial intelligence (former Deputy Vice-Chancellor for Research & Innovation at the University of Kent 2014 – 2020).

The conference program *welcomed 10 keynote speakers*: **Prof Maciej Wojtkowski**, Institute of Physical Chemistry, Polish Academy of Sciences, Poland, **Prof Richard Rosen** New York Eye and Ear Infirmary of Mount Sinai, USA, **Prof Jannick Rolland** University of Rochester, USA, **Prof Robert Huber** Universität zu Lübeck, Germany, **Prof Christoph Hitzenberger**, Medical University of Vienna, Austria, **Prof Stephen Matcher** University of Sheffield, UK, **Prof Meda Negruțiu**, Victor Babeș University of Medicine and Pharmacy, Romania, **Prof Ole Bang** Technical University of Denmark, **Prof Robert Zawadzki** University of California, Davis, USA, and **Prof David Sampson** University of Surrey, UK.



The event also welcomed great speakers coming either in person or online from different parts of the world: **Dr Radu-Florin Stancu**, University of Kent, UK, **Dr Maria-Alexandra Păun** Swiss Federal Institute of Technology (Lausanne), Switzerland, **Prof Fabrizio Frezza** Sapienza University of Rome, Italy, **Dr Bettina Heise**, Research Center for Non-Destructive Testing (Linz), Austria, **Prof Claudia Coțca**, Washington Institute for Dentistry & Laser Surgery, USA, **Dr Peter Munro**, University College London, UK, **Dr Andrew Thrapp** Wellman Center for Photomedicine, Harvard Medical School, USA, **Dr Yong Hu** iCare, Italy, **Prof Humberto Michinel**, Universidad de Vigo, Spain, **Prof Nigel Mason** University of Kent, UK, **Dr Chao Wang**, University of Kent, UK, **Prof Kirill Larin** University of Houston, USA, **Dr Carla Rosa**, University of Porto, Portugal, **Prof Crina Cojocaru** Polytechnic University of Catalonia, Spain, **Dr Jingyu Wang** University of Oxford, UK, **Prof Cosmin Sinescu** Victor Babeș University of Medicine and Pharmacy, Romania, **Prof Adrien Desjardins** University College London, UK, **Prof Aristide Dogariu** CREOL, The College of Optics and Photonics, USA, **Natalie Tuchapsky/Dr Vladimir Shidlovski** Superlum Ireland, **Prof Kamran Avanaki** University of Illinois Chicago, USA, **Prof. Marinko Sarunic** Moorfields Eye Hospital / University College London, UK, **Prof Sherif Sherif** University of Manitoba, Canada, **Prof Irina Larina** Baylor College of Medicine, Houston, USA, **Prof Gabriel Popescu** University of Illinois at Urbana Champaign, USA, and **Prof Mircea Guina** Tampere University, Finland.

The conference was divided in 9 sessions and had a dedicated time for poster presentations on Thursday 26th May. NETLAS PhD students attending the event in person had the following poster presentations:

- [Irene Rodriguez Lamoso](#), Technical University of Darmstadt: *“High-Tunable Fabry-Pérot MEMS-filters and MEMS-VCSEL for OCT applications”*,
- [Rene Riha](#), University of Kent: *“Dispersion tuned akinetic swept source”*
- [Gopika Venugopal](#), University of Kent: *“Development of 850 nm Galvo Scanner based Swept Source for Full Field OCT”*
- [Sacha Grelet](#), NKT Photonics: *“Fast Akinetic Swept Source for Optical Coherence Tomography”*
- [Marie Klufts](#), Institute of Biomedical Optics, Universität zu Lübeck: *“840nm FDML Laser”*

- [Alejandro Martínez Jiménez](#), University of Kent: *"Time stretch laser technology for OCT"*
- [Esteban Andres Proano Grijalva](#), Technical University of Denmark (DTU): *"Electrically Pumped MEMS VCSEL for OCT"*
- [Philipp Tatar-Mathes](#), Tampere University: *"Membrane external-cavity surface-emitting lasers (MECSELs): A light source for vis-OCT"*



