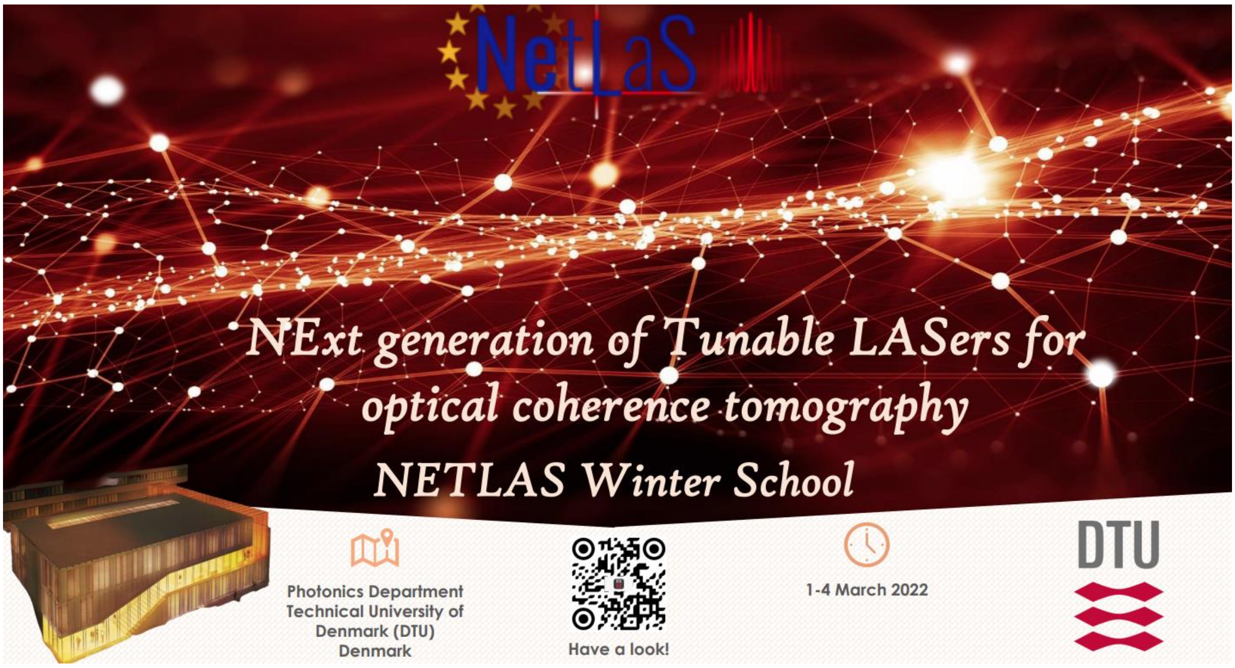
NETLAS NEWSLETTER 2-2022

NETLAS Winter School



NETLAS Winter school is scheduled to take place at Technical University of Denmark (DTU), Denmark between 1st and 4rd March 2022.
Organizers are preparing the event to be attended in person, however online participation is possible for those who do not feel safe to travel.

Thank you DTU for organizing the event!

SECONDMENTS

S PhD1 Andrei Anikeev from Superlum (SUP)

Secondment is planned to start February 20, 2022 at Tampere University (TAU)

Andrei is heading to Tampere University for minimum 6 months. His principal activities would be:

- Getting the necessary courses and lectures to gain credits for PhD studies

- Gaining hands-on experience with the Optoelectronics research centre (ORC) in TAU – MBE wafer growth, processing and laboratory measurements. ORC has a world-class laboratory for the epi wafer growth and characterization.

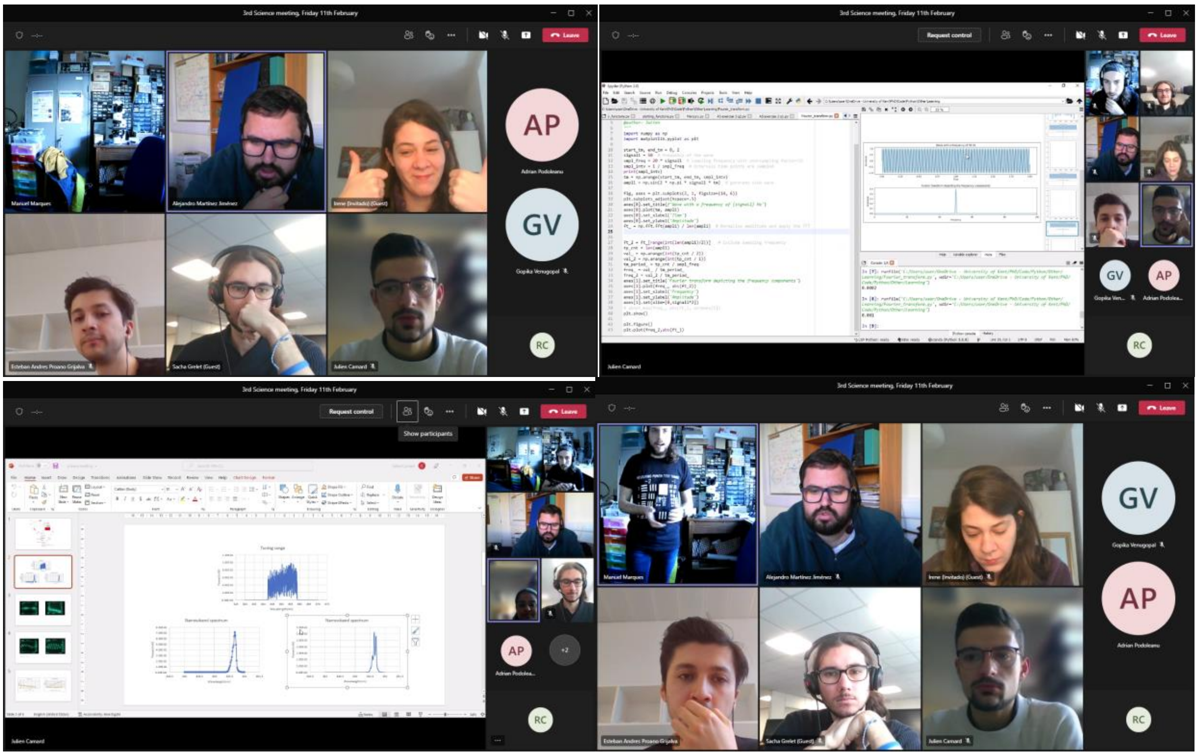
- Work together with TUNI team on improving the performance parameters of high power 1064 nm SLED emitters TAU and Superlum designed several epi wafer variant towards high power broad band emission around 1064 nm. Designs were grown at TAU. Andrei will participate in measurements, will compare the results with the performance obtained at SUP and participate in design optimisations.

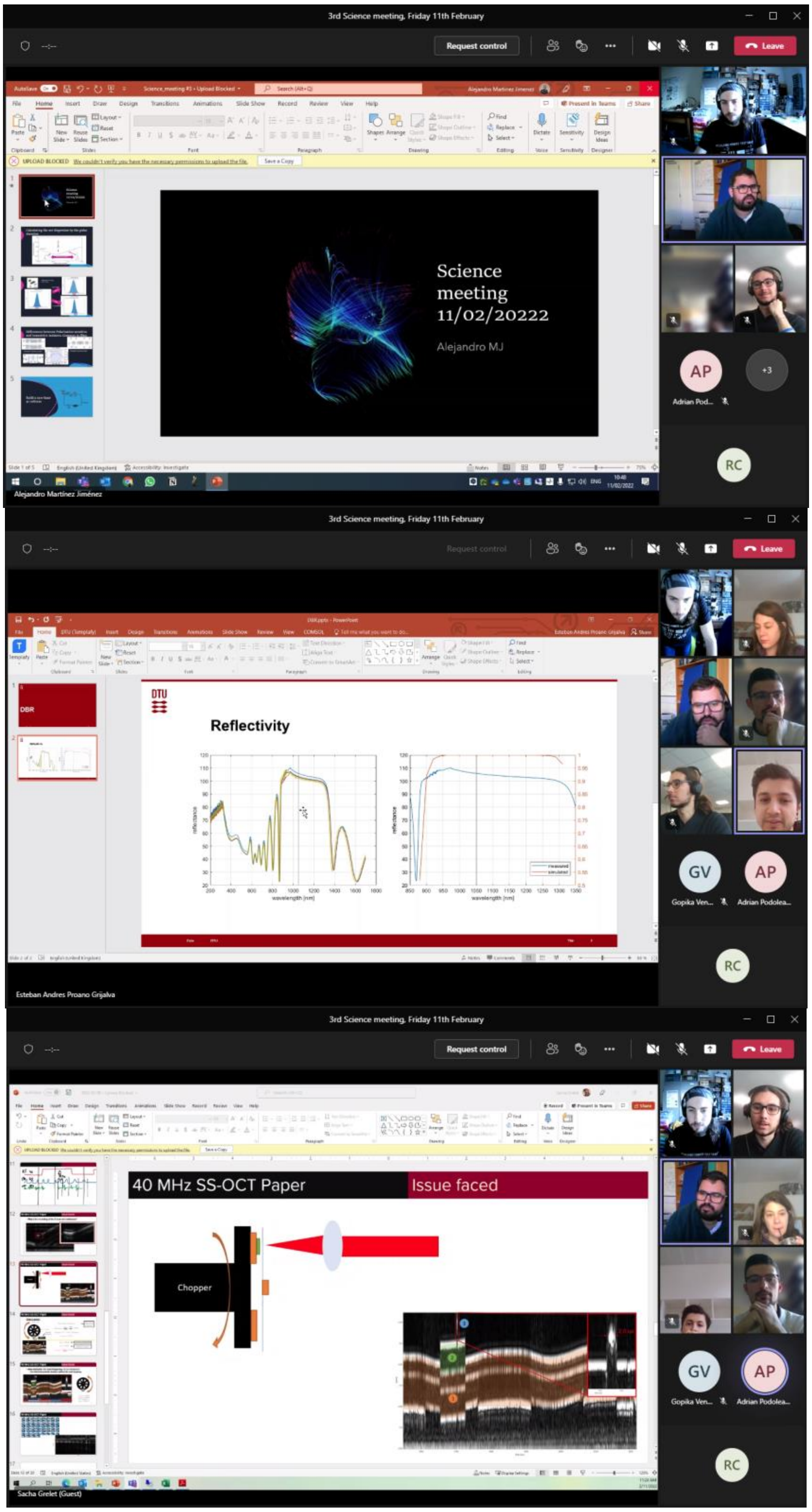
Good luck Andrei!!!

NETLAS ESRs Science Meetings

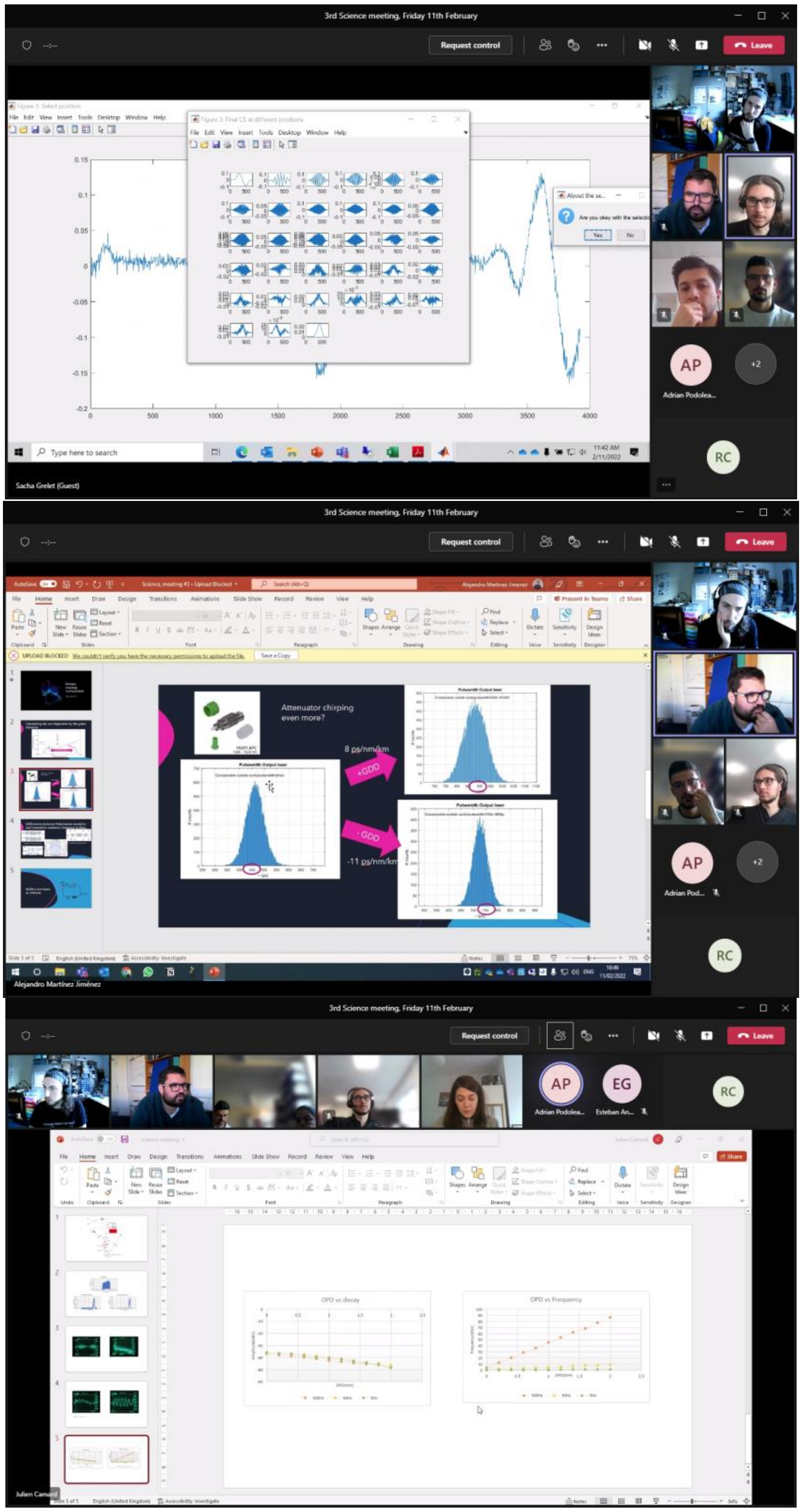
NETLAS PhD Student Alejandro Martinez and other members of the AOG team took the initiative to organize Science Meetings. The idea is for the ESRs to present their work in a few slides starting with the background of their research, results they have obtained in the lab, and discuss problems and possible solutions.

