35th Newsletter of the ITN:

"NExt Generation of Tuneable LASers for optical coherence tomography"

(NETLAS)

led by University of Kent

May 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 organized 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 Reserch Centre in Tampere and the pioneer of optoelectronics and semiconductor laser technology in Finland.

Tutorial type of lectures covering laser technologies, imaging (including bio-imaging technology), quantum technology, photonic integration, transferable skills and Student Mentoring Activities.

All NETLAS ESRs are expected to present orally.

Registration is now open, more information can be found at:

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

International Day of Light 16 May 2023

The International Day of Light is a global initiative that provides an annual focal point for the continued appreciation of light and the role it plays in science, culture and art, education, and sustainable development, and in fields as diverse as medicine, communications, and energy. The broad theme of light will allow many different sectors of society worldwide to participate in activities that demonstrates how science, technology, art and culture can help achieve the goals of UNESCO – education, equality, and peace.

Read the Newsletter from International Day of Light website:

International Day of Light 16 May 2023

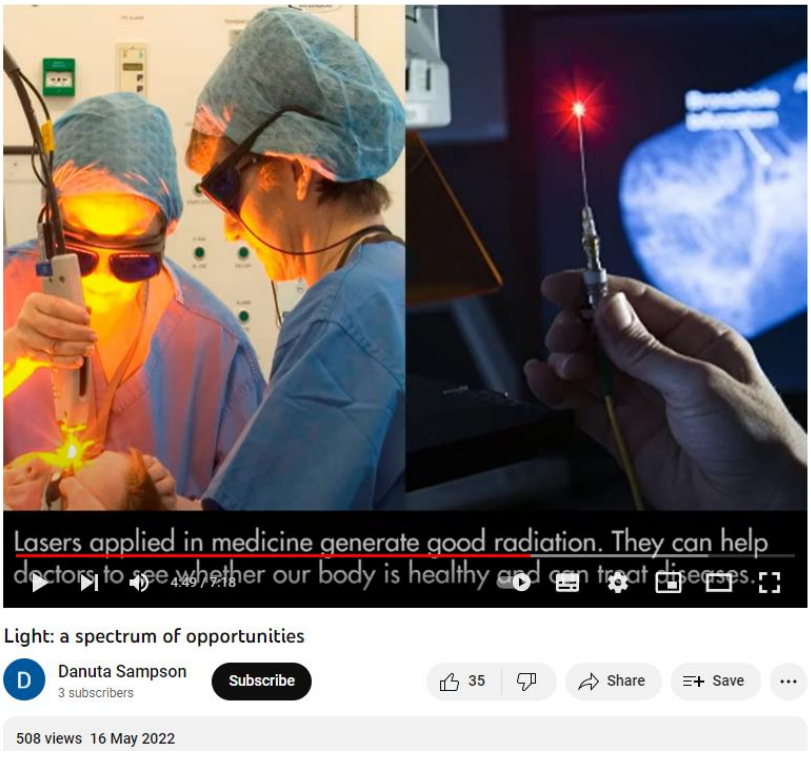
Watch the International Day of Light 16 May official video on YouTube

International Day of Light 16 May 2023

May 16th marks the International Day of Light ☀, celebrated globally to acknowledge the importance of light and light-based technologies in science, culture, and art. Light, optics, and photonics significantly impact our lives, including entertainment, medicine, communication, energy, agriculture, art, and culture.

Dr Danuta Sampson, researcher and senior lecturer in UWA Doctor of Optometry, has created a captivating video to showcase this influence. We hope you enjoy the video and gain inspiration from the everlasting presence of light in our world.

https://lnkd.in/gKqRY9gu



Light: a spectrum of opportunities

International Day of Light 16 May 2023

Experts from **ZEISS Medical Technology** presented a series of talks on the intersection between the spectrum of light and optical technologies.

International Day of Light is a global initiative by UNESCO and is annually celebrated on May 16. As light is an essential aspect of life, this day focuses on appreciating its role in science, culture, art, education and sustainable development, in fields such as medicine, energy and communications.

International Day of Light 2023 (zeiss.com)

ZEISS International Day of Light 2023

A recording of these presentations can be found:

ZEISS International Day of Light 2023 (vimeo.com)

International Day of Light 16 May 2023

Longing for the Earth

Poem by
António Gedeão, *Máquina de Fogo* (1961)

Eyes that looked at me at length,
out of love or compassion,
I do not know,
made me think about death, and on the longing
I would feel if I died now.

And I thought that I would not
long for life or regret losing it,
but that in my dead eyes I would keep
some images of what I have seen.

I enjoyed light. I enjoyed seeing it in every other way,
from the glow of the firefly to the cold starlight,
from the blaze of firestorms to the flames of bonfires.

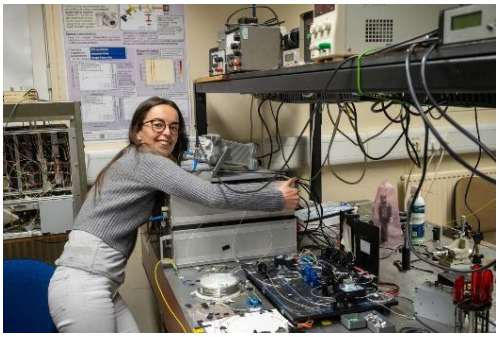
I much fonded seeing it when sparkling
on the face of a crystal,
when it stabs, as a quiet blade,
the dusty mist of a pinewood,
when it leaps, in snake writhing, on the waters,
shattering in pieces from a faceted scepter,
when it falls on a prism and unfolds
in the seven colors of the spectre.
...

@ **Dr Manuel Marques:** "This is a excerpt of poem from a Portuguese poet, António Gedeão, part of his 1961 anthology *Máquina de Fogo*. His name is actually a pseudonym – he built his career as a Physics (and Chemistry) schoolteacher in the mid 20th century".

Poem translated by Marisa Monteiro (Manuel's mum),
Curator Of Collections at Science Museum of the University of Porto

Secondments

NETLAS PhD 9 **Marie Klufts**



Recruited by: University of Lübeck (Uzl) Germany

Secondments started on **10th October 2022** at University of Kent, ended on **17th May 2023**

PhD Project: Short wavelength FDML laser

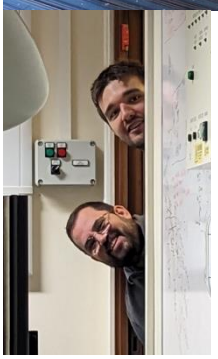
End of my 2nd secondment in Canterbury

As I write these few lines after a long journey back home in Lübeck, I am feeling nostalgic about my time in Canterbury. A lot happened during those 7 months: a few conferences, one coronation, almost a 3rd star on our French Team jersey, and the first retinal images acquired with an 850 nm FDML laser.

It was such a great and invaluable experience for me to join the AOG team during my PhD journey. **Collaboration with a new group of research teach you a lot about new perspectives, methodologies, and areas of expertise.** OCT and the CMS method were at the very core of my research in Kent. Prof. Adrian Podoleanu and Dr Adrian Bradu have been crucial mentors throughout my time at the university, dedicating their time and competence to patiently explain and guide me over the past 7 months. Their commitment to sharing knowledge has been instrumental in expanding my understanding and skills.

I would also like to say a special thank you to my NETLAS colleague Alejandro Martinez, who has put up with me all these months and answered all my questions, whether at work or in life. Even if some questions remain unanswered: Why are our friends our friends? What makes you happy? Or can trying to love yourself make you stop loving yourself? All these questions in the hope of one day having an ideal life without noticing that it's already here.
Long story short, thank you all for helping me to make progress with my thesis. I have managed to take a big step forward in my last few months, and now… it's time to write.







