



52nd Newsletter of the ITN:

**“NEXt Generation  
of Tuneable LASers for optical  
coherence tomography”**

**(NETLAS)**

led by University of Kent



November 2024



Congratulations  
to the new NETLAS PhDs  
(Doctor of Philosophy)

**Masoud Payandeh**

(DTU, Denmark)

&

**Alejandro Martinez Jimenez**

(Kent Univ, UK)

∞ ∞ ∞ ∞ ∞

**Congratulations go also to their  
supervisors**

**Prof. Kresten Yvind**

**& Prof. Adrian Podoleanu**



**On Tuesday 19 November 2024**



**NETLAS ESR [Masoud Payandeh](#) defended his PhD thesis entitled: 'Long-Wavelength MEMS VCSEL for Swept-Source OCT'**

In his thesis Payandeh addresses the need for more effective, high depth resolution, and non-invasive diagnostic 3D imaging techniques in healthcare 🚑

Current imaging methods like Ultrasound and MRI, while powerful, can be limited in depth resolution and speed, when used for critical applications such as early detection and monitoring of eye or skin diseases, cardiovascular conditions, and other medical diagnostics 🔍

Improved imaging capabilities can lead to earlier diagnoses, better treatment outcomes, and more efficient healthcare systems, ultimately enhancing patient care and quality of life.

Beyond healthcare, there is also a growing demand for high-speed, precise imaging and sensing in fields like autonomous vehicles (LiDAR), spectroscopy, communication systems, and industrial non-destructive testing.

Payandeh has developed high-speed, widely tunable, 1310 nm MEMS (Micro Electromechanical Systems) VCSELs (Vertical-Cavity Surface-Emitting Lasers) 💡

These lasers are specifically designed for use in swept-source optical coherence tomography, a technology capable of high-resolution, real-time 3D imaging at greater tissue depths.

The result is a laser source that enhances imaging depth, resolution, and speed, enabling more effective medical diagnostics and expanding the capabilities of 3D imaging and sensing systems across multiple industries 🤝

[PhD defence by Masoud Payandeh](#)

19 Nov.  
2024

# MASOUD PAYANDEH PhD DEFENCE

## Industry

Tunable light sources with high speed, wide tuning range, and long wavelengths to achieve deeper tissue imaging, which is essential for high-resolution diagnostics.



## Demand



1310 nm MEMS VCSELs are well-suited for deeper penetration in biological tissues, fulfilling the demand for high-resolution, high-speed imaging in applications like vascular, skin, and anatomic imaging.

## Benefits

Silicon-based bidirectional MEMS VCSELs with wide tunability enhance imaging depth and enable real-time, fast imaging for SS-OCT.



## Results



Achieved wafer-level bonding of InP to Si, a key step for bidirectional MEMS VCSELs. This device demonstrated a tuning range of 73 nm and a resonant frequency of 2.5 MHz, vital for high-resolution, fast OCT imaging.

## Societal value

improved diagnostic imaging, providing accurate, faster, and non-invasive procedures in healthcare. Applications extend beyond medical diagnostics, including LiDAR, spectroscopy, communication systems, and non-destructive testing.



DTU Electro

Department of Electrical and Photonics Engineering



@ photos by Masoud

# Congratulations Masoud!!



**On Tuesday 26 November 2024**

**[NETLAS ESR Alejandro Martinez](#)**

**[Jimenez](#)** defended his PhD thesis entitled:  
***‘Towards high-speed Swept Source Optical Coherence Tomography’***



**Abstract:**

Optical coherence tomography (OCT) has evolved over the last three decades to become a major optical imaging modality in the biomedical optics field.

This thesis is divided into 6 chapters. A presentation of the thesis in **Chapter 1. Chapters 2 and 3** are the theory required for the experimental chapters 4,5 and 6. The theory chapters consist of **Chapter 2:** The basics of OCT and an explanation of different OCT techniques. **Chapter 3:** Divided into two main parts, pulsed fibre lasers and swept sources. The most common swept source modalities are described and compared at the end of the chapter **The experimental work of this thesis focused on the construction and the use of lasers for high-speed swept source OCT. It is divided into three main sections.**