NETLAS PhD Student Alejandro Martinez said: "I would like to restart the science meetings again and I suggest Friday 11th February at 10.00 UK time. You may have found new problems in your research (like me) which you would like to discuss. Remember, you don't need to prepare a huge amount of slides, just the needed to make others understand your problem. And the point is not to take too much of your time to prepare them. Please take all of that into account. I'll send a link invitation in the following email."





Print screens from the science meeting which took place on 11th February 2022



Print screens from the science meeting which took place on 11th February 2022

NETLAS PhD Students recommendations to their peers

Alejandro Martinez from Kent University

As a person of this world, I have my social media in which I spend a bit of time every day, maybe more time than I should, but that's because social media has something that makes you engage with the content. It is full of interactions, and for some people, this is even addictive, which can happen for some reasons. In my case I am a person that feels bad if I spend so much time on social media or procrastinating, so I asked myself, how I can get the best from my bad habits? And well I started to watch TED talks about keeping an structured procrastination [link] or the wheel of the procrastination… All of them quite interesting from my point of view, so briefing the thing is to find a bit of commitment in your bad habits.

So I decided to do a bit on research on Twitter, I use to have just my personal account in which I post nothing but still scrolling looking at what other people are doing. So I started to follow accounts related with my job, Thorlabs, several companies, Optica chapters around the world and finally I found the biophotonics cat! The biphotonic cat is a bot that is looking for the new papers in several journals optics related, classify them into different categories and give a relevance number based on the novelty and some other criteria. Of course there is some people behind it who RT others research centers news and more. I was in shock with the community's widespread and powerful utilization of this social media. Many group leaders show their latest papers, new developments in the field and their personal musing on research trends and social implications.

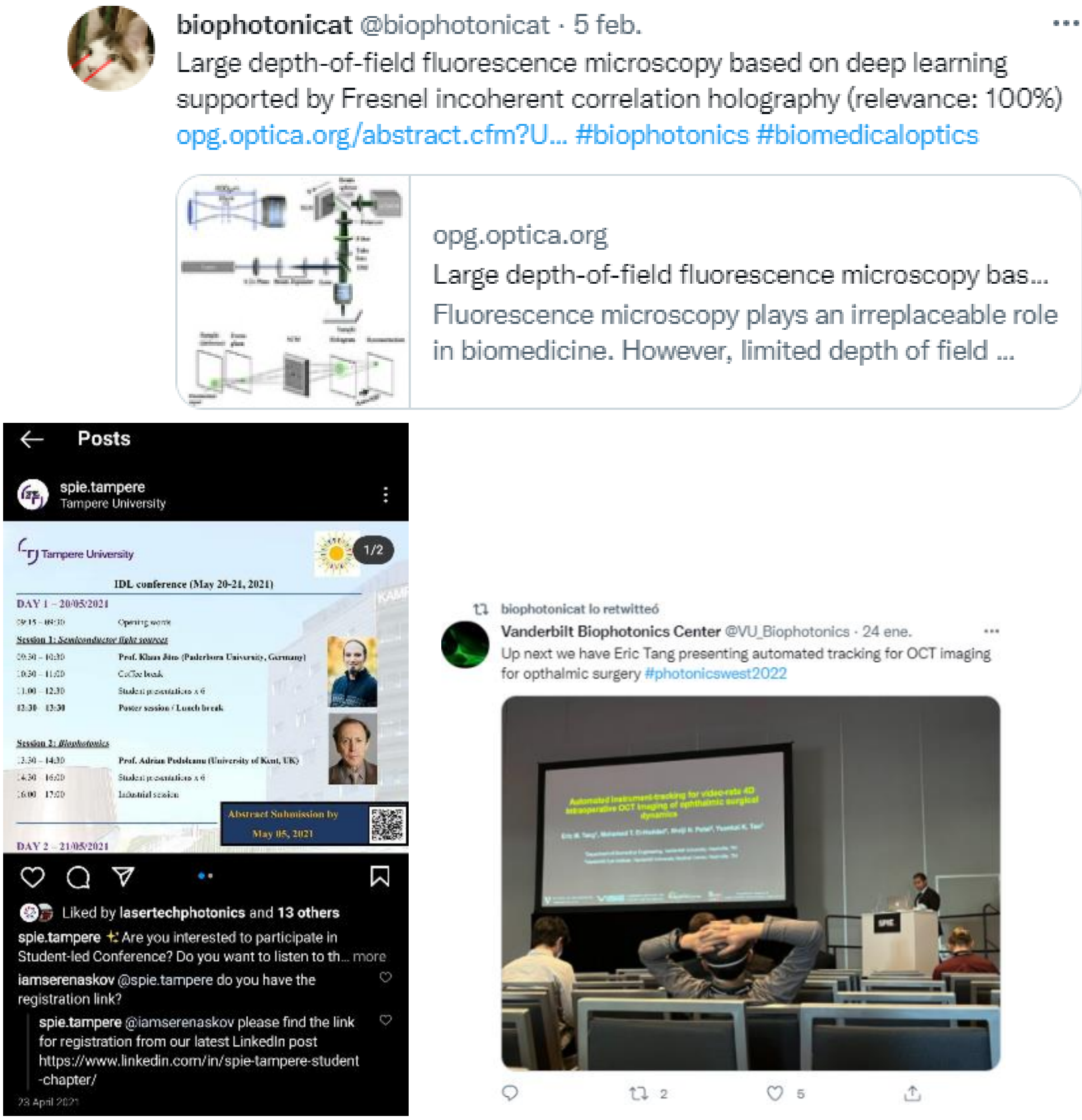


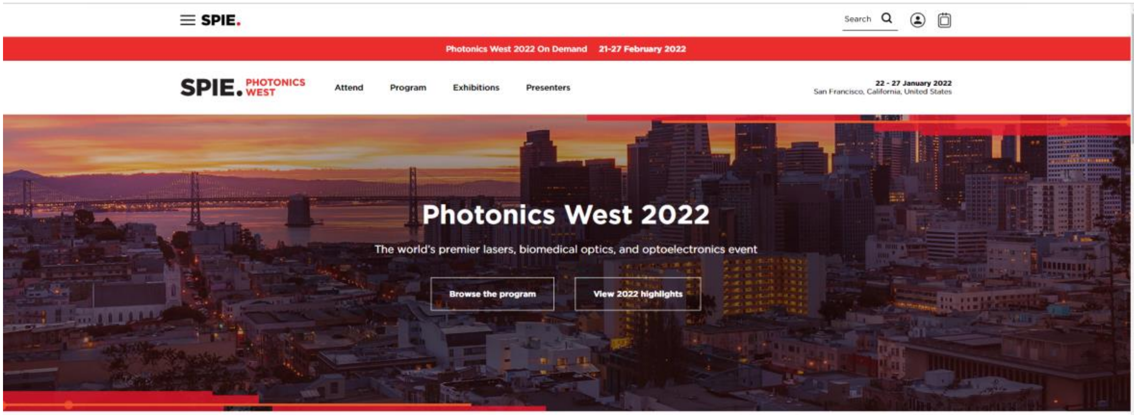
Figure 1. Screenshots of Twitter and Instagram posts.

I did the same on Instagram with optics chapters from my home country and all around and all of a sudden, I had an account with full of interactions more related with my job. You may think that could be a bit boring but now my procrastination time is mixed with some fun job related stuff. And I would say it started to move a wheel in the good direction.

CONFERENCES

SPIE Photonics West 2022

San Francisco, California, United States, 22-27.1.2022



NETLAS participants from Lübeck and Tampere University

Presentations by NETLAS ESRs:

1.Marie Klufts, Simon Lotz, Muhammah Bashir (NETLAS fellow), Sebastian Karpf, Robert Huber "***Ultra-high-accuracy chromatic dispersion measurement in optical fibers***" (recorded presentation).

2. Philipp Tatar-Mathes, Hoy-My Phung, Aaron Rogers, Patrik Rajala, Sanna Ranta, Hermann Kahle, Mircea Guina, "***MECSELs with a non-resonant sub-cavity design***", SPIE Photonics West, 11984-11 (2022) (oral presentation on site, recorded).

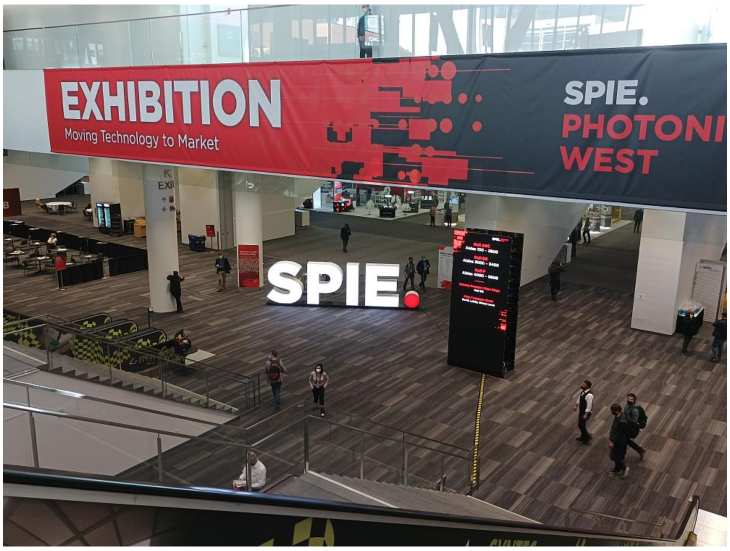
PhD Student Philipp Tatar-Mathes (Tampere University) (1st right) and his supervisor Prof. Mircea Guina (middle) representing NETLAS at the conference

PhD Student Philipp Tatar-Mathes (Tampere University) about his experience at the SPIE Photonics West 2022 conference

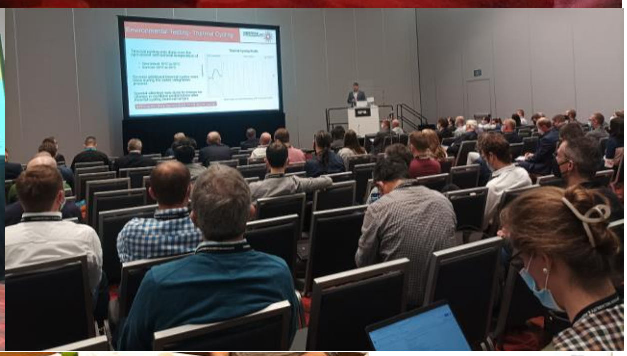
'As this was my first experience of the Photonics West, I cannot compare it to pre-covid times, but I heard that apparently before was bigger than this year (for me this conference is the biggest conference I ever attended). In the sessions, there were experts from academia also from the industry who had very interesting presentations and questions, and it was really joyful to network with other PhD-students in similar fields from all around the globe.

