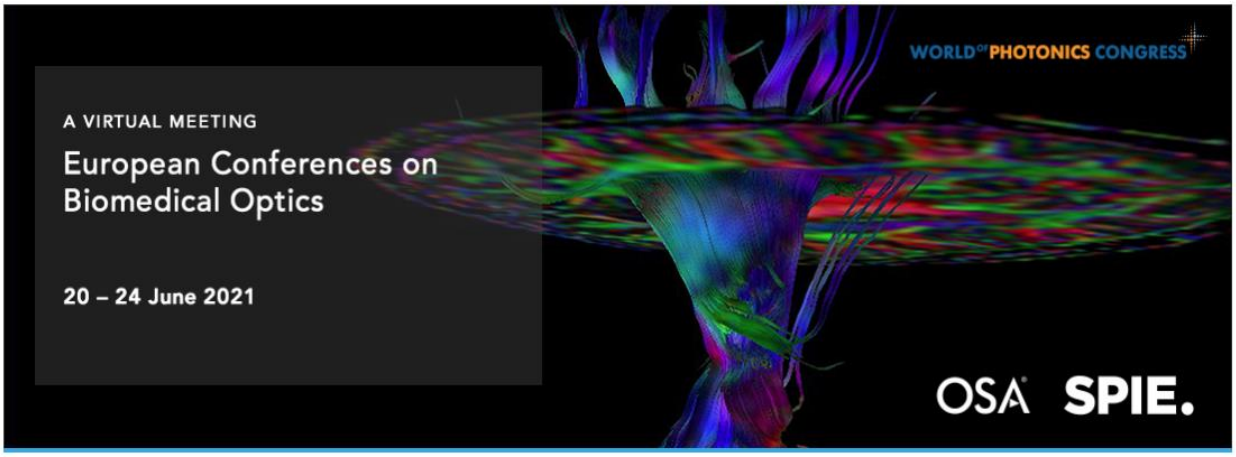
NETLAS NEWSLETTER 4-2021

NETLAS UPCOMING EVENT
1st year report (mid – interim) meetings
1st and 2nd July 2021

Attending Conferences

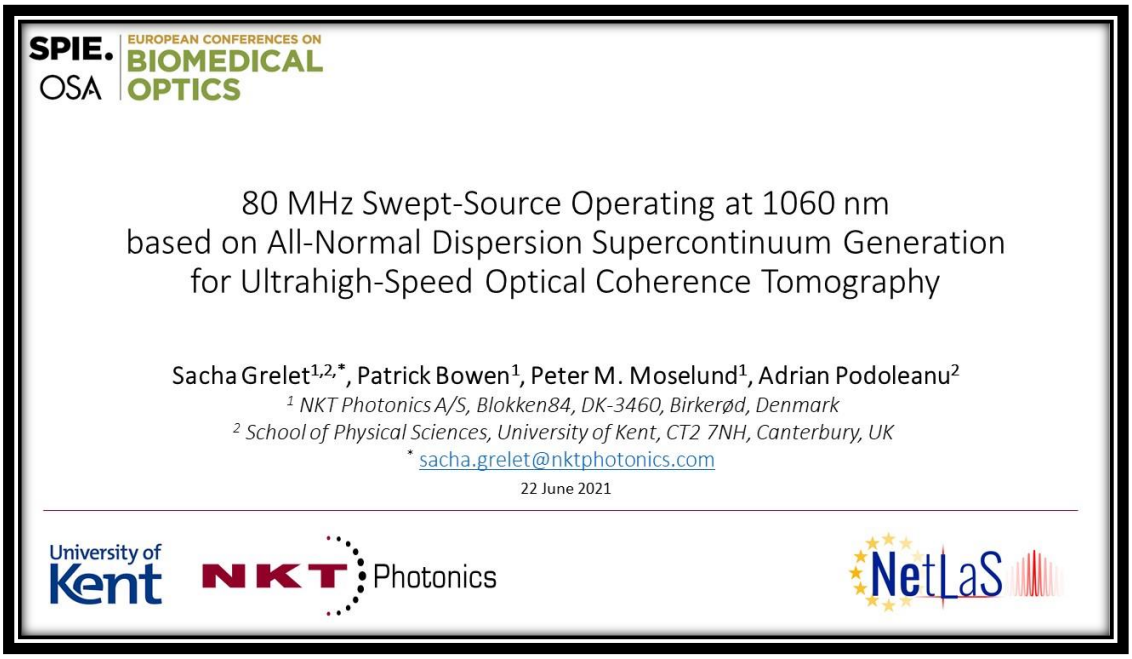


The European Conferences on Biomedical Optics - premier European event bringing together scientists, engineers, and clinicians who work with optics and photonics to solve problems in biomedicine; excellent opportunity to connect with other researchers.

Members of the Kent and UzL teams have attended the conference

NETLAS PhD Student Sacha Grelet, currently hosted by **NKT Photonics** in Denmark, attended the European Conference on Biomedical Optics with an oral presentation "*80 MHz Swept Source Operating at 1060 nm Based on All-Normal-Dispersion Supercontinuum Generation for Ultrahigh-Speed Optical Coherence Tomography*".

Sacha's presentation took place on June 22, 2021 under the Session "Advances in Optical Coherence Imaging". Print screen of his 1st slide presentation is presented below.