@ Article and Photos by Marie Klufts

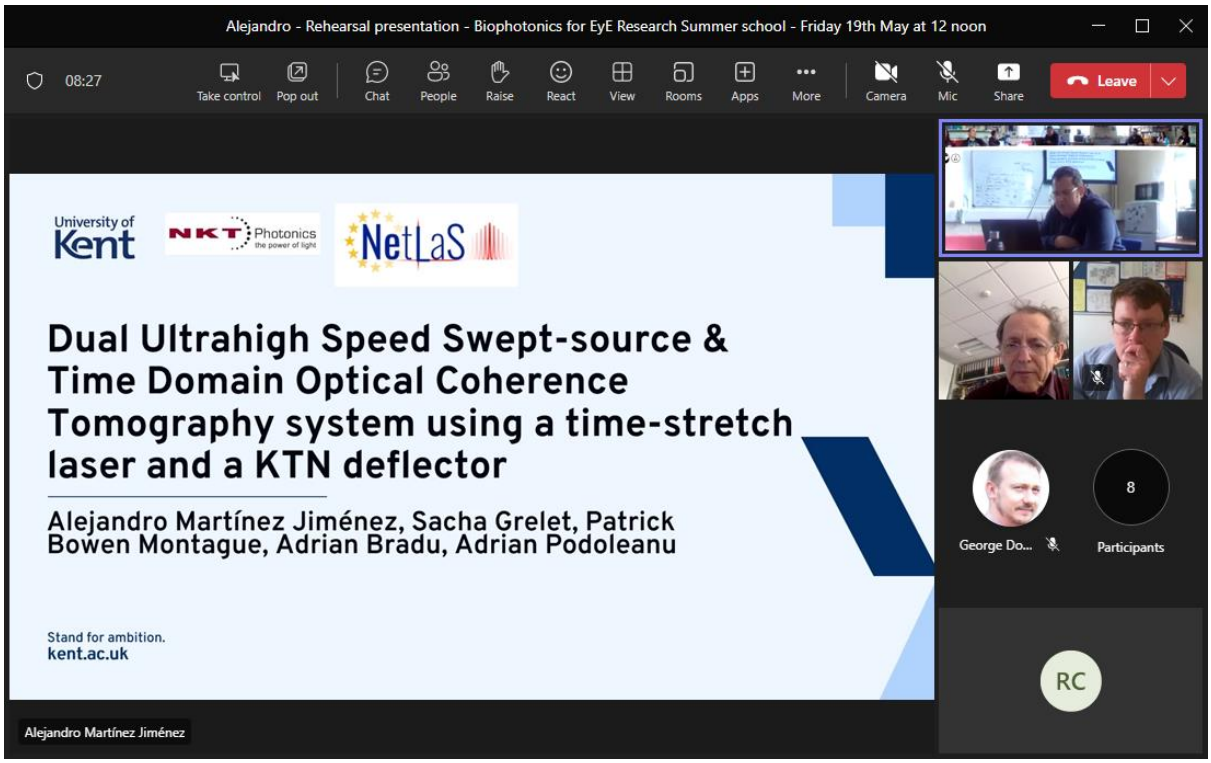
AOG Journal Club

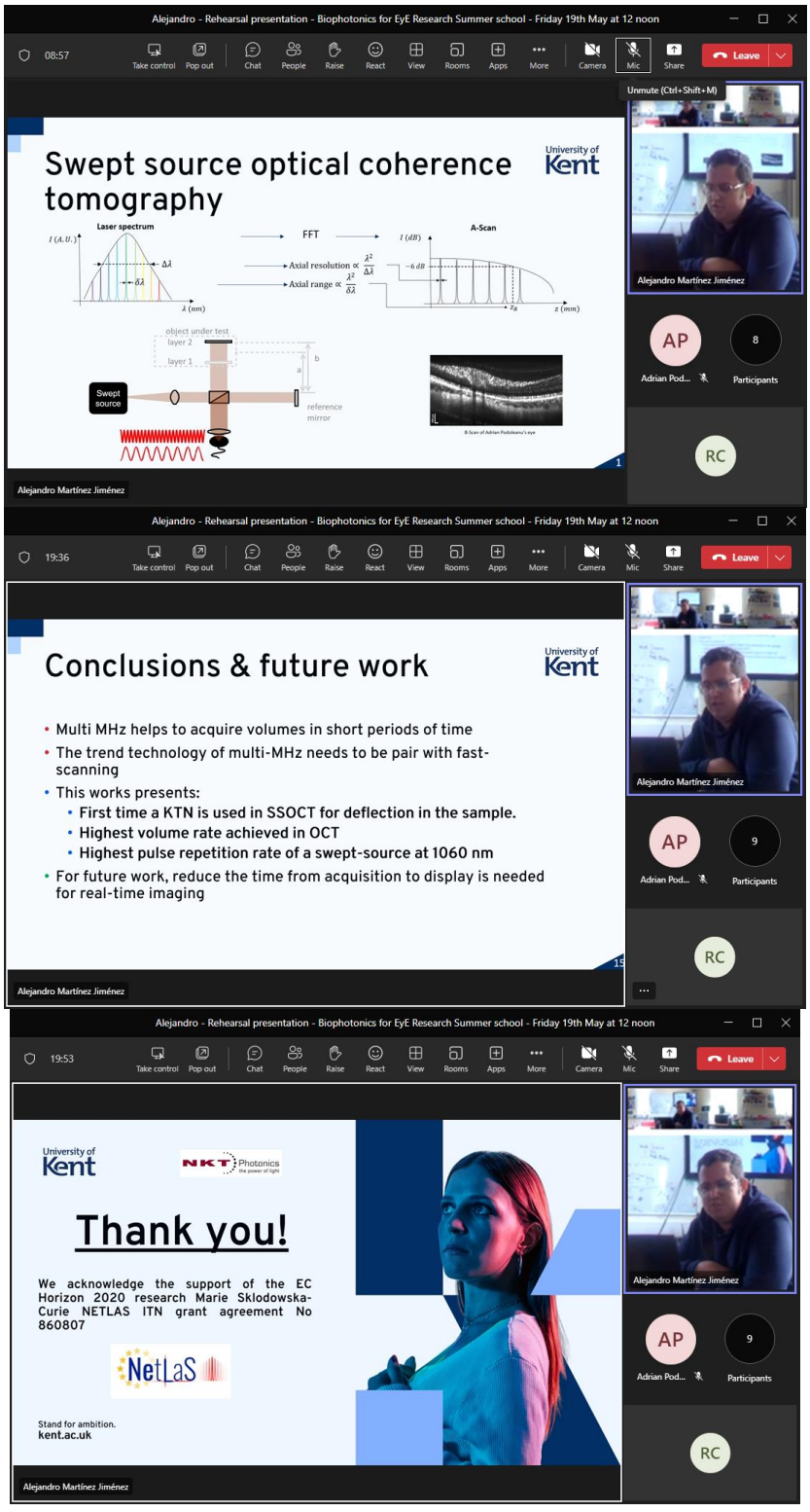
NETLAS PhD Student Alejandro Martinez Jimenez

19th May 2023 at 12 pm

Alejandro will be attending **Biophotonics for EyE Research Summer school**, University Residence of Jaca (Aragonese Pyrenees, Spain) of the University of Zaragoza from **June 1 to 4, 2023.** Please find the full programme of the school at **BER2023 (unizar.es)**

Alejandro's rehearsed his talk entitled "*Dual Ultrahigh Speed Swept-source & Time Domain Optical Coherence Tomography system using a time-stretch laser and a KTN deflector".* A few slides from Alejandro's rehearsal will follow.





A few slides from [NETLAS PhD Student Alejandro Martinez Jimenez's](#) **rehearsal presentation**

Congratulations to Dr. Taran Tatla - NETLAS Associated Partner from Northwick Park Hospital for his collaboration with DANISH ENT ACADEMY

The Denmark-UK Head & Neck Imaging Course

15th–17th of November 2023
The Panum Institute, Copenhagen, Denmark

This is an **Intensive 3-day Head and Neck Imaging Course** for ENT/OMFS Specialist Registrars and Consultants. It is also relevant to trainees and Consultants in Radiology and Plastic Surgery. The **course includes a combination of lectures, small group tutorials and workshops led by experienced Head & Neck Radiologists and Surgeons**. All aspects of Otolaryngology-Head & Neck Surgery imaging will be covered with particular emphasis on common diagnoses, anatomy, and **choice of imaging modalities** i.e. CT, MRI, PET-CT, and Ultrasound.

Dr Taran Tatla: *"Great to able to present the London MDT Head and Neck Imaging Course (in its 20th year since inauguration) for first time outside of London as the Joint Denmark-UK Head and Neck Imaging course. The course maintains the unique formula of repeated succesful year-on-year past delivery, with a celebrated multidisciplinary international faculty of experienced and dedicated trainers, aimed at a multidisciplinary international audience. Please do sign up and share with colleagues who may be interested, it is relevant for those at all stages of experience."*

REGISTER NOW: Head & Neck Imaging Course – DENTA Danish ENT Academy (entdenmark.com)

PUBLICATIONS

Effect of non-resonant gain structure design in membrane external-cavity surface-emitting lasers

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

Abstract—The operation of a semiconductor membrane external-cavity surface-emitting laser (MECSEL) employing a gain membrane with a cavity design, which is non-resonant regarding the two semiconductor - heat-spreader interfaces, is presented. **The MECSEL delivers watt-level output power, in line with state-of-the-art results**. The **study provides new evidence that the design criteria of a MECSEL gain region are significantly relaxed compared to active regions employing distributed Bragg reflectors,** for which the field distribution is set by the Bragg condition leading to tight tolerances for positioning of the emitting quantum structures. The study has relevance especially for the development of mode-locked MECSELs by minimizing the impact of defective Fabry-Pérot micro-cavity effects due to reflections between the semiconductor gain structure and the two heat-spreader elements placed on each side of the semiconductor membrane.

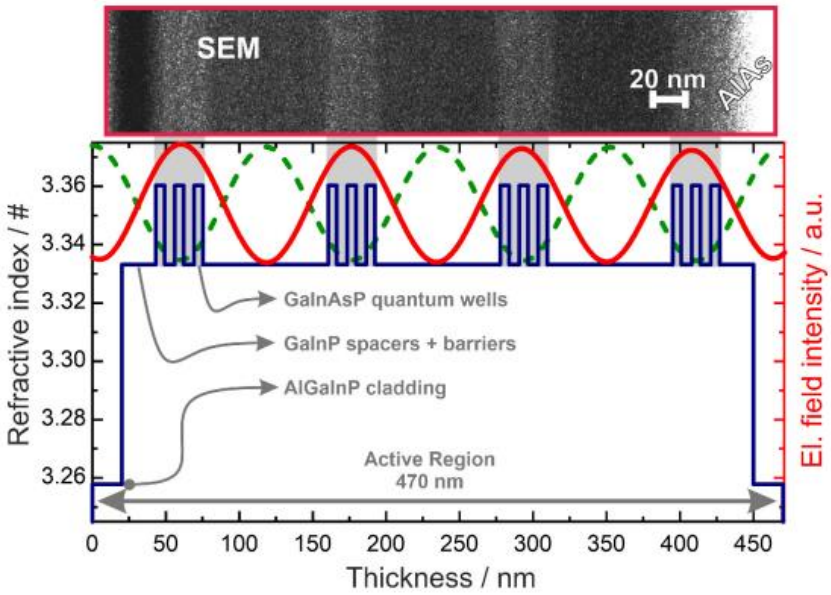


Fig. 2. SEM image of the unprocessed sample (top). Refractive index of the active region with the simulated intensity of the standing wave electric field distribution in red plotted over membrane thickness (bottom).

Impact of self-phase modulation on the operation of Fourier domain mode locked lasers

Özüm Emre Aşırım, **Robert Huber** & Christian Jirauschek

Optical and Quantum Electronics **volume 55**, Article number: 621 (2023)

https://doi.org/10.1007/s11082-023-04910-w

Fourier domain mode locked (FDML) lasers are a class of frequency-swept lasers that are used to generate optical pulses with a wide sweep range, high repetition rate, and a low instantaneous bandwidth. They are commonly used in sensing and imaging applications, especially in optical coherence tomography. Ideally, the aspired features in the design of FDML lasers include a high coherence length, large sweep bandwidth, adjustable output power, and a high signal to noise ratio (SNR). Read More

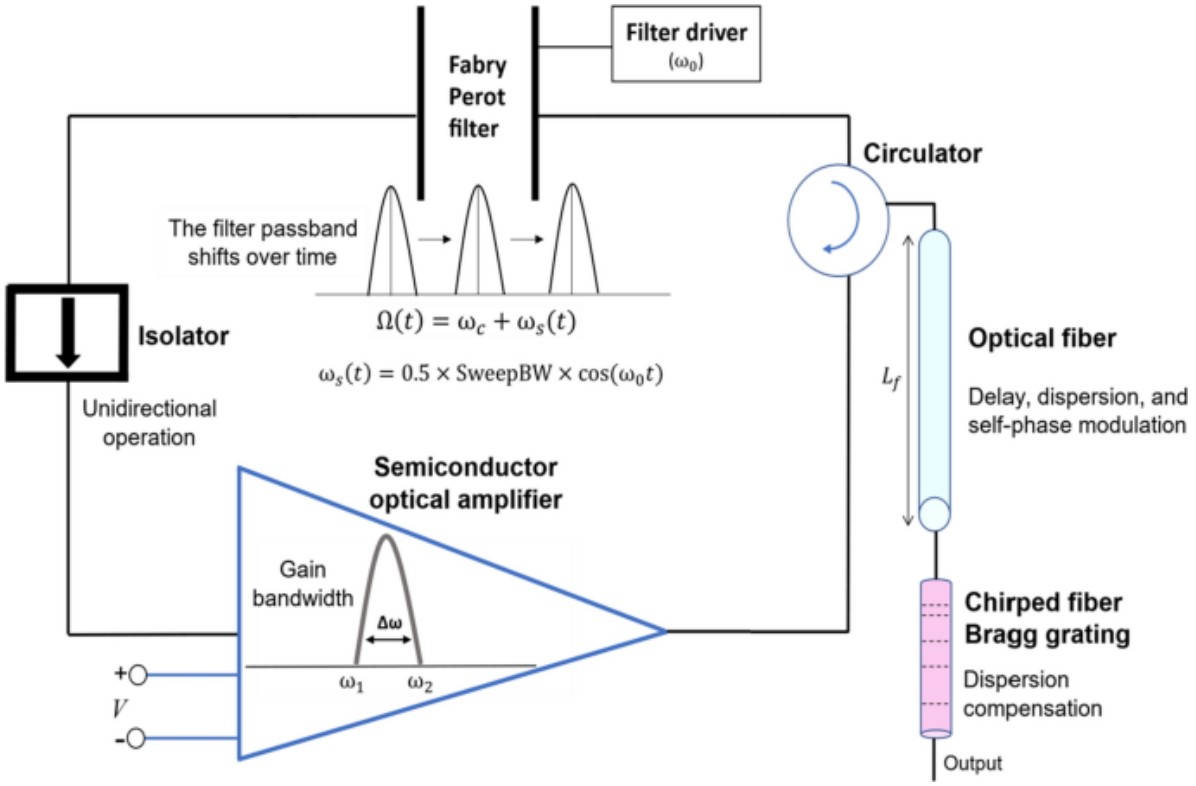


Fig.1 Fundamental components of an FDML laser and their arrangement in the experimental setup (Aşırım et al. 2022; Grill et al. 2022; Schmidt et al. 2020, 2021)

Visible-Light Optical Coherence Tomography Fibergraphy of the Tree Shrew Retinal Ganglion Cell Axon Bundles

David Miller at. all

https://doi.org/10.1101/2023.05.16.541062

We seek to develop techniques for **high-resolution imaging of the tree shrew retina for visualizing and parameterizing retinal ganglion cell (RGC) axon bundles in vivo**. We applied **visible-light optical coherence tomography fibergraphy (vis-OCTF) and temporal speckle averaging (TSA)** to visualize individual RGC axon bundles in the tree shrew retina. For the first time, we quantified individual RGC bundle width, height, and cross-sectional area and applied vis-OCT angiography (vis-OCTA) to visualize the retinal microvasculature in tree shrews.