Photo conference day 1: 26th May



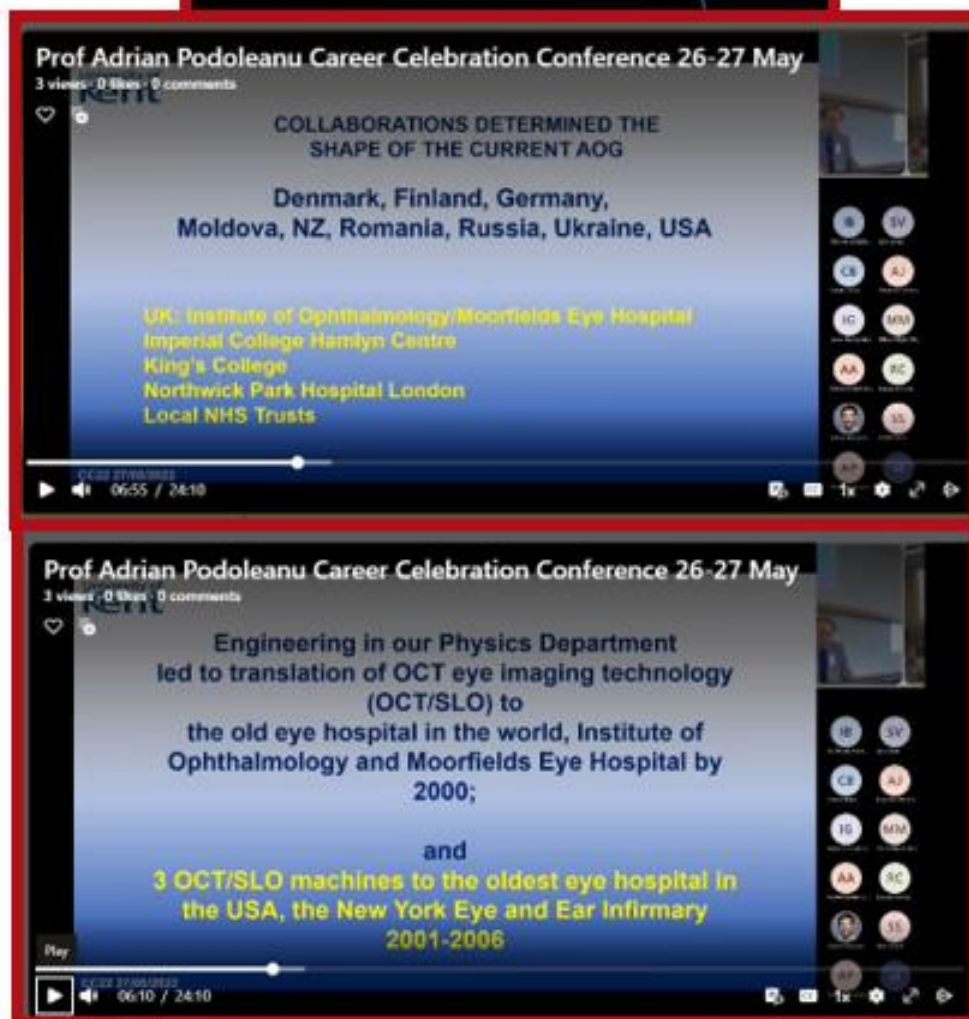
Photo conference day 2: 27th May



Print screens taken during the event



Photos and print screens taken during the event



Photos and print screens taken during the event

PUBLICATIONS

Towards red-emitting MECSELs for visible-light OCT applications

Philipp Tatar-Mathes, Hoy-My Phung, Aaron Rogers, Patrik Rajala, Sanna Ranta, **Hermann Kahle**, **Mircea Guina**

[Proceedings Volume 12170, Advances in 3OM: Opto-Mechatronics, Opto-Mechanics, and Optical Metrology](#); 1217003 (2022)

<https://doi.org/10.1117/12.2592919>

Event: Advances in 3OM: Opto-Mechatronics, Opto-Mechanics, and Optical Metrology, 2021, Timisoara, Romania

ABSTRACT

We demonstrate our latest work towards a red-emitting semiconductor membrane external-cavity surface-emitting laser (MECSEL) for applications in OCT. This light source technology employs both a near-diffraction limited beam profile ($M2 \geq 1.05$) and a broad tuning range at tailorable emission wavelength. Due to their potential for mass production, combined with the usage of broadly available CMOS-sensors as detector units, OCT imaging device costs can be reduced to a significant amount, while delivering state-of-the-art image quality.