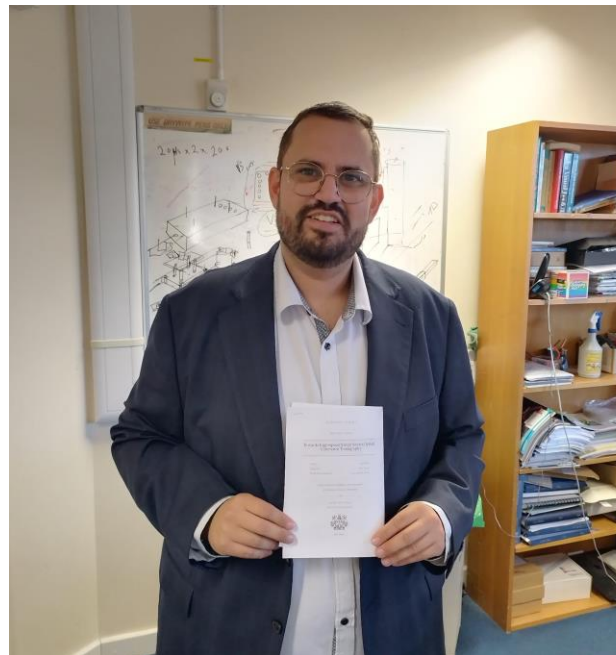
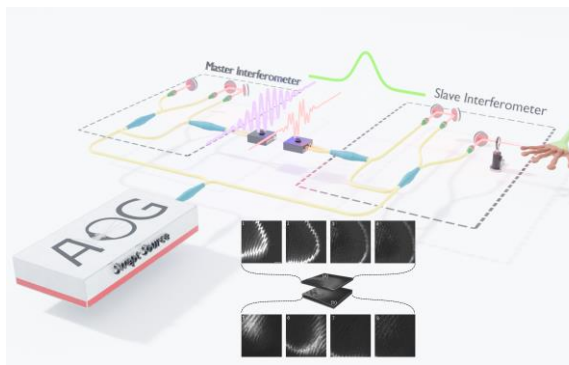
**In Chapter 4,** The construction of a mode-locked laser, followed by a time-stretch, a swept source was produced, reaching up to 9.65 MHz repetition rate. This demonstrated the challenges of using multi-MHz swept sources. A characterisation of the source for OCT was performed.





**In Chapter 5**, A multi-MHz swept source, provided by collaborators at NKT Photonics, was integrated into a system capable of coping with the required sweep rate, and images were acquired. The latest system reaches OCT volume rates of 400 Hz.

Finally, in **Chapter 6**, two state-of-the-art swept sources with sweep rates in the few-MHz range and bidirectional sweeping are used for real-time in-vivo imaging. Here, the use of an FDML laser using complex master-slave is demonstrated for the first time. Moreover, the asymmetry due to the bidirectional sweeping is analysed for both sources. Finally, a downconversion system is employed with a bidirectional laser, comparing the benefits of the OCT protocol with this type of laser.



**Congratulations**  
**Alejandro!!!**



**Congratulations to [NETLAS ESR](#)**

**[Ifte Khairul Alam Bhuiyan](#)**

for presenting his work at

**[IEEE Photonics Conference \(IPC\)](#)**

10-14 November 2024 in Rome, Italy

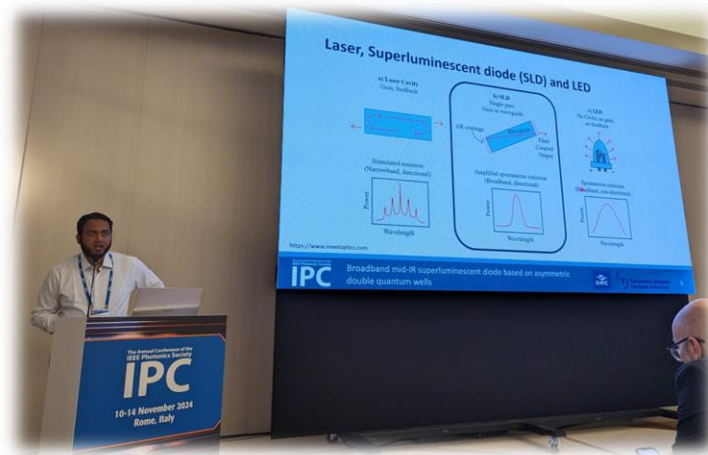
*Ifte said: “I have recently presented one of my latest works on GaSb based broadband low coherent light source during [IPC2024](#) in beautiful Rome in Italy. Thanks [IEEE Photonics Society](#) for organizing such wonderful event where I had a chance to come across peers and latest advances in Photonic technologies. Especially, I have enjoyed the brain-storming session, discussion and group works during “Young Professionals Luncheon” and “Future Thought Leaders Forum”. Thanks to the audience for listening my talk and asking questions.*

*Nevertheless, I also would like to acknowledge the unprecedent support received from Professor [Mircea Guina](#), Dr. [Jukka Viheriala](#) and my colleagues at Optoelectronics Research Centre (ORC) in [Tampere University](#).”*



Ifte delivered an oral presentation with the title **“Broadband mid-IR superluminescent diode based on asymmetric double quantum wells”**.

Full Conference Program can be found [here](#)



@ photos by Ifte Khairul Alam Bhuiyan





## Secondment

### [NETLAS PhD8: Mojdeh Vakili Tabatabaei](#)



Recruited by: [Technical University of Darmstadt](#) (TUDA), Germany

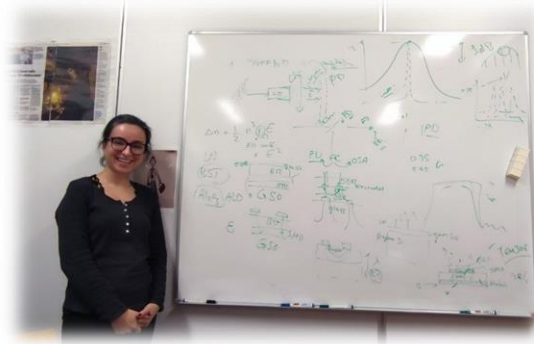
Secondment at: [Tampere University](#), Finland  
under the supervision of Prof. Mircea Guina

Period: *29.09.2024 to 30.11.2024*

**The objective of this secondment** is to foster collaboration between **TU Darmstadt in Germany** and **Tampere University, Finland**, in developing electrically tunable lasers operating in the **2 to 2.1  $\mu\text{m}$  wavelength range**. My contribution has focused on the simulation and fabrication of optical filters designed for this range, which selectively transmit light at the notch wavelength while blocking all other wavelengths. The preliminary results are promising, and I remain optimistic about achieving fruitful outcomes from this collaboration as the work progresses.