There were interesting Keynote presentations, all of them were recorded and will be available online sometime after the conference. I can highly recommend to watch those. All in all, the program was so full that it was more of a struggle to decide which one to attend next because there were so many interesting talks – however, it took a while to get a proper program overview as it was specifically designed for app usage, and one had to first click oneself through the session titles that were sometimes quite general ("Devices", or "applications"). The conference even provided one evening program with dinner, as well as live music and professional dancers.

While at Photonics West conference venue, I spotted a professional photographer who went around taking pictures all the time. I proceeded to ask him whether I could get a chance to get some of his pictures and gave him my business card as he didn't have his own one. He promised to head back to me, which he hasn't done yet. I therefore can only provide my own pictures that I took while being there and I am happy to share with everyone'.



All photos were taken by PhD Student Philipp Tatar-Mathes (Tampere University) at the SPIE Photonics West Conference, San Francisco, California, United States, 22-27.1.2022



All photos were taken by PhD Student Philipp Tatar-Mathes (Tampere University) at the SPIE Photonics West Conference, San Francisco, California, United States, 22-27.1.2022

NETLAS PhD Student Marie Klufts'(Lübeck University) personal experience

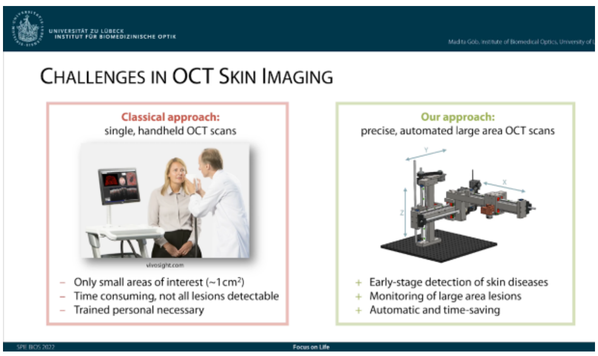
Not being allowed to go to Photonics West 2022 Conference because of the University regulations due to coronavirus pandemic was at first sight very frustrating. Indeed, a lot of work had to be done in order to be ready in time and to finally be able to make a presentation in presence, which I still haven't had the opportunity to do since the beginning of my thesis. However, having access to all the conferences on demand is very pleasant, a large number of talks can be watched, and we can pause the presentations when a scheme appears. Not being able to ask questions is and remains limiting.

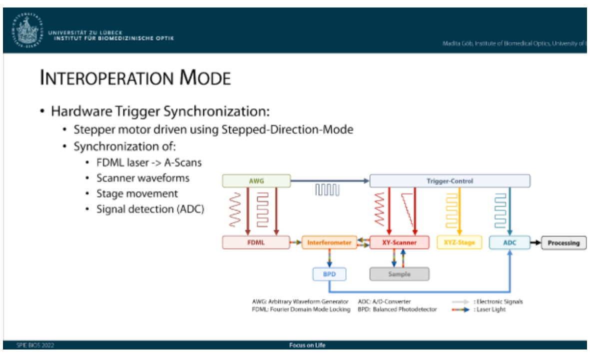
It is always a pleasure and a real plus to participate in big conferences like Photonics West. It is even more motivating to get results. Moreover, when writing and preparing a presentation, new uncertainties may arise and lead to further tests and results.

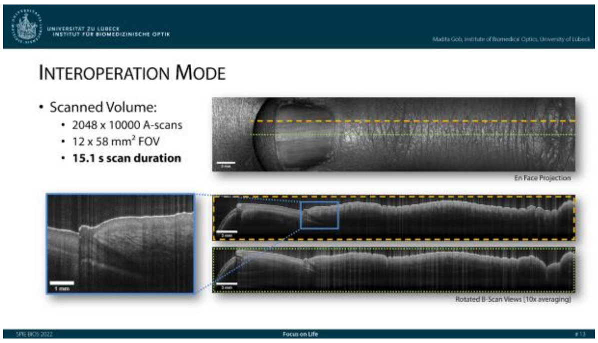
Interesting talks I would recommend:

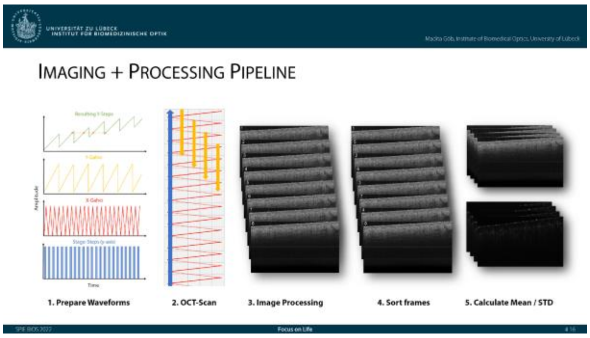
1. M. Göb, S. Burhan, S. Lotz, R. Huber, "**Towards ultra-large area vascular contrast skin imaging using multi-MHz-OCT**," Proc. SPIE 11948, Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XXVI, 1194830 (January 2022)

   "The integration of a movable stage into our self-built 3.3 MHz- OCT system allows acquiring coherent ultra-large area images, fully leveraging the high speed potential of our system."



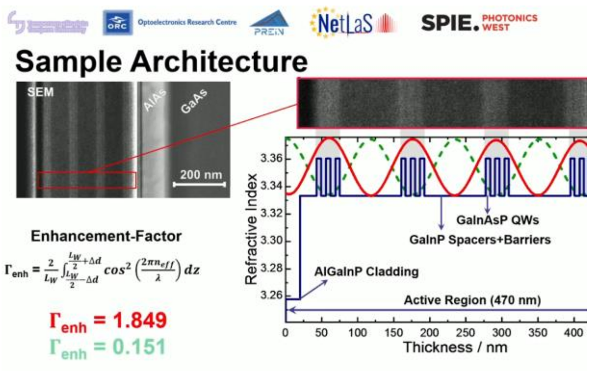


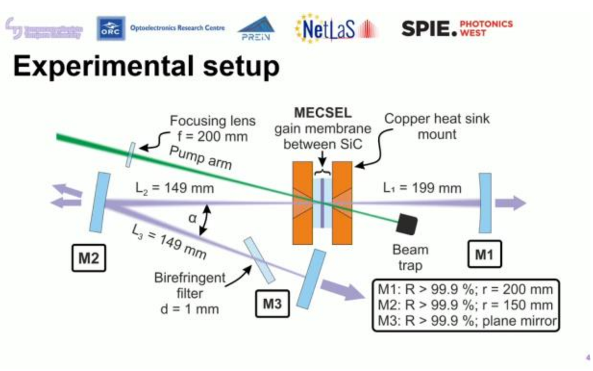


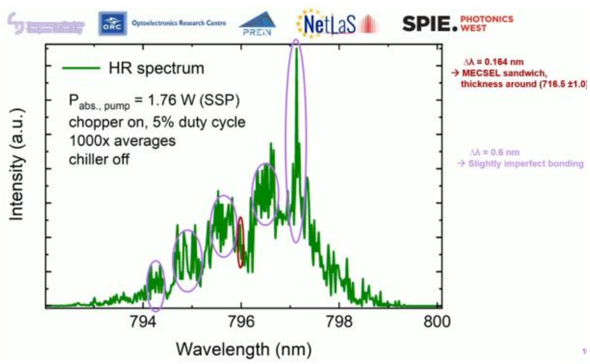


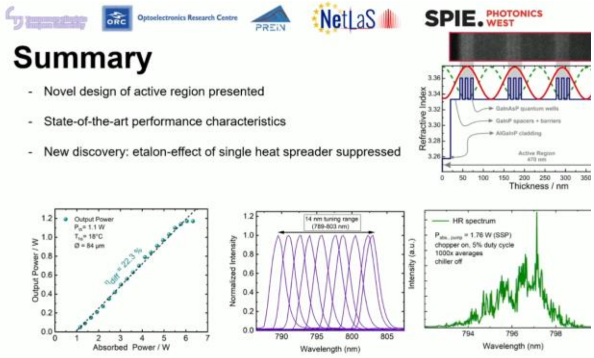
2. P. Tatar-Mathes, H-M. Phung, A. Rogers, P. Rajala, S. Ranta, H. Kahle, M. Guina, "**MECSELs with a non-resonant sub-cavity design**," Proc. SPIE 11984, Vertical External Cavity Surface Emitting Lasers (VECSELs) XI, 11984811 (January 2022)

> *"We report on the performance of MECSELs based on a non-resonant gain structure in respect with the operating lasing emission wavelength at 800 nm. Preliminary observations reveal an output power of 1.1 Watt and a 20 nm tuning range."*



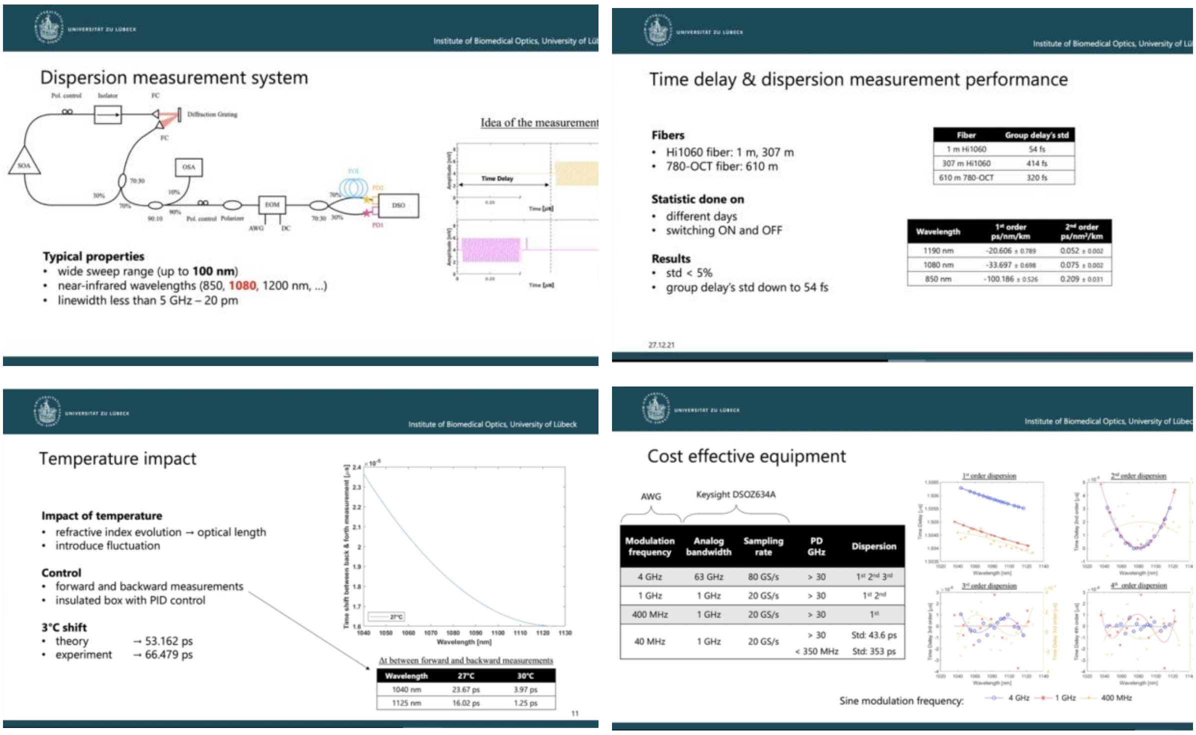






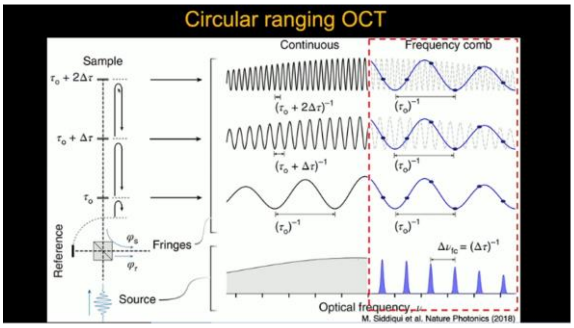
3. M. Klufts, S. Lotz, M. Bashir, S. Karpf, R. Huber, "**Ultra-high-accuracy chromatic dispersion measurement in optical fibers**," Proc. SPIE 11997, Optical Components and Materials XIX, 1199736 (January 2022)

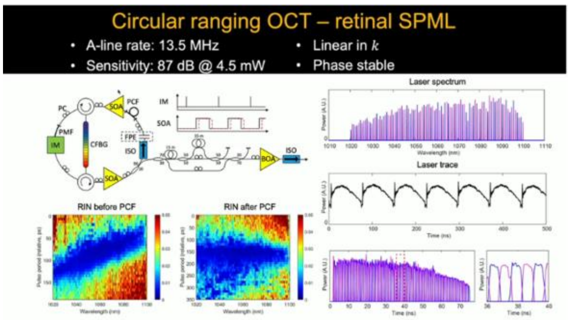
"We present a setup able to measure the 1st and 2nd order dispersion with a high accuracy. Our system is suitable for all length of fiber longer than 2 meters. We achieve to measure a group delay dispersion with a standard deviation down to 54 fs with a 1 m fiber."