Other presentations from the NETLAS teams to the European Conference on Biomedical Optics

Kent:

23 June 18:00 - 18:00	Chasing sub-Micrometer Axial Resolution in Visible Optical Coherence Tomography (EW4A.32) Adrian Bradu, *Applied Optics Group, University of Kent*
23 June 18:00 - 18:00	Non-Destructive Identification Document Inspection With Swept-Source Optical Coherence Tomography Imaging (EW4A.6) Manuel Marques, *University of Kent at Canterbury*

23 June 18:00 - 18:00	Time-Lapse Optical Coherence Tomography Embryo Imaging With Minimal Disturbance (EW4A.7) Manuel Marques, *University of Kent at Canterbury*

UzL

22 June 17:15 - 17:45 (UTC + 01:00)	1.6 MHz FDML OCT for Intraoperative Imaging in Neurosurgery (ETu4A.2) Dirk Theisen-Kunde, *Medical Laser Center Lübeck* **Invited**
23 June 12:15 - 12:30 (UTC + 01:00)	Comparison of two Optical Coherence Tomography Systems to Identify Human Brain Tumor (EW1C.7) Paul Strenge, *Medical Laser Center Lübeck*
23 June 15:30 - 15:45	Towards Densely Sampled Ultra-Large Area Multi-MHz-OCT for in Vivo Skin Measurements Beyond 1 cm2/sec (EW3C.4) Madita Göb, *University of Lübeck*
24 June 12:30 - 13:00	Phase Sensitive Optical Coherence Tomography at Megahertz Speed (ETh2C.1) Tianshi Wang, E*rasmus mc* **Invited**

24 June 15:00 - 15:30	Spectroscopic Analysis Through Thermoelastic Optical Coherence Microscopy (ETh3C.1) Aaron Doug Deen, *Erasmus MC* **Invited**
24 June 15:30 - 15:45	Phase-Sensitive Optical Coherence Elastography With a 3.2 MHz FDML-Laser Using Focused Air-Puff Tissue Indentation (ETh3A.3) Katharina Rewerts, *Institute of Biomedical Optics*

CLEO/QELS Conference

2021 Conference on Lasers and Electro-Optics Europe & European Quantum Electronics Conference

21-25 June 2021

NETLAS Participants from KENT, TAU, DTU, UzL, and NKT teams

KENT

- **Adrian Podoleanu,** member in the organizing committee chaired the session CH-5, Imaging in Scattering Media, 22 June 2021

TAU

- **Mircea Guina,** delivered an invited talk, GaSb-based SESAM technology for mid-IR ultrafast lasers

- **Room temperature operation of SiC-cooled and AlGaInP-based, red-emitting membrane external-cavity surface-emitting lasers (MECSELs),** ***P. Tatar-Mathes****, H.-M. Phung, A. Rogers, A. Tukiainen, P. Rajala, S. Ranta, H. Kahle, and* ***M. Guina****,*

- **Design strategy for broadband MECSELs,** ***H. Kahle,*** *H.-M. Phung,* ***P. Tatar- Mathes,*** *P. Rajala, and* ***M. Guina*****;** CB-1.4

- **Sub-50-fs SESAM mode-locked Tm,Ho:Ca(Gd,Lu)AlO4 laser** *L. Wang*[1]*, W. Chen*[2]*, Y. Zhao*[1]*, Z. Pan*[1]*, M. Mero*[1]*, X. Mateo*[3]*, P. Loiko*[4]*,* ***M. Guina***[5]*, U. Griebner*[1]*, and V. Petrov*[1]

DTU

- **Comparison of electrically and optically pumped buried-heterostructure photonic crystal lasers,** *E. Dimopoulos, Y. Yu, A. Sakanas, A. Marchevsky, M. Xiong, K.S. Math- iesen, E. Semenova,* ***K. Yvind,*** *and J. Mørk*;

- **Stimulated Brillouin Scattering on AlGaAs on Sapphire platform**, *H.K. Sahoo, Y. Zheng, C. Kim, M. Galili,* ***K. Yvind,*** *L.K. Oxenløwe, M. Pu, and H. Hu*;

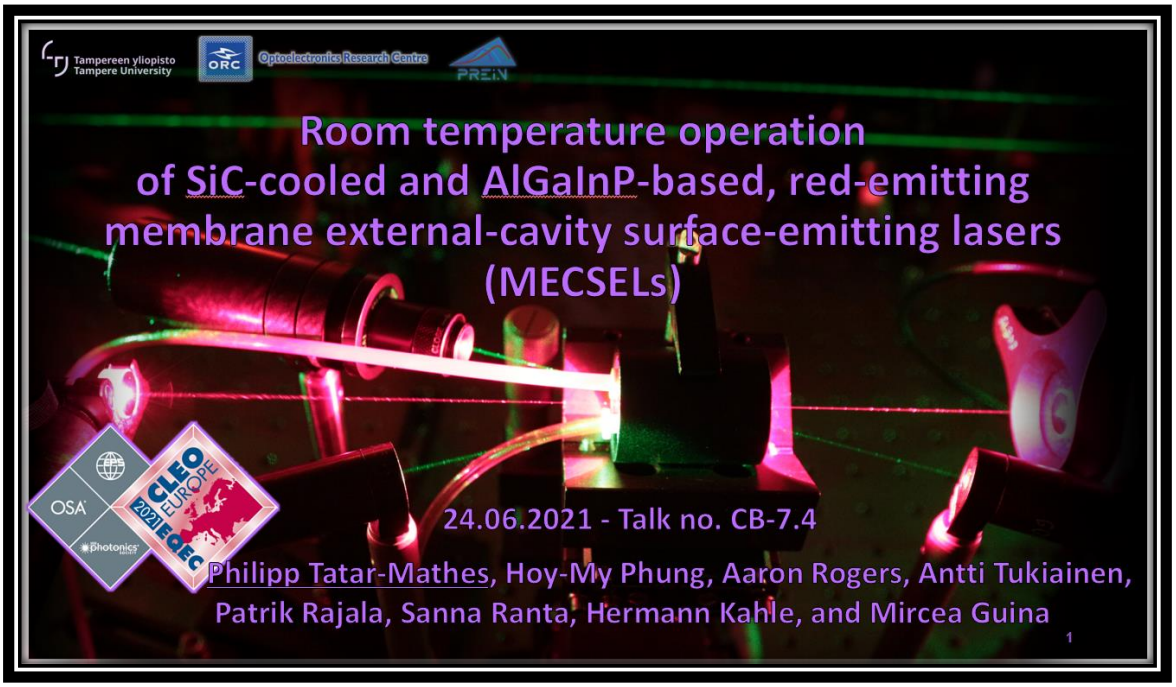
UzL

- **Superposition of two independent FDML lasers,** *C. Grill*[1], S. Lotz, T. Blomber, M. Schmidt, W. Draxinger, J.P. *Kolb*[1], *C. Jirauschek*[2] , *and* ***R. Huber***[1]

