37th Newsletter of the ITN:

"NExt Generation of Tuneable LASers for optical coherence tomography"

(NETLAS)

led by University of Kent

July-August 2023

NETWORK EVENTS

Markus Pessa Summer School "New Frontiers in Optical Technologies", August 7-11, Tampere, Finland, in conjunction with the NETLAS International Conference

The International Summer School New Frontiers in Optical Technologies was established in 2001. The 11th edition which took place this year marks a name change to "**Markus Pessa International Summer School New Frontiers in Optical Technologie**s" – a tribute to the memory of the late Prof. Markus Pessa, the founder of the Optoelectronics Research Centre in Tampere and the pioneer of optoelectronics and semiconductor laser technology in Finland.

Lectures covered laser technologies, imaging (including bio-imaging technology), quantum technology, photonic integration, transferable skills and Student Mentoring Activities.

NETLAS ESRs presented their research in front of an international audience of experts on laser technology and fabrication, meta surfaces and quantum photonics.

The full programme is available at

Markus Pessa Summer School | Tampere Universities (tuni.fi)

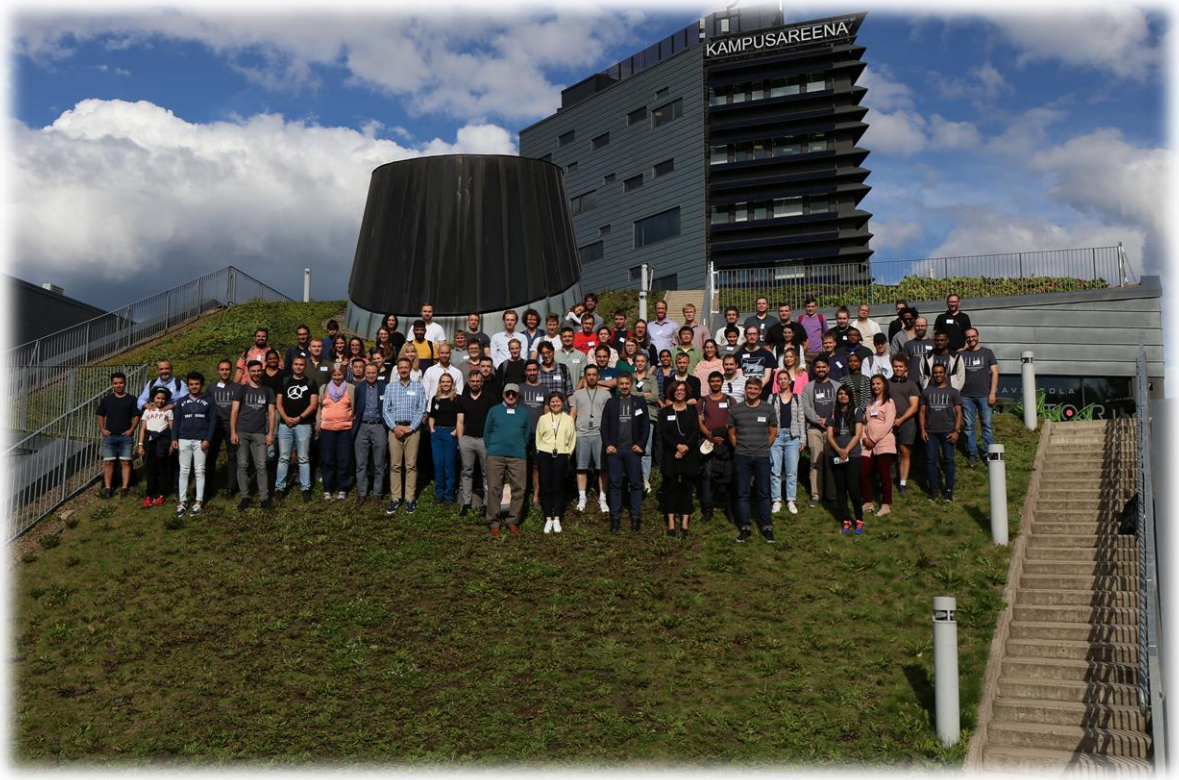
As part of the International Conference, there were 13 NETLAS ESR presentations on 11 August 2023:

Presenter	University/Company	Presentation title
Marie Klufts	University of Luebeck	850 nm Fourier domain mode-locked laser for retinal imaging
Andrei Anikeev	Superlum	Influence of SiO_x and SiN_x film deposition parameters on the InGaAs/GaAs quantum well intermixing by impurity-free vacancy disordering
Esteban Andres Proano Grijalva	Technical University of Denmark	Optimization of the High Contrast Grating in an Electrically Pumped 1060nm MEMS-VCSEL for OCT
Rene Riha	University of Kent	Dispersion tuned mode-locked lasers, mathematical modelling and dual resonance sweeping regime
Ifte Khairul Alam Bhuiyan	Tampere University	Wide spectral band quantum-well design and gain-chip devices operating at 2 μm wavelength
Masoud Payandeh	Technical University of Denmark	Long Wavelength MEMS VCSEL for Swept Source OCT
Philipp Tatar-Mathes	Tampere University	Recent developments of polarization-sensitive OCT
Irene Lamoso	University of Kent	Silicon-rich nitride silicon oxide MEMS for Fabry-Perot filters
Sacha Grelet	NKT Photonics	Time-stretched coherent supercontinuum: a path toward high resolution MHz scan rate optical coherence tomography
Alejandro Martinez Jimenez	University of Kent	Recent swept source OCT developments
Mojdeh Vakili	Technical University of Darmstadt	Development of Electro-Optically Tunable LASERs with Large Frequency Coverage
Asim Bashir	University of Luebeck	Dual Amplification of 1190 nm FDML Laser
Gopika Venugopal	University of Kent	Full Field Swept Source OCT with a Commercial Grade Camera and an In-House Developed Swept Source

NETLAS Management Updates

The NETLAS management meeting took place on 11 August 2023 in Tampere, Finland, after the conclusion of the International Conference.

Participants at the meeting discussed by the end possibilities to apply to Marie Curie actions in a new format of NETLAS.



Markus Pessa Summer School "New Frontiers in Optical Technologies", August 7-11, 2023, Tampere, Finland, in conjunction with the NETLAS International Conference

Thank you, Tampere University
&
thank you, Prof. Mircea Guina & your team,
for organizing the event!

Thank you everyone involved in the Summer School 2023 for your great contribution! @NETLAS

Summer Schol feedback from PhD9 Marie Klufts

The final summer school with the ITN-NETLAS project was an incredible culmination of our academic journey!

“Surrounded by fellow Ph.D. students, we delved deep into captivating discussions on quantum physics and explored diverse facets of OCT. **The intellectual exchange was enriching, leaving us with a wealth of knowledge**. A notable aspect was the opportunity to network with esteemed professors, whose insights were invaluable. Another highlight was the visit to their well-equipped lab, offering us insights into cutting-edge research.

The sun beamed down on us, enhancing the vibrant atmosphere. The organizers thoughtfully arranged an array of activities, from a soothing wood sauna to an invigorating little hike and a captivating museum tour. Tampere exudes a unique charm with its blend of natural beauty and urban vibrancy. The city's lakes, parks, and stunning architecture create a tranquil and lively mindset.

This gathering served as a poignant farewell, a moment to cherish before we embark on the final leg of our PhD journeys. **Thank you all for sharing this journey together. See you around”.**

@photos by PhD9 Marie Klufts








@photos by PhD9 Marie Klufts

MARKUS PESSA AND NETLAS CONFERENCE

by PhD13: Alejandro Martinez Jimenez

The conference held in Finland was an exciting event that brought together students and experts from various fields to share their experiences and insights!

"Throughout the conference, **our peers in NETLAS discussed research endeavours from the last three years, both successful outcomes and valuable lessons learned along the way.** The conference had an impressive lineup of speakers who shared their cutting-edge research on advanced laser technologies. Some of them included **Ursula Keller, Mark Kuznetsov, Frank Wise, and Ioan Dancus,** who captivated the audience.

The conference wasn't solely focused on laser technologies; it also dip into Optical Coherence Tomography (OCT). **Prof. Christoph Hitzenberger,** a pioneer in this technology, shared the latest developments and breakthroughs in the field over history. This holistic approach allowed participants to gain a comprehensive understanding of the current state of research and innovation.

From a clinical perspective, **Dr Ranjan Rajendram and Dr Taran Tatla** provided valuable insights into the practical applications of these technologies, bridging the gap between research and real-world medical applications. Apart from the academic sessions, the conference also prioritised the development of transferable skills. Renowned figures such as **Jose Pozo**, an associate editor at Nature, and the Chief Technology Officer of Optica, **delivered engaging talks that enriched attendees with knowledge and expertise beyond their research domains.**

In addition to the stimulating academic program, the conference offered participants a chance to unwind and connect on a personal level. **Relaxing walks and traditional Finnish saunas in the picturesque city of Tampere provided a perfect backdrop for networking and forging lasting friendships**. All in all, the conference in Finland was an incredible experience that seamlessly blended academic excellence with relaxation and camaraderie, leaving a lasting impression on all who attended".