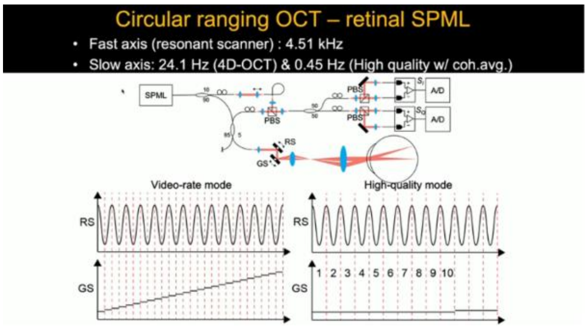


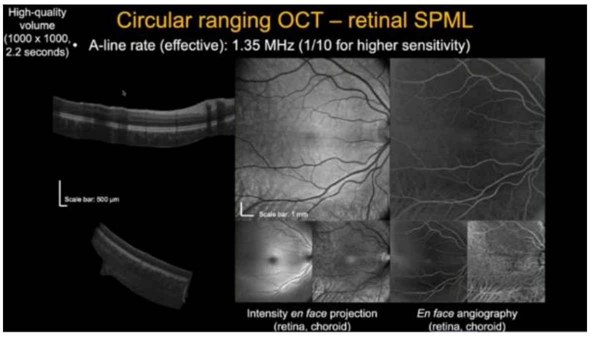
4. T. S. Kim, B. Braaf, Y. Kim, D. J. Harper, B. J. Vakoc, "**13.5 MHz circular-ranging optical coherence tomography of the human retina**," Proc. SPIE 11948, Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XXVI, 1194823 (January 2022)

"Here, we demonstrate retinal imaging by CR-OCT for the first time. We achieved a 13.5 MHz A-line rate and performed high-quality wide-field and video-rate normal-field imaging in human subjects."



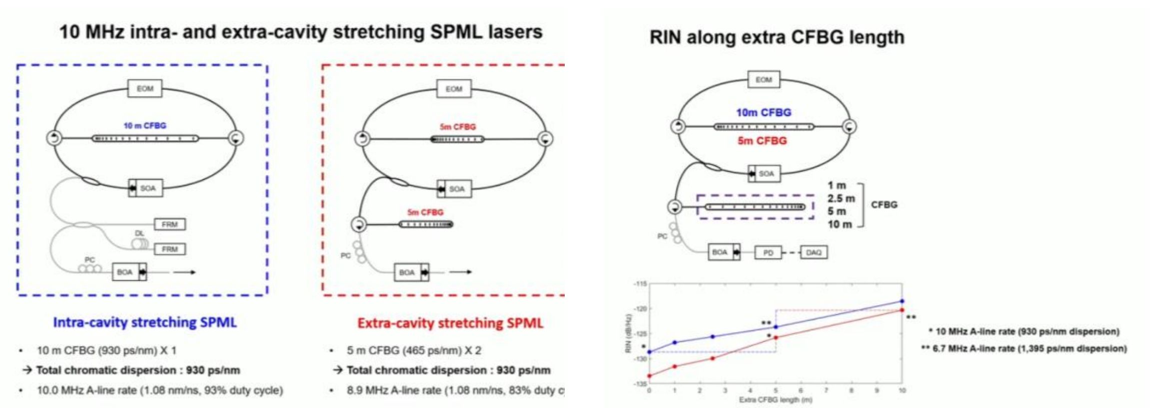


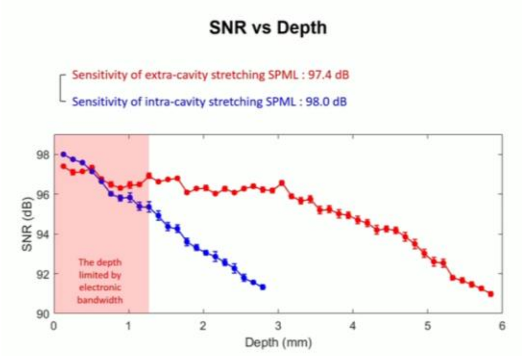


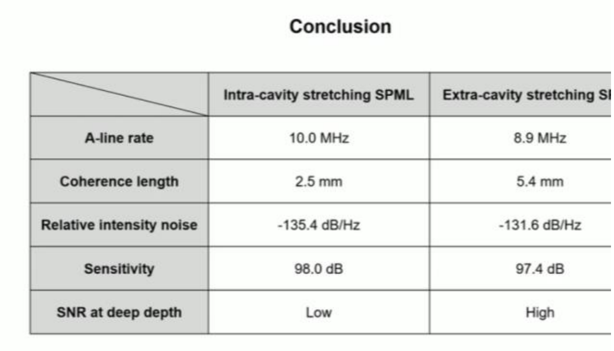


5. J. Y. Joo, B. J. Vakoc, W-Y. Oh, "**Stretched-pulse mode-locked wavelength-swept laser with intra- and extra-cavity stretching for ultrahigh-speed optical coherence tomography**," Proc. SPIE 11948, Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XXVI, 1194826 (January 2022)

> *"In this work, we present SPML wavelength-swept laser using intra- and extra-cavity CFBG for the ultrahigh-speed OCT. We investigated the performance of the SPML laser as a light source for the ultrahigh-speed OCT by utilizing a combination of intra and extra-cavity stretching."*



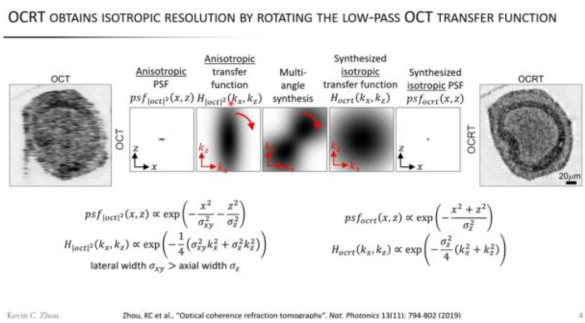


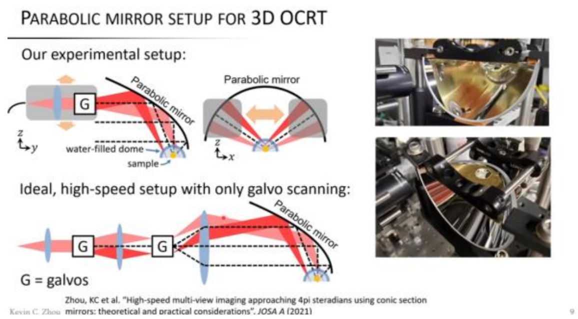

Conclusion

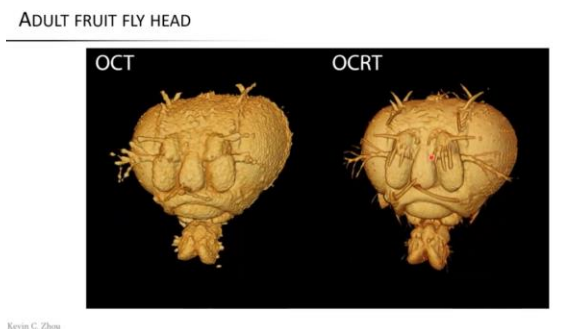
	Intra-cavity stretching SPML	Extra-cavity stretching SI
A-line rate	10.0 MHz	8.9 MHz
Coherence length	2.5 mm	5.4 mm
Relative intensity noise	-135.4 dB/Hz	-131.6 dB/Hz
Sensitivity	98.0 dB	97.4 dB
SNR at deep depth	Low	High

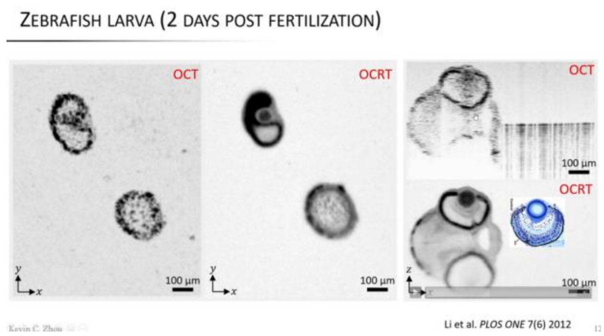
6. K. C. Zhou, R. P. McNabb, R. Qian, S. Degan, A-H. Dhalla, S. Farsiu, J. A. Izatt, "**3D optical coherence refraction tomography using a parabolic mirror**," Proc. SPIE 11948, Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XXVI, 1194842 (January 2022)

> *"We present 3D optical coherence refraction tomography (OCRT), which computationally combines 3D volumes from two rotational axes to form a 3D reconstruction with substantially reduced speckle noise and enhanced lateral resolution. Our approach features a parabolic mirror as the objective, which enables multi-view OCT volume acquisition over up to ±75° without moving the sample."*



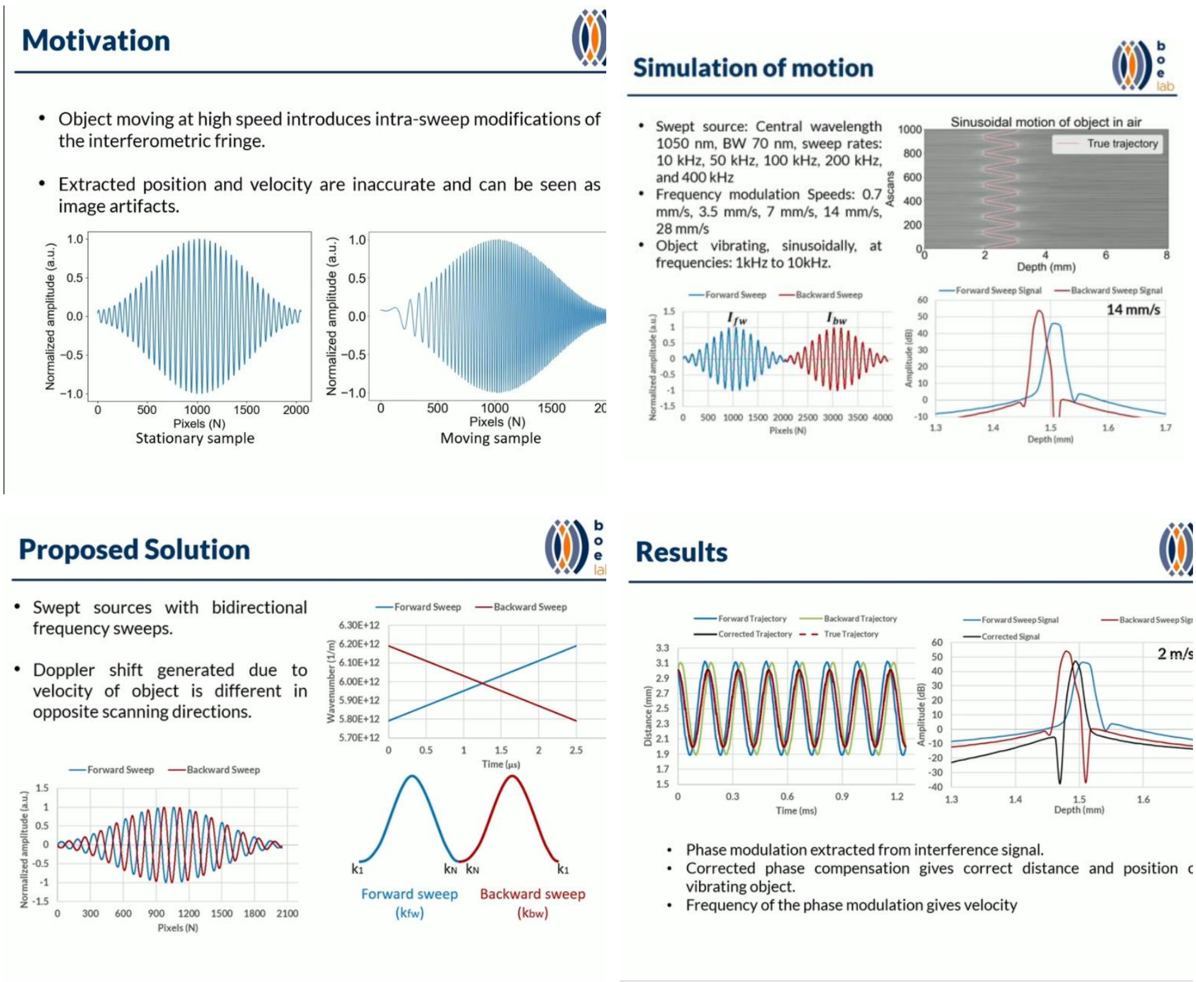






7. A. Gupta, D. Ruminski, G. Gondek, I. Grulkowski, "**Impact of ultrafast motion on signal in SS-OCT and method for correction of motion-related image artifacts**," Proc. SPIE 11948, Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XXVI, 1194828 (January 2022)

> *"Analysis of phase changes of interferograms recorded with bi-directional laser sweeps at high sweep rates can be used to determine the true trajectory of the fast moving object. This technique also helps in monitoring velocity of the object exceeding the velocity range set by the acquisition speed of the OCT system."*



8. J. K. Clark, S. Nakamura, "**Swept-source optical coherence tomography with a compact and low-cost wavelength-tunable laser realized through the application of compressed sensing**," Proc. SPIE 11948, Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XXVI, 1194884 (January 2022)

"Here, a SS-OCT system utilizing a low-cost and compact wavelength-tunable laser designed for telecommunications is presented. The limited tuning range and discontinuous tuning of the telecommunications laser, is overcome through the use of compressed sensing, enabling the acquisition of OCT scans with enhanced resolutions and signal-to-noise ratios."