NKT

- **Generation of an ultra-flat, low-noise and linearly polarized fiber supercontinuum covering 670 nm-1390 nm,** *E. Genier*[1,2], ***S. Grelet***[1], *R.D. Engelsholm*[1] , ***P. Bowen***[1], *P.M. Moselund*[1], *O. Bang*[3] , *J.M. Dudley*[2] , *and T. Sylvestre*[2]

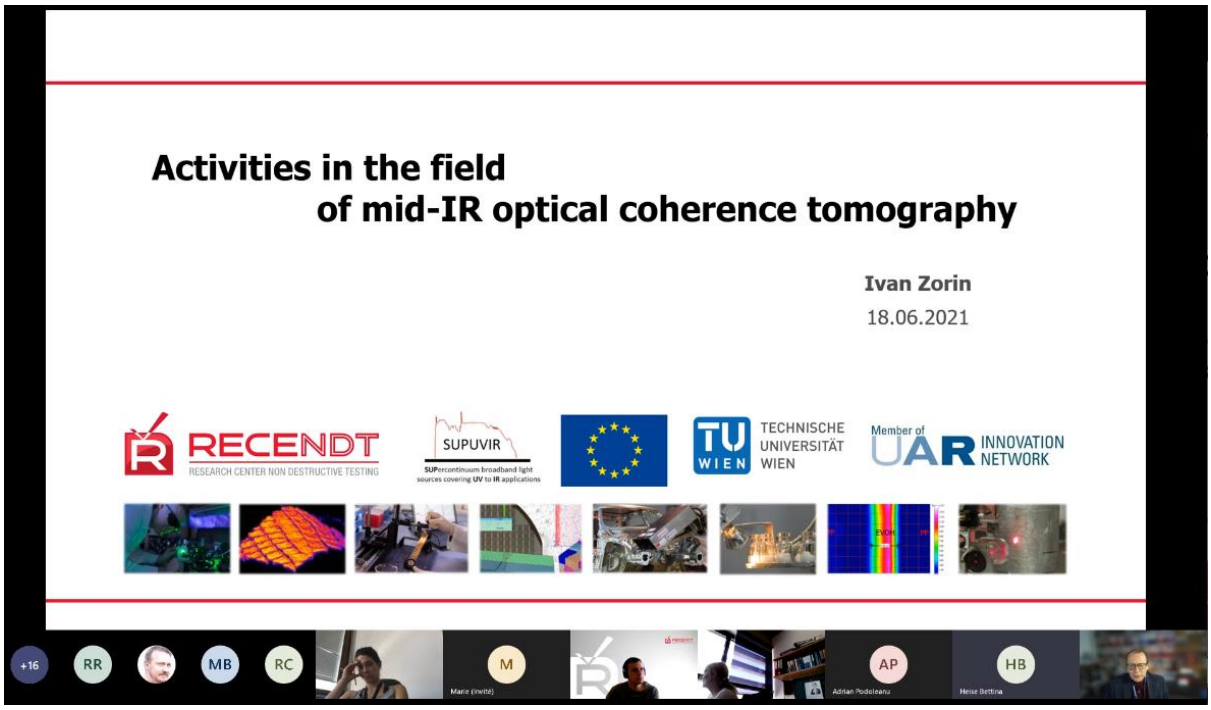
NETLAS PhD Student Philipp Tatar-Mathes, currently hosted by **Tampere University** in Finland, attended the CLEO conference with an oral presentation "*Room temperature operation of SiC-cooled and AlGaInP-based, red-emitting membrane external-cavity surface-emitting lasers (MECSELs)".* Print screen of Phillipp's 1st slide presentation is presented below.

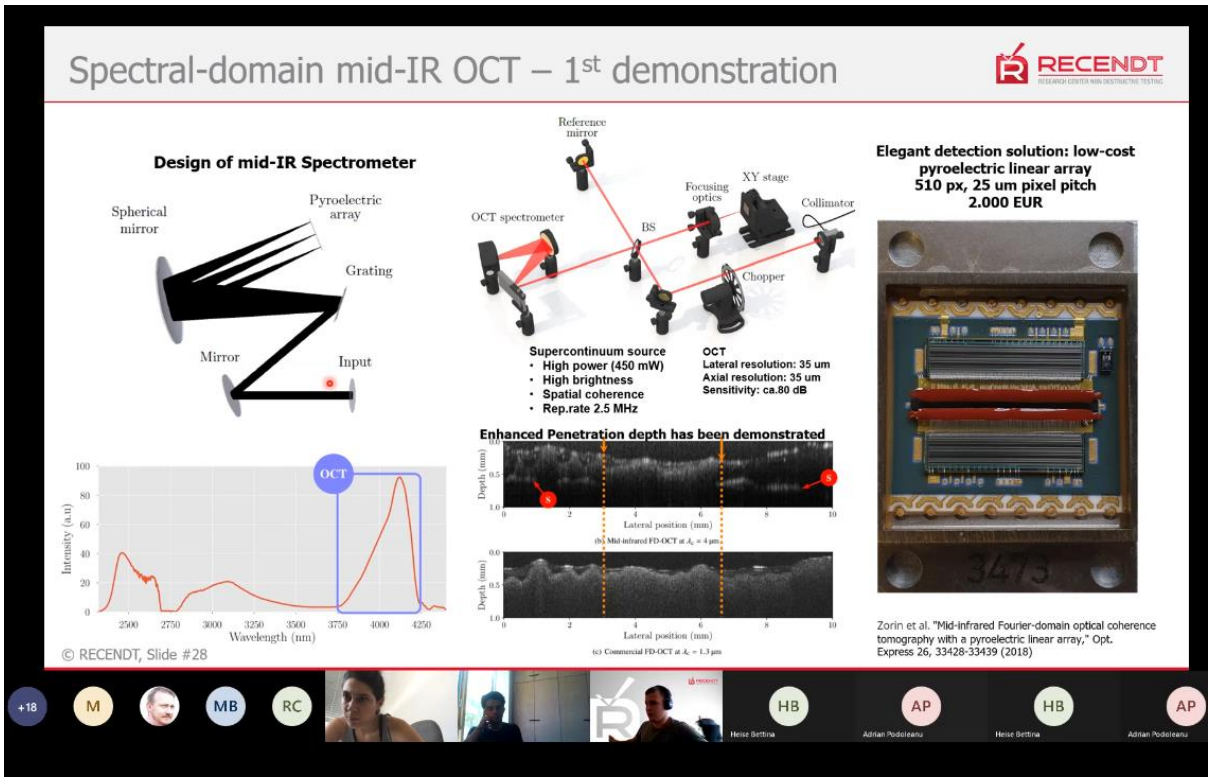


NETLAS NETWORK SEMINAR

Dr. Ivan Zorin from the Associated NETLAS Partner **Research Center for Materials Characterization and Non-Destructive Testing (RECENDT GmbH)** delivered a talk on 18th June 2021 on RECENDT activities in the field of (MIR)OCT. A few slides from his presentation are shown below.