I would like to express my heartfelt gratitude to **Prof. Sascha Preu**, my supervisor at TU Darmstadt, as well as **Prof. Mircea Guina**, **Dr. Jukka Viheriälä**, and **Dr. Samu-Pekka Ojanen** at Tampere University for their invaluable support and constructive discussions throughout this journey.

Finally, I would like to share a couple of photos that capture the highlights of my stay so far.



**After an hour of brainstorming with Prof. Mircea Guina**



**Fully armed to enter the clean room 😊**

**The first results are achieved!**



**TAU, covered in snow, captured from the window of my office**

@ photos by Mojdeh



## NETLAS INVITED TALK and PHYSICS DEPARTMENT SEMINAR

Tuesday 19th November 2024,  
2pm UK time, online & in person, LT in Marlowe Building,  
University of Kent, UK



**Prof. Olga M. Conde**

Telecommunications Engineering from  
the University of Cantabria

Tuesday 19th November 2024 **Prof. Olga M. Conde** visited Applied Optics Group (AOG) and delivered a presentation online & in person with the title “*Advanced Optical Imaging for Diagnosis in Precision Medicine Techniques and Applications*”, LT in Marlowe Building, University of Kent. Before and after the presentation Prof. Conde visited the AOG’s labs and had the opportunity to meet and discuss with NETLAS ESRs, PhD Students and Researchers about their research interests and results. Abstract, biography, print screens and photos from her presentation will follow.

### **ABSTRACT:**

Advanced optical imaging technologies including HyperSpectral Imaging (HSI), Optical Coherence Tomography (OCT), Polarization Sensitive-OCT (PS-OCT), Raman spectroscopy and Mueller polarimetry, provide valuable and rich chemical and morphological information about biological tissues. Optical imaging technologies help clinicians to assess the evolution and diagnosis tissue impairment while performing surgery, pathological assessment, diagnosis, etc. Under this perspective, the adoption of optical imaging techniques within the biomedical field will enhance CADe (Computer-Aided Detection) and CADx (Computer-Aided Diagnosis) disciplines. Tissue composition changes qualitatively and quantitatively during the evolution of a disease. Understanding the physics of light-tissue interaction mechanisms helps to obtain accurate optical properties (absorption and scattering coefficients, birefringence, anisotropy, etc.) that can be



used for diagnosis. In general, and due to the heterogeneity of tissues, this problem is affected by a multiparametric scenario that cannot be always addressed by deterministic or empirical approaches.

**Our research is focused both, in the development of optical imaging technologies to extract optical properties from tissue, and on the development of automated classification methods for biological tissue diagnosis based on statistical, multivariate methods and artificial intelligence including deep-learning methods.**

These general computational methodologies, aimed to discover unknown and hidden relationships between input and output data, can be transversally transferred to different modalities. Results of this approach cover from cardiovascular diseases to the early assessment of neuromuscular diseases or the determination of margin assessment in cancer, among others.

