NETLAS NEWSLETTER 7-2021

This newsletter marks another success in terms of recruitment of this year, we welcome the 14th ESR, Haris, to NETLAS!

PhD6: Haris Ashraf

Host: **Technical University of Denmark** (DTU)
Secondments: **Superlum Diodes**

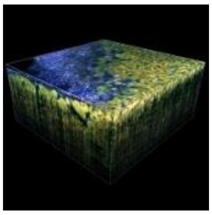
PhD Project: Ultra-narrow linewidth swept sources at 850 nm based on acousto-optical tunable filter (AOTF) technology

Objective of my project: The objective of my project is modelling of an emission linewidth broadening mechanism in a ring laser fibre cavity with an intra-cavity AOTF as a wavelength-selective element. In addition, this project also focuses on the development of linewidth narrowing to < 5pm FWHM by incorporating frequency-shift compensation techniques to an AOTF-assembly.

Short description of my previous education:

- BSc Electrical Engineering from Bahauddin Zakariya University, Pakistan
- Erasmus Mundus Masters in Photonic Integrated Circuits, Sensors, and Networks (PIXNET) from Aston University, UK (1-year); OSAKA University, Japan (3rd Semester), and Scoula Superiore Sant'Anna, Italy (4th Semester).

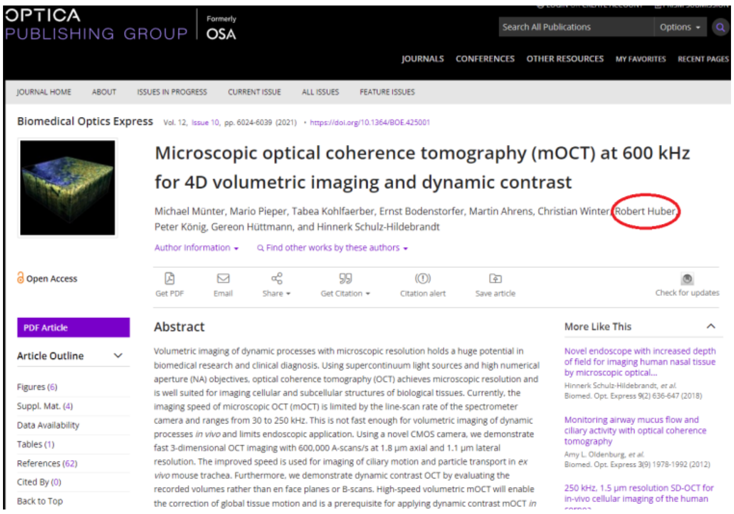
PUBLICATIONS



Microscopic optical coherence tomography (mOCT) at 600 kHz for 4D volumetric imaging and dynamic contrast

Michael Münter, Mario Pieper, Tabea Kohlfaerber, Ernst Bodenstorfer, Martin Ahrens, Christian Winter, **Robert Huber,** Peter König, Gereon Hüttmann, and Hinnerk Schulz-Hildebrandt

- Biomedical Optics Express Vol. 12, Issue 10, pp. 6024-6039 (2021) https://doi.org/10.1364/BOE.425001



A True Optoelectronic Spectrum Analyzer for Millimeter Waves With Hz Resolution

D. J. Fernandez Olvera, B. L. Krause and **S. Preu,**

IEEE Access, vol. 9, pp. 114339-114347, 2021,
DOI: 10.1109/ACCESS.2021.3105030

Journals & Magazines > IEEE Access > Volume: 9

A True Optoelectronic Spectrum Analyzer for Millimeter Waves With Hz Resolution

Publisher: IEEE

Cite This | PDF

Anuar De Jesus Fernandez Olvera ; Benedikt Leander Krause ; Sascha Preu   All Authors

Abstract:
We present an architecture for millimeter-wave spectrum analyzers with Hz resolution and precision based on heterodyne down-conversion using ErAs:InGaAs photoconductive mixers driven by a tunable ultra-narrow linewidth continuous-wave (CW) photonic local oscillator. Unlike previous optoelectronic or electronic architectures, there is no requirement for an external electronic spectrum analyzer or any frequency extenders, keeping the system less complex and less expensive. We demonstrate the architecture for a frequency range that surpasses the E-band range by 10 GHz, i.e. from 50 to 90 GHz, but it is easily extendable to frequencies beyond 300 GHz or to frequencies as low as 25 GHz. A minimum power of 300 fW at 72 GHz was detected when using a resolution bandwidth of 1 Hz.