Zorin's presentation has been uploaded to the NETLAS YouTube channel at [TalkNETLAS18JUne2021 - YouTube]

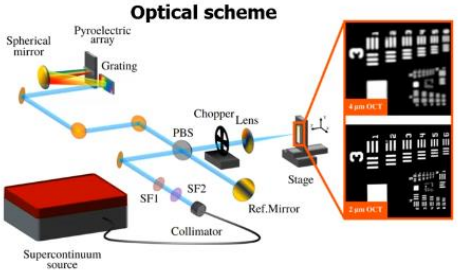

Activities in the field
of mid-IR optical coherence tomography
Ivan Zorin
18.06.2021
RECENDT
RESEARCH CENTER NON DESTRUCTIVE TESTING
SUPUVIR
SUPercontinuum broadband light sources covering UV to IR applications
TECHNISCHE UNIVERSITÄT WIEN
Member of UAR INNOVATION NETWORK


Spectral-domain mid-IR OCT – 1st demonstration
RECENDT
Design of mid-IR Spectrometer
Spherical mirror
Pyroelectric array
Grating
Mirror
Input
Reference mirror
OCT spectrometer
BS
Focusing optics
XY stage
Collimator
Chopper
Supercontinuum source
• High power (450 mW)
• High brightness
• Spatial coherence
• Rep.rate 2.5 MHz
OCT
Lateral resolution: 35 um
Axial resolution: 35 um
Sensitivity: ca.80 dB
Elegant detection solution: low-cost pyroelectric linear array
510 px, 25 um pixel pitch
2.000 EUR
Enhanced Penetration depth has been demonstrated
Intensity (a.u)
Wavelength (nm)
OCT
Depth (mm)
Lateral position (mm)
Zorin et al. "Mid-infrared Fourier-domain optical coherence tomography with a pyroelectric linear array," Opt. Express 26, 33428-33439 (2018)
© RECENDT, Slide #28

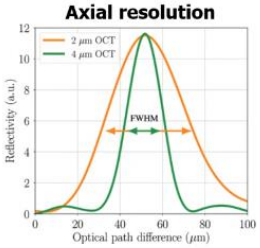
Dual-band operation

RECENDT

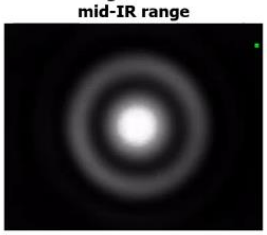
Optical scheme



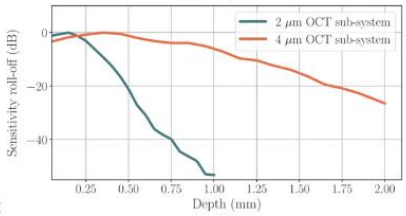
Axial resolution



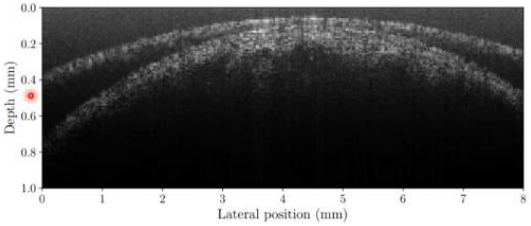
"White" light interference mid-IR range



Sensitivity roll-off



OCT Imaging in two regions using one detector

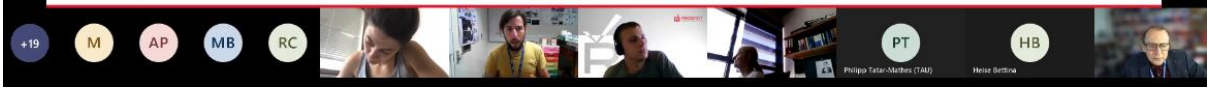


© REC

Thank you!

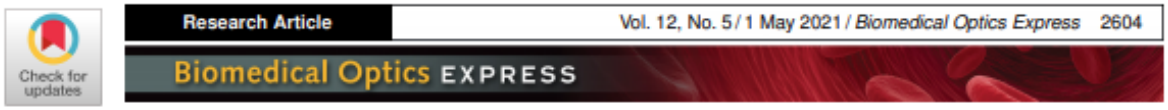
- Mid-IR OCT is a versatile tool (always?) for investigation of scattering (NIR, VIS) materials
- Water containing samples are problematic (we are in the optimal range currently), is there a reason to go further?
- Currently, our time-encoded mid-IR OCT system is the primary setup for research and development
- Optimization of imaging speed and sensitivity (coupled) are the primary tasks

- **RECENDT GmbH**
- **Ivan Zorin:** ivan.zorin@recendt.at
- **Head of OCT:** **Bettina Heise** Bettina.Heise@recendt.at +43 / 732 / 2468-4666
- www.recendt.at
- A – 4040 Linz, Altenberger Straße 69, Science Park 2



PUBLICATIONS

- ***'Cavity length control for Fourier domain mode locked (FDML) lasers with µm precision'*** Simon Lotz, Christin Grill, Madita Göb, Wolfgang Draxinger, Jan Philip Kolb, and **Robert Huber, Biomedical Optics Express,** Vol. 12, Issue 5, pp. 2604-2616, (2021), https://doi.org/10.1364/BOE.422898



Cavity length control for Fourier domain mode locked (FDML) lasers with µm precision