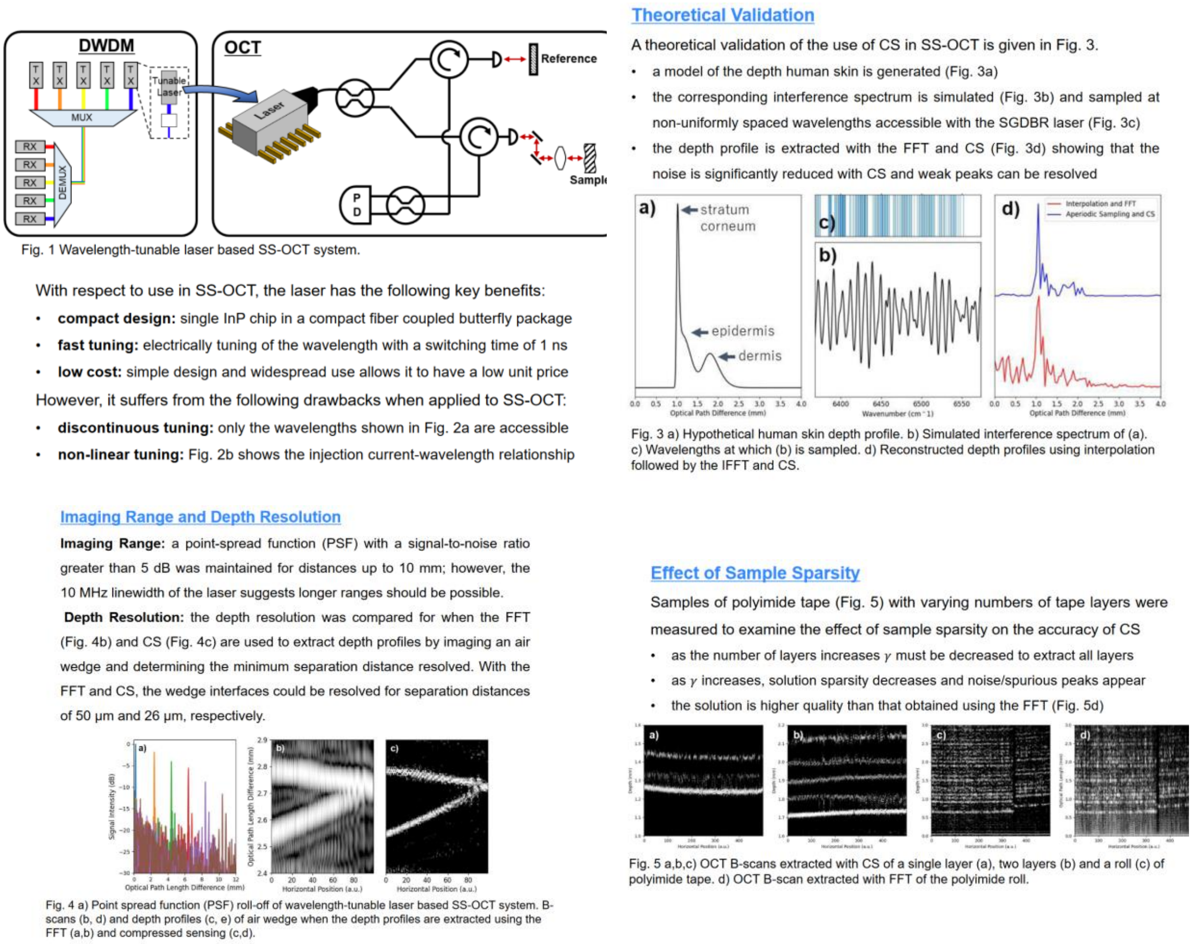


Fig. 1 Wavelength-tunable laser based SS-OCT system.

With respect to use in SS-OCT, the laser has the following key benefits:

- **compact design:** single InP chip in a compact fiber coupled butterfly package
- **fast tuning:** electrically tuning of the wavelength with a switching time of 1 ns
- **low cost:** simple design and widespread use allows it to have a low unit price

However, it suffers from the following drawbacks when applied to SS-OCT:

- **discontinuous tuning:** only the wavelengths shown in Fig. 2a are accessible
- **non-linear tuning:** Fig. 2b shows the injection current-wavelength relationship

Theoretical Validation

A theoretical validation of the use of CS in SS-OCT is given in Fig. 3.

- a model of the depth human skin is generated (Fig. 3a)
- the corresponding interference spectrum is simulated (Fig. 3b) and sampled at non-uniformly spaced wavelengths accessible with the SGDBR laser (Fig. 3c)
- the depth profile is extracted with the FFT and CS (Fig. 3d) showing that the noise is significantly reduced with CS and weak peaks can be resolved

Fig. 3 a) Hypothetical human skin depth profile. b) Simulated interference spectrum of (a). c) Wavelengths at which (b) is sampled. d) Reconstructed depth profiles using interpolation followed by the IFFT and CS.

Imaging Range and Depth Resolution

Imaging Range: a point-spread function (PSF) with a signal-to-noise ratio greater than 5 dB was maintained for distances up to 10 mm; however, the 10 MHz linewidth of the laser suggests longer ranges should be possible.

Depth Resolution: the depth resolution was compared for when the FFT (Fig. 4b) and CS (Fig. 4c) are used to extract depth profiles by imaging an air wedge and determining the minimum separation distance resolved. With the FFT and CS, the wedge interfaces could be resolved for separation distances of 50 μm and 26 μm, respectively.

Fig. 4 a) Point spread function (PSF) roll-off of wavelength-tunable laser based SS-OCT system. B-scans (b, d) and depth profiles (c, e) of air wedge when the depth profiles are extracted using the FFT (a,b) and compressed sensing (c,d).

Effect of Sample Sparsity

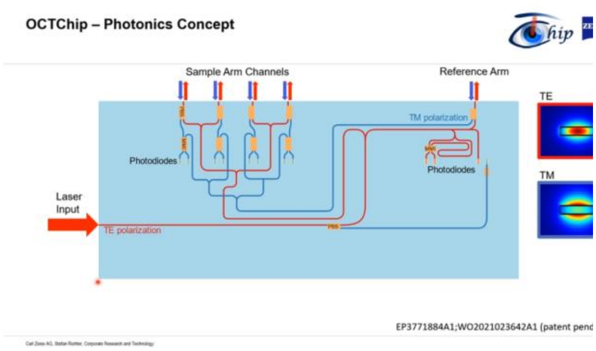
Samples of polyimide tape (Fig. 5) with varying numbers of tape layers were measured to examine the effect of sample sparsity on the accuracy of CS

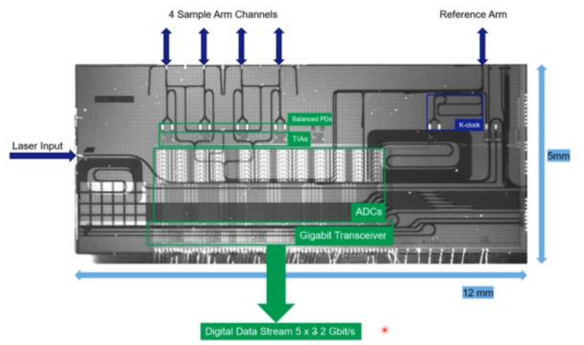
- as the number of layers increases γ must be decreased to extract all layers
- as γ increases, solution sparsity decreases and noise/spurious peaks appear
- the solution is higher quality than that obtained using the FFT (Fig. 5d)

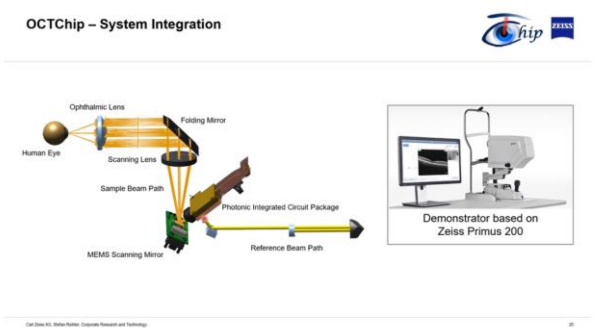
Fig. 5 a,b,c) OCT B-scans extracted with CS of a single layer (a), two layers (b) and a roll (c) of polyimide tape. d) OCT B-scan extracted with FFT of the polyimide roll.

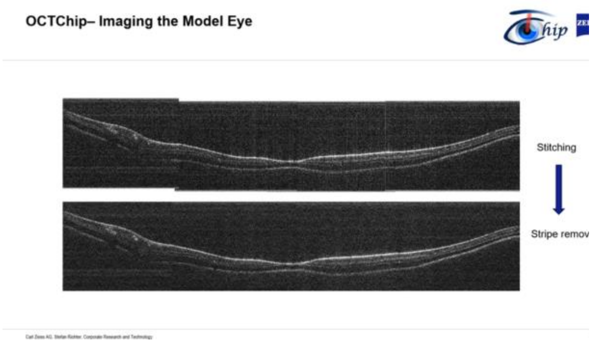
9. S. Richter, A. K. Krause, E. A. Rank, S. Nevlascil, M. Kempe, P. Muellner, R. Hainberger, S. Gloor, M. Duelk, N. Verwaal, L. Klein, M. Sagmeister, G. Meinhardt, J. Kraft, M. Jezzini, D. Carey, W. Drexler, " **Multi-channel 400 kHz 840nm swept-source OCT system based on a photonic-electronic integrated circuit**," Proc. SPIE 11948, Optical Coherence Tomography and Coherence Domain Optical Methods in Biomedicine XXVI, 1194821 (January 2022)

> *"We report on a swept-source OCT system based on a photonic-electronic integrated circuit. It enables a parallelization of data acquisition resulting in an effective A-scan rate of 4x100 kHz at a central wavelength of 840 nm. The monolithic co-integration of photonic elements forming the multiplexed interferometers and the system electronics on one chip allows a very compact OCT engine in a photonic package."*