Published in: IEEE Access (Volume: 9)

Page(s): 114339 - 114347

DOI: 10.1109/ACCESS.2021.3105030

Date of Publication: 16 August 2021

Publisher: IEEE

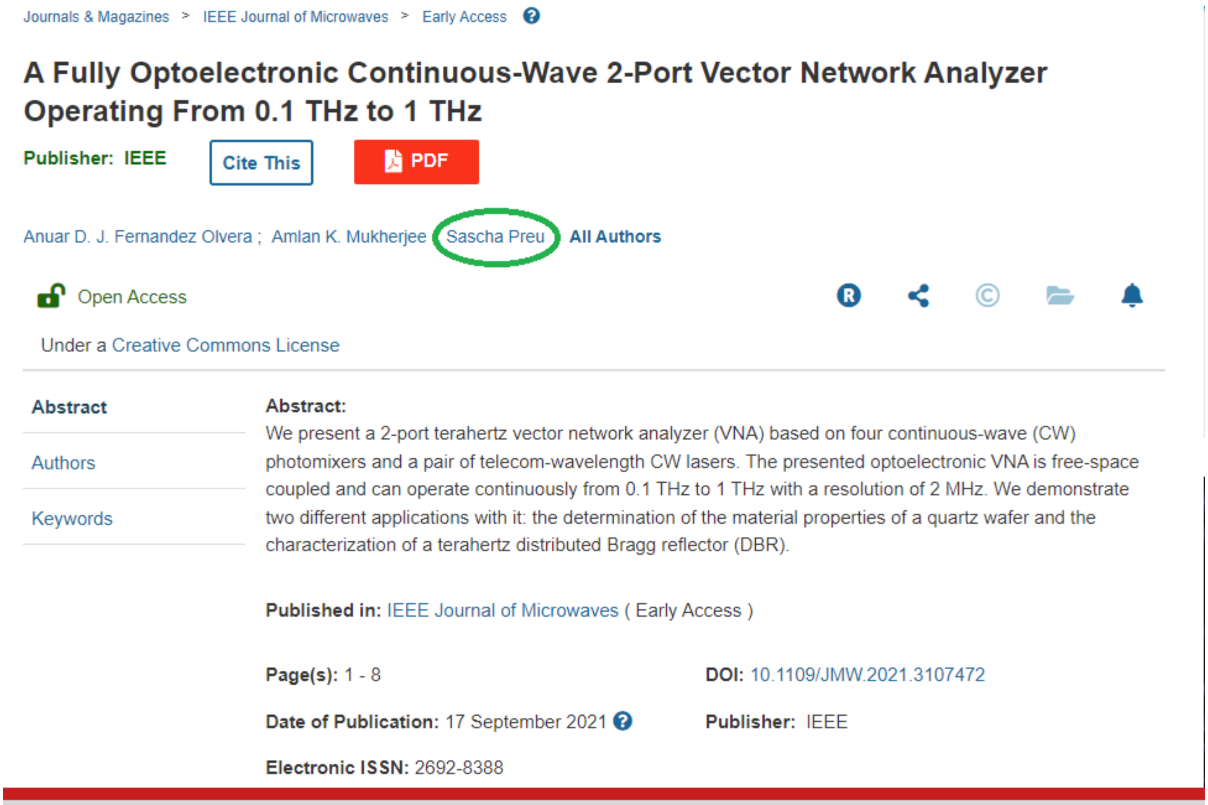
Electronic ISSN: 2169-3536

A Fully Optoelectronic Continuous-Wave 2-Port Vector Network Analyzer Operating From 0.1 THz to 1 THz

A.D. J. F. Olvera, A. K. Mukherjee and **S. Preu,**

Published in: IEEE Journal of Microwaves, **Electronic ISSN:** 2692-8388, **Date of Publication:** 17 September 2021