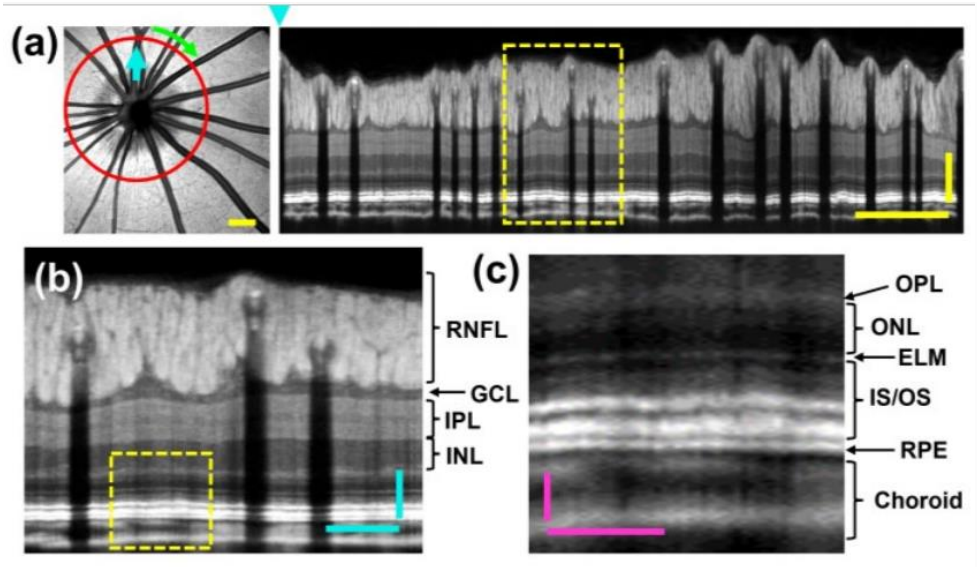


Fig. 4. ONH TSA image with 30 volume averages. (a) En-face (left) and resampled circumpapillary B-scan reconstructed along the red circle. Scale bars: 150 µm. (b) Magnified view of dashed box in (a) with inner retinal layers labeled. Scale bars: 50 µm. GCL: ganglion cell layer; INL: inner nuclear layer (c) Magnified view of dashed yellow box in (b) with outer retinal layers labeled. Scale bars: 25 µm. OPL: outer plexiform layer; ELM: external limiting membrane; IS/OS: inner segment/outer segment junction; RPE: retinal pigment epithelium.

Multi-megawatt pulses at 50 MHz from a single-pump Mamyshev oscillator gain-managed amplifier laser

Vincent Boulanger, Michel Olivier, François Trépanier, Pascal Deladurantaye, and Michel Piché

Optics Letters, Vol. 48, Issue 10, pp. 2700-2703, (2023)

https://doi.org/10.1364/OL.490075

We have developed a **compact all-PM-fiber ytterbium-doped Mamyshev oscillator-amplifier laser system generating compressed pulses of 102 nJ and 37 fs**, thus having over 2 MW of peak power, at a **repetition rate of 52 MHz**. The pump power from a single diode is shared between a linear cavity oscillator and a gain-managed nonlinear amplifier. The oscillator is self-started by pump-modulation and a linearly polarized single-pulse operation is achieved without filter tuning. **The cavity filters are near-zero dispersion fiber Bragg gratings with a Gaussian spectral response**. To our knowledge, this simple and efficient source has the **highest repetition rate and average power among all-fiber multi-megawatt femtosecond pulsed laser sources** and its architecture holds potential for generating higher pulse energies.

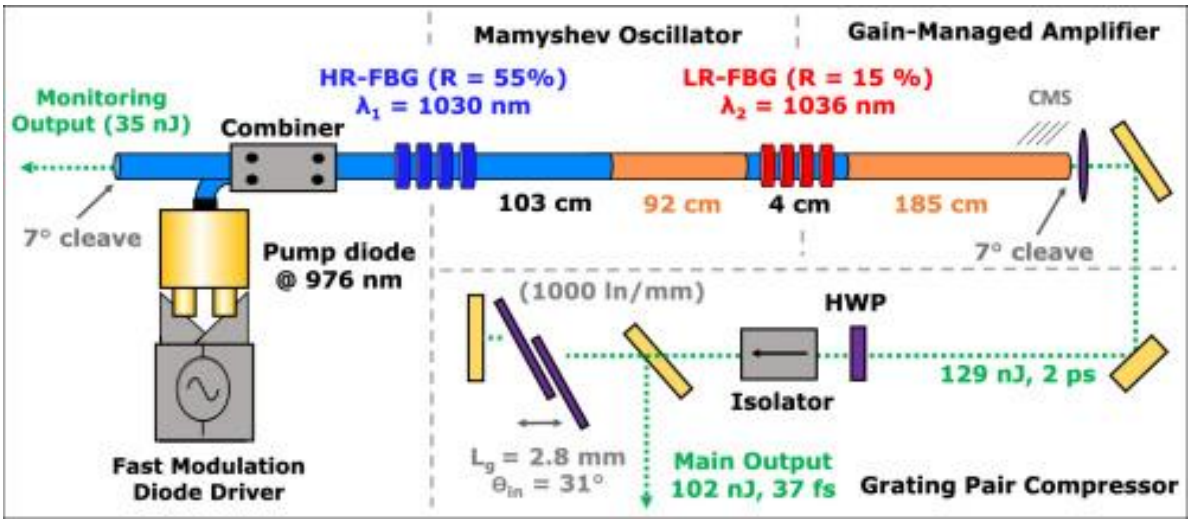


Fig. 1. MOGMA laser setup. The blue/orange sections are Coractive passive 10/125DC-PM and gain DCF-YB-10/125E-PM fibers, respectively. HR/LR-FBG, high/low reflectivity fiber Bragg gratings; CMS, cladding mode stripper; and HWP, half-wave plate.

Stretchable ultrasonic arrays for the three-dimensional mapping of the modulus of deep tissue

Hongjie Hu, at al

Nature Biomedical Engineering (2023)

https://doi.org/10.1038/s41551-023-01038-w

Serial assessment of the biomechanical properties of tissues can be used to aid the early detection and management of pathophysiological conditions, to track the evolution of lesions and to evaluate the progress of rehabilitation. However, current methods are invasive, can be used only for short-term measurements, or have insufficient penetration depth or spatial resolution. Here **we describe a stretchable ultrasonic array for performing serial non-invasive elastographic measurements of tissues up to 4 cm beneath the skin at a spatial resolution of 0.5 mm**. The array conforms to human skin and acoustically couples with it, allowing for accurate elastographic imaging, which we validated via magnetic resonance elastography. We used **the device to map three-dimensional distributions of the Young's modulus of tissues ex vivo,** to detect microstructural damage in the muscles of volunteers before the onset of soreness and to monitor the dynamic recovery process of muscle injuries during physiotherapies. The technology may facilitate the diagnosis and treatment of diseases affecting tissue biomechanics.

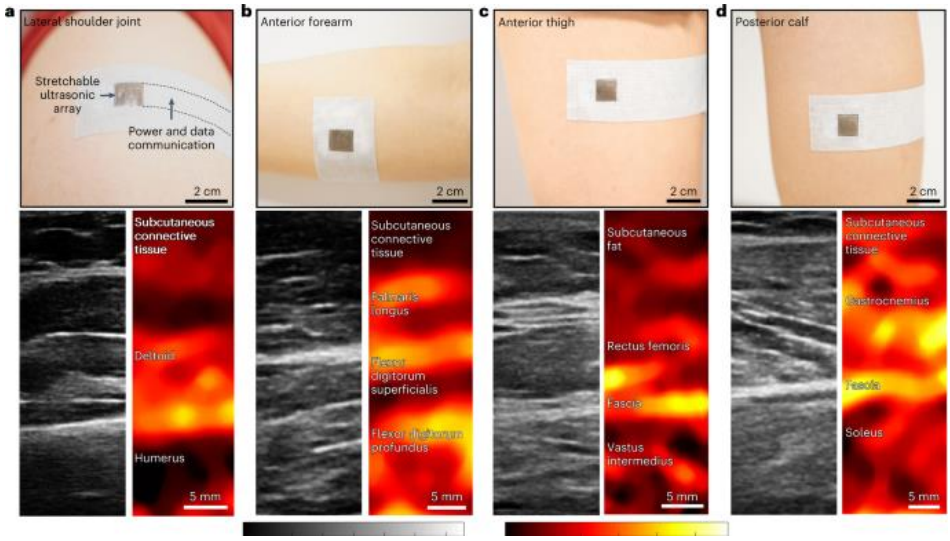
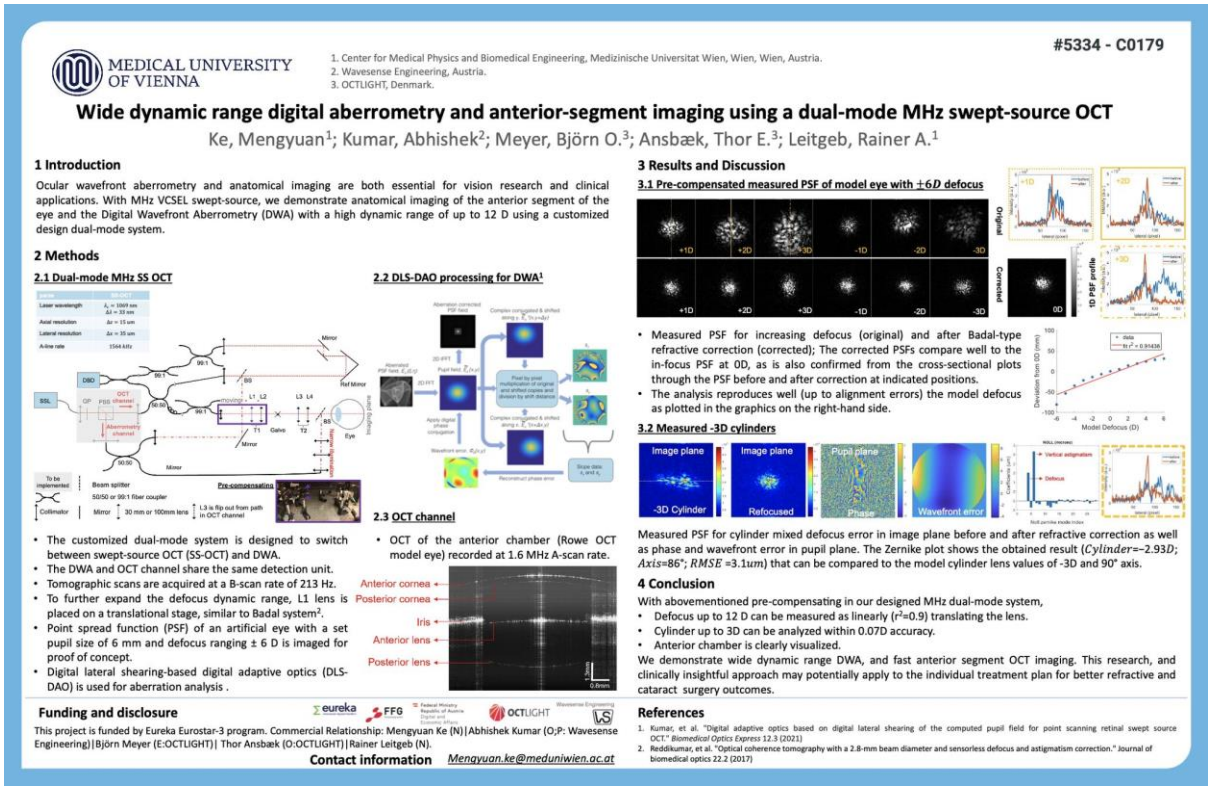


Fig. 5: Multi-site mapping and serial surveillance of delayed-onset muscle soreness in human.