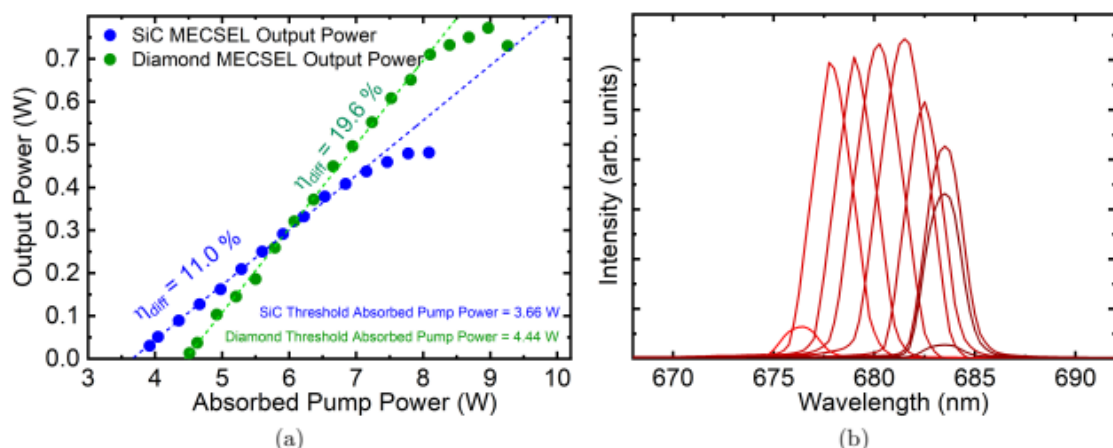


Figure 3. (a) Power performance characteristics of the red-emitting MECSEL using SiC or diamond as intra-cavity heat spreaders. Due to the better thermal conductivity of diamond compared to SiC, higher output power could be reported, combined with a higher threshold. The highest output power achieved was 772 mW with diamond heat spreaders and 481 mW with SiC heat spreaders, respectively. (b) Various emission spectra plotted over the wavelength. 6 nm of tuning range from 676 nm to 683 nm could be achieved using SiC heat spreaders at room temperature operation.



Conference paper: Membrane external-cavity surface-emitting lasers (MECSELs): State of the art in broadband (> 25 THz) tuning and antiresonant gain structure design

Hermann Kahle, Philipp Tatar-Mathes, Patrik Rajala, Mircea Guina

[Proceedings Volume PC12141, Semiconductor Lasers and Laser Dynamics](#)

[X](#); PC1214109 (2022), <https://doi.org/10.1117/12.2632734>

Event: [SPIE Photonics Europe, 2022, Strasbourg, France](#)

Abstract

Membrane external-cavity surface-emitting lasers (MECSELs) are a new kind of vertically emitting semiconductor laser with enormous potential and versatility for tailoring the laser parameters. Part of their benefits is related to the fact that they do not need to employ integrated distributed Bragg reflectors (DBRs), which are known to hamper the heat transfer and limit wavelength versatility via strain and band-gap engineering constraints. [Read More](#)





Slotted Y-branch laser for cw-THz thickness measurements at 1 THz

Nils Surkamp, Alexandra Gerling, James O'Gorman, Martin Honsberg, Sebastian Schmidtmann, Uttam Nandi, **Sascha Preu**, Joachim Sacher, Carsten Brenner, Martin R. Hofmann

Proceedings Volume 12021, Novel In-Plane Semiconductor Lasers XXI: 1202104 (2022)

<https://doi.org/10.1117/12.2609787>

Event: SPIE OPTO, 2022, San Francisco, California, United States

ABSTRACT

This work investigates a monolithic slotted Y-branch diode laser as a beating source to drive a continuous wave Terahertz spectrometer. Both arms of the Y-branch laser exhibit spectral selective feedback, which causes simultaneous emission at two frequencies. At first, a thorough optical characterisation with 5400 individual setpoints is performed to find the best point of operation. Two operational regimes with difference frequencies of $1 \text{ THz} \pm 10.5 \text{ GHz}$ and $0.85 \text{ THz} \pm 6.5 \text{ GHz}$ were identified. While validating the laser as a beating source to drive a cw-THz spectrometer, it was demonstrated that the device supports current-induced tuning of the emitted difference frequency. This technique allows frequency sweeps in the terahertz regime that can be used to measure the transmitted field without a mechanical delay stage. Finally, this technique is demonstrated to independently determine the thickness and refractive index of high resistive float zone silicon wafers of 2, 3.5, 4 and 8 mm thickness without a priori knowledge.