@ Photos by Alejandro Martinez

PhD5: Masoud Payandeh

Combining a general photonic summer school with the NETLAS conference was a great idea!

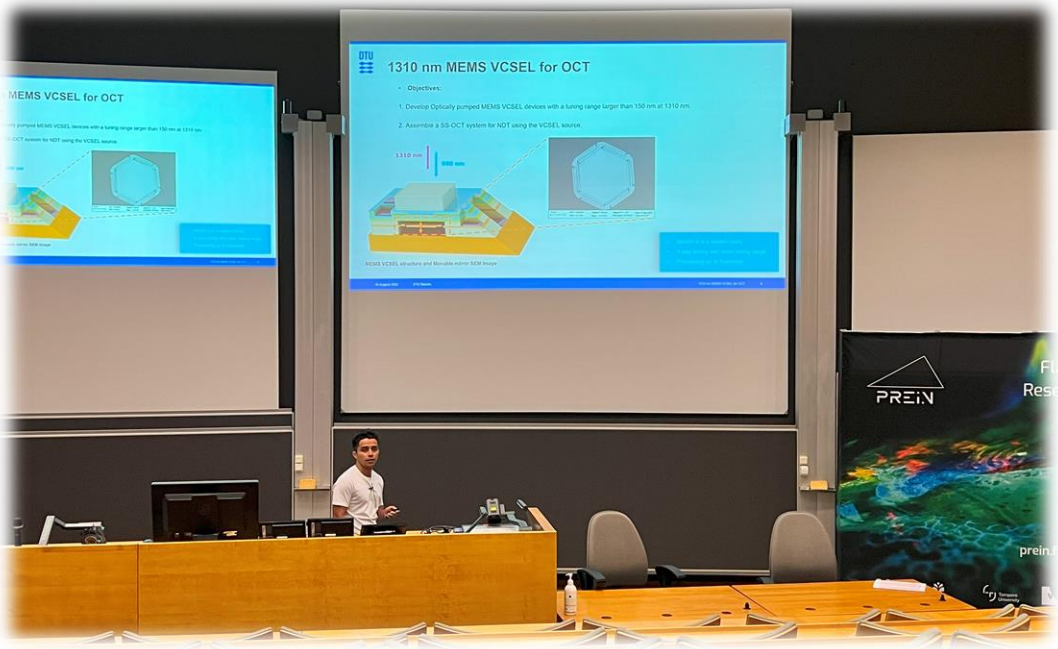
"The summer school was an introduction to the NETLAS conference. The event started with the summer school from the basic photonics concepts, mainly on lasers- the cornerstone of OCT- and diverse topics followed it in optics and photonics. **The first day of NETLAS conference was beneficial for the ESRs as we had some lectures from experts in the OCT field.** The last day of the conference was mainly focused on ESR presentations. The ESRs' presentations were the outcomes of almost three years of effort on OCT in the network, which were very informative for me.

Attending this summer school/conference was an invaluable experience that significantly influenced my professional journey. The sessions, led by expert speakers, provided a wealth of knowledge and fresh perspectives. The diverse range of topics and high-calibre presentations challenged me to expand my horizons.

The conference also **facilitated meaningful networking opportunities**, allowing me to **connect with like-minded professionals and forge valuable collaborations**.

I left the event feeling profoundly inspired and motivated to apply the insights gained in my work and research.

I want to say thank you to the organizers both from Tampere University and NETLAS for organizing the summer school/conference and planning the memorable events in Tampere city."



@ Photos by Masoud

Finland Summer School experience

by PhD7 Irene Rodriguez Lamoso

Finland was a great experience, many thanks to the organizers! I will miss the opportunity to attend further schools and events with my all colleagues from NETLAS: it has been three amazing years together!

It was our last school all together and overall it was an amazing experience. Finland and Finnish people are lovely and we had the luck to have an amazing weather in the beautiful city of Tampere. During the entire week, we had the privilege to attend different plenary sessions in the University of Tampere where we learned a lot about different topics: Advanced Laser Technologies, Photonic Integration Technologies, Quantum Technology, Biomedical Imaging, and Student Mentoring Activities. I found very interesting the Integrated Optics as VECSEL, also Dr José Pozo, CTO at Optica, prepared a great presentation to motivate the students and delivered a lecture on the impact of Photonics and how ESRs can contribute to different outreach activities. The Students also appreciated the interesting OCT session with many speakers. There was a great opportunity to attend the presentations and witness the progress of our NETLAS colleagues, and to meet very interesting people and share with them our research during our oral presentations in a more relaxed way.

Many thanks for the organizers, which made possible a visit of the university labs. Very much appreciated were also the social events: sauna and a visit to Amuri museum. I will miss the opportunity to attend further schools and events with my all colleagues from NETLAS: it has been three amazing years together!

Adrian leading one of the sessions

Marie and Alejandro

Gopika and Irene

Sauna in a lake

@photos by Irene

Summer school in Tampere by PhD14 Rene Riha

"Throughout the conference, we attended many talks on basics of semiconductor technology, laser dynamics, VECSELs, or last but not least nonlinear and mode-locking phenomenon. A talk was even provided by Ursula Keller, a big name in ultrafast lasers and from whose book I regularly study for my project and thesis. One day we had an opportunity to see the uni's lab equipment during a tour. The last day was devoted for NETLAS students to show progress in their own projects since the last NETLAS event.
In the evenings, we could engage in more leisure activities of which a sauna event by a lake with a spectacular scenery was an apex.
Conference in Tampere was the last NETLAS event.

I wish all the best to the NETLAS students in their future professional and personal life."

@ photos by Rene

The Markus Pessa summer school by PhD12 Sacha Grelet

"**The Markus Pessa summer school was special for NETLAS as** it was co-organized by Tampere University and open to all interested students. This had two major great benefits: First, the topics covered were even more diverse than the previous NETLAS training schools. **We learned about pulsed laser physics, semiconductor lasers, extreme power lasers, photonic integration technologies, quantum applications, and biomedical imaging.**

I felt that it was a perfect middle ground between the lectures we attended previously, with deep technical explanations, and the international conferences where the topics are rapidly and superficially discussed due to busy schedule. **We learned about new technologies,** but as most speakers attended multiple days of this school, **we could continue the discussion and ask for in-depth explanations.**

The second bonus of this co-organization was that **many students and teachers from other universities were present, making it an excellent networking opportunity**. In particular, the activities organized during the week helped me meet new people. Is there a better way to break the ice than a 110°C Finnish sauna?

As this was the last event organized by the NETLAS consortium, **I would like to thank all my colleagues, both the academics and the PhD students, for the years we spent working together. That was an incredible professional and personal experience"**.

@ photos by Sacha

@ photos by Sacha

PhD1 Andrei Anikeev recruited by Superlum, Ireland

It was exciting to participate in a joint event Markus Pessa International Summer School and NETLAS summer school and to visit Tampere again!

The Summer school was a great event organized by Tampere University, where I found many interesting speakers attending, in special the ones that showed the main direction of development of the semiconductor industry. **I was amazed at how big the scientific community has been created in Tampere** and that they are collaborating to develop and achieve new milestones. I had my first presentation in person; in fact, it turned out to be better than I thought. **I am grateful for this rare opportunity to have the chance to see everyone from the NETLAS Community and to attend great plenary lectures.** Of course, I should say thank you for the wonderful evening in the sauna on the lakeshore, which was organized for all of us.

P.S.: Special thanks to Philipp who invited Sacha and me to hike during the weekend after the event was finished. We were able to collect a “small” bag with mushrooms and berries. It was an amazing day!

@ photos by Andrei

PhD15 Gopika Venugopal recruited by AOG, University of Kent

The Netlas conference along with the Markus Pessa summer school was an incredible experience with a wide range of fascinating talks and engaging social events!

As it was the final event of Netlas, it was a mix of emotions to see how quickly time flew by. **It was a great opportunity to reconnect with the Netlas community and meet new people through the summer school.** The social events, particularly the sauna experience, were fascinating, and I thoroughly enjoyed my first time in a sauna. I've attached some photos from my trip to Finland.