Full optical and anatomical information of the eye to achieve better refractive and cataract surgery outcomes

The first results of the Digital OCT-Aberrometry (DOCTA) project were presented recently at the ARVO 2023 conference held in New Orleans, USA . The demonstrated results included a wide dynamic range Digital Aberrometry in combination with Anterior Segment Imaging using a single Multimodal MHz Swept Source OCT system based on a customized modular design. **The presented system and the technical approach can provide access to the full optical and anatomical information of patient's eye** which can potentially **help clinicians and surgeons to devise customized treatment plan for patients** in order to achieve **better refractive and cataract surgery outcomes**. DOCTA project is a joint collaboration between Wavesense Engineering, **OCTlight** and Medical University of Vienna.



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MEDICAL UNIVERSITY OF VIENNA

1. Center for Medical Physics and Biomedical Engineering, Medizinische Universitat Wien, Wien, Wien, Austria.
2. Wavesense Engineering, Austria.
3. OCTLIGHT, Denmark.

Wide dynamic range digital aberrometry and anterior-segment imaging using a dual-mode MHz swept-source OCT

Ke, Mengyuan[1]; Kumar, Abhishek[2]; Meyer, Björn O.[3]; Ansbæk, Thor E.[3]; Leitgeb, Rainer A.[1]

1 Introduction

Ocular wavefront aberrometry and anatomical imaging are both essential for vision research and clinical applications. With MHz VCSEL swept-source, we demonstrate anatomical imaging of the anterior segment of the eye and the Digital Wavefront Aberrometry (DWA) with a high dynamic range of up to 12 D using a customized design dual-mode system.

2 Methods

2.1 Dual-mode MHz SS OCT

2.2 DLS-DAO processing for DWA[1]

- The customized dual-mode system is designed to switch between swept-source OCT (SS-OCT) and DWA.
- The DWA and OCT channel share the same detection unit.
- Tomographic scans are acquired at a B-scan rate of 213 Hz.
- To further expand the defocus dynamic range, L1 lens is placed on a translational stage, similar to Badal system[2].
- Point spread function (PSF) of an artificial eye with a set pupil size of 6 mm and defocus ranging ± 6 D is imaged for proof of concept.
- Digital lateral shearing-based digital adaptive optics (DLS-DAO) is used for aberration analysis .

2.3 OCT channel

- OCT of the anterior chamber (Rowe OCT model eye) recorded at 1.6 MHz A-scan rate.

Anterior cornea
Posterior cornea
Iris
Anterior lens
Posterior lens

3 Results and Discussion

3.1 Pre-compensated measured PSF of model eye with ±6D defocus

- Measured PSF for increasing defocus (original) and after Badal-type refractive correction (corrected); The corrected PSFs compare well to the in-focus PSF at 0D, as is also confirmed from the cross-sectional plots through the PSF before and after correction at indicated positions.
- The analysis reproduces well (up to alignment errors) the model defocus as plotted in the graphics on the right-hand side.

3.2 Measured -3D cylinders

Image plane | Image plane | Pupil plane | | |
-3D Cylinder | Refocused | Phase | Wavefront error | |

Measured PSF for cylinder mixed defocus error in image plane before and after refractive correction as well as phase and wavefront error in pupil plane. The Zernike plot shows the obtained result ($Cylinder$=-2.93D; $Axis$=86°; $RMSE$ =3.1um) that can be compared to the model cylinder lens values of -3D and 90° axis.

4 Conclusion

With abovementioned pre-compensating in our designed MHz dual-mode system,

- Defocus up to 12 D can be measured as linearly (r^2=0.9) translating the lens.
- Cylinder up to 3D can be analyzed within 0.07D accuracy.
- Anterior chamber is clearly visualized.

We demonstrate wide dynamic range DWA, and fast anterior segment OCT imaging. This research, and clinically insightful approach may potentially apply to the individual treatment plan for better refractive and cataract surgery outcomes.

Funding and disclosure

This project is funded by Eureka Eurostar-3 program. Commercial Relationship: Mengyuan Ke (N)|Abhishek Kumar (O;P: Wavesense Engineering)|Björn Meyer (E:OCTLIGHT)| Thor Ansbæk (O:OCTLIGHT)|Rainer Leitgeb (N).

Contact information Mengyuan.ke@meduniwien.ac.at

References

1. Kumar, et al. "Digital adaptive optics based on digital lateral shearing of the computed pupil field for point scanning retinal swept source OCT." *Biomedical Optics Express* 12.3 (2021)
2. Reddikumar, et al. "Optical coherence tomography with a 2.8-mm beam diameter and sensorless defocus and astigmatism correction." Journal of biomedical optics 22.2 (2017)

OCTLIGHT selected for Eurostars project - OCTLIGHT

News (wavesense-engineering.com)

Photonic topological insulators show no protection against backscattering

By Sally Cole Johnson

Researchers in Denmark **discovered that for a waveguide to offer on-chip backscattering protection, the topological insulator must be made of materials that break time-reversal symmetry without absorbing light—and these don't exist yet.**

Integrated photonics can be fabricated today to contain only very minute defects, a.k.a. surface roughness, but it's still impossible to eliminate them entirely—and this disorder can result in a loss of photons. Photonic quantum technologies require encoding information into fragile quantum states, so it's essential to minimize these losses to enable quantum photonics to scale.

A team of **Technical University of Denmark** (DTU, Denmark) **researchers decided to take a closer look at photonic topological interfaces (waveguides) designed to guide light through a chip to reduce this loss of photons/backscattering.** Previous studies indicated it may be possible to prevent backscattering, but actual measurements of the losses and backscattering in topological waveguides had never been done.

"Simply put, we felt this was a key experiment missing within the field of topological photonics," says Søren Stobbe, an associate professor in the department of electrical and photonics engineering at DTU.

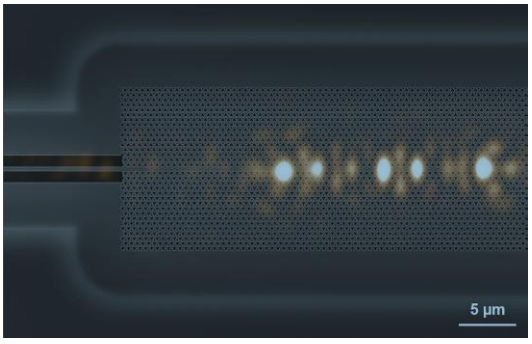


FIGURE 2. **Scattered light imaged for a localized mode, composited to scale on top of a scanning electron microscope image of the waveguide.** These modes are a signature of strong backscattering, which stops light input from the strip waveguide on the left from propagating further in the topological waveguide

Photonic topological insulators show no protection against backscattering | Laser Focus World

UK's first fibre optic-guided blood vessel surgery

For the first time in the UK, surgeons at Guy's and St Thomas' have performed complex procedures using fibre optics to guide their way through a patient's blood vessels.

This pioneering technology uses hair-thin optical fibres threaded through a patient's blood vessels to create real-time, 3D colour footage when doctors implant medical devices in a patient.

The operating team at Guy's and St Thomas' **used the fibre optics to successfully fix an abdominal aortic aneurysm** in a 72-year-old grandfather. An aneurysm develops when a portion of the aorta (the main pipe which carries blood from the heart to all areas of the body) weakens, causing a bulge. This then has a risk of bursting - a situation which can be life-threatening.

Led by Bijan Modarai, professor of vascular surgery and consultant vascular surgeon, the team at St Thomas' Hospital performed a minimally invasive procedure guided by the fibre optic technology that is being developed by Philips. This involves **inserting a stent graft in through the groin and up the body to repair the aorta.** The stent graft is a device customised to the patient's body which provides a new lining in the aorta, sealing above and below the bulging area to exclude the aneurysm. These highly complex procedures in the blood vessels (known as endovascular procedures) are usually done using a series of x-rays to guide the surgical team and to ensure the stent graft is properly fitted. However, repeated radiation exposure can pose risks to the patient and the operating team. **The high-quality images of the fibre optic technology could enable surgeons to complete procedures quicker, more accurately and with improved safety.** The technology could be used for all endovascular procedures, with the eventual aim of allowing x-ray free navigation, not just for aneurysms but for any intervention aimed at repairing a diseased blood vessel.

Guy's and St Thomas' is one of nine centres in Europe and the USA using this pioneering technology to develop its possible uses in surgery. Read More

Visual inertial odometry enabled 3D ultrasound and photoacoustic imaging

Deeksha M. Sankepalle, Brian Anthony, and Srivalleesha Mallidi

Biomedical Optics Express, Vol. 14,Issue 6,, pp. 2756-2772, (2023)

https://doi.org/10.1364/BOE.489614

There is an increasing need for 3D ultrasound and photoacoustic (USPA) imaging technology for real-time monitoring of dynamic changes in vasculature or molecular markers in various malignancies. Current 3D USPA systems utilize expensive 3D transducer arrays, mechanical arms or limited-range linear stages to reconstruct the 3D volume of the object being imaged. In this study, we developed, characterized, and demonstrated an economical, portable, and clinically translatable handheld device for 3D USPA imaging. An off-the-shelf, low-cost visual odometry system (the Intel RealSense T265 camera equipped with simultaneous localization and mapping technology) to track free hand movements during imaging was attached to the USPA transducer. Read More

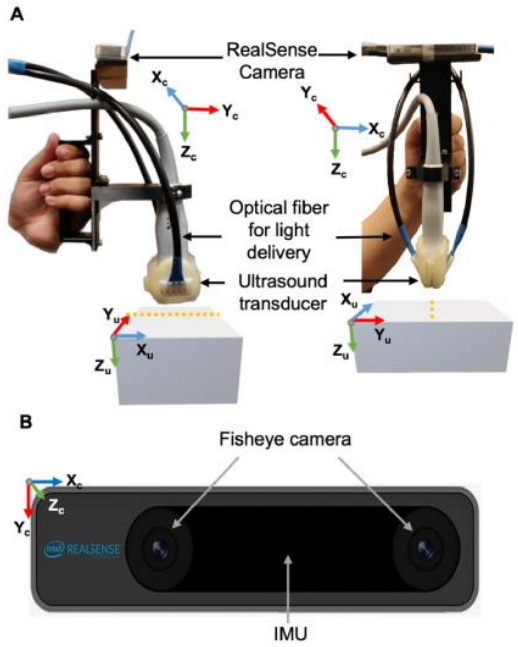


Fig. 1. A) Custom 3D-printed handheld probe to housing the US transducer, optical fiber for laser light delivery and Intel RealSense T265 camera. The camera and USPA image co-ordinates are represented as X_c, Y_c and Z_c and X_u, Y_u and Z_u respectively. All axes color coded with blue, red and green for X, Y and Z respectively. B) The T265 camera has two fisheye imagers and an integrated IMU where X_c is long axis, Y_c is the short axis, and Z_c is the height of the camera.

Super-resolution ultrasound microvascular imaging: Is it ready for clinical use?

Pengfei Song, Jonathan M. Rubin, Matthew R. Lowerison

https://doi.org/10.1016/j.zemedi.2023.04.001

The goal of this short review is to provide an **update on recent advancements in super-resolution ultrasound imaging**, with a focus on **summarizing existing applications and discussing the prospects of translating super-resolution imaging to clinical practice and research.** In this review, we also provide brief introductions of how super-resolution ultrasound works, how does it compare with other imaging modalities, and what are the trade-offs and limitations for an audience who is not familiar with the technology.