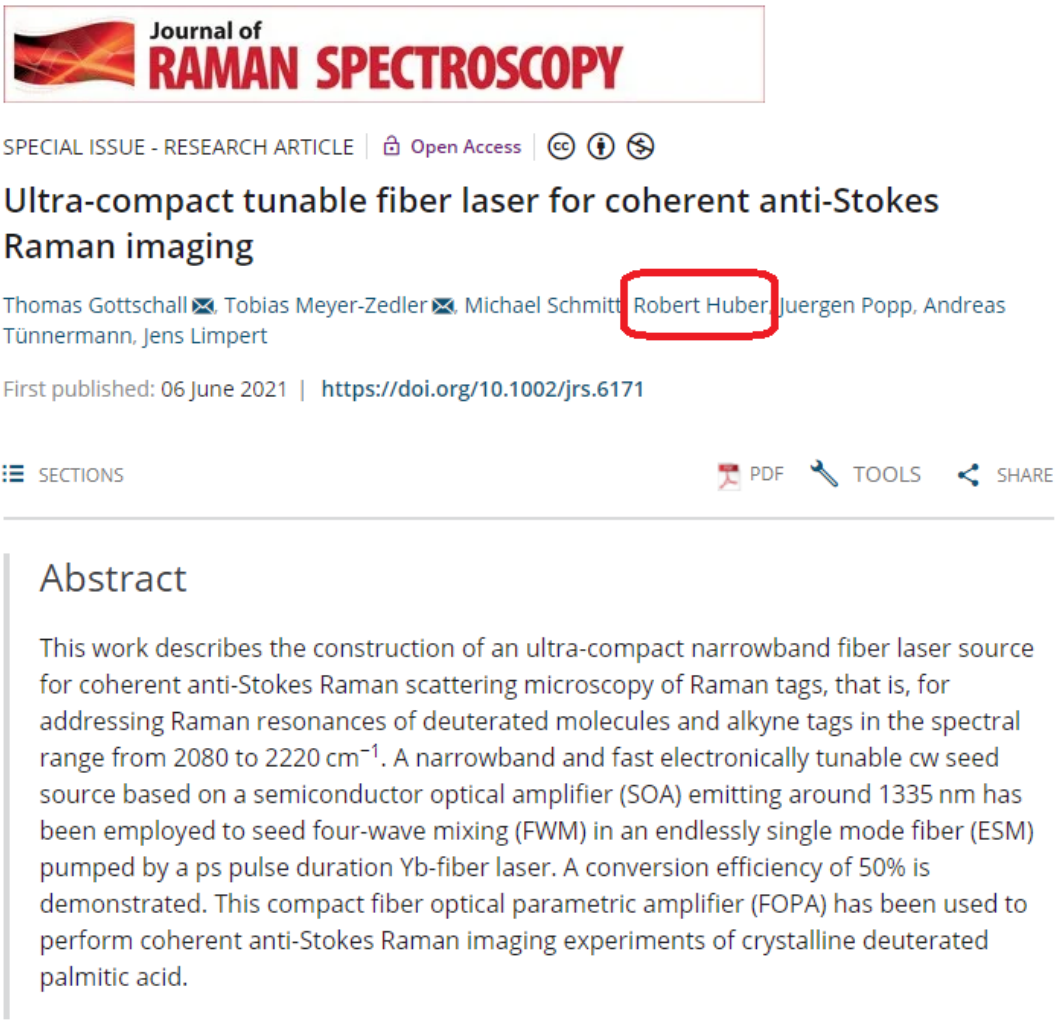
SIMON LOTZ,[1,2] CHRISTIN GRILL,[1] MADITA GÖB,[1] WOLFGANG DRAXINGER,[1] JAN PHILIP KOLB,[1] AND ROBERT HUBER[1,*]

[1]*Institut für Biomedizinische Optik, Universität zu Lübeck, Peter-Monnik-Weg 4, 23562 Lübeck, Germany*
[2]*Medizinisches Laserzentrum Lübeck GmbH, Peter-Monnik-Weg 4, 23562 Lübeck, Germany*
[*]*Robert.Huber@uni-luebeck.de*

Abstract: In highly dispersion compensated Fourier domain mode locked (FDML) lasers, an ultra-low noise operation can only be achieved by extremely precise and stable matching of the filter tuning period and light circulation time in the cavity. We present a robust and high precision closed-loop control algorithm and an actively cavity length controlled FDML laser. The cavity length control achieves a stability of ~0.18 mHz at a sweep repetition rate of ~418 kHz which corresponds to a ratio of 4×10^{-10}. Furthermore, we prove that the rapid change of the cavity length has no negative impact on the quality of optical coherence tomography using the FDML laser as light source.

SPECIAL ISSUE - RESEARCH ARTICLE

- **Ultra-compact tunable fiber laser for coherent anti-Stokes Raman imaging,** Thomas Gottschall, Tobias Meyer-Zedler, Michael Schmitt, **Robert Huber**, Juergen Popp, Andreas Tünnermann, Jens Limpert, J. Raman Spectrosc. 1–8, 2021, https://doi.org/10.1002/jrs.6171



Journal of RAMAN SPECTROSCOPY

SPECIAL ISSUE - RESEARCH ARTICLE | Open Access

Ultra-compact tunable fiber laser for coherent anti-Stokes Raman imaging

Thomas Gottschall, Tobias Meyer-Zedler, Michael Schmitt, Robert Huber, Juergen Popp, Andreas Tünnermann, Jens Limpert