@ photos by Gopika

PhD2 Ifte Khairul Alam Bhuiyan

recruited by Tampere University, Finland

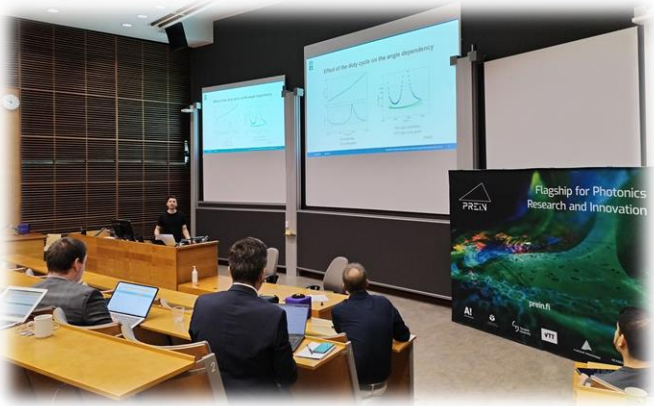
"I attended the first Markus Pessa International Summer School, which fortunately merged with the NETLAS conference in Tampere. Participating in such a week-long scientific summer school with our fellow ESRs dedicated to the realm of laser technology was a profoundly enlightening experience. **The event has not only expanded my intellectual horizons but also deepened my grasp of this dynamic and cutting-edge field, especially the application of lasers in optical coherence tomography (OCT).**

In this event, **I had the chance to come across many top-notch industrial experts, especially in the field of semiconductor lasers**. I left the summer school not only with **enhanced knowledge** but also with a **burning desire to contribute to the advancement of laser science and OCT**, **to harness the power of light in even more innovative and groundbreaking ways.** I cannot be more thankful to Dr. Jukka Viheriälä, Prof. Mircea Guina, and Prof. Adrian Podoleanu for their interactive support and discussions. Photos I took during the event will follow".


Flagship for Photonics
Research and Innovation


Flagship for Photonics
Research and Innovation


Flagship for Photonics
Research and Innovation


Flagship for Photonics
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Silicon-Rich Silicon Nitride/Silicon Oxide MEMS Fabry-Pérot Filters for SS-OCT
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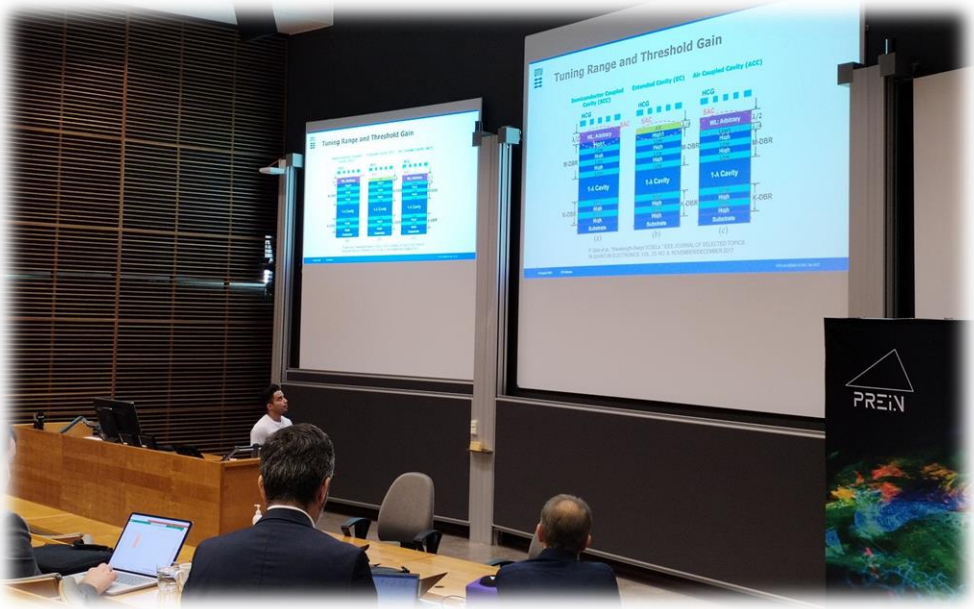
prein.fi


Tuning Range and Threshold Gain
PREIN


NetLaS
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prein.fi


TIME STRETCHED COHERENT SUPERCONTINUUM
PREIN
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@photos by PhD2 Ifte Khairul Alam Bhuiyan

PhD4 Esteban Andres Proano Grijalva

recruited by **Technical University of Denmark** (DTU)

Tampere's event was a great experience to learn about the latest advances in optical technologies from experts in the field. It was also great chance to hear about the progress of the other ESRs in their projects. The opportunity to share with like-minded people during the presentations and the social events made it a very remarkable experience. **I hope to participate in future editions and I hope that this was not the last Netlas meeting.**

@photos by Esteban

PhD3 Philipp Tatar-Mathes

recruited by Tampere University, Finland

The summer school contained many interesting speeches from high-level presenters such as Prof. Hitzenberger, Prof. Kuznetsov and Prof. Keller. **It was a great opportunity to extend the knowledge on OCT and dive into other topics.** Furthermore, the summer school dedicated an entire day to NETLAS activities, which gave us the opportunity to present our work to a larger audience. This was also particularly interesting as it helped to see the progress of everyone within the project.

@ photos by Philipp

PhD8 Mojdeh Vakili Tabatabaei

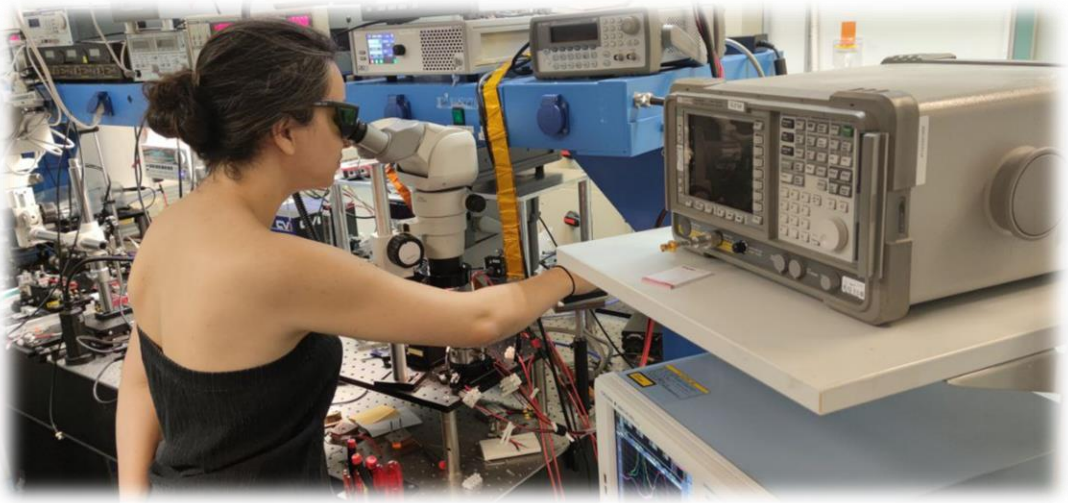
recruited by Technical University of Darmstadt (TUDA), Germany

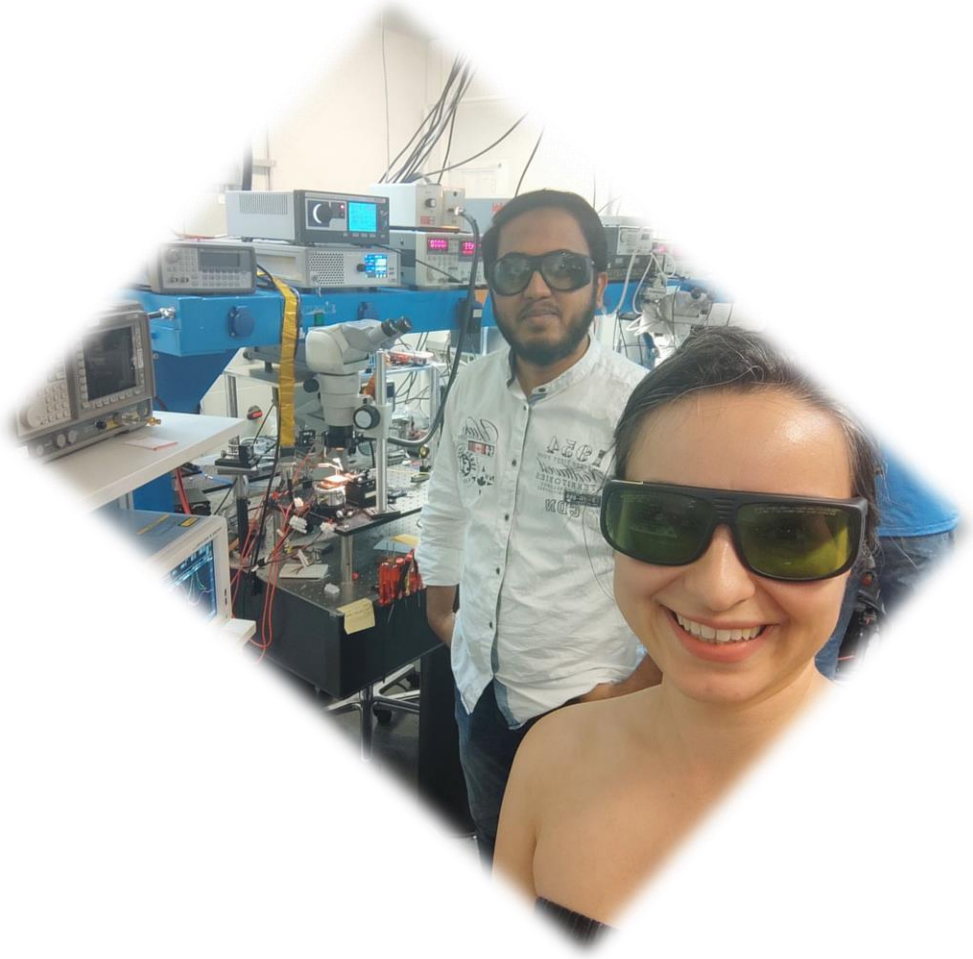
About teaser of my secondment @ Tampere

During the initial meeting with advisors, we made a plan that first we start with a short visit for 2 weeks to visit the laboratory, setups and potential lasers, where we could integrate optical filters to make a tunable laser at the end.