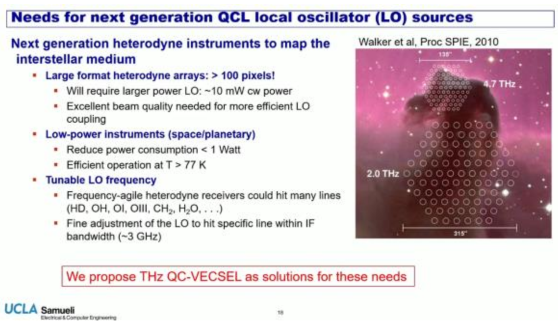


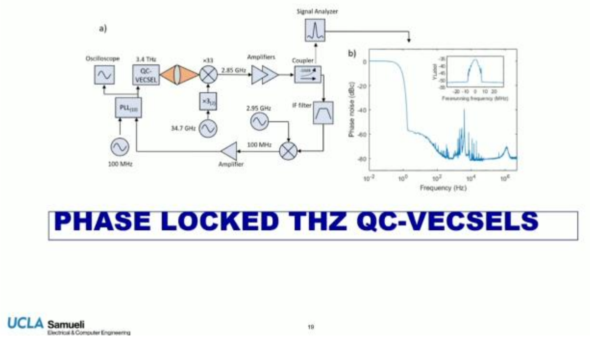


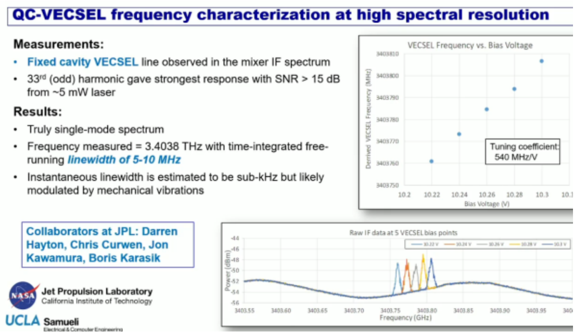


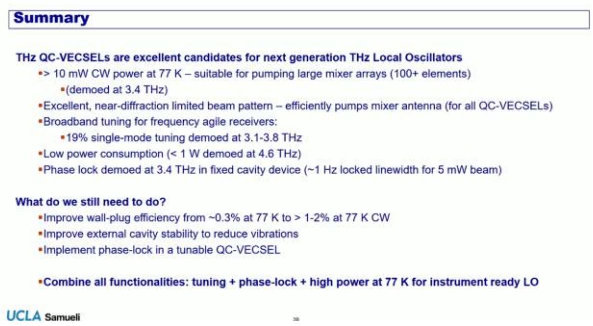
10. C. A. Curwen, A. D. Kim, Y. Wu, Yue. Shen, D. J. Hayton, J. H. Kawamura, B. S. Karasik, S. Addamane, J. L. Reno, B. S. Williams, "**Towards quantum-cascade VECSELs for terahertz heterodyne local oscillators**," Proc. SPIE 11984, Vertical External Cavity Surface Emitting Lasers (VECSELs) XI, 119842 (January 2022)

> *"By using a patch-based amplifying metasurface we obtain QC-VECSEL lasing with milliwatt output power at 4.6 THz with reduced power consumption less than 1 W. Second, we report the phase locking of a QC-VECSEL at 3.4 THz to a microwave reference using a Schottky diode mixer. Finally, we report efforts and challenges to scale down the lasing frequency of the VECSELs to 1.9 THz."*









PUBLICATIONS

Thermal behavior and power scaling potential of membrane external-cavity surface-emitting lasers (MECSELs)

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

IEEE Journal of Quantum Electronics
doi: 10.1109/JQE.20223147482

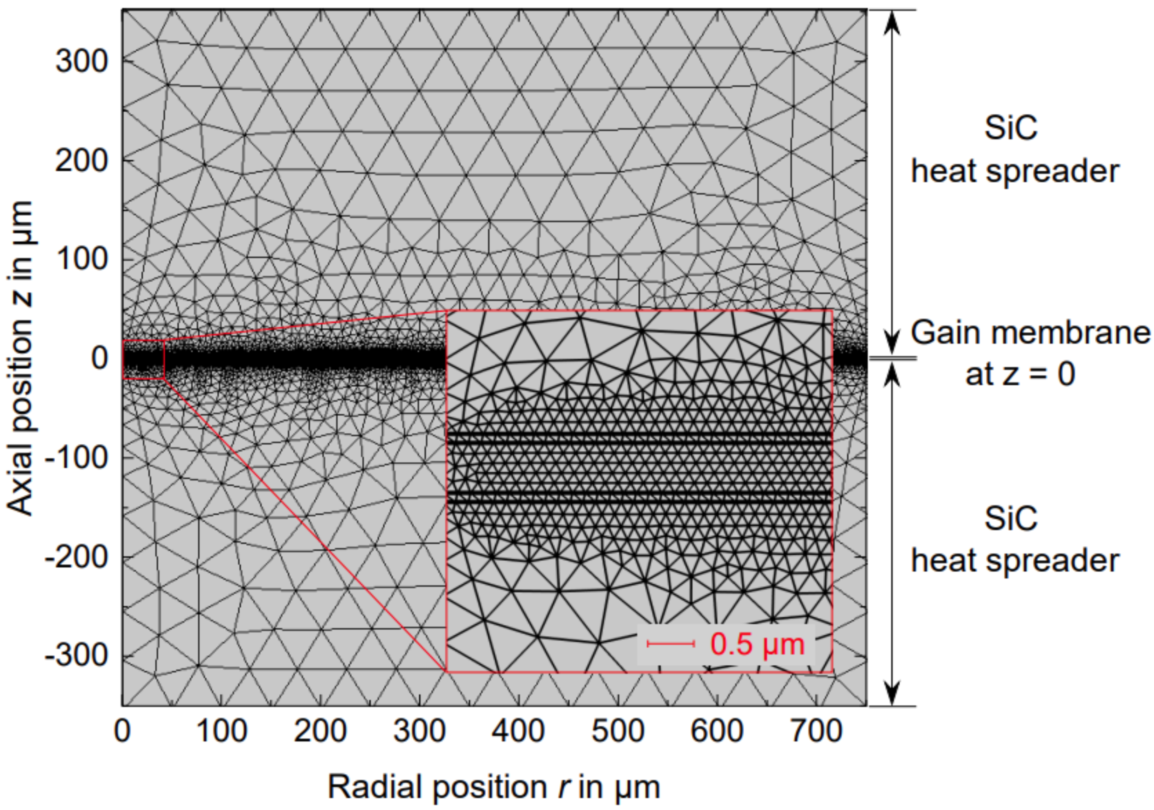


Fig. 3. Cross-section of the FEM mesh created for the MECSEL. A 550 nm thick gain membrane is located at z= 0 and sandwiched between two 0.35 mm thick heat spreaders. The y-axis corresponds to the axial dimension and the x-axis to the radial dimension across the MECSEL gain sandwich.

Quantum dot membrane external-cavity surface-emitting laser (MECSEL) at 1.5 µm

Hoy-My Phung, **Philipp Tatar-Mathes,** Cyril Paranthoen, Christophe Levallois, Nicolas Chevalier, **Hermann Kahle,** Mehdi Alouini, **Mircea Guina**

2021 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC)
DOI: 10.1109/CLEO/Europe-EQEC52157.2021.9542252

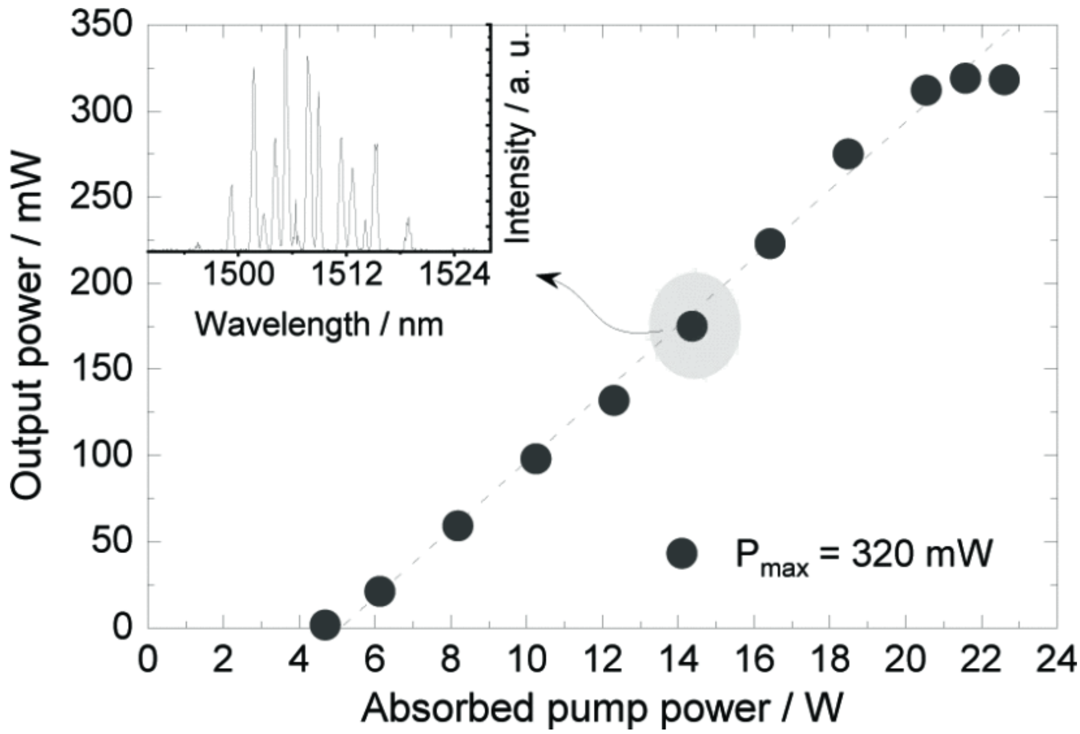


Fig. 1: Output power curves recorded at 19°C cooling water temperature with an emission spectrum plotted in the inset.

[Broadband Terahertz Photonic Integrated Circuit with Integrated Active Photonic Devices]

Amlan Kusum Mukherjee, Mingjun Xiang and Sascha Preu

Photonics **2021**, *8*(11), 492;
https://doi.org/10.3390/photonics8110492

Abstract

Present-day photonic terahertz (100 GHz–10 THz) systems offer dynamic ranges beyond 100 dB and frequency coverage beyond 4 THz. They yet predominantly employ free-space Terahertz propagation, lacking integration depth and miniaturisation capabilities without sacrificing their extreme frequency coverage. In this work, we present a high resistivity silicon-on-insulator-based multimodal waveguide topology including active components (e.g., THz receivers) as well as passive components (couplers/splitters, bends, resonators) investigated over a frequency range of 0.5–1.6 THz. Read More

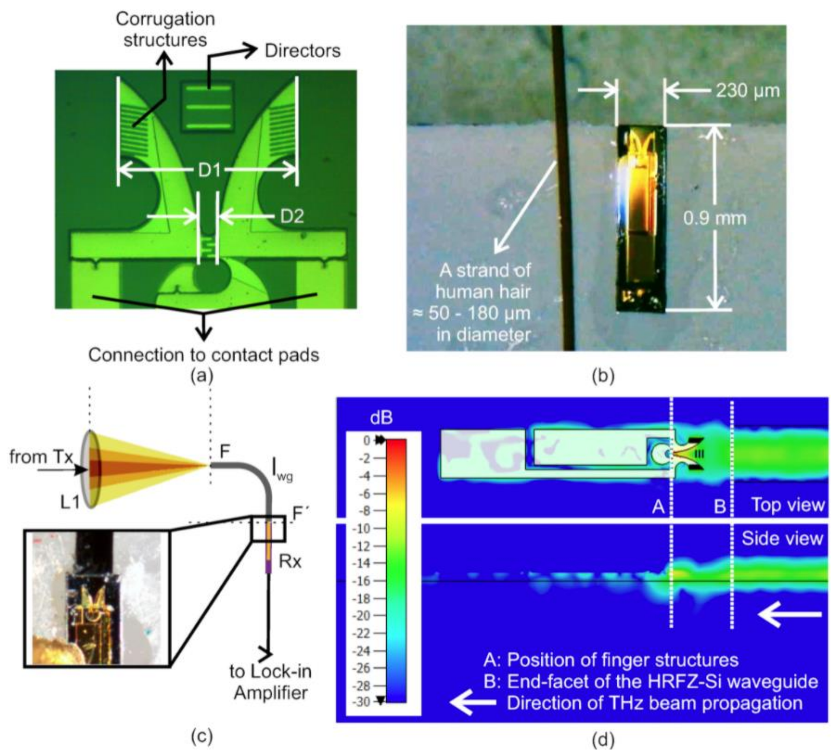


Figure 5 (a) Micrograph of a VA fabricated in-house. (b) Receiver integrated with a VA, which is ≈230µm wide, 0.9 mm long and with a substrate thickness of only 32µm mounted on HDPE. The substrate is thinner than a human hair. Schematic in (c) shows the experimental setup with Vivaldi antenna coupled THz receiver. An actual microscopic image of the coupled waveguide is in the inset. (d) shows simulation of the average power flowing from the waveguide into VA at 0.875 THz. The simulated coupling efficiency of the waveguide-VA interface at 0.875 THz is −4.3 dB.