DOI: 10.1109/JMW.2021.3107472



Journals & Magazines > IEEE Journal of Microwaves > Early Access

A Fully Optoelectronic Continuous-Wave 2-Port Vector Network Analyzer Operating From 0.1 THz to 1 THz

Publisher: IEEE Cite This PDF

Anuar D. J. Fernandez Olvera ; Amlan K. Mukherjee ; Sascha Preu All Authors

Abstract

Authors

Keywords

Abstract:
We present a 2-port terahertz vector network analyzer (VNA) based on four continuous-wave (CW) photomixers and a pair of telecom-wavelength CW lasers. The presented optoelectronic VNA is free-space coupled and can operate continuously from 0.1 THz to 1 THz with a resolution of 2 MHz. We demonstrate two different applications with it: the determination of the material properties of a quartz wafer and the characterization of a terahertz distributed Bragg reflector (DBR).

Published in: IEEE Journal of Microwaves (Early Access)

Page(s): 1 - 8

DOI: 10.1109/JMW.2021.3107472

Date of Publication: 17 September 2021

Publisher: IEEE

Electronic ISSN: 2692-8388

VECSELs in the Wavelength Range 1.18–1.55 µm

Antti Rantamäki & Mircea Guina,

September 2021, DOI:10.1002/9783527807956.ch2

In book: Vertical External Cavity Surface Emitting Lasers (pp.27-62)

Chapter

VECSELs in the Wavelength Range 1.18−1.55 µm

September 2021
DOI:10.1002/9783527807956.ch2
In book: Vertical External Cavity Surface Emitting Lasers (pp.27-62)

Authors:

Antti Rantamäki

Mircea Guina
Tampere University

Abstract

This chapter provides an overview of vertical external-cavity surface-emitting lasers (VECSELs) with fundamental emission in the wavelength range of 1.18−1.55 µm. The main challenges related to the properties of the semiconductor materials used to address this wavelength range are discussed. In particular, we present the advantages and disadvantages of InP- and GaAs-based materials and review the developments reported based on various gain-mirror implementations with these material systems. The focus is then shifted to overcoming their limitations. To this end, the emphasis is on semiconductor-dielectric-metal mirrors, wafer bonding, and mirror-free VECSEL structures.

A quantitative analysis of electronic transport in n- and p-type modulation-doped GaAsBi/AlGaAs quantum well structures

Omer Donmez, Ayse Erol, Çağlar Çetinkaya, Erman Çokduygulular, Mustafa Aydın, Saffettin Yıldırım, Janne Puustinen, Joonas Hilska and **Mircea Guina**

Semiconductor Science and Technology, Accepted Manuscript 29 September 2021

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Semiconductor Science and Technology

PAPER

A quantitative analysis of electronic transport in n- and p-type modulation-doped GaAsBi/AlGaAs quantum well structures

Omer Donmez[4,1], Ayse Erol[1], Çağlar Çetinkaya[1], Erman Çokduygulular[2], Mustafa Aydın[1], Saffettin Yıldırım[1], Janne Puustinen[3], Joonas Hilska[3] and Mircea Guina[3]