I spent a period between 11-22 September 2023 at Tampere University, where I had a chance to work with Dr Jukka Viheriälä and my NETLAS colleague Ifte Bhuiyan (ESR2). Ifte is currently working on a gain chip at 2um wavelength. We designed a setup to integrate an optical filter with gain chip working as SLED. During my stay I accompanied Ifte while doing light- voltage- current measurement to check the quality of the fabricated gain chips and later in the optics lab to measure the spectrum of the chip by applying current between electrodes and couple the out going light to a fiber to see the spectrum via OSA (Optical Spectrum Analyser).

The main activity of the secondment will be during my next visit. Hopefully, by then we will order the related components, have functional chips and filters for the respective wavelength and we will try to build the setup.





@photos by Mojdeh

Biophotonics for Eye Research summer school 2023

by Alejandro Martinez Jimenez

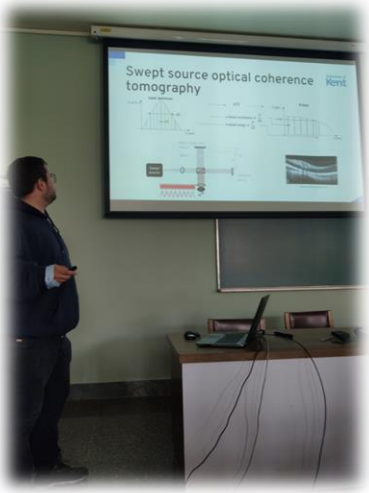
From the 1st to the 4th of June 2023, I had the privilege of participating in the **Biophotonics for Eye Research summer school**, a prestigious event organized by the Spanish Optical Committee. This enlightening experience provided me with the opportunity to engage with prominent optics groups from Zaragoza, Barcelona, Valencia, Madrid, and Murcia, all of whom are at the forefront of research in Spain.

During the conference, which primarily **focused on advancements in eye-related studies such as Intraocular Lenses (IOL) and eye aberrations**, **I was happy to share my own research findings with my esteemed colleagues from Spain**. This interaction allowed me to **gain valuable insights into their ongoing projects and discoveries.** However, I would like to draw attention to two particular research endeavours taking place in Madrid.

Firstly, the **company 2eyevision is making significant strides in the development of an optical simulator designed for pre-surgery patients**. This simulator allows individuals to explore various types of intraocular lenses and determine which one would offer the best visual acuity for their unique prescription. Given the inherent differences between individual eyes and the multitude of IOL options available, this innovation holds great promise in optimizing patient outcomes.

Secondly, the **VioBio lab in Madrid is engaged in pioneering research on Optical Coherence Elastography (OCE) utilizing techniques such as air-puff, sound, and ultrasound.** Their work, pushing the boundaries of existing knowledge, is of great relevance to our research group and certainly warrants further discussion and collaboration.

In addition to the remarkable research environment at the conference, I would like to **express my heartfelt gratitude to SPIE and OPTICA for generously awarding me travel grants** that enabled my attendance**. I am also indebted to our primary funding source, NETLAS, for their invaluable support in facilitating my participation in this event.**



[@ photos by Alejandro Martinez Jimenez]

Industry and Enterprise Updates

INNOLUME

INNOLUME are recruiting for a position within NETLAS for a period of 12 months with a start date between 1 Oct and 1 Dec 2023. The Early Stage Researcher will spend time at the Innolume GmbH and during the 12 months, up to 3.6 months at the University of Kent, Canterbury, UK.

Research will focus on the development of fast narrow linewidth tunable Laser Diode with wide tuning bandwidth for optical coherence tomography.

This position will require highly imaginative and self-motivated individuals with expertise in lasers, semiconductor physics and technology, with a good background either in III-V semiconductor technology (epitaxial growth, wafer processing, design) or in device design and characterization and expected to have graduated in Physics (Solid State Physics, Optics, Electronics) or Electrical Engineering (Microelectronics, Nanotechnology or similar).

Extensive experience in deposition methods of semiconductors or dielectric thin films (molecular beam epitaxy, sputtering) and their physical characterization and/or a strong background in ultra-high vacuum equipment operation is essential. Prior experience of LabView or Pyton are also essential. Basic knowledge in semiconductor laser physics is desirable.

Applications should be submitted **before 15th September 2023** and should include: a full CV as well as a one page summary (this should consists of a description of your skills and experience in Optics, practical Lab projects, software expertise and digital signal processing and other information in support of your application with direct reference to the advertisement and further particulars) and any supporting documents to Konstantin.Morozov@innolume.com and ap11@kent.ac.uk.

OCTLIGHT

https://www.linkedin.com/feed/update/urn:li:activity:7051858055163994112

OCTLIGHT is working with a partner to commercialize its VCSEL technology based on its successful demonstration of SS-OCT imaging.

The company is seeking ambitious team members to join in bringing this disruptive technology to market. For this we are looking for people to join within

- Application and Development Engineering of VCSEL SS-OCT
- Lead and Test Engineering of VCSEL technology

Together with our partners within VCSELs, optics packaging and MedTech product development. VCSEL technology is in a period of maturation with product coming out in the next years within several product categories to make medical, industrial and autonomous solutions more efficient, safer and effective.

To hear more about the opportunities reach out to career@octlight.com

Secondments

NETLAS PhD 14 Rene Riha
Recruited by: University of Kent (UoK) UK

PhD Project: "Dispersion tuned mode-locked laser for OCT"

Secondment at iCare (Centervue), Padua, Italy **under the supervision of Dr Sara Vannini**,
4 July 2023 – 30 July 2023

Outreach event at the University of Kent

On the weekend of 12th/13th August 2023, Space School made a return to the University of Kent for the first time since 2019. The event invites students aged 14-18 to participate in interactive sessions held in the university's laboratories to enable them to get hands-on learning around different topics relating to space science and rocketry.

The Space School team led by the outreach officer, **Megan Bell**, consisted of undergraduate, postgraduate and academic staff. There was contribution from the **Applied Optics Group** through **Lucy Abbott** (second year PhD student) and **Dr Manuel Marques** (Lecturer in Physics and Researcher in Applied Optics). Lucy took part with the students throughout the Saturday half of the event where she was assigned a team for the Rocket Building. The team was named by the students as 'Team Stargazer'. **Using special design software, students designed their rocket and once happy with the statistics, made their design come to life ready for the launch in the afternoon**. The weather thankfully permitted the launch to go ahead, despite a bit of wind!

Following from the rocketry, **tours of the Natural Sciences facilities were given by respective members of the research groups**. For this, Lucy was joined by Manuel to give a tour of the photonics labs alongside brief scientific explanations of the current experiments and set-ups belonging to the research group.

There was **great team spirit and enthusiasm toward the science and creativity** required of such a day, as reflected in a sample of feedback from the students by the end of the weekend:

"I also really enjoyed the interactive-ness of the activities and the staff really helped as well making difficult and hard topics more light hearted for everyone."

"Thanks for making the weekend such a fun experience!"

Rocket design and construction. Photo credit: Lucy Abbott.

Team Stargazer with the rocket prior to launch.

Photo credit: Lucy Abbott.

One of the rockets being successfully launched. Photo credit: Lucy Abbott

@ article by Lucy Abbott

PUBLICATIONS

10 MHz Swept-Source for Optical Coherence Tomography at 1050 nm

S. Grelet, P. B. Montague and **A. Podoleanu,**

2023 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC), Munich, Germany, 2023, pp. 1-1,

doi: 10.1109/CLEO/Europe-EQEC57999.2023.10231366.