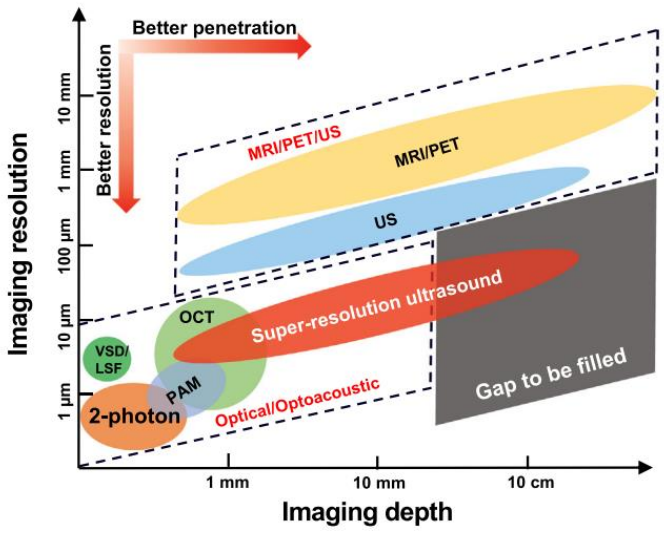


Figure 4. Comparison of imaging resolution and imaging penetration depth for different modalities that are capable of vascular imaging. (**2-photon: two-photon microscopy**; **LSF**: laser-speckle flow imaging; **MRI**: magnetic resonance imaging; **OCT**: optical coherence tomography; **PAM**: photoacoustic microscopy (optical resolution); **PET**: positron emission tomography; **US**: ultrasound; **VSD**: voltage sensitive dye imaging).

Is super-resolution ultrasound ready for the clinic?

Although super-resolution ultrasound is likely ready for research investigations in clinic, a pressing issue for its application for large-scale clinical use is the lack of demonstrated clinical value of super-resolution imaging over conventional contrast-enhanced ultrasound (CEUS). This raises further questions: can super-resolution imaging provide better quantification (than CEUS) which translates to more accurate diagnoses? Is super-resolution imaging less susceptible to the sources of variabilities in CEUS ? Is super-resolution imaging repeatable? Since CEUS is a much simpler and faster technique than super-resolution imaging, the added benefit must be significant for super-resolution to gain traction in the clinic. Read More

Wearable cardiorespiratory monitoring with stretchable elastomer optical fiber

Bingjie Zha, Zhuo Wang, Linqing Li, Xuehao Hu, Beatriz Ortega, Xiaoli Li, and Rui Min

Biomedical Optics Express, Vol. 14, Issue 5, pp. 2260-2275, (2023)

https://doi.org/10.1364/BOE.490034

This work presents a stretchable elastomer optical fiber sensor incorporated into a belt for respiratory rate (RR) and heart rate (HR) monitoring. Different materials and shapes of prototypes designed were tested in terms of performance and the best choice was identified. The optimal sensor was tested by 10 volunteers to evaluate the performance. The proposed elastomer optical fiber sensor can achieve simultaneous measurement of RR and HR in different body positions, and also ballistocardiography (BCG) signal measurement in the lying position. The sensor has good accuracy and stability, with maximum errors of 1 bpm and 3 bpm for RR and HR, respectively, and average weighted mean absolute percentage error (MAPE) of 5.25% and root mean square error (RMSE) of 1.28 bpm. Moreover, the results of the Bland-Altman method showed good agreement of the sensor with manual counting of RR and with electrocardiogram (ECG) measurements of HR.

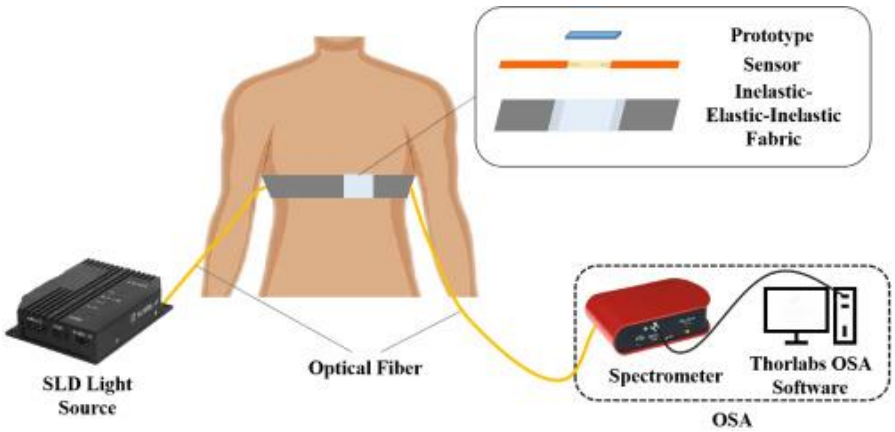


Fig. 5. Experimental schematic diagram.

In-depth optical characterization of spectacle lenses for myopia progression management

Augusto Arias, Arne Ohlendorf, Pablo Artal, and Siegfried Wahl

Optica, Vol. 10, Issue 5, pp. 594-603, (2023),

https://doi.org/10.1364/OPTICA.486389

In this paper, we quantify and compare the focusing and scattering properties of a single vision (SV) lens with two types of spectacle lenses for myopia progression management: defocus incorporated multiple segments (DIMS), and diffusion-optical technology (DOT). To investigate the focusing properties across the eccentricity of the lenses, we have developed an instrument based on spatial light modulation technology that reproduces myopic eyes' foveal and peripheral aberrations. Our characterization showed an increased contrast and sharpness of images through the DIMS lens at the peripheral retina when inducing myopic defocus with respect to the SV and DOT lenses. On the other hand, the contrast reduction by the DOT lens strongly depends on the luminance at the pupil. The understanding of the imaging properties of the lenses achieved through our results might help optimize future spectacles designs for myopia progression management.

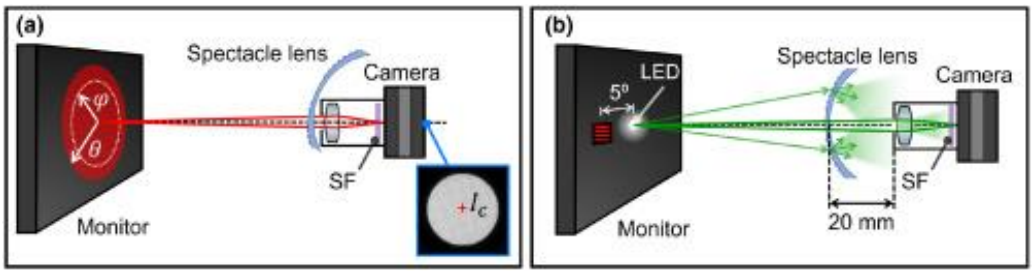


Fig. 2. **Measurement of the scattering and their effects on the contrast reduction. (a) Setup for implementing optical integration method, used to retrieve the wide-angle PSF from the peripheral side-vision zone of the spectacle lenses. For this measurement, the spectacle lens was placed closest to the aperture of the imaging system. (b) Setup for assessing the effects of a glare source (a) light-emitting diode, LED on the contrast of a binary grating through the spectacle lens. In this case, the spectacle lens was placed 20 mm in front of the aperture of the imaging system. Only the red channel of the monitor was used, whose main spectral peak is centered at 631 nm. SF, infrared blocking spectral filter.**

Modified Endolaser Instrument for Chandelier Scleral Buckling

Nilesh Raval, MD, Yafeng Li, MD PhD, [...], and Richard B. Rosen, MD

Journal of VitreoRetinal Diseases

First published online May 8, 2023

https://doi.org/10.1177/24741264231171243

Purpose: To report a new modification of an illuminated endolaser to facilitate safe endophotocoagulation during chandelier-assisted scleral buckling surgery. **Methods:** This case series comprised phakic patients with rhegmatogenous retinal detachments (RRDs) who had primary scleral buckling with chandelier endoillumination, external drainage, and endophotocoagulation using the modified endolaser instrument. **Results:** All 6 patients had successful outcomes after primary scleral buckling for RD repair without significant intraoperative or postoperative complications. **Conclusions: The new modified endolaser instrument can be safely used in a nonvitrectomized eye during chandelier scleral buckling.**

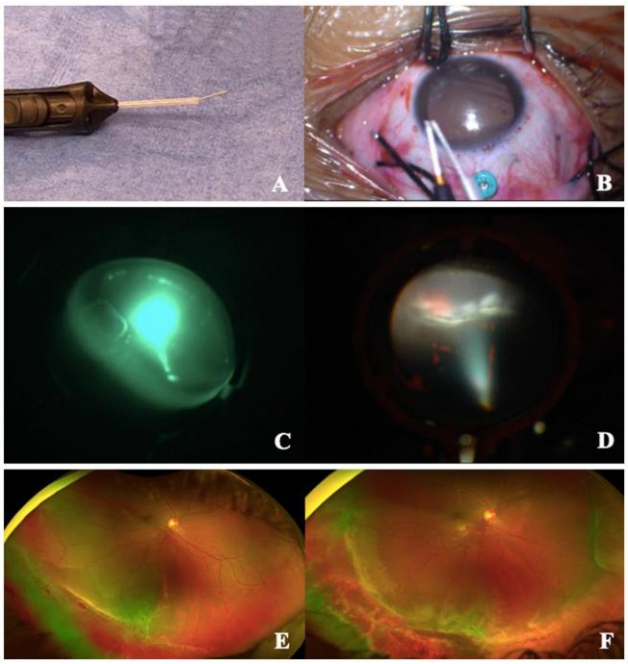


Figure 1. **(A)** The 18-gauge angiocatheter sleeve is sheathed over **the lighted endolaser tip.** The exposed tip measures 7 mm, limiting penetration into the vitreous 1.412 mm beyond the tip of trocar shaft. **(B)** The chandelier tip and endolaser tip are placed side by side to ensure they are of equal length**. (C) The 7 mm lighted endolaser tip is inserted into the 25-gauge trocar, and the laser is engaged at a power of 400 mW. (D)** Laser uptake is confirmed around the site of the retinal breaks. **(E)** Preoperative widefield fundus photograph shows a fovea-splitting inferior rhegmatogenous retinal detachment. **(F)** Widefield fundus photography taken at postoperative week 6 shows successful scleral buckle placement and **old laser scars around the retinal breaks.** A small amount of residual subretinal fluid is seen in the posterior pole.

Coherent 10 kW direct-diode lasers used by APEX ETG for efficient, high-speed cladding of components for industries such as mining, energy and construction

Laser cladding almost universally provides the best way to resurface a worn metal part. Apex Engineering Technology Group uses a 10 kW direct-diode laser for efficient, high-speed cladding of components for industries such as mining, energy, and construction.

WHAT IS LASER CLADDING ?

Cladding is an additive manufacturing process used in a variety of industries for improving the surface properties of a part, or to resurface a component that has become worn through use. Cladding involves the creation of a new surface layer on a substrate having a different composition than the base material. **There are a number of different techniques for performing cladding**, each with its own specific characteristics in terms of the materials employed, the quality of the clad layer, and various practical issues, including throughput speed, process compatibility, and cost.

Some methods involve some form of arc welding, such as gas tungsten arc welding (GTAW), **plasma arc welding** (PAW), plasma transferred arc (PTA), **gas metal arc welding** (GMAW), **submerged arc welding** (SAW), or several others. In all these processes, an arc melts the surface of the base material. Cladding material is then introduced in either wire or powder form and is also melted by the arc. It mixes with the molten part surface, and then resolidifies to form the clad layer. Another approach is **thermal spraying.**

Laser cladding is similar to arc welding methods. The laser melts both the substrate surface and the clad material, which can be in wire, strip or powder form. However, **laser cladding offers significant advantages over all these other techniques**. Like welding methods, the laser clad layers make a true metallurgical bond with the substrate. This means an extremely durable cladding layer, which won't chip or delaminate, and which provides superb wear and corrosion resistance. This isn't the case with thermal spraying methods.