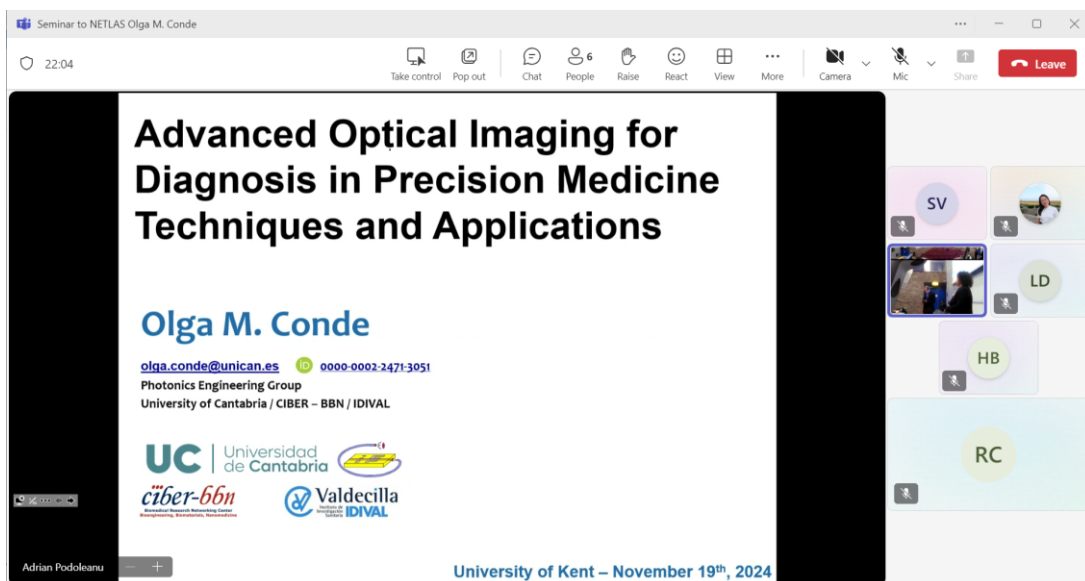
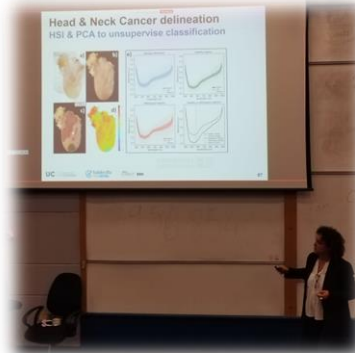
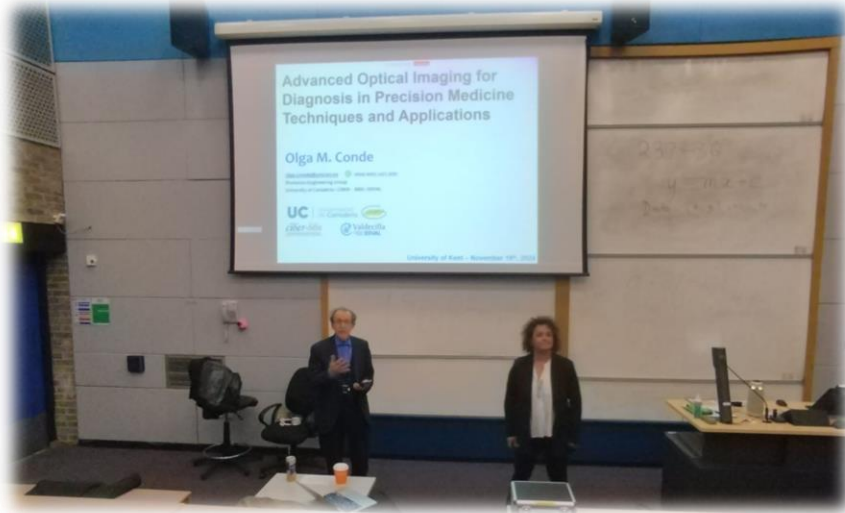
#### **BIOGRAPHY:**

**Olga M. Conde** Ms and Ph.D. in Telecommunications Engineering from the University of Cantabria. **Associate Professor since 1999 in the Photonics Engineering Group of the University of Cantabria and associated researcher of IDIVAL (Marqués de Valdecilla Biomedical Research Institute) and CIBER-BBN (Bioengineering, Biomaterials and Nanomedicine Networking Biomedical Research Centre).**

Her research interests are focused **in medical imaging techniques for tumour delineation (breast, melanoma, pancreas, glioma) and diagnosis of cardiovascular pathologies (aneurysm, hearth valve repair surgery) and rare diseases along with the imaging of physico-chemical properties of organoids; the development of artificial intelligence (pattern and features recognition techniques, spectral analysis, etc.) applied to artificial vision and imaging spectroscopy for biomedical, agri-food and industrial environments; and the development of spectroscopic/hyperspectral imaging systems for materials in the visible, NIR and SWIR ranges.**

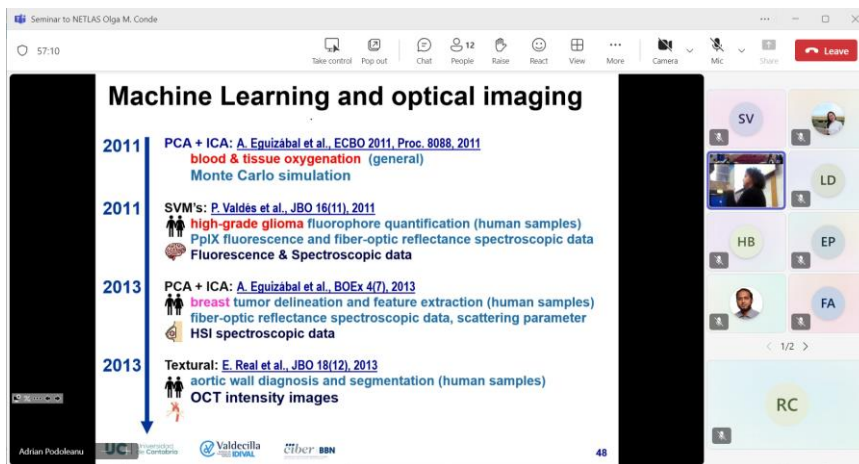
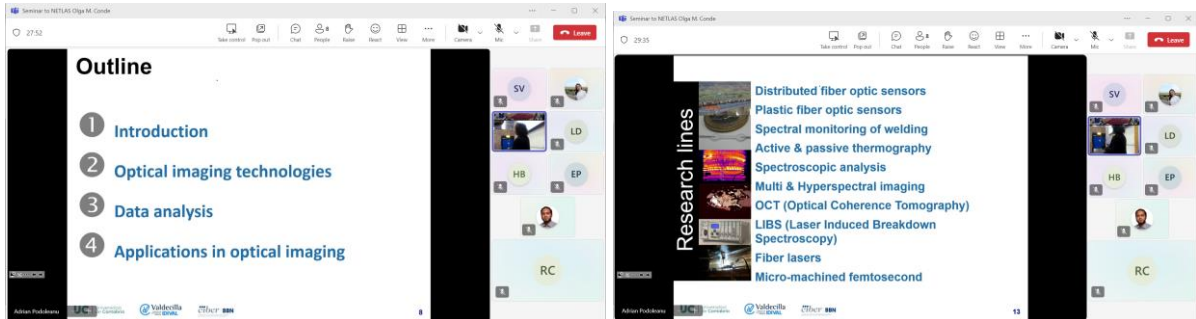
Her research is funded by the Institute of Health Carlos III and the Ministry of Economy and Competitiveness publishing over 50 peer-reviewed papers and over 180 conference papers. She is Vice President of the Imaging Techniques Committee of SEDOPTICA (Spanish Optical Society), Associate Editor of JBO (Journal of Biomedical Optics, SPIE), member of the TPC (Technical Program Committee) and IAB (International Advisory Board) of different conferences (SPIE, OSA, IEEE, LALS) and reviewer of evaluation agencies ANEP (Spanish National Agency for Evaluation and Forecasting) and FNRS (Belgium Fund for Scientific Research) and different scientific journals.