Optical Coherence Tomography (OCT) is a technology that allows non-invasive volume imaging with high resolution. The use of swept sources allowed a significant increase in imaging speed, shifting the speed limitation from the detector to the light source [1]. However, most of the current swept source designs use mechanical parts that have intrinsic speed and bandwidth limitations, translating to an axial resolution limitation for the OCT system. Therefore, the development of akinetic swept sources could lead to a further increase in speed and bandwidth. Most such sources have been demonstrated in the telecom band, due to the mature components that are low-cost and low-loss [2]. Due to the high absorption of water in this band that prevents biomedical applications, there is an interest in adapting such a swept source at 1060 nm central wavelength. We present a swept source with an 86 nm spectral bandwidth at full-width half maximum (FWHM), centered at 1050 nm, sweeping at 10 MHz. It is based on a combination of all-normal dispersion (ANDi) supercontinuum dynamics and optical time stretch to achieve a low-noise broadband high-speed swept source.

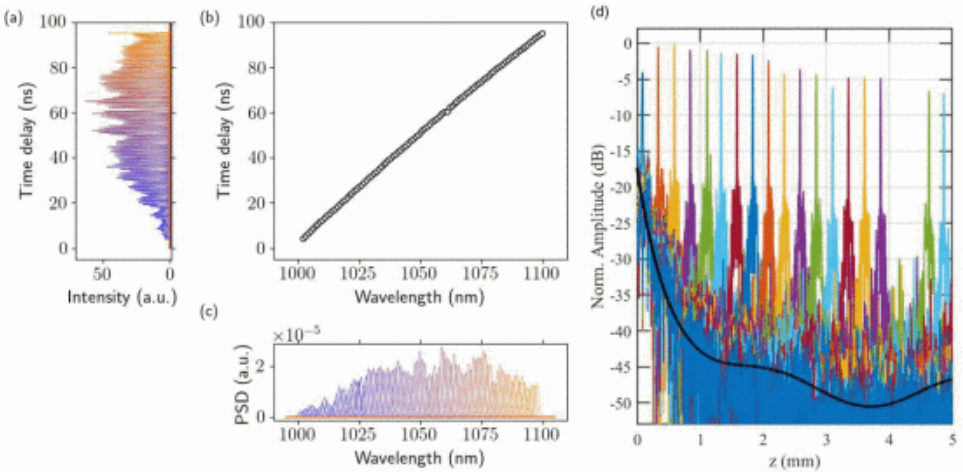


Fig. 1. Swept source output in the time domain (a), spectral domain (c), and the sweep mapping (b), measured with a monochromator; (d) characterization with a silver mirror as a sample. The background noise is shown in black.

Dual Amplification 850 nm FDML Laser

M. Klufts, S. Lotz, **M. A. Bashir,** T. Pfeiffer, A. Mlynek, W. Wieser, **A. Chamorovskiy,** V. Shidlovski, **A. Podoleanu, R. Huber**

2023 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference (CLEO/Europe-EQEC)

DOI: 10.1109/CLEO/Europe-EQEC57999.2023.10232019

Fourier domain mode locked (FDML) lasers have been widely used in optical coherence tomography (OCT) for many years at 1550 nm, 1310 nm and 1064 nm [1]–[4]. Developing a shorter wavelength FDML laser is interesting for eye imaging for instance, due to less water absorption and increased scattering which can improve the contrast of low scattering features. Read More

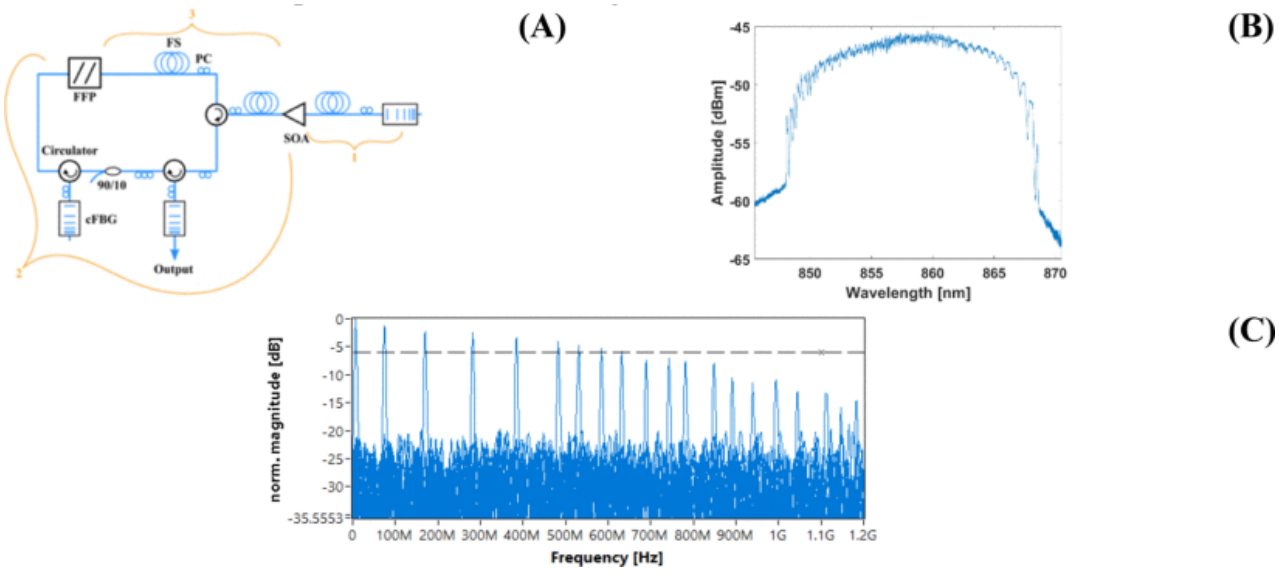


Fig. 1
Set-up (a) and spectrum (b) of the dual-pass ss fdml laser sweeping over 20 nm. (C) Sensitivity roll-off of more than 1.2 cm at −6 db. Soa: semiconductor optical amplifier, pc: polarization controller, cfbg: chirped fiber bragg grating, ffp: fiber fabry-pérot filter.

Design of a robust photonic crystal mirror for MEMS VCSELs

Arnhold Simonsen*, Gyeong Cheol Park, Thor Ersted Ansbæk, Ole Hansen, Kresten Yvind

Optics Express, *31*(11), 18240-18249.

https://doi.org/10.1364/OE.491411

Wavelength tunable lasers with narrow dynamic linewidths are essential in many applications, such as optical coherence tomography and LiDAR. In this letter, we present a 2D mirror design that provides large optical bandwidth and high reflection while being stiffer than 1D mirrors. Specifically, we investigate the effect of rounded corners of rectangles as they are transferred from the CAD to the wafer by lithography and etching.

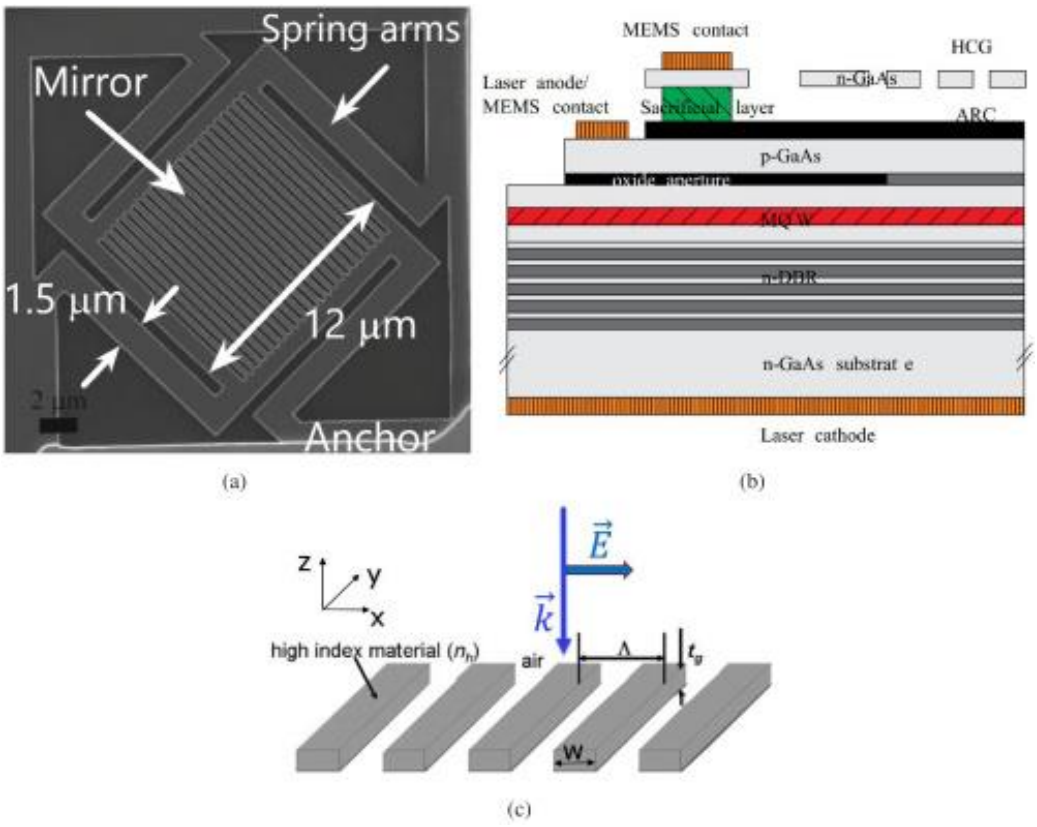


Fig. 1. (a) shows a SEM image of a HCG (top view) over an airgap on top of the VCSEL structure. (b) shows the epitaxial structure of the MEMS VCSEL [5]. (c) shows a model of the HCG with incident (TM) light.