First published: 06 June 2021 | https://doi.org/10.1002/jrs.6171

SECTIONS PDF TOOLS SHARE

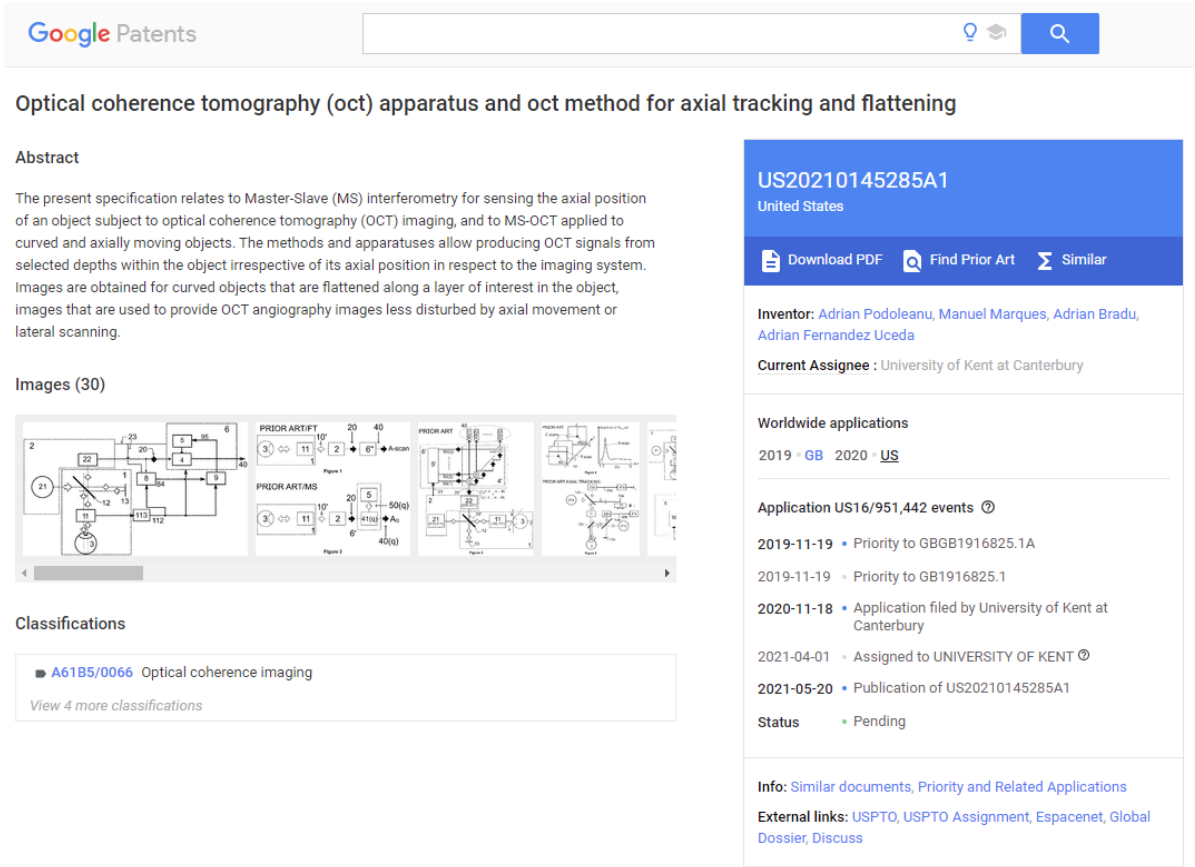
Abstract

This work describes the construction of an ultra-compact narrowband fiber laser source for coherent anti-Stokes Raman scattering microscopy of Raman tags, that is, for addressing Raman resonances of deuterated molecules and alkyne tags in the spectral range from 2080 to 2220 cm^{-1}. A narrowband and fast electronically tunable cw seed source based on a semiconductor optical amplifier (SOA) emitting around 1335 nm has been employed to seed four-wave mixing (FWM) in an endlessly single mode fiber (ESM) pumped by a ps pulse duration Yb-fiber laser. A conversion efficiency of 50% is demonstrated. This compact fiber optical parametric amplifier (FOPA) has been used to perform coherent anti-Stokes Raman imaging experiments of crystalline deuterated palmitic acid.

AOG New Patent - recently published

Optical coherence tomography (OCT) apparatus and OCT method for axial tracking and flattening

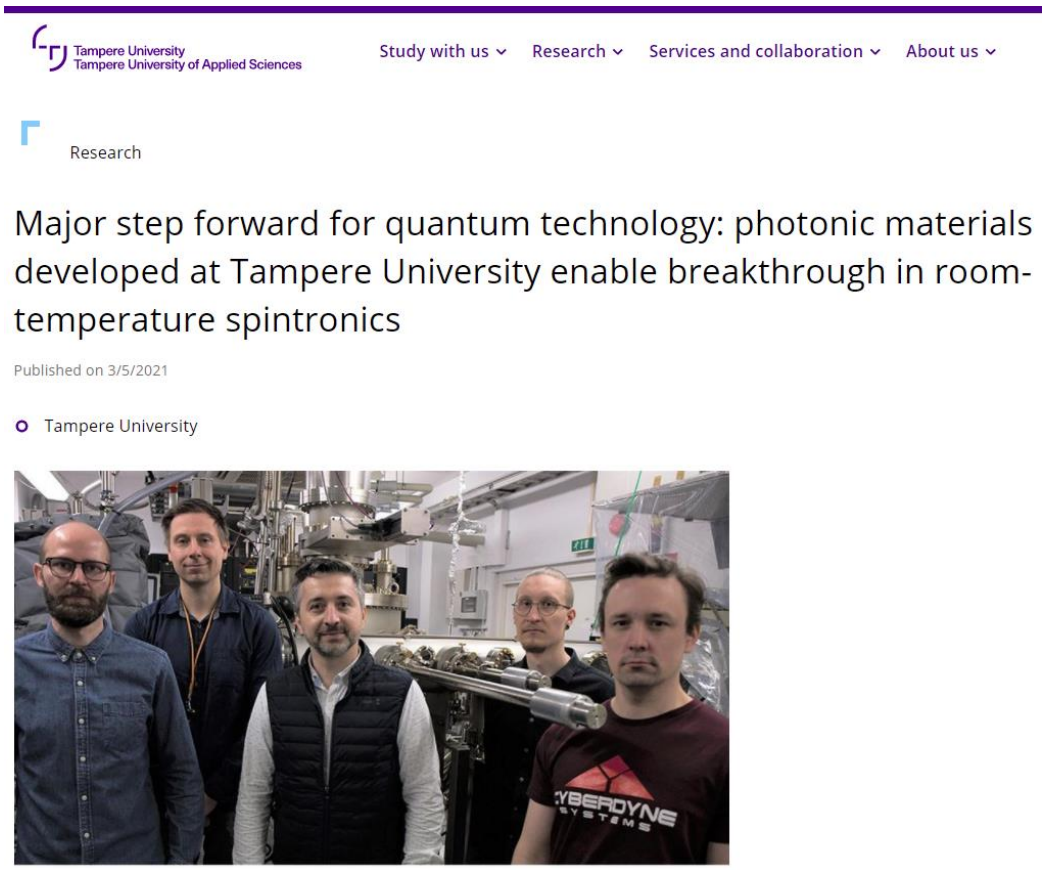
Inventor: Adrian Podoleanu, Manuel Marques, Adrian Bradu, Adrian Fernandez Uceda