Visualizing nanometric structures with sub-millimeter waves

Alonso Ingar Romero, Amlan kusum Mukherjee, Anuar Fernandez Olvera, Mario Méndez Aller and **Sascha Preu**

Nature Communications, 12, Springer, ISSN 2041-1723,
DOI: 10.1038/s41467-021-27264-x

Abstract

The resolution along the propagation direction of far field imagers can be much smaller than the wavelength by exploiting coherent interference phenomena. We demonstrate a height profile precision as low as 31 nm using wavelengths between 0.375 mm and 0.5 mm (corresponding to 0.6 THz–0.8 THz) by evaluating the Fabry-P\'rot oscillations within surface-structured samples. We prove the extreme precision by visualizing structures with a height of only 49 nm, corresponding to 1:7500 to 1:10000 vacuum wavelengths, a height difference usually only accessible to near field measurement techniques at this wavelength range. At the same time, the approach can determine thicknesses in the centimeter range, surpassing the dynamic range of any near field measurement system by orders of magnitude. The measurement technique combined with a Hilbert-transform approach yields the (optical) thickness extracted from the relative phase without any extraordinary wavelength stabilization.

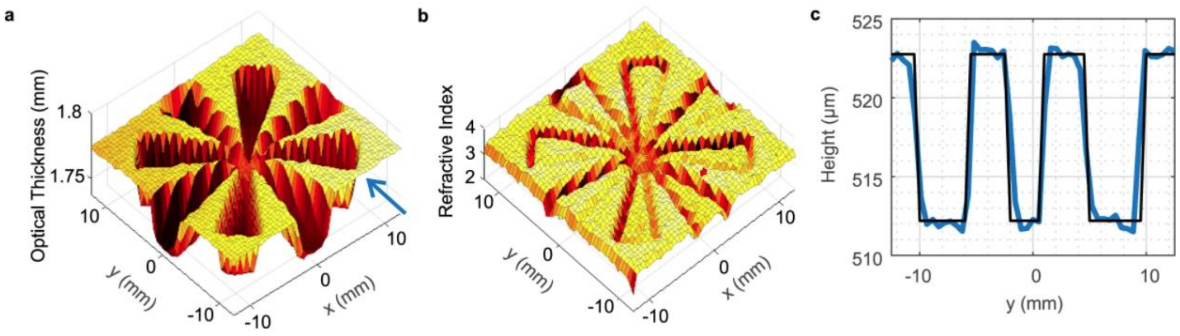


Fig. 2: Measurement of a 10 µm etched Siemens star on silicon wafer. a 3D Terahertz image of a Siemens star with a depth of 10.7 µm etched into a 520 µm thick silicon wafer. The vertical axis shows the optical thickness. **b** 3D image of the refractive index of the silicon Siemens star. **c** Extracted physical thickness of the silicon Siemens star for a cut along the line x=x= 8 mm indicated by the blue arrow in (**a**).

OCT-Guided Surgery for Gliomas: Current Concept and Future Perspectives. Diagnostics

Konstantin Yashin, Matteo Mario Bonsanto, Ksenia Achkasova, Anna Zolotova, Al-Madhaji Wael, Elena Kiseleva, Alexander Moiseev, Igor Medyanik , Leonid Kravets , **Robert Huber,** Ralf Brinkmann, and Natalia Gladkova

Diagnostics 2022, 12, 335.
https://doi.org/10.3390/diagnostics12020335

Abstract:
Optical coherence tomography (OCT) has been recently suggested as a promising method to obtain in vivo and real-time high-resolution images of tissue structure in brain tumor surgery. This review focuses on the basics of OCT imaging, types of OCT images and currently suggested OCT scanner devices and the results of their application in neurosurgery. OCT can assist in achieving intraoperative precision identification of tumor infiltration within surrounding brain parenchyma by using qualitative or quantitative OCT image analysis of scanned tissue. Read More

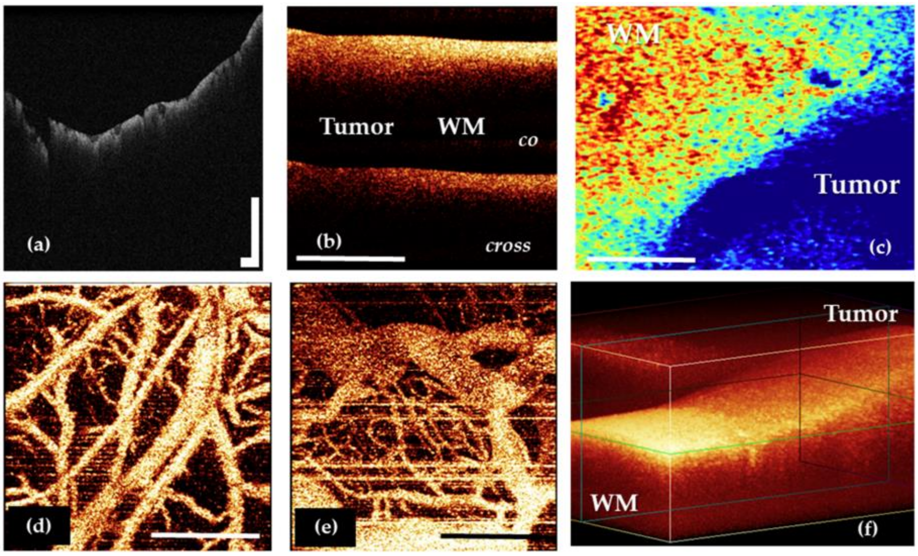


Figure 2 OCT data types in neuro-oncology: 2D OCT images of brain tissue obtained by OCT-integrated microscope (a) and portable CP OCT system with handled probe (b); based on attenuation coefficient color-coded map of border between white matter and glioma obtained by CP OCT device from human biopsy sample (c); OCTA images of cortex (d) and glioblastoma 101.6 in rat (e); 3D OCT image of border between white matter and glioma (f). WM—white matter. Scale bar is 1 mm in all images.

[Continuous spectral zooming for in vivolive 4D-OCT with MHz A-scan rates andlong coherence]

Madita Göb, Tom Pfeiffer, Wolfgang Draxinger, Simon Lotz, Jan Philip Kolb, and **Robert Huber**

January 2022, Biomedical Optics Express 13(2)

DOI:10.1364/BOE.448353

Abstract

We present continuous three-dimensional spectral zooming in live 4D-OCT using a home-built FDML based OCT system with 3.28 MHz A-scan rate. Improved coherence characteristics of the FDML laser allow for imaging ranges up to 10 cm. For the axial spectral zoom feature, we switch between high resolution and long imaging range by adjusting the sweep range of our laser. We present a new imaging setup allowing for synchronized adjustments of the imaging range and lateral field of view during live OCT imaging. Read More

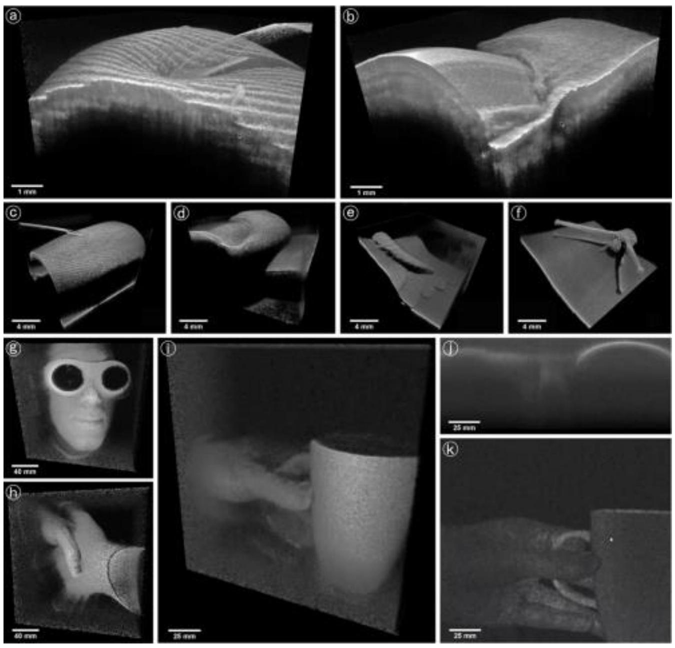


Fig. 4. Three discrete resolution modes: Live 4D-OCT using the high-resolution mode with 120 nm bandwidth (the standard imaging mode of our system [20,24,25] (a-b), intermediate mode with 17 nm bandwidth (c-f) and long-range mode with 4 nm bandwidth (g-k). 3D views of a fingertip and a canula (a, c), of a fingernail (b, d), a caterpillar on a leaf (e) and a snail (f). 3D views of the researcher's face wearing laser protection glasses (g), shaking hands (h), and holding a cup (i). The corresponding 2D view (j) and en face view (k) of the cup scene. The displayed images are taken from screen recordings of the live 4D-OCT software; the corresponding videos can be found within the supplementary materials (Visualization 1, Visualization 2, Visualization 3). Estimated scale bars.

OCT Assisted Quantification of Vitreous Inflammation in Uveitis

Xiaoxuan Liu; Aditya U. Kale; Giovanni Ometto; Giovanni Montesano; Alice J. Sitch; Nicholas Capewell; Charlotte Radovanovic; Nicholas Bucknall; Nicholas A. V. Beare; David J. Moore; **Pearse A. Keane;** David P. Crabb; Alastair K. Denniston

Translational Vision Science & Technology January 2022, Vol.11, 3.
doi:https://doi.org/10.1167/tvst.11.1.3

Purpose: Vitreous haze (VH) is a key marker of inflammation in uveitis but limited by its subjectivity. Optical coherence tomography (OCT) has potential as an objective, noninvasive method for quantifying VH. We test the hypotheses that OCT can reliably quantify VH and the measurement is associated with slit-lamp based grading of VH.
Methods: In this prospective study, participants underwent three repeated OCT macular scans to evaluate the within-eye reliability of the OCT vitreous intensity (VI). Association between OCT VI and clinical findings (including VH grade, phakic status, visual acuity [VA], anterior chamber cells, and macular thickness) were assessed.
Results: One hundred nineteen participants were included (41 healthy participants, 32 patients with uveitis without VH, and 46 patients with uveitis with VH). Within-eye test reliability of OCT VI was high in healthy eyes and in all grades of VH (intraclass correlation coefficient [ICC]>0.79). Average OCT VI was significantly different between healthy eyes and uveitic eyes without and uveitic eyes with VH, and was associated with increasing clinical VH grade ($P < 0.05$). OCT VI was significantly associated with VA, whereas clinical VH grading was not. Cataract was also associated with higher OCT VI ($P = 0.03$).
Conclusions: OCT VI is a fast, noninvasive, objective, and automated method for measuring vitreous inflammation. It is associated with clinician grading of vitreous inflammation and VA, however, it can be affected by media opacities.

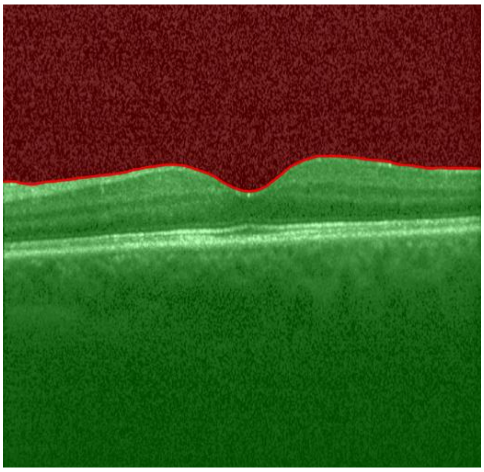


Figure 1. Segmented B scan with region of interest, vitreous. A ratio of the signal intensity between the red area and the whole B scan (red plus green areas) yields a measurement of vitreous signal intensity which is logarithmically transformed and recorded in arbitrary units.

[Deep learning to detect optical coherence tomography-derived diabetic macular edema from retinal photographs: a multicenter validation study]

Xinle Liu, Tayyeba K. Ali, Preeti Singh, Ami Shah, Scott Mayer McKinney, Paisan Ruamviboonsuk, Angus W. Turner, **Pearse A. Keane,** Peranut Chotcomwongse, Variya Nganthavee, Mark Chia, Josef Huemer, Jorge Cuadros, Rajiv Raman, Greg S. Corrado, Lily Peng, Dale R. Webster, Naama Hammel, Avinash V. Varadarajan, Yun Liu, Reena Chopra, Pinal Bavishi

Ophthalmology Retina, January 2022

DOI:10.1016/j.oret.2021.12.021

Purpose
To validate the generalizability of a deep learning system (DLS) that detects diabetic macular edema (DME) from two-dimensional color fundus photography (CFP), where the reference standard for retinal thickness and fluid presence is derived from three-dimensional optical coherence tomography (OCT).