@photos and print screens by Dr Ramona Cernat





Prof. Conde said: *“Honored to visit and be invited to the [University of Kent](#) within the [NETLAS](#) Doctoral School! ✨ Thanks to Prof [Adrian Podoleanu](#) and the team for the warm welcome and the opportunity to catch up. Eager for more collaborations and learning!”*



@ print screens by Dr Ramona Cernat and group photo by Dr George Dobre



## CONFERENCES

### **International School of Biophysics** **Erice School 2025:** **Shaping light in space and time for** **biomedical imaging**

**Sicily (Italy), 14 – 20 May 2025**

The aim of the school is to bring together leading experts, researchers, and scholars in the field of biomedical optical imaging to share their knowledge, insights, and **latest advancements in shaping light in time and space for biomedical applications.**

**The Ettore Majorana Institute**, nestled in the picturesque village of Erice, serves as the venue for the school. It offers an idyllic setting conducive to collaborative learning, stimulating discussions, and valuable networking opportunities. The center will provide the full coverage of the lodging and meals in a single room with a private bathroom in one of the four Monasteries in Erice and the transfer from the airports (Palermo or Trapani) to Erice (one hour by private car). No fees are required to the invited speakers.

Read More about [Erice School 2025](#) & [ETTORE MAJORANA FOUNDATION](#) and Centre for Scientific Culture

**Applications should be sent through [this form](#)**



# **Annual International Conference on Optics, Photonics and Lasers ([AICOPL2025](#))**

**March 13-15, 2025, Rome (Italy)**

The objective of AICOPL2025 is to provide a unique forum for discussion of the latest developments, refresh your knowledge and will offer plenty of networking opportunities, providing you a chance to meet and interact with leading researchers as well as most influential minds in the field of optics, photonics and lasers.

There will be awards

**Best Poster Award & Young Scientist Award**

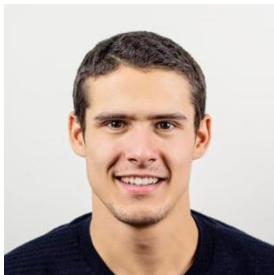
**Abstract submission closes:  
January 30, 2025**

**[AICOPL2025 | Optics Conference | Photonics | Lasers | Rome | Italy | Top conferences in Optics](#)**



## **Student Theses -Optical Coherence Tomography News**

### **Deep learning for medical image analysis in cancer diagnosis**



**By Iulian Emil Tampu**

**Linköping University, Department of  
Biomedical Engineering, Division of  
Biomedical Engineering, Sweden**

This thesis explores the application of Deep Learning (DL)-based methods for medical image analysis, focusing on cancer diagnosis at various treatment planning stages, including preoperative, intraoperative, and postoperative procedures. Methods were developed and applied to three medical imaging modalities: optical coherence tomography (OCT) for intraoperative diagnosis, magnetic resonance imaging (MRI) for pre-operative diagnosis and radiotherapy treatment planning, and histopathology whole-slide images (WSI) for postoperative final diagnosis, addressing tasks such as detection, semantic segmentation, and classification for thyroid diseases and paediatric and adult brain tumours.

In summary, the outcomes of this thesis highlight the potential of deep learning-based methods for medical image analysis in the context of cancer diagnosis. These works demonstrate the versatility of deep learning in processing medical images from various sources and at different spatial resolutions and dimensionalities. Appropriate dataset curation, method validation and interpretation, and translational research are needed to promote the integration of deep learning-powered tools in the clinic. [Read More](#)