Preprint

Real-timing processing of fiber bundle endomicroscopy images in Python using PyFibreBundle

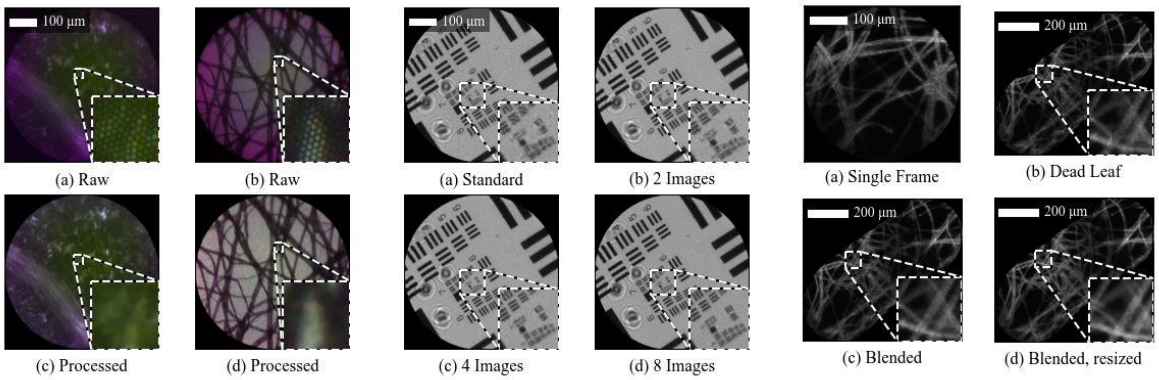
MICHAEL R. HUGHES

A pre-print of a manuscript evaluating PyFibreBundle python package for **real-time fibre bundle image processing** (core removal, mosaicing, resolution enhancement) has just gone up on Optica Open:

Preprint:
https://lnkd.in/edMx6qdg

Data and code:
https://lnkd.in/eji_X-SH

Details on the PyFibreBundle package: https://lnkd.in/egP9vdPg



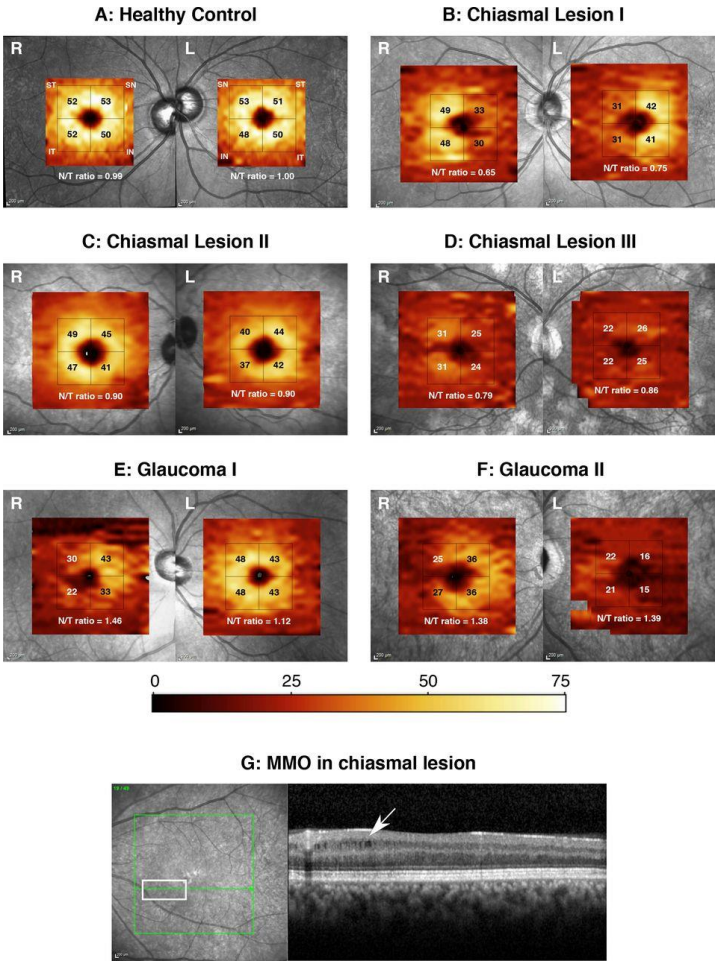
Differentiating glaucoma from chiasmal compression using optical coherence tomography: the macular naso-temporal ratio

Iris Kleerekooper et al….. and Pearse Andrew Keane

June 2023, The British journal of ophthalmology

DOI:10.1136/bjo-2023-323529

The analysis of visual field loss patterns is clinically useful to guide differential diagnosis of visual pathway pathology. This study investigates whether a novel index of macular atrophy patterns can discriminate between chiasmal compression and glaucoma.



Examples of optical coherence tomography (OCT) scans in healthy controls, pituitary lesions and primary open-angle glaucoma (POAG).

Methods A retrospective series of patients with preoperative chiasmal compression, primary open-angle glaucoma (POAG) and healthy controls. Macular **optical coherence tomography (OCT) images were analysed for the macular ganglion cell and inner plexiform layer (mGCIPL) thickness.** The nasal hemi-macula was compared with the temporal hemi-macula to derive the macular naso-temporal ratio (mNTR). Differences between groups and diagnostic accuracy were explored with multivariable linear regression and the area under the receiver operating characteristic curve (AUC).

Four-wave mixing seeded by rapid wavelength sweeping FDML laser for nonlinear imaging at 900 nm and 1300 nm

Philipp Lamminger at all….. and Robert Huber

June 2023, Optics Letters 48(14)
DOI:10.1364/OL.488181

Four-wave mixing (FWM) enables the generation and amplification of light in spectral regions where suitable fiber gain media are unavailable. The 1300 nm and 900 nm regions are of especially high interest for time-encoded (TICO) stimulated Raman scattering microscopy and spectro-temporal laser imaging by diffracted excitation (SLIDE) two-photon microscopy. We present a new, to the best of our knowledge, FWM setup where we shift the power of a home-built fully fiber-based master oscillator power amplifier (MOPA) at 1064 nm to the 1300-nm region of a rapidly wavelength-sweeping Fourier domain mode-locked (FDML) laser in a photonic crystal fiber (PCF) creating pulses in the 900-nm region. Read More

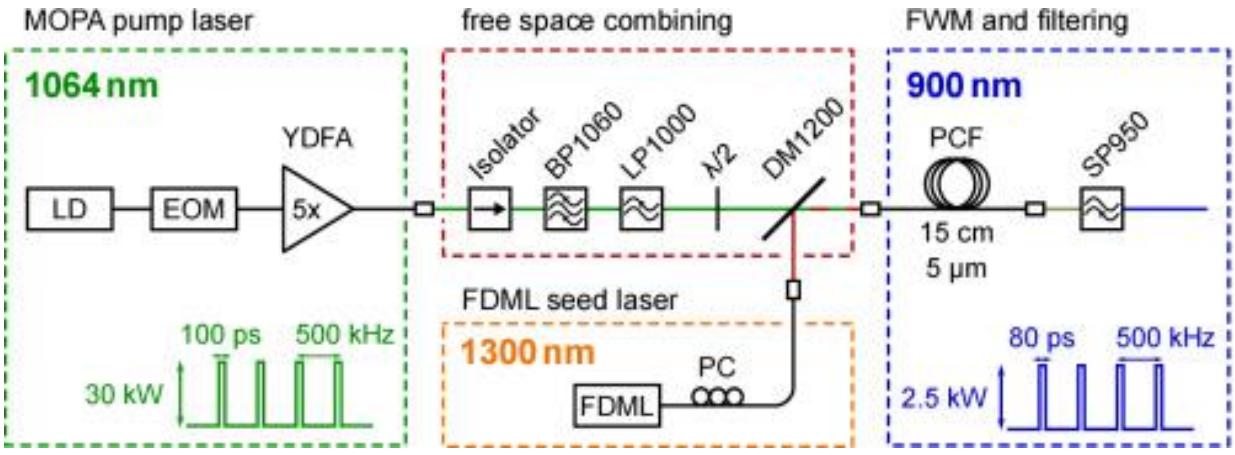


Fig. 1. FWM setup. Green: 1064-nm MOPA laser used as pump. EOM, electro-optic modulator; YDFA, ytterbium-doped fiber amplifier. Red: free space combining of the 1064-nm MOPA laser and the 1300-nm FDML laser. BP, bandpass filter; LP, longpass filter; SP, shortpass filter. Blue: FWM in the PCF with filters afterwards.