Full story: APEX Engineering Techology Group | Coherent

IPS: OPTICAL ISOLATORS IMPROVE LASER RELIABILITY

Raman spectroscopy and imaging are powerful methods for **interrogating samples in research and industrial settings**, for everything from quality control (QC) to identifying polymorphs, to label-free imaging of live cells, as well as chemical process monitoring applications. That's because the Raman effect produces spectrally resolved chemical-fingerprint data similar to Fourier Transform Infrared (FTIR) but uses light at visible and near-IR wavelengths that can be transmitted through glass fibers, lenses, and into water-based samples. The tools required to **accurately measure a Raman spectrum completely changed with the convergence of three technologies that enabled compact self-contained spectrometers and microscopes**. The three technologies are compact high-power narrow-linewidth semiconductor and solid-state lasers, holographic and steep-edge long-pass **filters to eliminate the relatively intense (Rayleigh) scattered laser light, and low-noise multi-element photodetectors and cameras.**

Figure 2. *IPS uses customized Coherent Tornos Isolators to completely eliminate back reflections into the laser module that could damage the diode laser chip.*

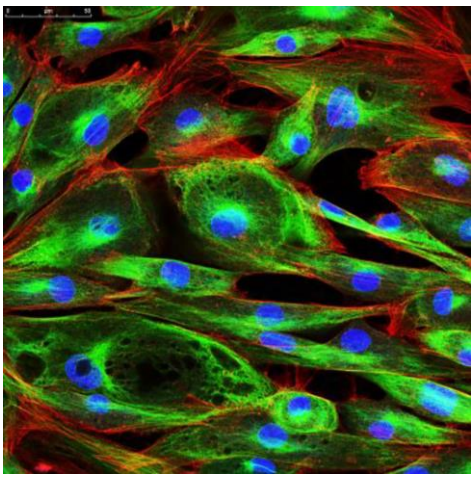


Figure 3. *Raman microscopy is used in life sciences and elsewhere to acquire a multi-dimensional "map" of specific chemicals, often represented in false color. Image courtesy IPS.*

IPS: Optical Isolators Improve Laser Reliability | Coherent

Achieving the Visual Turing Test: Integrated Display and Eye Tracking Technologies

Mantas Žurauskas (former Applied Optics Group, that obtained his PhD under A. Podoleanu's supervision), Mohamed El-Haddad, Barry Silverstein, Douglas Lanman, Rob Cavin

With AR and VR displays, we aim to deliver visual experiences that are indistinguishable from reality - a bar we call the **Visual Turing Test**. This sets a high bar for the technology that is being used to deliver the photons to the user's eyes.

Designing such a system will require both **continuous knowledge of the eye conditions and the anticipated optical performance** under these conditions to effectively correct for the combined system. We anticipate that in the near term **the benefit of early integration and co-design of display and eye tracking sub-systems will allow us to make the best possible tradeoffs between performance and system complexity.** In the long term, to ensure the efficient use of generated display photons and image rendering compute, the eye tracking and light delivery will have to converge into a seamless single system.

Here we will provide a **brief overview of the optimizations space that can be leveraged by combining state of the art display and eye tracking technology**. We will also provide rationale that supports the need to consider both display and eye tracking technologies as two inseparable architectural elements of a single light projection system.

Unlocking AR/VR Potential: High-Performance Displays and Eye Tracking

Achieving high-performance displays and eye tracking systems in AR/VR wearable devices is important to revolutionizing various aspects of our lives, such as entertainment, education, training, and communication. These advances enable realistic, life-like virtual environments, and accommodate users with different vision needs, paving the way for future innovations.

- Revolutionizing entertainment, education, training, and communication
- Creating realistic and life-like virtual environments
- Accommodating users with different vision needs
- Enhancing interactivity with accurate eye tracking
- Supporting future innovations in AR/VR technology

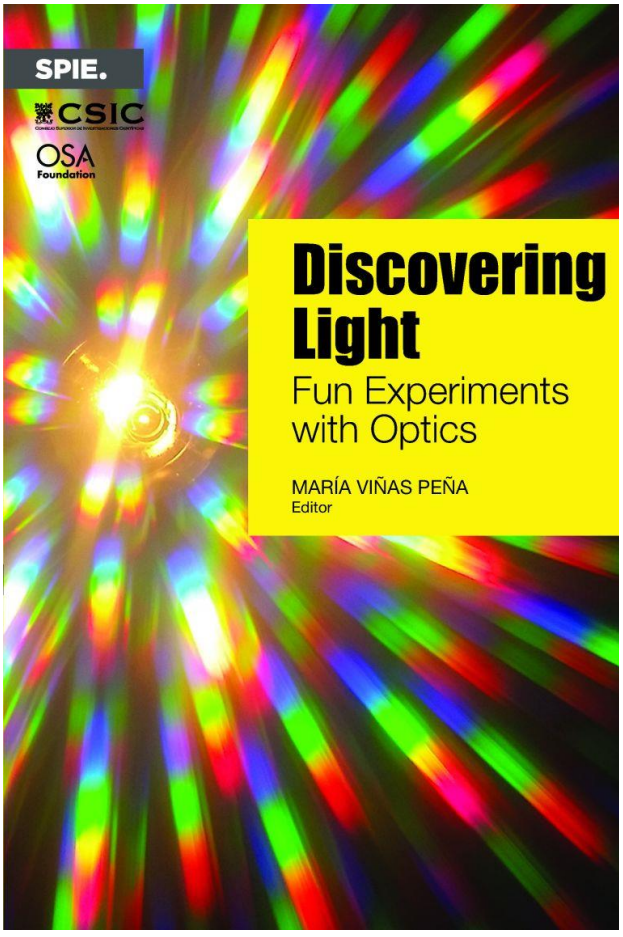
20230425 SID Display week Zurauskas invited talk.pptx (fbcdn.net)

BOOKS

Discovering Light: Fun Experiments with Optics

edited by Maria Viñas-Peña is one of the most downloaded titles from the SPIE digital library, and it's **FREE!**

It introduces the reader to the fundamentals of optics using intuitive real-world examples and simple experiments that can be performed at home. Written for high school students and the curious, this book explains complex optical phenomena using simple language.



Published: 2021
https://doi.org/10.1117/3.2579764

Download your free copy here:

https://lnkd.in/gy_BUXTu

Student Theses -Optical Coherence Tomography News

400 kHz Spectral Domain Optical Coherence Tomography for Corneal Imaging

By **Lin Kun Chen**

Waterloo, Ontario, Canada

Aims of this thesis: The main objectives of my research project were: a) to upgrade the 34 kHz OCT system with a new camera that offered a 400 kHz data acquisition rate and 8192-pixel linear array sensor, b) test the performance of the 400 kHz OCT system for ex-vivo and in-vivo corneal imaging, and c) develop preprocessing for the interferogram and post-processing algorithms for the images. Implementing a camera with a faster acquisition rate will help to reduce the motion artifact caused by involuntary eye motions. Also, compared to 4500 pixels used in the 34 kHz camera, the new system utilizes all the pixels, resulting in a larger scanning range. Although new camera has smaller sensor size (30% smaller), vertical binning is applied to ensure the light signal is all captured. However, due to the faster acquisition rate (~11 times faster), about 10 dB of SNR will suffers from the reduced integration time. Doubling the sample arm power while keep all other conditions the same can boost the SNR by about 3 dB. Therefore, incident power at the sample arm will be raised carefully according to the maximum permissible exposure calculated using the American National Standard for Ophthalmics – Light Hazard Protection for Ophthalmics instruments provided by ANSI. The result from the technical tests shows that the 400 kHz SD-OCT system offers 1 μm axial resolution in biological tissue with an extended scanning range of 2.8 mm (compared to 1.2 mm of the 34 kHz system). It has a lateral resolution of 1.04 μm/pix and can resolve group 7 element 6 of the USAF target with a 20x objective. It can provide 83 dB SNR with 0.95 mW of incident power at a 400 kHz image acquisition rate which should be sufficient to image semi-transparent biological tissues such as the human retina and cornea. So far, **the performance of the 400 kHz OCT system has been tested by imaging plant tissues (cucumber) and ex-vivo pig corneas, due to the cancellation of all in-vivo human and animal studies imposed by COVID-19.**

Link to this record

Microsoft Word - 400 kHz Spectral Domain Optical Coherence Tomography for Corneal Imaging Final with Tracking_KB.docx (uwaterloo.ca)

OPTICS & PHOTONICS NEWS

Optics & Photonics News Magazine
May 2023 Issue

- Fifty Years of Fiber Solitons
- Breaking Barriers, Advancing Optics
- The Race to Electronic Photography

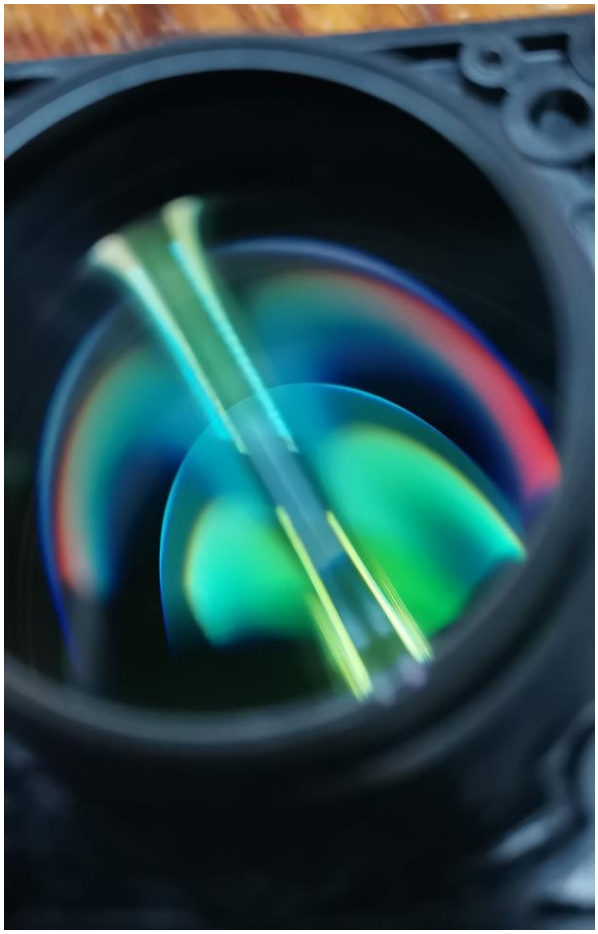
Browse all Issues

NetLaS

OPTICS & PHOTONICS NEWS

Image of the Week

Striking images of optics and photonics, contributed by OPN readers



Coloured Lens

The objective lens of a digital projector is illuminated with white light from a lamp.

The interaction of **light propagating through the lenses** and separating into different colors is captured by a cell phone camera.

—Yareli Navarro-Martínez, Erika Nohemí Hernández-Escobar and Miguel Ángel Bello-Jiménez, Universidad Autónoma de San Luis Potosí, Mexico

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.

June
14
2023

Introducing the Coded-Aperture Benchtop Raman Spectrometer

With Raman spectroscopy becoming an increasingly important part of the chemical analysis toolbox, we would like to present the latest addition to Thorlabs' growing spectroscopy portfolio, the soon-to-be-released benchtop Raman spectrometer. In this webinar, Thorlabs Spectroscopy Sales & Solutions Manager Nicola Reusch will demonstrate how the spectrometer can be used to identify unknown substances such as different polymers or active pharmaceutical ingredients.

Presented Dr. Nicola Reusch

Spectroscopy Sales & Solutions Manager, Thorlabs

Dr. Nicola Reusch studied physical chemistry at the Philipp University of Marburg. After completing her Ph.D., she began her career at Thorlabs in 2016 as a Tech Support Engineer. Dr. Reusch started managing the Thorlabs Technical Sales team in March 2021, and today she is the Spectroscopy Sales & Solutions Manager. In her spare time, Dr. Reusch volunteers as a translator at the European Southern Observatory.

Click to Register!

Thorlabs Offers a Variety of Spectrometers and Signal Detectors

Dispersion engineering with meta-optics

Meta-optics is an emerging technology that provides for dispersion-free optical engineering.

It's always fascinating to learn what bright minds can accomplish with optics. In this case story, you can read about dispersion engineering with meta-optics.

The Ren Group – a research team at the School of Physics and Astronomy, Monash University – has developed a broadband achromatic metafiber and used a SuperK FIANIUM supercontinuum white light laser to characterize it.