### **Access to Document:**

**[Deep learning for medical image analysis in cancer diagnosis](#)**



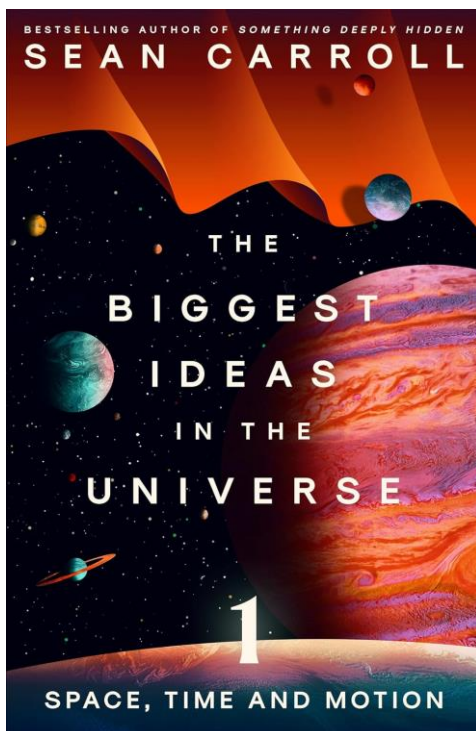
## Books & Reviews

### [The Biggest Ideas in the Universe 1: Space, Time and Motion](#)

By [Sean Carroll](#) (Author)

**THE NEW YORK TIMES BESTSELLER**

*‘Sean Carroll has achieved something I thought impossible: a bridge between popular science and the mathematical universe of working physicists. Magnificent!’* **Brian Clegg, author of *Ten Days in Physics that Shook the World***



Immense, strange and infinite, the world of modern physics often feels impenetrable to the undiscerning eye – a jumble of muons, gluons and quarks, impossible to explain without several degrees and a research position at CERN.

But it doesn't have to be this way!

Allow world-renowned theoretical physicist and bestselling author Sean Carroll to guide you through the biggest ideas in the universe. Elegant and simple, Carroll unravels this web of theories and formulae equation by equation, getting to the heart of the truths they represent.

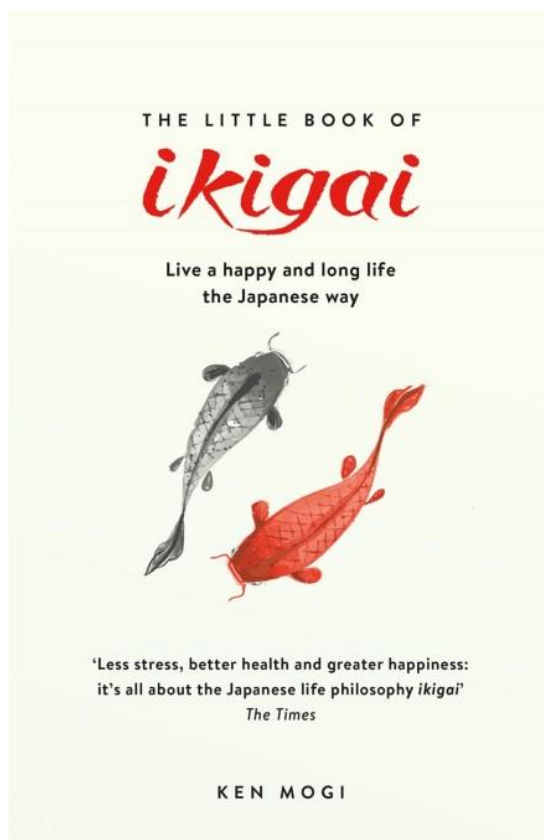
Order the book [here](#)



## The Little Book of Ikigai

by [Ken Mogi](#)

**The secret Japanese way to live a happy and long life**



*Japanese men's longevity ranks 4th in the world, while Japanese women's ranks 2nd. Perhaps this comes as no surprise when you know that the Japanese understanding of ikigai is embedded in daily life, careers, relationships, and hobbies.*

*Neuroscientist and bestselling Japanese writer Ken Mogi shares personal insight and scientific research to provide a colourful narrative of Japanese culture and history along the way.*

**The authors identifies five key pillars to ikigai:**

- 1: Starting small**
- 2: Releasing yourself**
- 3: Harmony and sustainability**
- 4: The joy of little things**
- 5: Being in the here and now**

Order the book [here](#)



## Did you know ?!

### [UCL Institute of Ophthalmology involved in launch of new Centre of Excellence \(CoE\) for eye health](#)

Collaboration between our institute and two international strategic partners leads to a new Centre of Excellence focused on advancing eye health in Warsaw



**UCL Institute of Ophthalmology Director, Prof Andrew D Dick said:**

“ This marks a significant milestone in our commitment to enhancing vision research, education, and enterprise initiatives globally, while also reinforcing our strategic partnership with the International Centre for Translational Eye Research (ICTER). I am delighted to see our collaboration with colleagues in Poland and France take shape in the establishment of a new centre focused on better understanding eye disease, and developing alternative treatments, including gene therapies.

[UCL Institute of Ophthalmology involved in launch of new Centre of Excellence \(CoE\) for eye health | UCL Institute of Ophthalmology - UCL – University College London](#)



## **JOB Alert**

**EXALOS is hiring a Production Process Control Engineer.  
Part-time (80%) or full-time (100%).**

**Join the [EXALOS team](#) and help to create market-leading laser and SLED technology.**

**They develop and produce semiconductor-based broadband light sources for biomedical imaging, fiber optic sensing, or other high-tech applications immediate.**

They need a Production Process Control Engineer to monitor, maintain, improve and develop automated manufacturing processes for advanced light sources based on micro-optical integration and automated sub-micron assembly on manufacturing robots. You will work with design engineers and operators to ensure the product can be built in high volumes with best-in-class yield and reliability.