Photonic Spectrum Analyzer for Wireless Signals in the THz Range

BENEDIKT LEANDER KRAUSE , ANUAR DE JESUS FERNANDEZ OLVERA,
AND **SASCHA PREU**

Published in: [IEEE Access](#) (Volume: 10)

DOI: [10.1109/ACCESS.2022.3168162](#)

ABSTRACT We present an ultra-broadband and inexpensive photonic spectrum analyzer (PSA) for wireless signals with a frequency coverage from the microwave range till deep into the terahertz range. The difference frequency of two continuous-wave laser diodes works as the local oscillator frequency and a photoconductive antenna downconverts a signal under test with the aid of the optical local oscillator. With this approach we achieve a frequency coverage from less than 25 GHz to more than 1.25 THz, mostly limited by the tuning range of the lasers. No component of our spectrum analyzer needs to be interchanged in order to achieve the full tuning range, which makes our spectrum analyzer a fraction of the cost of an electronic spectrum analyzer that requires several extension modules for covering a similar frequency range. The system offers a minimum resolution bandwidth of 1.2 MHz at a displayed average noise level (DANL) as low as -113.8 dBm/Hz at 100 GHz or as low as -88.2 dBm/Hz at 1050 GHz.

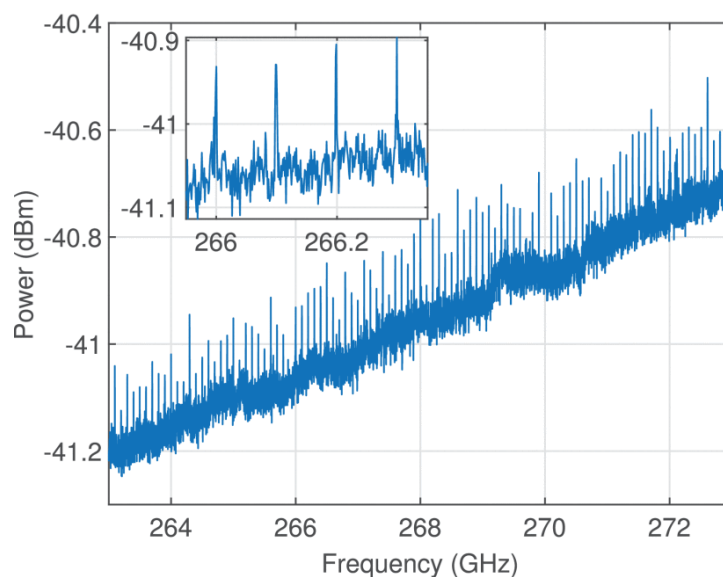


Fig. 11 Spectrum of the pulsed SUT from 263 GHz to 273 GHz with zoomed-in spectrum showing the individual modes.



Registration of histological brain images onto optical coherence tomography images based on shape information

Paul Streng, Birgit Lange, Christin Grill, Wolfgang Draxinger, Veit Danicke, Dirk Theisen-Kunde, Christian Hagel, Sonja Spahr-Hess, Matteo M Bonsanto, **Robert Huber**, Heinz Handels and Ralf Brinkmann

Abstract

Identifying tumour infiltration zones during tumour resection in order to excise as much tumour tissue as possible without damaging healthy brain tissue is still a major challenge in neurosurgery. The detection of tumour infiltrated regions so far requires histological analysis of biopsies taken from at expected tumour boundaries. The gold standard for histological analysis is the staining of thin cut specimen and the evaluation by a neuropathologist. This work presents a way to transfer the histological evaluation of a neuropathologist onto optical coherence tomography (OCT) images. OCT is a method suitable for real time in vivo imaging during neurosurgery however the images require processing for the tumour detection. The method demonstrated here enables the creation of a dataset which will be used for supervised learning in order to provide a better visualization of tumour infiltrated areas for the neurosurgeon. [Read More](#)

To cite this article before publication:

Paul Streng et al 2022 Phys. Med. Biol. in press

<https://doi.org/10.1088/1361-6560/ac6d9d>

Proposal of a new slit-lamp shield for ophthalmic examination and assessment of its effectiveness using computational simulations