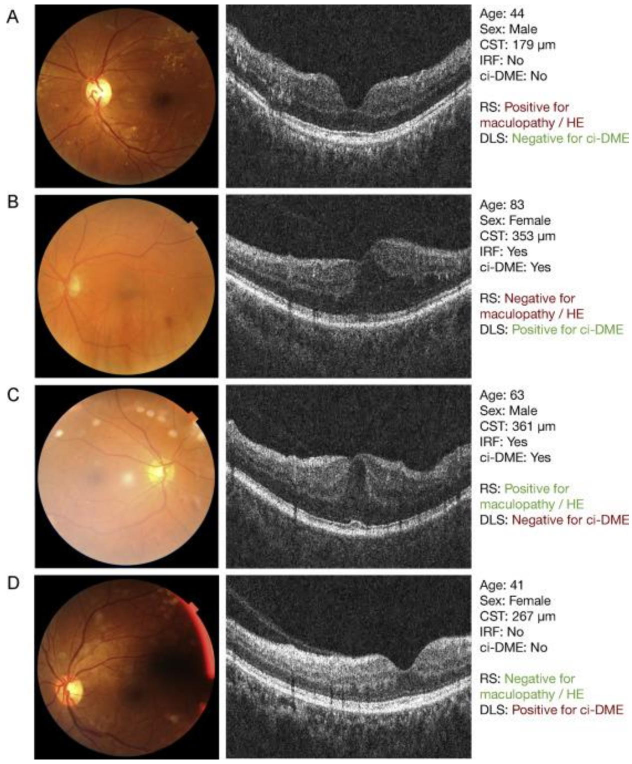


Figure 4. Selected paired CFPs and OCTs for DLS success and failure, as compared with retina specialists (RS) grading CFPs. A) Hard exudates (HE) within 1500 µm, no thickening or fluid on the OCT - detected correctly by the DLS. B) No HE within 1500 µm, thickening and fluid on the OCT - detected correctly by the DLS. C) HE within 1500 µm, thickening and fluid on the OCT - missed by the DLS. D) No HE within 1500 µm, no thickening or fluid on the OCT - false positive reported by the DLS.

The utility of wide-field optical coherence tomography angiography in diagnosis and monitoring of proliferative diabetic retinopathy in pregnancy

Philip H. Wright, Hagar Khalid, **Pearse A. Keane**

January 2022, American Journal of Ophthalmology Case Reports 25(10):101280

DOI:10.1016/j.ajoc.2022.101280

Purpose
Diabetic retinopathy is an increasingly common complication of diabetes mellitus that benefits from early diagnosis and frequent monitoring, especially in pregnancy where there is a greater risk of progression. Fundus fluorescein angiography is currently the gold standard method of investigation for neovascularization. However, this has risks of unpleasant and potentially dangerous side effects, with an added theoretical risk to the fetus in pregnancy. Wide-field optical coherence tomography angiography (PLEX Elite 9000, Carl Zeiss Meditec, Inc. USA and DRI Swept Source OCT Triton, Topcon Medical Systems, Inc. USA) potentially offers a safer, faster and equally effective alternative method for diagnosis and monitoring of diabetic retinopathy in pregnant patients.

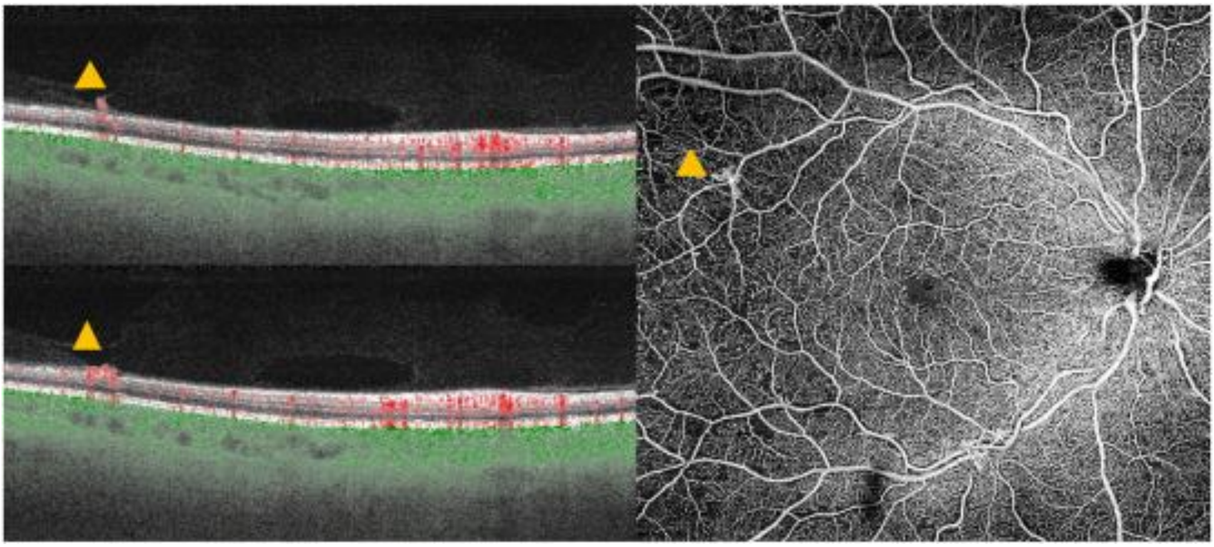


Fig. 2. Central 12 × 12 mm OCTA-B scans and *en face* OCTA at the superficial capillary plexus slab of Case 1 demonstrating a preretinal hyperreflective lesion with evident flow signals corresponding to the flat NVE seen on the *en face* OCTA (yellow arrowheads). (For interpretation of the references to color in this figure legend, the reader is referred to the Web version of this article.)

Widefield imaging with Clarus fundus camera vs slit lamp fundus examination in assessing patients referred from the National Health Service diabetic retinopathy screening programme

Wei Sing Lim, Gabriela Grimaldi, Luke Nicholson, Khadijah Basheer and **Ranjan Rajendram**

Eye **35,** 299–306 (2021)
http://dx.doi.org/10.1038/s41433-020-01218-x

Objectives

To compare diabetic retinopathy (DR) grading and management plan between virtual review using widefield Clarus imaging and macular optical coherence tomography (OCT) versus slit lamp clinical examination and macular OCT.

Method

New referrals over 3 months from the National Diabetic Eye Screening programme (DESP) were screened. Patients who had both Clarus widefield imaging and macular OCT were included. All patients underwent slit lamp examination in clinic. Data obtained from electronic patient records included referral reason, DR grading and management plan. Two graders retrospectively reviewed imaging and formulated a management plan blinded to results from patients' clinic visit. Results from virtual examination were compared with those from slit lamp examination. Read more

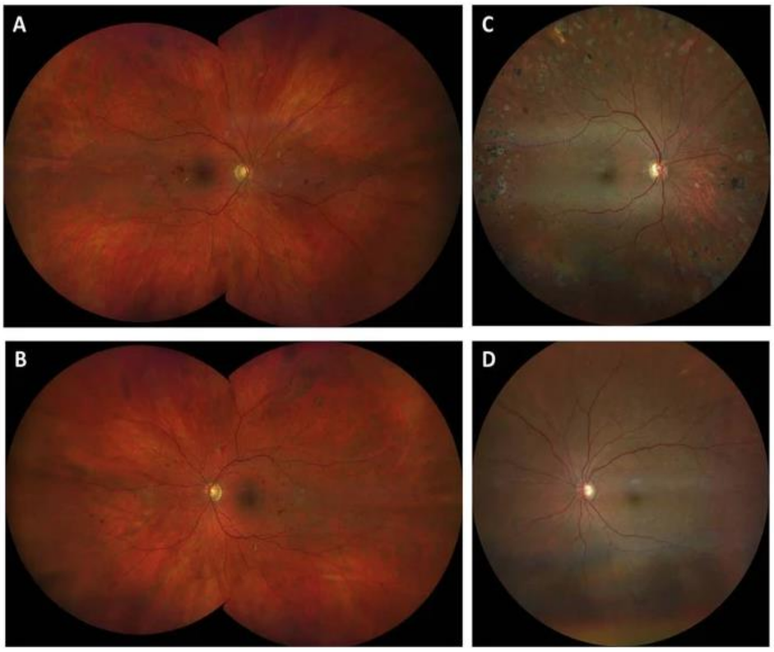


Figure 1 shows examples of Clarus fundus photos for 2 patients. A and B are montage of 2 photos combining to give a field of 200º. They are from a patient with non proliferative diabetic retinopathy. C and D are single photos of 133º wide from a patient with proliferative diabetic retinopathy. The inferior blot haemorrhage seen in D was shown to be neovasularisation on fluorescein angiogram.

A problem with Pitot tubes that prevented Aircraft take-offs at Heathrow Airport, UK

Article in the "Daily Telegraph" and in BBC News

Planes forced to abort take-off as wasp nests skewed speed reading

By **Olivia Rudgard**
ENVIRONMENT CORRESPONDENT

PLANES aborted take-offs at Heathrow after being infested by wasps and bees which built nests in the aircraft during lockdown, a report has found.

Lower demand for flights last spring left planes sitting idle for longer, meaning insects had time to move in, the Air Accidents Investigation Branch (AAIB) said.

Nests blocked speed-measuring pitot probes on six British Airways aircraft and one Virgin Atlantic jet over a three-week period.

Two BA planes were forced to abort take-offs while speeding down runways because blockages caused inaccurate speed readings, which is a "serious hazard", investigators said.

The issue could become more severe as efforts to "green" aviation and cities attract more insects, the report warned.

Airlines and airports are carrying out extra inspections and surveillance to manage the risk. A British Airways spokesman said: "Safety is always our highest priority and, like other operators, we put additional measures in place, as detailed in the AAIB report."

Virgin Atlantic did not immediately respond to a request for a comment.

"The Pitot tube (PT) is the most important navigation aid for air craft, satellite navigation is not used as an alternative. Many planes have crashed as a result of PT problems for example the Airbus A330 from Brazil to Paris deadliest crash in the history of Air France. It occurred to me that the problems of PT blockage might be solved optically under many conditions. I designed a simulated metal PT using a fibre optic sensor to solve the problem (without any funding!). A potential solution to removing blockages from a Pitot Tubes was published in 2015 entitled: **Concept of a Pitot tube able to detect blockage by ice, volcanic ash, sand and insects, and to clear the tube**.
So next time you fly make sure the Pilot has checked the Pitot tubes!" ***Prof. David Jackson, FInstP, FOSA, Emeritus Professor of Applied Optics, University of Kent***

Quantum noise squeezing with Koheras lasers

The Nonlinear Quantum Optics group at the University of Hamburg has been working with Koheras BOOSTIK lasers to make squeeze lasers for quantum noise squeezing

Quantum-squeezed laser light shows less noise in the statistics of the detected photons than shot noise, even though shot noise represents the lowest noise of all conventional lasers.

What the group calls a "squeeze laser" can establish correlations between detected photons. These so-called quantum correlations can be used to:

- improve ultra-sensitive measurements beyond what is possible with conventional ultra-stable laser light
- raise the security of quantum key distribution to a new level
- build optical quantum computers

Read how the group used a Koheras BOOSTIK for their experiments.

READ THE CASE

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 back for next year's schedule and browse content from prior ones on the Recorded Webinars tab.

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.

International Day of Women and Girls in Science - February 11

February 11 is the International Day of Women and Girls in Science, a day adopted by the United Nations General Assembly to promote full and equal access and participation for women and girls in science.

Full and equal access and participation is a goal ... we have a long way to go before this is a reality. UNESCO estimates women represent only 33% of STEM researchers globally. The UK's Intellectual Property Office estimates women inventors account for 13% of worldwide patent applications. In addition, the pandemic has disproportionately affected women's careers.

Optica is focused on supporting full and equal access and participation for women and girls in science and particularly the amazing world of optics. Reflecting on our internal statistics, our membership is currently 16% women, but taking steps to change that. We're offering a number of programs to attract and retain more women. Read more

Applied Optics Group and Student Optica Chapter in Kent
celebrated the event with hard working in the lab followed by drinks in the evening

University of Kent earns gold award for work to protect hedgehogs

We are delighted to announce that the University of Kent has been awarded the gold Hedgehog Friendly Campus award!

The Hedgehog Friendly Campus is a programme funded by the British Hedgehog Preservation Society. The aim is to offer support to staff and students at Universities to encourage impactful changes for hedgehogs. Hedgehogs in the UK aren't just in a prickly situation, they're in danger.

Hedgehog populations have plummeted by 50% since 2000. They are threatened by habitat loss and fragmentation, struggles to find food and water, littering, poisoning, and traffic on the roads.

Check out the videos on our webpage for more information. Now we have achieved Gold, we are aiming to expand the work we do for hedgehogs as well as many other species. We will soon be transforming the Hedgehog Friendly Campus working group into a new 'Biodiversity Forum'. This will have a broader focus on the wide variety of biodiversity that is present on our campuses.

Since the University joined the programme in 2019, we have been striving to ensure our campus is a safe place for hedgehogs to live. Some of our initiatives include: read more

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