Patent can be found on the following link:

https://patents.google.com/patent/US20210145285A1/en

NETLAS News

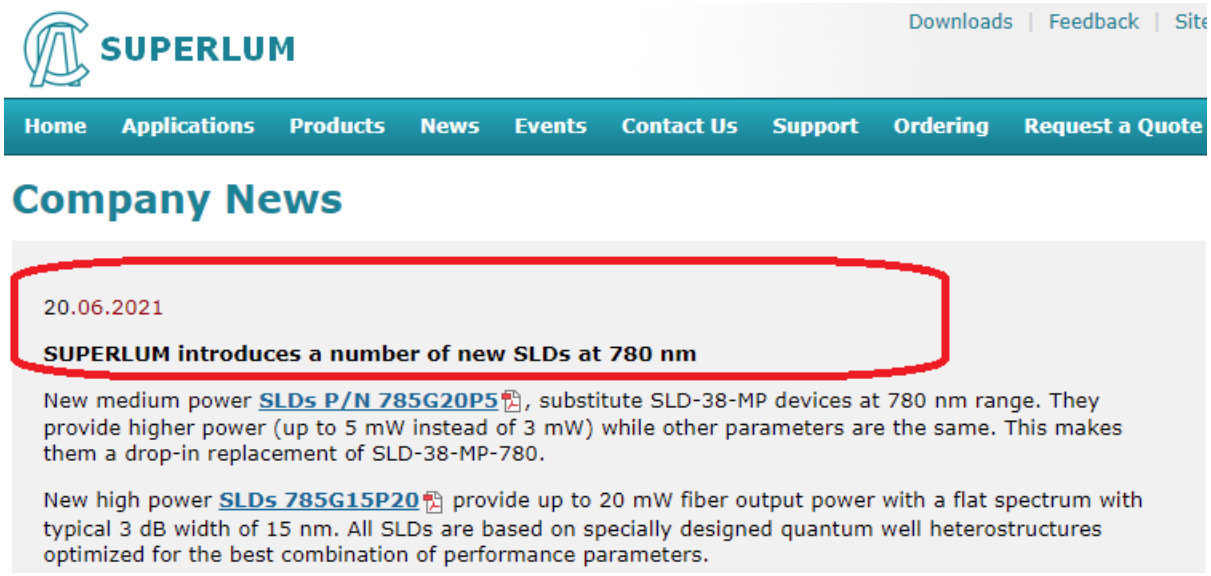


A team of researchers from **Finland,** Sweden, and Japan have developed a semiconductor component in which quantum information can be efficiently exchanged between electron spin and photons at room temperature and above. The new method, described in an article recently published in Nature Photonics, is based on amplifying the spin polarisation in a semiconductor structure made up of InAs quantum dots and nitrogen-containing semiconductor compounds. **The component was fabricated by researchers at Tampere University** using the molecular beam epitaxy (MBE) technique. The full read of the article can be found at [Major step forward for quantum technology: photonic materials developed at Tampere University enable breakthrough in room-temperature spintronics | Tampere universities (tuni.fi).]

SUPERLUM introduces

a number of new SLDs at 780 nm

- New medium power SLDs P/N 785G20P5, substitute SLD-38-MP devices at 780 nm range
- New high power SLDs 785G15P20



SUPERLUM

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Company News

20.06.2021

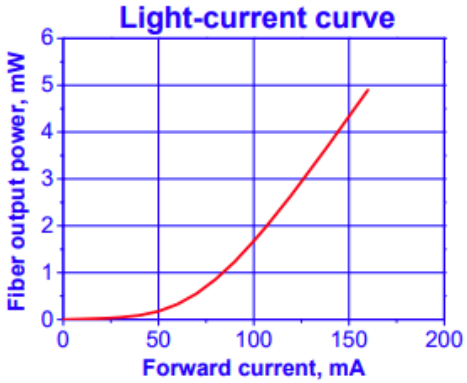
SUPERLUM introduces a number of new SLDs at 780 nm

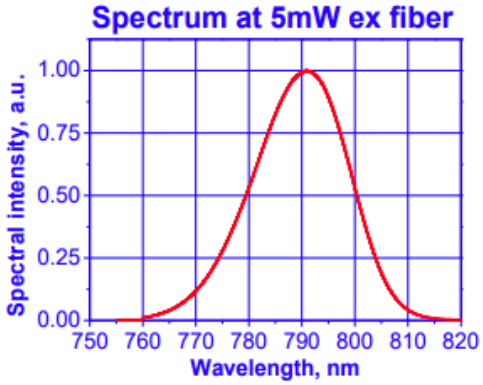
New medium power SLDs P/N 785G20P5, substitute SLD-38-MP devices at 780 nm range. They provide higher power (up to 5 mW instead of 3 mW) while other parameters are the same. This makes them a drop-in replacement of SLD-38-MP-780.

New high power SLDs 785G15P20 provide up to 20 mW fiber output power with a flat spectrum with typical 3 dB width of 15 nm. All SLDs are based on specially designed quantum well heterostructures optimized for the best combination of performance parameters.