Daniel Araújo Ferraz; Zeyu Guan; Edinilson A. Costa; Eduardo Martins; **Pearse A. Keane**; Daniel Shu Wei Ting; Rubens Belfort Jr; Rafael Scherer; Victor Koh; Cristina Muccioli

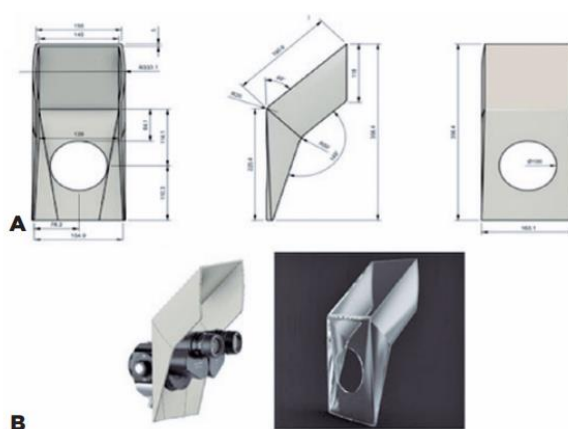
May 2022, Arquivos Brasileiros de Oftalmologia 86(4)

DOI:[10.5935/0004-2749.20230058](https://doi.org/10.5935/0004-2749.20230058)

ABSTRACT

Purpose: This study aimed to use computational models for simulating the movement of respiratory droplets when assessing the efficacy of standard slit-lamp shield versus a new shield designed for increased clinician comfort as well as adequate protection.

Methods: Simulations were performed using the commercial software Star-CCM+. Respiratory droplets were assumed to be 100% water in volume fraction with particle diameter distribution represented by a geometric mean of 74.4 (± 1.5 standard deviation) μm over a 4-min duration. The total mass of respiratory droplets expelled from patients' mouths and droplet accumulation on the manikin were measured under the following three conditions: with no slit-lamp shield, using the standard slit-lamp shield, and using our new proposed shield. [Read More](#)