Rasmus Eilkær Hansen

PhD Student from Technical University of Denmark (DTU)

Fiber Sensors & Supercontinuum Department of Electrical and Photonics Engineering

Rasmus visited AOG at University of Kent between April – August 2022 and recently successfully defended his thesis now available online

https://orbit.dtu.dk/en/publications/mid-infrared-supercontinuum-based-spectroscopic-oct

This thesis provides a thorough review of mid-infrared (mid-IR) supercontinuum (SC) laser sources and their application within optical coherence tomography (OCT). A strong emphasis has been put on the development of the SC light sources as the performance of the light source in terms of power, spectral range, and noise directly impacts the quality, and acquisition speed of the OCT images. The beautiful theory behind the nonlinear dynamics that is responsible for SC generation has been applied in numerical modelling. The numerical simulations are a useful tool to investigate a large set of fiber, and input pulse parameters. This has resulted in the prediction of a pump modulation scheme that can provide a more flat blue edge of commercially relevant SC sources based on input pulses with picosecond duration. Read More

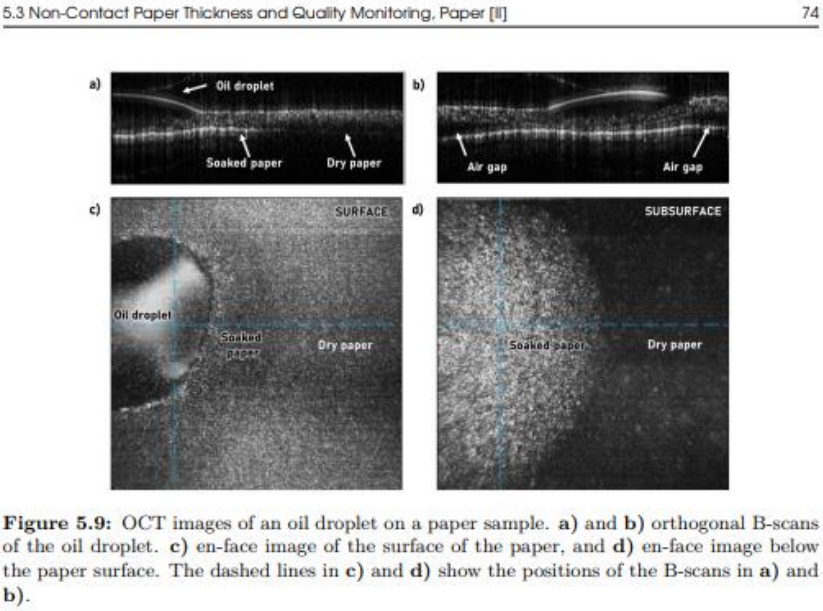
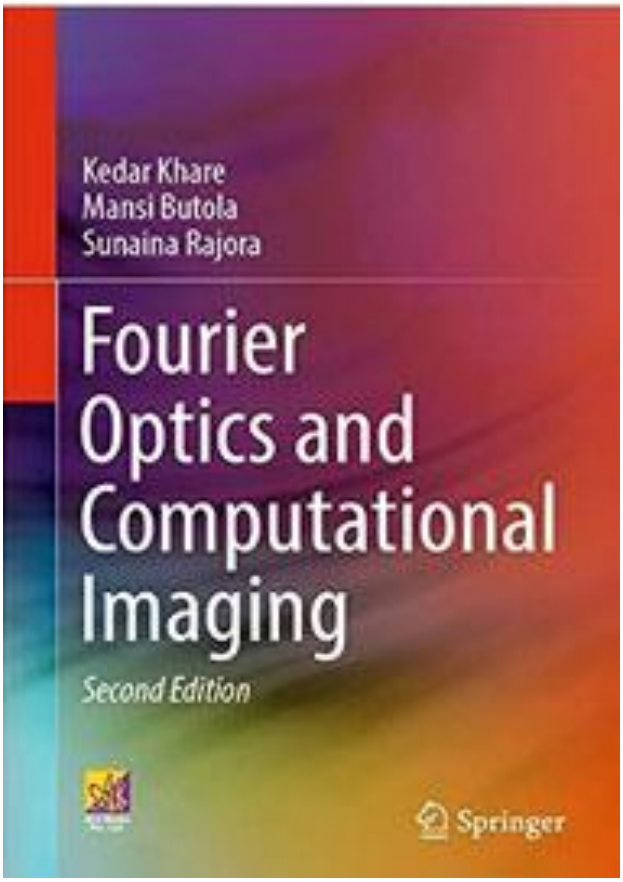


Figure 5.9: OCT images of an oil droplet on a paper sample. **a)** and **b)** orthogonal B-scans of the oil droplet. **c)** en-face image of the surface of the paper, and **d)** en-face image below the paper surface. The dashed lines in **c)** and **d)** show the positions of the B-scans in **a)** and **b)**.

CONGRATULATIONS RASMUS!

BOOKS



This book is addressed mainly to undergraduate and Ph.D. students interested in the topics of **Fourier optics and imaging**, which are of paramount importance in optics.
More specifically, the first part of the book is dedicated to the mathematical basis of optics and optical signal processing: **Fourier series and transforms, the sampling theorem, inverse problems and random processes**, while the second part of the book deals with **the main concepts of classical optics such as the wave equation, diffraction and polarization.**

Finally, the third part is focused on **computational imaging systems, where holography, phase retrieval and image reconstruction methods are presented in detail.**

The book is very clearly written and must be read by anybody working in optics.

Publish Date: 10 August 2023

Optics & Photonics News - Fourier Optics and Computational Imaging, Second Edition (optica-opn.org)

Fourier Optics and Computational Imaging | SpringerLink

Student Theses -Optical Coherence Tomography News

Visible Light Optical Coherence Tomography of the Retina: From Technical Improvements to Discovering New Bands

By **AARON MICHAEL KHO**

UNIVERSITY OF CALIFORNIA

Optical Coherence Tomography (OCT) has greatly advanced the diagnosis and management of many retinal diseases by enabling in vivo volumetric structural imaging of the retina with high resolution. Usually, retinal OCT is performed at near-infrared (NIR) wavelengths, limiting both axial resolution and contrast for molecules that play a role in vision. Though NIR OCT defines biomarkers that quantify progression of dry age-related macular degeneration (AMD), NIR OCT cannot yet delineate the finest structural and functional changes that define AMD. Visible light OCT has the ability to delineate these changes by providing high resolution and spectroscopic information that can aid in assessing AMD. The higher axial resolution can observe the retinal pigment epithelium (RPE) and Bruch's membrane (BM) on a sub-micron scale, potentially expanding our knowledge of AMD progression. The molecular contrast can be used for retinal oximetry of blood vessels and potentially photopigment or melanin densitometry which could portend early AMD.

Although **visible light OCT holds the promise of micron and even unprecedented sub-micron axial resolution and molecular contrast**, **visible light OCT systems to date have not delivered on this promise. There are many confounding factors that need to be addressed before the full potential of visible light OCT is realized.** These include the cost of hardware, size of imaging system, safety considerations limiting light exposure, excess noise in light sources, motion artifacts, chromatic aberrations, and spatially-dependent dispersion. **This thesis advances the development of visible light OCT by addressing all of the previously listed issues. With these advances, we can now clearly visualize additional retinal bands in the mouse (and human) retina such as the RPE, BM, inner plexiform layer (IPL) sublaminae, and the dark band inner to the external limiting membrane (ELM).**

Link to this record

Visible Light Optical Coherence Tomography of the Retina: From Technical Improvements to Discovering New Bands - ProQuest