SUPERLUM	SLD-785G20P5. Medium power single mode fiber pigtailed SLD modules at 785 nm with wide bell-shaped spectrum

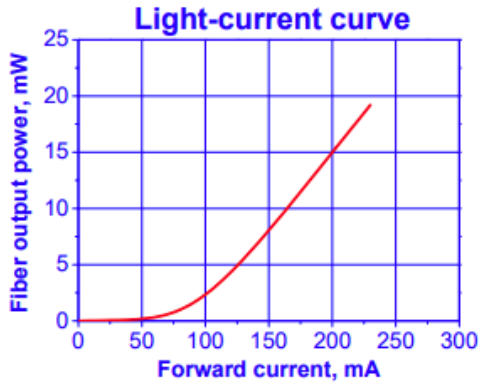
TYPICAL PERFORMANCE EXAMPLES

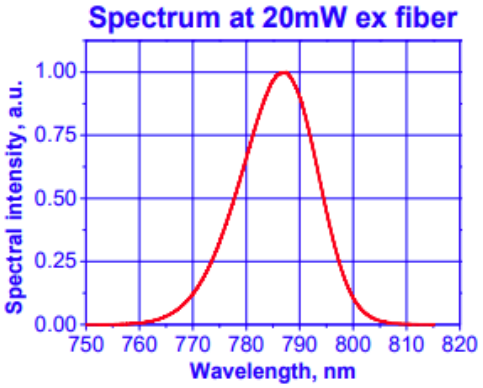




SUPERLUM	SLD-785G15P20. High power single mode fiber pigtailed SLD modules at 785 nm with bell-shaped spectrum

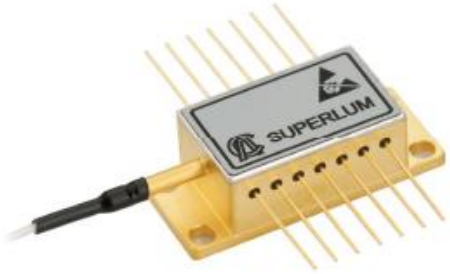
TYPICAL PERFORMANCE EXAMPLES





Features:

- 20-mW output power
- FC/APC connectors
- 15-nm bell-like optical spectrum
- Very small secondary coherence artifacts



Applications:

- Fiber-optic sensors
- OCT, Low coherence interferometry
- Optical measurements
- Others

Custom:

- Free space temperature controlled TOW packaged modules
- > 15-nm FWHM spectrum upon request

#1 VIRTUAL EXHIBITION FOR THE PHOTONICS INDUSTRY

PHOTONICS+ Virtual Exhibition and Conference, in partnership with EPIC, is a new, efficient networking event for the photonics industry that already takes place for the second time on **June 29th + 30th, 2021**

13:00 – 17:00 CEST timezone

Photonics+ – Virtual Exhibition and Conference (photonicsplus.com)

GET READY FOR THE SECOND PHOTONICS+

PHOTONICS+ Virtual Exhibition and Conference, in partnership with EPIC, is a unique & efficient networking event for the photonics industry due to already take place for the second time on **29 + 30 June 2021**. The innovative live, digital event brings stakeholders in the photonics industry together with relevant user areas. The organiser is **FLEET Events** – which also arranges the W3+ Fair high-tech trade fair. The company has developed the innovative digital event together with **EPIC – European Photonics Industry Consortium**, the largest association in the photonics sector.

AT A GLANCE - YOUR BENEFITS AT THE MOST EFFECTIVE DIGITAL EVENT FOR THE PHOTONICS INDUSTRY:

- Focus on complete photonics value chain Europe wide
- More than 120 exhibitors registered
- Top conference programme with more than 120 presentations
- 5 themed networking rooms for spontaneous contacts
- 20 high-class keynotes from application industry

NKT Photonics at the EPIC PHOTONICS + Virtual Exhibition & Conference

NKT virtual booth will be staffed by our skilled sales managers. They will happily and eagerly answer your laser-related questions.

On Wednesday, June 30, NKT VP of Sales, Sascha Häuser, will give a short talk at 2:30 PM CEST. Let Sascha inspire you on how innovators use our ultrafast laser solutions in life science and industrial applications.

TALK TO US AT PHOTONICS+ ON JUNE 29-30

The OSA Student Chapter at the University of Kent is back to business!

On Monday 7th of June, the OSA Student Chapter* members at the University of Kent had a meeting to restart the Chapter's activities, nearly two months after their successful online conference, OPSP2021, organised in collaboration with the Student Chapter at the University of Surrey. During the meeting, the members validated the election of this year's officers:

- Julien Camard: President
- Alejandro Martinez Jimenez (NETLAS member): Vice-President
- Rachel Sully: Treasurer
- Hal Dorrington: Secretary

The meeting was a good opportunity for brainstorming on ideas for forthcoming events, discussing both online and in-person options. The possibility of a joint event with NETLAS has also been discussed.

**OSA has a worldwide network of Student Chapters and participation in one of them is a great way to build technical and leadership skills while networking with peers and the greater OSA community. OSA and the OSA Foundation provide each chapter with a wide range of benefits, financial support and professional development opportunities.*

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.

July 14 2021 **Coming Soon! Photodetectors: Technology and Selection Criteria**

The second webinar in our light characterization series will include a review of different photodiode materials and types, how to operate them, and methods for processing their output signals.

Presented by Manfred Gonnert, Team Leader, Light Detection and Analysis

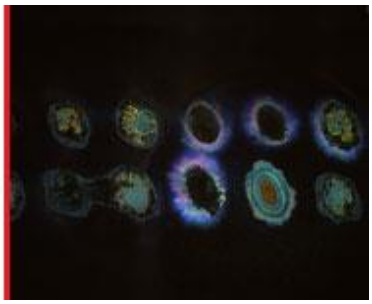
Click to Register!

July 21 2021 **Coming Soon! Understanding Laser-Induced Damage**

In this webinar, Michael Gartman will explain the importance and theory of Laser-Induced Damage Thresholds (LIDT), and how you can plan for it in your application.

Presented by Michael Gartman,
Optical Design Engineer,
Thorlabs Advanced Photonics

Click to Register!



Close-Up of Laser-Induced Damage on Optic

NETWORK EVENTS

We invite all partners to communicate events and ideas to place in our newsletter

Please send any piece of news, on NETLAS activities or anything else happening that may be of interest to the NETLAS community, to Ramona Cernat: R.Cernat@kent.ac.uk and to Adrian Podoleanu: ap11@kent.ac.uk