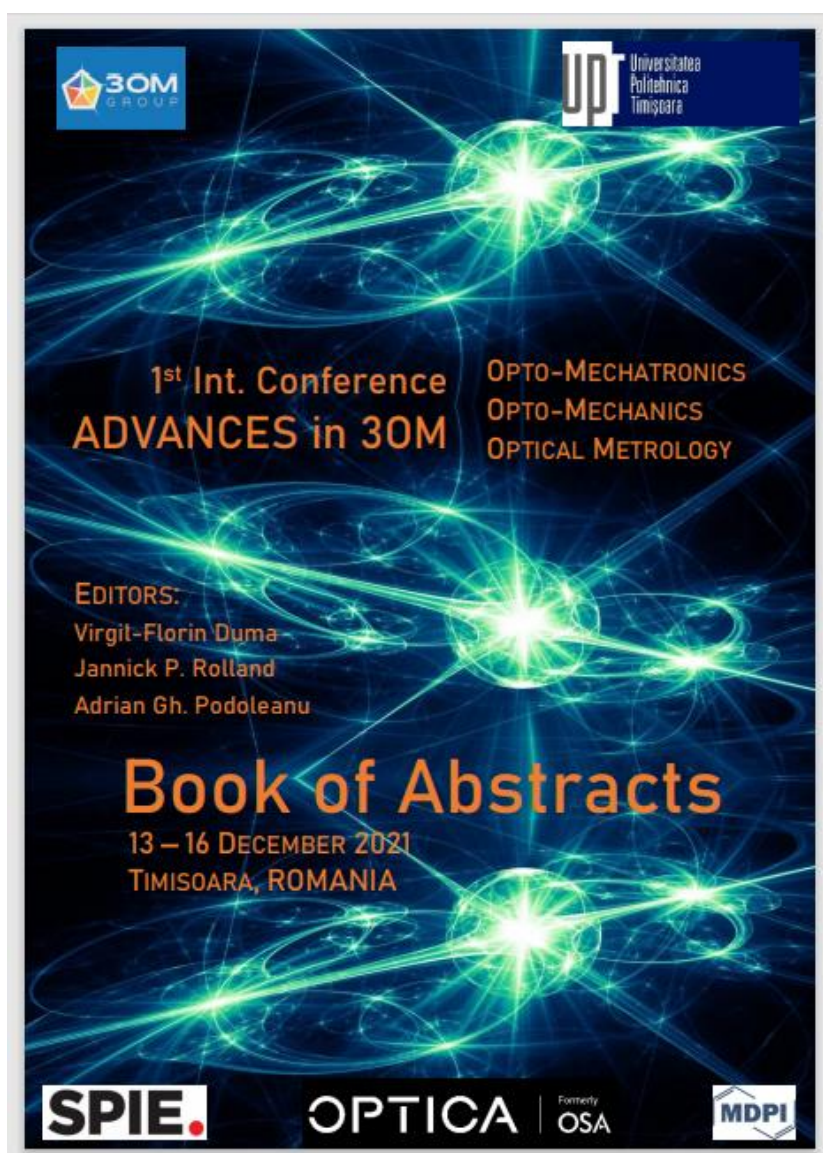


(A) Illustration of the measurements of the proposed shield. (B) Left image illustrates how the proposed shield will fit around the slit-lamp. The right image displays a 3D image of the proposed shield. These are the original figures drawn by the author; therefore, permission is granted for publishing and reproducing this figure.

Figure 1. Illustration of the measurements of the proposed shield.



Book of Abstracts:
1st Int. Conference ADVANCES in 3OM
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OPTICAL METROLOGY).
13–16 December 2021, Timisoara, ROMANIA



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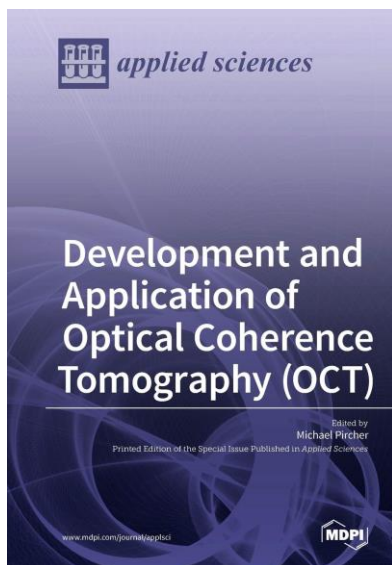
*** Adrian Gh. Podoleanu**, University of Kent (UK)

PDF available



BOOK of interest for NETLAS PhD Students

**Development and Application of
Optical Coherence Tomography (OCT)
by Michael Pircher (Editor)**



**This special feature issue has
been initiated to celebrate
the 25th anniversary of
Optical Coherence
Tomography (OCT).**

Publisher : MDPI AG;

Illustrated edition (7 Feb. 2018)

In OCT, broad bandwidth light is used in order to produce cross sectional images of turbid and translucent samples with high axial resolution (in the order of a few μm). The imaging speed of OCT can be as high as several millions of depth scans (A-scans) per second which allows for various applications in different fields. This special feature issue consists of three overview papers covering OCT angiography, polarization-sensitive OCT and dental applications of OCT. Additional applications and the latest developments in OCT are covered in nine research papers. The latest developments presented in this issue include magnetomotive OCT, resonant Doppler OCT, full field OCT, new segmentation algorithms and depth range extension. Applications of OCT are widely spread and range from quality control in tooth prostheses and coating thickness measurements in the automotive industry to the assessment of degradation of coatings and alveolar dynamics.

[Order the book](#)