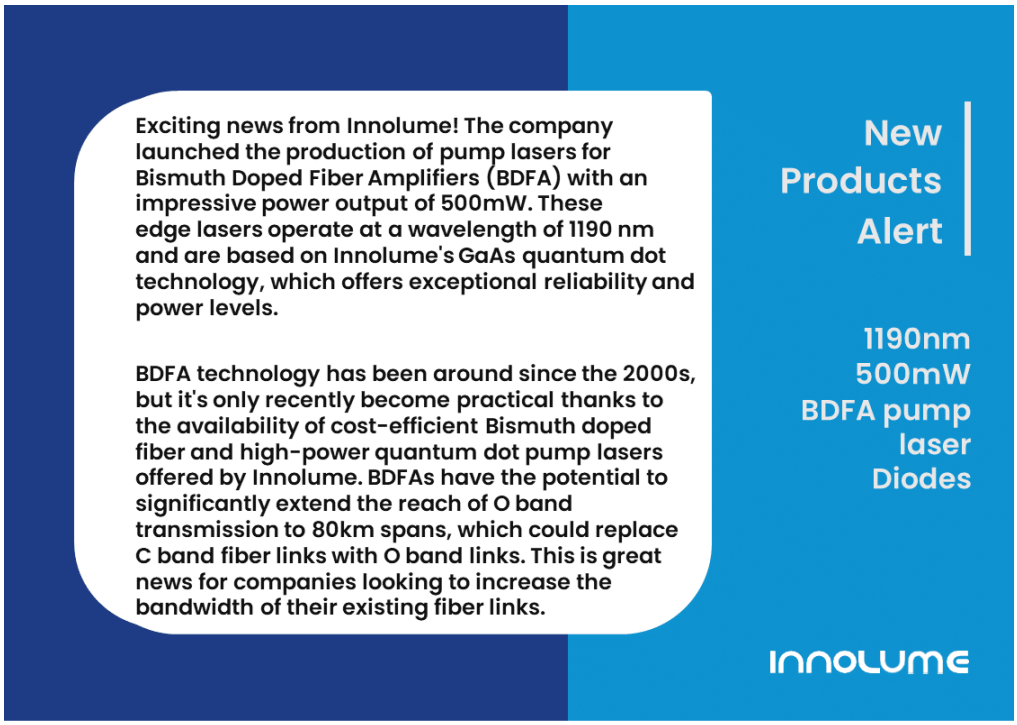
NKT Photonics SuperK lasers are ideal for the characterization of advanced optical components, metamaterials, plasmonics, etc., due to **their high brightness, high spatial resolution, and flat and broad spectrum.**

Read the summary in the case story or the full story in the article in Nature Communications.

Exciting news from Innolume GmbH!

NETLAS Beneficiary Innolume launched the production of #pump lasers for Bismuth Doped Fiber Amplifiers (#BDFA) **with an impressive power output of 500mW.**

These cutting-edge lasers operate at a wavelength of 1190 nm and are based on Innolume's GaAs quantum dot technology, which offers exceptional reliability and power levels.



Pump lasers for Bismuth Doped Fiber Amplifiers (BDFA) - Innolume

SUPERLUM

COMING SOON

BLL OEM Ultra-Compact SLD Light Source for PCB On-Board Integration

Features

- Ultra-Compact design 45x60x21.5 mm
- Designed for integration onto PCB boards
- UART control interface
- Pushbutton control
- USB control interface through an optional evaluation board
- Up to 400 mA SLD drive current, compatible with most Superlum SLDs
- Supply voltage 5 V
- Automatic Current Control (ACC) mode
- Automatic Power Control (APC) mode
- 10 kHz modulation (ON/OFF)
- 0…+50 °C operating temperature range
- High stability, low noise

Product Description:

BLL Ultra-Compact Broadband Light Sources are wide spectrum SM- or PM-fiber coupled light source modules for applications requiring a reliable, powerful, stable, and low-noise SLD light source with a broad and flat spectrum and a short coherence length. A high-precision current and temperature controller powers the SLD module inside the light source. The SLD output can be modulated (ON/OFF) **at the rate of up to 10 kHz**. BLL Light source is designed to be mounted on a PCB or a Superlum BLL Evaluation Board. An optional BLL Evaluation Board allows for a quick and easy BLL light Source setup and testing.

BLL Light Source allows various options to control the optical output: by the pushbutton on the case, by logic signals via the 12-pin connector, or from a USB interface via a Superlum BLL Evaluation Board.

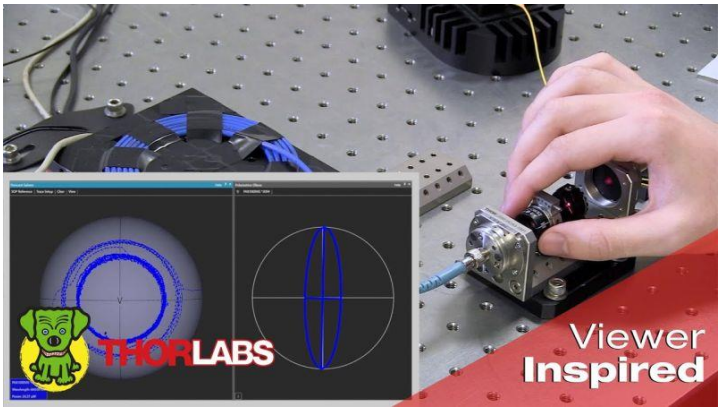
PM Fiber Measurements Used to Align Incident Polarization State

(Viewer Inspired)| Thorlabs Insights

Thorlabs demonstrates **two different methods for optimizing the incident polarization's orientation when coupling light into a PM fiber.**

The first uses a polarimeter and begins with a friendly introduction to the Poincaré sphere. For those who do not have a polarimeter, we also show a way to use an analyzing polarizer in front of a power sensor to achieve equally good results.

When coupling light into a PM Fiber, the incident light should be linearly polarized and oriented parallel to the fast or slow fiber axis. If not, the polarization state will not be preserved when the PM fiber is perturbed by bends, vibrations, or temperature fluctuations.



Watch the YouTube video:

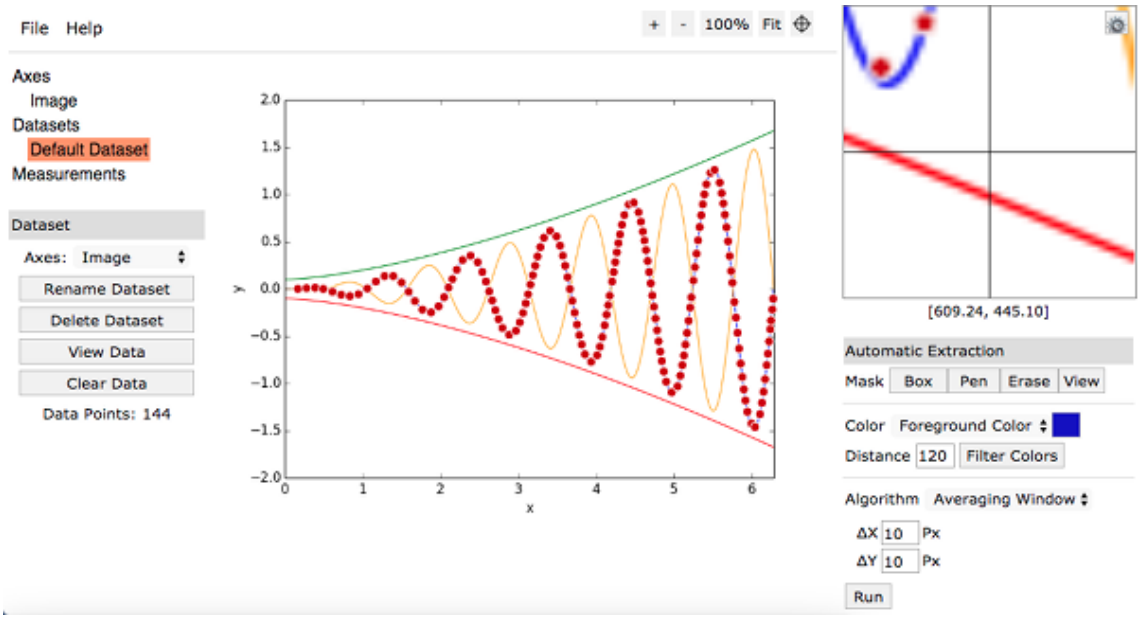
[PM Fiber Measurements Used to Align Incident Polarization State (Viewer Inspired)| Thorlabs Insights - YouTube]

Did you know?

Annoyed about figures in publications without the raw data provided?
Remember that **you can use WebPlot digitiser to extract the data**

It is often necessary to reverse engineer images of data visualizations to extract the underlying numerical data. WebPlotDigitizer is a semi-automated tool that makes this process extremely easy:

- Works with a wide variety of charts (XY, bar, polar, ternary, maps etc.)
- Automatic extraction algorithms make it easy to extract a large number of data points
- Free to use, opensource and cross-platform (web and desktop)
- Used in hundreds of published works by thousands of users
- Also useful for measuring distances or angles between various features

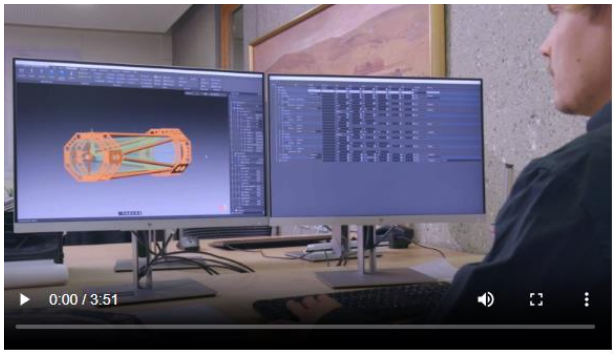


[WebPlotDigitizer - Extract data from plots, images, and maps (automeris.io)]

What is Quadoa® Optical CAD?

Quadoa® Optical CAD is the first sequential and multi-sequential optical design software for the complete prototyping process of optical systems

The intention of Quadoa® is to **provide a modern optical design software** based on latest software technologies for the fast growing and rapidly developing optical market and especially to provide a software solution which can keep up with the design requirements for modern complex systems. Quadoa® Optical CAD is a **state of the art optical design software** with a vast range of features and functions for the complete prototyping process of modern optical systems. The feature highlights listed below should only abstract the comprehensive design capability of Quadoa®



Modern Object-Based Architecture
Multi-Sequential Raytracing
Flexible Surface Type Definition
Intuitive Design of Folded- and Off-Axis Systems
Bidirectional Exchange with Mechanical CAD
Scripting Interface
Polarization Raytracing
Real World Tolerance Analysis
Wide Range of Analysis Features
In-System Sequential Ghost Analysis
Lens- and Material Catalogs

Application Examples | Quadoa Optical CAD

Did you know?

Asdoptics is the sole authorized distributor of ASAP optics software, which **simulates the performance of optical system by non-sequence ray tracing** ?

Application Fields: *Stray light analysis, Physical optics analysis, Bio-optic system, Aerospace, Coherent Optics, Photonics, Binocular Analysis...*

Their Clients: *Sony, Ford, Sumsung, Fudan University, National Astronomical Observatories, NUDT, Xerox, Philips ...*

Asdoptics Advantages:

1. ASAP can analyze the origin of ghosting, and it successfully repair the Hubble Telescope;
2. ASAP uses CoreMax technology to support parallel computing by multiple computers;
3. ASAP computes hundreds of millions of rays in just a few minutes;
4. ASAP can handle almost all optical simulation analysis;
5. ASAP can simulate the interaction between light and cells with high precision

For more information

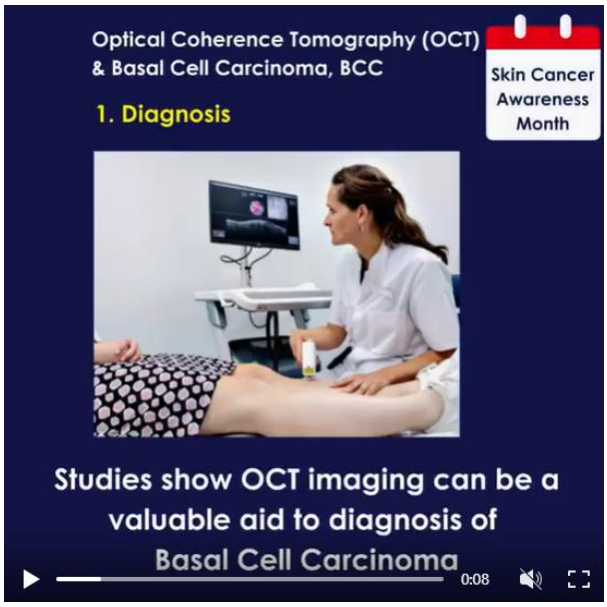
Wuhan Asdoptics Science And Technology Co.,Ltd.
Website: http://asdoptics.com/en

Did you know ?