Interested? Apply via email at [hr@exalos.com](mailto:hr@exalos.com).



## A new job offer at ICTER

**ICTER (International Centre for Translational Eye Research) - a multidisciplinary research centre, focused on the dynamics and plasticity of the human eye – Warsaw, Poland**

### **Exciting translational Proof of Concept project to build a prototype for two-photon AR glasses!**

Two-photon vision is the visual perception of pulsed infrared lasers, which we have been studying since 2014. In this project, they would like to exploit this type of vision to display AR content.

👉 **They are looking for a post-doc or experienced engineer with practice in LabVIEW software development for optical systems** and the ability to design with CAD/CAM tools.

➤ **Familiarity with visual stimulus projection methods using MEMS scanners** and knowledge of psychophysical testing methods would be welcome.

[PostDoc/Inżynier position - Recruitment No 60/2024 | EURAXESS](#)

[Proof of Concept Call 1/2023; Proposal Number FENG FENG.02.07-IP.05-0233/23, 60/2024 | IChF PAN](#)



## **Postdoctoral position available at University of Illinois Chicago**

OPIRA laboratory has a postdoctoral position available in the area of Ultrasound and Photoacoustic Imaging, **with an immediate start date.**

Strong prior experience in instrumentation OR programming in MATLAB or Python is required for this position.

If you are interested, please reach out via  
**avanaki@uic.edu.**

Include the following in your Email: (1) Your CV, (2) copy of your journal publications, (3) a paragraph outlining your motivation and goals.

**Please also mention if you are currently residing in the United States.**

To learn more about our current research, please look at the lab website [Research | opira-avanaki](#)





**Superlum** is pleased to announce the launch of their new SLD at 1050 nm:

**S1050.85.7.**



**New!**  
**1050 nm SLDs**

These devices open a new range of Superlum SLDs emitting in the 1000 – 1100 nm spectral range. Due to their very wide spectrum, they **may be of particular interest for high-resolution Optical Coherence Tomography and other similar low-coherence interferometry systems**, as well as spectroscopy, optical sensing, and testing.

Visit <https://lnkd.in/eBE Hss>  
or inquire [sales@superlum.ie](mailto:sales@superlum.ie) to learn more!



## 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](#).



At Thorlabs, we believe that the transition from college to career is an excellent opportunity for both personal and professional growth!

Watch now to discover how our interns gain hands-on experience, work on cutting-edge technology, and develop skills that set them up for a bright future. See what makes Thorlabs internship the perfect launchpad for your career!

To learn more about internships or other career opportunities, visit [Thorlabs - Your Source for Fiber Optics, Laser Diodes, Optical Instrumentation and Polarization Measurement & Control.](#)



## Up Next! Optimizing Acquisition of Pulsed Sources in Spectroscopy

Spectroscopical experiments often involve light sources that are pulsed. Measuring pulsed sources with Fourier-based spectrometers can be challenging, since the abruptly changing interferograms give rise to spurious ghost features in the optical spectrum. In this webinar, Thorlabs' Research and Development Engineer, Carl Borgentun, will explain the cause for the spectral ghosts and how to minimize their impact.



**Presented by Dr. Carl Borgentun, OSA Research and Development Engineer, Thorlabs**

Dr. Carl Borgentun is part of the development team behind Thorlabs' optical spectrum analyzers. He received his Ph.D. from Chalmers University of Technology in Gothenburg in 2012, where he designed and built widely tunable semiconductor disk lasers. After a few years of developing custom lasers for space applications at Jet Propulsion Laboratory in Pasadena, CA, he moved back to Sweden and joined the spectroscopy team at Thorlabs.



OSA302

The Redstone® [OSA302](#) covers a wide wavelength range: 250 - 2500 nm or 4000 - 40 000  $\text{cm}^{-1}$ .

## PUBLICATION

### Phase-Shifted Fiber Bragg Grating by Selective Pitch Slicing

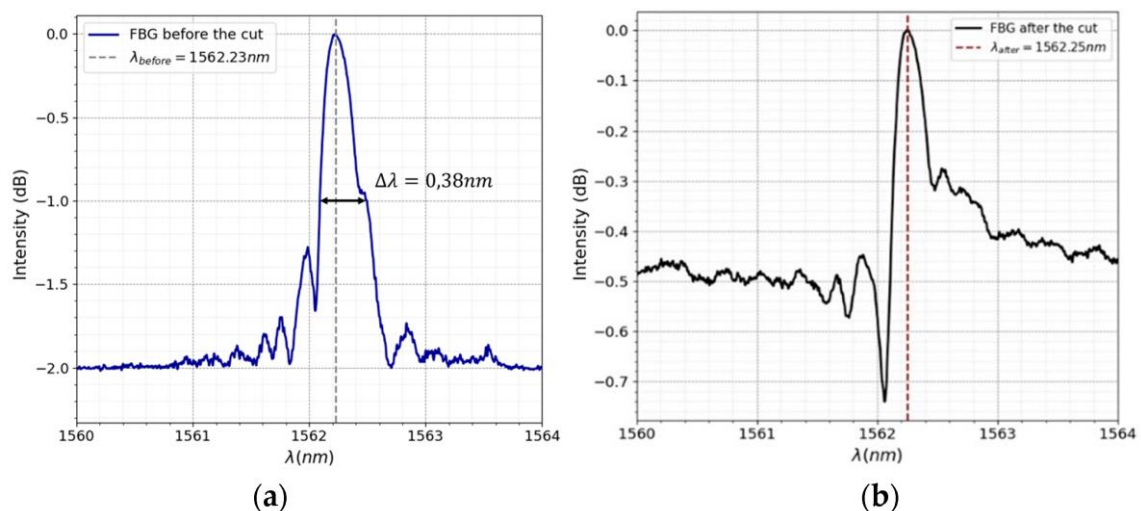
Paulo Robalinho, Vinícius Piaia, Liliana Soares, Susana Novais.  
**António Lobo Ribeiro**, Susana Silva and Orlando Frazão