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OPTICS & PHOTONICS NEWS

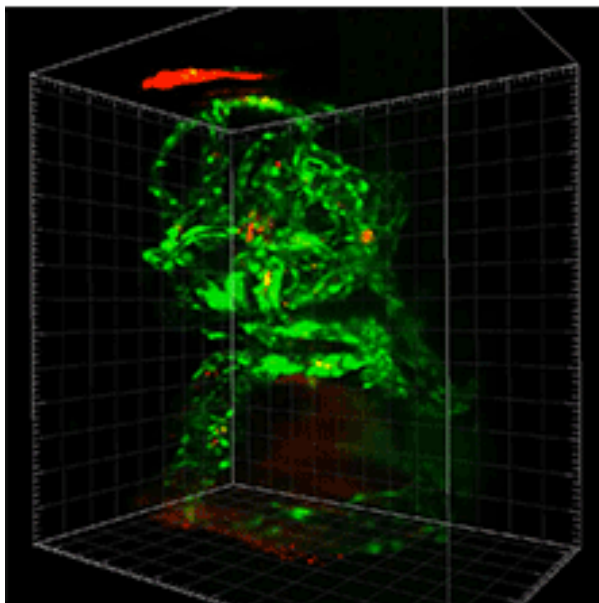


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IMAGE OF THE WEEK



**Airy-like beam-
based light-sheet
microscopy with
improved FOV for
zebrafish
intracerebral
hemorrhage**

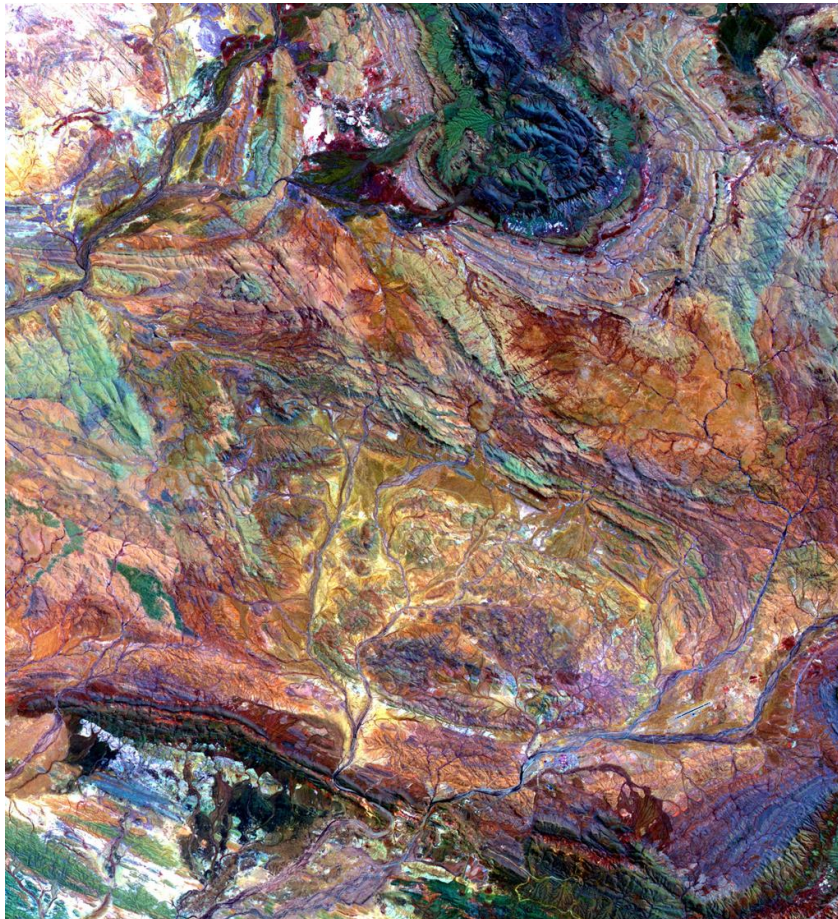
9 May 2022

**[See Visualization 3 in Opt. Express 30\(9\),
14709-14722 \(2022\).](#)**



3.6 Billion Years in Color

The Pilbara, north western Australia, which exposes some of the oldest rocks on Earth—over 3.6 billion years old—is captured in a composite image by the **Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER)** on the Terra satellite.



**NASA/METI/AIST/Japan Space
Systems, and U.S./Japan ASTER
Science Team**



The World's broadest tunable laser from NKT Photonics



SuperK CHROMATUNE

A new laser that gives
you gap-free tuning
from 400-1000 nm.

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We have designed it for applications such as:

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- Spectroscopy
- Fluorescence
- Lifetime imaging
- Optical characterization
- Plasmonics & metamaterials

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NKT Photonics – LASER World of PHOTONICS

[26 -29 April 2022, Munich Summary](#)



Couldn't make it to LASER World of PHOTONICS? Or didn't you make it to the NKT booth? Here are some videos that sum it up.

[Our Laser Munich 2022 summary - NKT Photonics](#)

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The [Koheras HARMONIK lasers](#) for quantum applications give you performance like never before. New wavelengths. Higher power. Lower noise. Narrow linewidth. Industrial reliability.

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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. Their live webinars have concluded for 2021. Check for this year's schedule and browse content from prior ones on the Recorded Webinars tab.



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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