May is Skin Cancer Awareness Month!

VivoSight
The Whole Picture ™

Basal Cell Carcinoma, BCC, is the most common form of skin cancer with 3.6 million cases in the USA alone diagnosed every year. **Studies have shown that Optical Coherence Tomography, OCT, can be a valuable aid to the diagnosis of BCC,** with a recent publication indicating that, "in 66% of patients, a biopsy could be avoided, thus minimising treatment delay and avoiding an invasive procedure." (Adan, F. et.al, 2022)



To learn more about the key clinical evidence for the use of OCT in BCC diagnosis, **download your up-to-date Reference List** of published work.

66% of diagnostic biopsies for common skin cancer can be avoided using Michelson Diagnostics' VivoSight OCT laser scanner (prnewswire.com)

SEMINAR

What Role can Femtosecond Lasers Play in Microscopy Applications?

Event by Laser Focus World
Event link: https://www.laserfocusworld.com/14292178
Originally broadcast on May 11, 2023 6 PM GMT. Now available On Demand.

Summary

In the world of microscopy, bio-imaging techniques have grown in popularity over the past decade, necessitating increased capability in laser technology to address emerging application requirements. In an effort to provide innovative solutions, laser manufacturers have developed technologies beyond traditional Ti:Sapphire lasers. In this webinar, these new technologies are discussed, as well as how their evolution supports advancements in experimental techniques.

Speaker

Adam M. Larson, Ph.D | Manager, Scientific Laser Sales | MKS Spectra Physics

Adam Larson manages **scientific laser sales for MKS Spectra-Physics** in the Southwestern United States. He received his BS in Biomedical Engineering from the University of Rochester and his Ph.D. in Biomedical Engineering from Texas A&M University. Before joining Spectra-Physics, Adam had **over 10 years of experience designing and developing two-photon imaging systems during his Ph.D. work and then after with a commercial two-photon microscope company.** Leveraging his deep understanding of laser technology and microscopy applications, Adam also serves as the microscopy and imaging applications specialist for the Spectra-Physics Scientific Sales team.

This Month in Physics History

May 1801:

Thomas Young and the Nature of Light

The debate over whether light is a wave or a particle goes back many centuries. In the 17th century, Isaac Newton believed light was composed of a stream of corpuscles. At that time, a few scientists, most notably Dutch physicist and astronomer Christiaan Huygens, thought light was a wave vibrating in some sort of ether.

There was evidence for both pictures. For instance, sound, known then to be a wave, can travel through crooked pipes and around corners, while light cannot, and this fact was taken as evidence for the corpuscular theory of light. But phenomena such as refraction were difficult to explain with the corpuscular theory. Newton had to invoke an inexplicable force that changed the velocity of light in water. Newton was also intrigued and puzzled by colored fringes in soap films, but stuck to the corpuscular theory despite its difficulties.

Newton was so greatly revered as a scientist that it was nearly impossible for anyone to dispute his theory. **In 1801 Thomas Young presented a serious challenge to Newton's ideas on the nature of light.**

Young was a true polymath, with interests ranging from physics to Egyptology. He was born in 1773 in Milverton, in southwest England, into a large Quaker family. He was a prodigy as a child, learning to read by age two, and teaching himself Latin at age six.

Read More about Thomas Young and the Nature of Light

For your free time

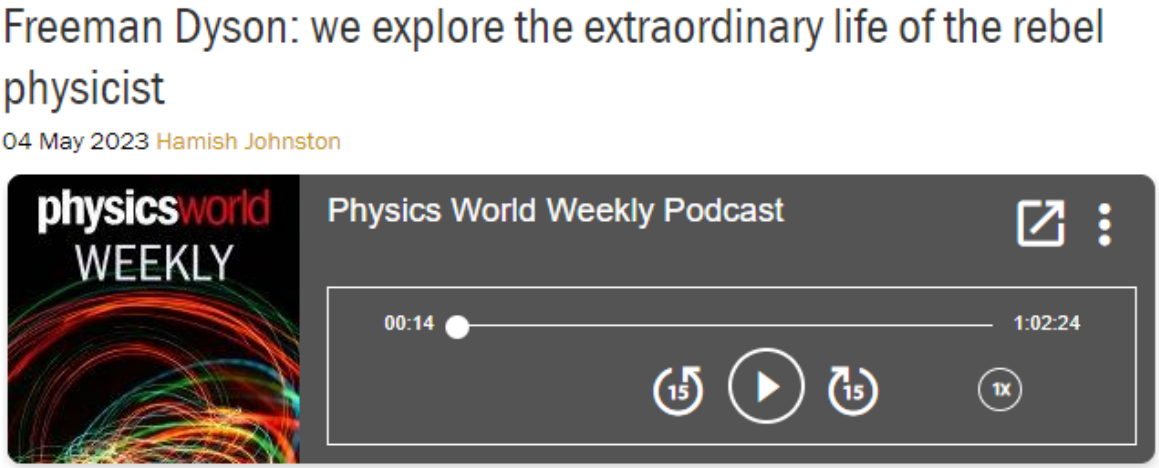
History podcast

Freeman Dyson: the extraordinary life of the rebel physicist

Born in England on 15 December 1923 (died on 28 February 2020 at the age of 96), Dyson **made important breakthroughs in quantum theory and applied mathematical rigour to a wide range of projects.** These included the design of a popular research reactor still in use today and a nuclear-powered rocket, which thankfully was never built.

Hamish Johnston, an online editor of *Physics World, is* exploring the remarkable life of Freeman Dyson with the historian and physicist David Kaiser.

Kaiser is editor of the new book *"Well, Doc, You're In": Freeman Dyson's Journey through the Universe*. This looks at the mathematical physicist's early life, formative years, and professional life in chapters written by historians and science journalists as well as colleagues and relatives of Dyson.



Listen to the podcast: Freeman Dyson: we explore the extraordinary life of the rebel physicist – Physics World

Did you know?

May is National Inventors Month –

a month-long event celebrating invention and creativity

Discover which clever creations came into being or received patents or trademarks during the May calendar, and find out which famous inventor shares your May birthday.

May 1

- 1888 - Patent #382,280 was granted to Nikola Tesla for the "**electrical transmission of power.**"

May 10

- 1752 - **Benjamin Franklin** first tested his lightning rod. Franklin **invented the lightening rod, iron furnace stove, bifocal glasses and odometer.**

May 14

- 1686 - **Daniel Gabriel Fahrenheit** invented the thermometer.
- 1946 - Surgeon and inventor **Robert Jarvik** invented the Jarvik 7 artificial heart.

May 15

- 1859 - French physicist Pierre Curie shared the Nobel Prize in 1903 with his wife, Marie Curie.

May 25

- 1948 - Andrew Moyer was granted a patent for **a method of mass production of penicillin.**

May 26

- 1857 - Robert Mushet received a patent for **methods of manufacturing steel.**

May 28

- 1742 - The first indoor **swimming pool** opened in Goodman's Fields, London.

May Calendar of Famous Inventions and Birthdays (thoughtco.com)

Bellis, Mary. "May Calendar of Famous Inventions and Birthdays." ThoughtCo, thoughtco.com/today-in-history-may-calendar-1992505.

Pint of Science event at the Foundry pub, Canterbury
Monday 22nd May 2023

On 22nd May 2023 between 7 - 10 pm there was an interactive evening about different aspects of how bodies work. There were **different presentations about the differences between how apes and humans use their bodies to manipulate objects and even walk**; **about how newly developed optical techniques allow us to better spot developmental abnormalities in IVF embryos**. There was a presentation about **how to breath most efficiently during illness or exercise**. Also during all of these presentations there was an opportunity to practice what was learnt!
The event had a booking required and it was sold out! The programme can be found:
Improving your breathing, IVF optics and man vs ape | Pint of Science

Hand it to primates by Christopher Dunmore (Lecturer in Biological Anthropology)

Better breathing by John Dickinson (Professor and Head of the Exercise Respiratory Clinic)

Improving in vitro fertilisation (IVF) by Julien Camard (former PhD Student in Applied Optics Group, supervisor A. Podoleanu, now PDRA with A. Podoleanu)

@ Photos with Julien Camard during his presentation: (on the left, taken by NETLAS ESR Alejandro Martinez and on the right by Adrian Fernandez)

Kerala food at University of Kent

University of Kent Catering Team launched Kerala Curry for the Kent community- responding to the battle call for more diverse food on campus for students and staff. The chef who has developed the offering - Kerala is where he is from originally.

Kerala Curry: authentic Indian street food - Student Guide - University of Kent

Coming from southern part of India, the one thing I miss the most in Canterbury is the food back home. Though there are many Indian restaurants in Canterbury, but fewer options for south Indian cuisine. I was very pleased to have the Kerala food stall in the campus, which will continue for few more weeks. Each week have a different menu from different south Indian cuisine. Masala dosa, a well-known south Indian breakfast dish, was one of the options. I was really excited to introduce the Kerala/south Indian cuisines to my AOG colleagues. Adding some photos from the food stall.

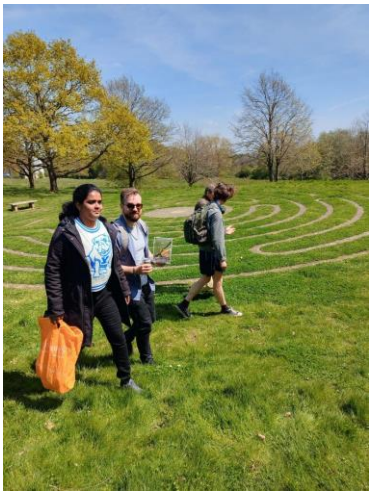
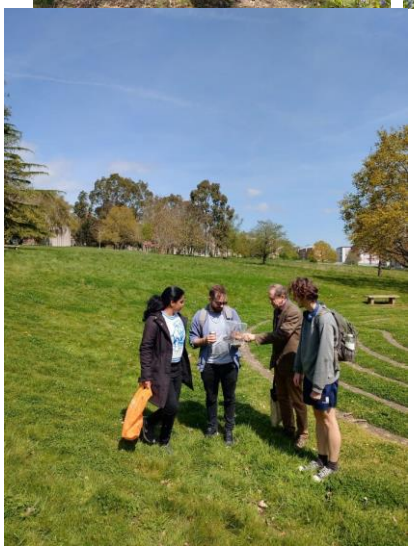


@Article by NETLAS ESR Gopika Venugopal

Bluebells at @UniKent
Canterbury campus

On Wednesday 3rd of May 2023, AOG had the privilege to enjoy the bluebells inside the University of Kent's campus, not far from Photonics building during the lunch break: sunshine, no muddy puddles, with great companies joining the group (Luna, Rosie and Rocky). A great day for everyone! Photos will follow.



@ Photos by Dr Manuel Marques (lecturer), Dr. Radu Stancu (PDRA) and Dr Ramona Cernat (NETLAS administrator and researcher in the AOG)

The Coronation of His Majesty King Charles III and Her Majesty The Queen Consort took place on Saturday 6 May 2023 at Westminster Abbey

You can watch the event or parts of the event at the following links:

Coronation ceremony: King Charles III and Queen Camilla enter Westminster Abbey - BBC News - YouTube

Watch: Highlights of King Charles's and Queen Camilla's coronation - YouTube

King Charles III coronation: Royal procession between Buckingham Palace and Westminster Abbey - YouTube

Watch King Charles III's coronation at Westminster Abbey in London - YouTube

Watch in full: The coronation of King Charles III and Queen Camilla - YouTube

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