**Sensors 2024, 24(21), 6898;**

<https://doi.org/10.3390/s24216898>

#### Abstract

This paper presents a new type of phase-shifted Fiber Bragg Grating (FBG): the sliced-FBG (SFBG). The fabrication process involves cutting a standard FBG inside its grating region. As a result, the last grating pitch is shorter than the others. The optical output signal consists of the overlap between the FBG reflection and the reflection at the fiber-cleaved tip. This new fiber optic device has been studied as a vibration sensor, allowing for the characterization of this sensor in the frequency range of 150 Hz to 70 kHz. How the phase shift in the FBG can be controlled by changing the length of the last pitch is also shown. This device can be used as a filter and a sensing element. As a sensing element, we will demonstrate its application as a vibration sensor that can be utilized in various applications, particularly in monitoring mechanical structures.



**Figure 3.** The spectrum of FBG structure: (a) before the cut and (b) after the cut.





# OPTICS & PHOTONICS NEWS



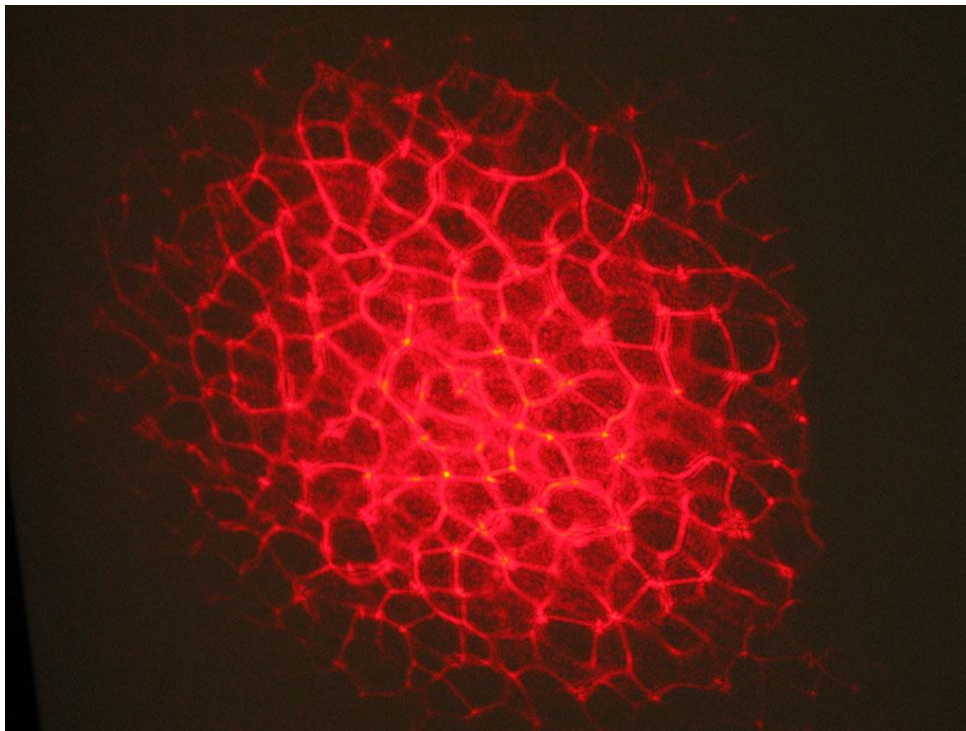
[Optics & Photonics News Magazine](#)  
[November 2024 Issue](#)

- [Thermoradiative Photovoltaics](#)
- [Enhancing Optical Microscopy with Quantum Entanglement](#)
- [Hydrogel Optical Fibers](#)

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Image of the Week

Striking images of optics and photonics, contributed by OPN readers



**Fiber Speckle Pattern**

Red laser light from the end-facet of a short sample of multimode polymer optical fiber was inspected on a black screen. The web pattern disappeared when optimizing the laser input coupling, with speckles from the expected guided modes available for further study, here seen in overlay.

[—Dirk Voigt, Leiden, Netherlands](#)

[22 Nov 2024](#)



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**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](mailto:R.Cernat@kent.ac.uk) and to Adrian Podoleanu: [ap11@kent.ac.uk](mailto:ap11@kent.ac.uk)**