OPTICS & PHOTONICS NEWS

Optics & Photonics News Magazine
July/August 2023 Issue

- James Webb Space Telescope: A Sparkling Optical Success
- Entrepreneurs to Watch
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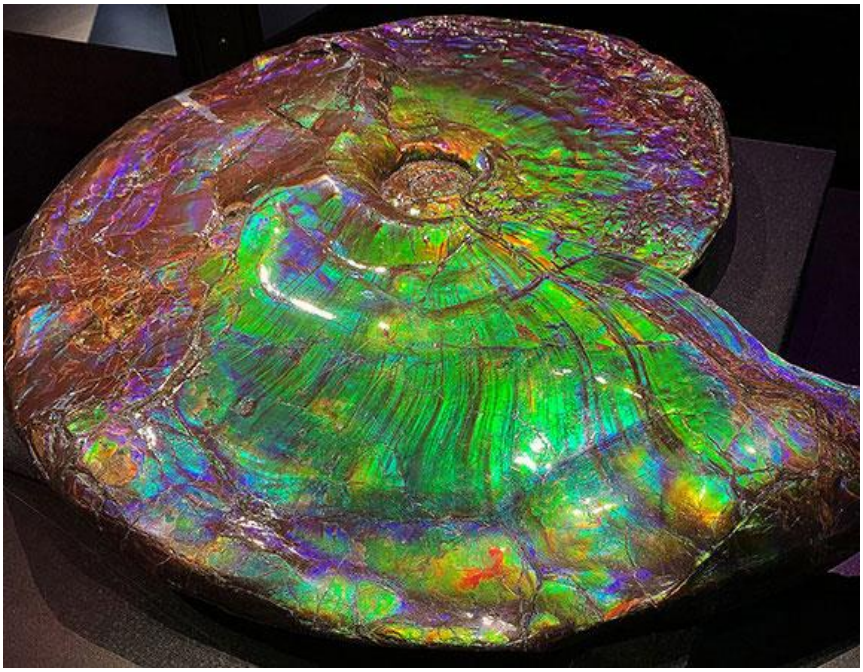
OPTICS & PHOTONICS NEWS

Image of the Week

Striking images of optics and photonics, contributed by OPN readers



Ammonite fossil replaced by aragonite mineral layers that produce iridescent colors by interference. Collection of Dr. Robert Lavinsky, exhibited at the Santa Barbara Museum of Natural History, USA, Summer 2022.

[OPN 2022 After Image Photo Contest]

Ammonite Fossil

—Samuel F. Pellicori, Senior Member, Optica, Santa Barbara, CA, USA

Webinars

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

Thorlabs Previously Recorded Webinars

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

September
20
2023

Up Next! At the Quantum Limit of Gravitational-Wave Detection

Quantum technologies are now rapidly expanding this observable horizon of gravitational-wave astrophysics. While the detectors already inject quantum states of light ("squeezed" vacuum) to reduce laser shot noise, this quantum enhancement comes at the cost of excess low-frequency noise due to quantum backaction. In this presentation, Victoria will highlight exciting discoveries from the LIGO detectors and show how quantum technologies are used in large-scale gravitational observatories.

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Presented by Dr. Victoria Xu,
Postdoctoral Associate, MIT-LIGO

Click to Register!

LIGO Uses Quantum Technologies to Detect Gravitational Waves like Those from Black Holes

Coming Soon! A Look Into Textured Antireflective Optics

In this webinar, Thorlabs Spectral Works Senior Scientist Longfei Ye and Technology Manager Ryan Priore will introduce our textured AR product line and current product offerings, discuss how textured AR surfaces work and make a comparison to traditional AR coatings, and present a few application examples and future initiatives.

Presented by Dr. Longfei Ye, Senior Scientist, and Ryan Priore, Technology Manager, Thorlabs Spectral Works

Click to Register!

An SEM Image Showing a Top-View of a Nanostructured Window Surface

Our Laser Munich 2023 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.

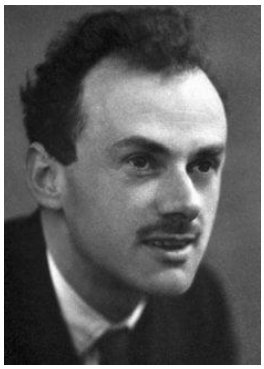
NKT super stable Koheras HARMONIK and Koheras ADJUSTIK fiber laser systems give you **high power**, **narrow linewidth**, and **low-noise light** at 317, 399, 532, 556, 638, 770, 780, 813, 840, 1064, and 1762 nm.

Watch the video for more details, or see examples of quantum applications on NKT website.

☆ **Coming soon to a campus near you, the Thorlabs Mobile Photonics Lab offers students a hands-on experience with photonics equipment used to measure, study, and harness the power of light!** ☆

Guided by current Thorlabs employees, students will be able to learn key photonics concepts, gain insight into potential careers, and network with individuals that have years of experience working in the field.

Happy Birthday to Paul A.M. Dirac



Paul Adrien Maurice Dirac was born on **8th August, 1902,** at Bristol, England, his father being Swiss and his mother English.

He was educated at the Merchant Venturer's Secondary School, Bristol, then went on to Bristol University. Dirac's work has been concerned with the mathematical and theoretical aspects of quantum mechanics.

He began work on the new quantum mechanics as soon as it was introduced by Heisenberg in 1925 – independently producing a mathematical equivalent which consisted essentially of a noncommutative algebra for calculating atomic properties – and wrote a series of papers on the subject, published mainly in the Proceedings of the Royal Society, leading up to his relativistic *theory of the electron* (1928) and the theory of holes (1930).
The importance of Dirac's work lies essentially in his famous wave equation, which introduced special relativity into Schrödinger's equation. Taking into account the fact that, mathematically speaking, relativity theory and quantum theory are not only distinct from each other, but also oppose each other, Dirac's work could be considered a fruitful reconciliation between the two theories.

Dirac's publications include the books *Quantum Theory of the Electron* (1928) and *The Principles of Quantum Mechanics* (1930; 3rd ed. 1947).

He was elected a Fellow of the Royal Society in 1930, being awarded the Society's Royal Medal and the Copley Medal. He was elected a member of the Pontifical Academy of Sciences in 1961.

Dirac has travelled extensively and studied at various foreign universities, including Copenhagen, Göttingen, Leyden, Wisconsin, Michigan, and Princeton (in 1934, as Visiting Professor). In 1929,after having spent five months in America, he went round the world, visiting Japan together with Heisenberg, and then returned across Siberia.
Read More

The Nobel Prize in Physics 1933 was awarded jointly to Erwin Schrödinger and Paul Adrien Maurice Dirac "for the discovery of new productive forms of atomic theory"

Did you know?

In July 1915 William Lawrence Bragg worked on sound ranging for artillery detection ?

During World War I, it proved difficult for British forces to pinpoint the location of enemy artillery—at least until the development of a technique called sound ranging, which employed microphones to pick up the boom of the heavy guns firing. The leader of the group that developed it was a newly minted Nobel Laureate named **William Lawrence Bragg**.
Born in Adelaide, Australia in 1890, young William Lawrence came by his passion for science and math quite naturally, given that his father, **William Henry Bragg,** was a physicist at the University of Adelaide.

Physicists around the globe were enthusiastically researching the properties of x-rays and exploring their potential for scientific applications. Bragg was inspired during a riverside stroll with an insight into the diffraction experiments conducted by Max von Laue involving x-ray beams scattering off a crystal. **He realized that this diffraction would be affected by both the wavelength of the x-rays, the angle at which the beam hit the crystal, and the distance between the crystal's atomic sheets, which he expressed mathematically as the Bragg equation.**

Bragg the elder devised an experimental apparatus to confirm Bragg junior's equation. Unfortunately, his father gave only passing (unnamed) credit to "his son" for the equation in the resulting paper, but did not list him as a co-author, hurting Bragg deeply. Nonetheless, he shared the 1915 Nobel Prize in Physics with his father, "[f]or their services in the analysis of crystal structure by means of x-ray." He remains the youngest recipient of the physics Nobel to this day, and his work with his father laid the groundwork for the development of x-ray crystallography. That same year, both Bragg and his brother Robert enlisted to fight for Great Britain in World War I. Tragically, his brother was killed in September, just before Bragg and his father received the Nobel Prize. Bragg started out in the Royal Horse Artillery, but that summer he was sent to the Royal Engineers and assigned the task of developing sound ranging to locate enemy artillery. Prior attempts had proved unsuccessful, in part because the heavier guns fired at such a low frequency the microphones couldn't detect them. Read More

Did you know?

This Day in History: August 12 1877,

Phonograph invented by Thomas Alva Edison

An american inventor Thomas Alva Edison made perhaps his most original discovery, the phonograph, and his early recordings were indentations embossed into a sheet of tinfoil by a vibrating stylus.

Thomas Edison is best remembered as the inventor of the electric light bulb, but he first attracted great fame by creating an astounding machine that could record sound and play it back. In the spring of 1878, Edison dazzled crowds by **appearing in public with his phonograph**, which would be **used to record people talking, singing, and even playing musical instruments.**

Thomas Edison created the first device to both record sound and play it back. He was awarded U.S. Patent No. 200,521 for his invention—the phonograph—on February 19, 1878.

History of the Phonograph

Thomas Edison's Early Life, Later Years and Inventions

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 George Dobre: gd@kent.ac.uk and to Adrian Podoleanu: ap11@kent.ac.uk