Published 20 October 2021 • © 2021 IOP Publishing Ltd

Semiconductor Science and Technology, Volume 36, Number 11

Citation Omer Donmez *et al* 2021 *Semicond. Sci. Technol.* **36** 115017

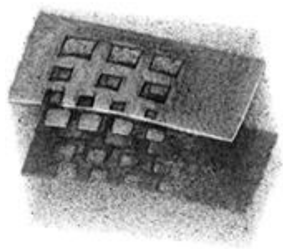
Article PDF

Figures   References

+ Article information

Abstract

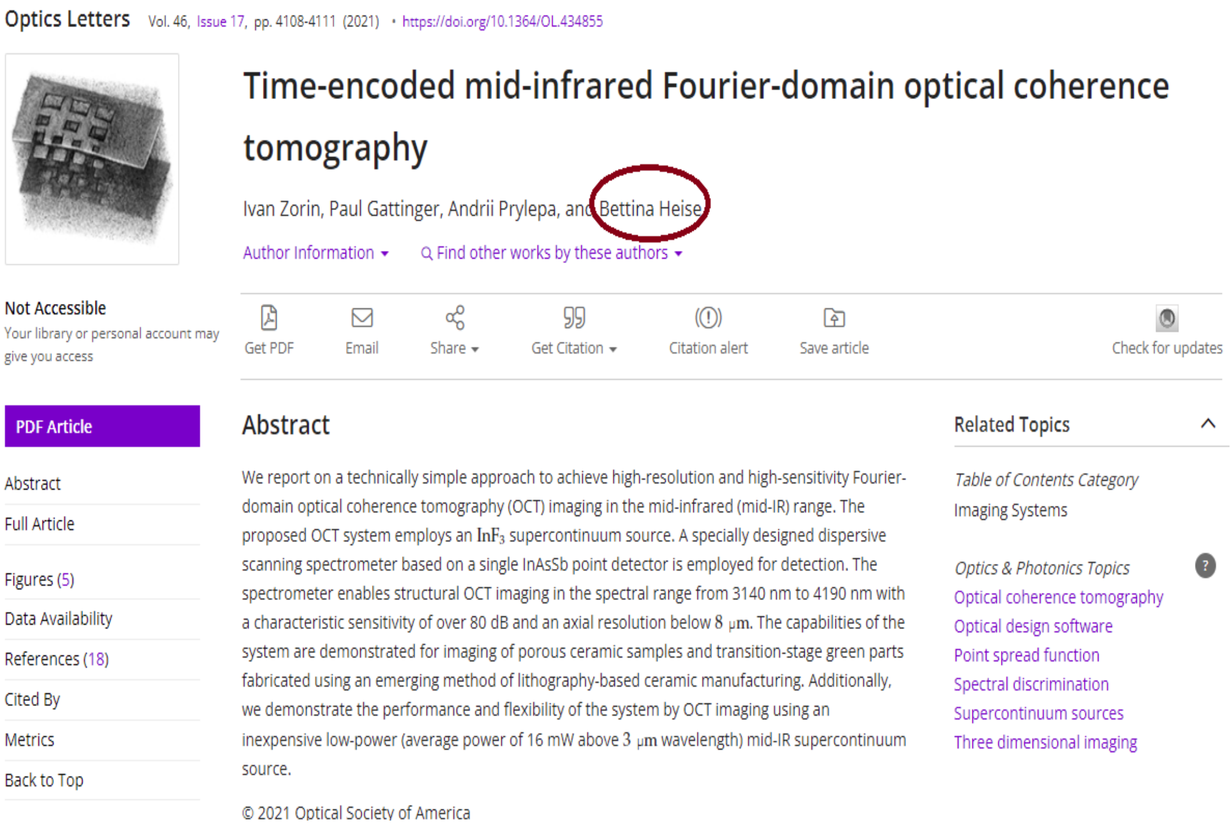
Electronic transport properties of as-grown and thermally annealed n- and p-type modulation-doped GaAsBi/AlGaAs quantum well (QW) structures were investigated. Hall mobility of as-grown, n- and p-type modulation doped QW structures are found from raw experimental data as ~1414 and 95 cm^2 Vs^{-1} at room temperature. A comparison between reported two-dimensional (2D) electron density determined from the analyses of Shubnikov de Haas oscillations and the 2D Hall electron density indicates a presence of parallel conduction in barrier layer (AlGaAs) and QW layer (GaAsBi) in n-type samples, therefore a parallel channel conduction theory is used to separate the electron mobility in the QW and the barrier layers in n-type modulation doped GaAsBi/AlGaAs QW structure. The extracted electron mobility of the as-grown n-type GaAsBi/AlGaAs QW sample is determined as ~5975 cm^2 Vs^{-1}



Time-encoded mid-infrared Fourier-domain optical coherence tomography

Ivan Zorin, Paul Gattinger, Andrii Prylepa, **and** **Bettina Heise,**

[Opt. Lett. 46, 4108-4111 (2021)](), DOI: 10.1364/OL.434855



Optics Letters Vol. 46, Issue 17, pp. 4108-4111 (2021) • https://doi.org/10.1364/OL.434855

Time-encoded mid-infrared Fourier-domain optical coherence tomography

Ivan Zorin, Paul Gattinger, Andrii Prylepa, and Bettina Heise

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Abstract

We report on a technically simple approach to achieve high-resolution and high-sensitivity Fourier-domain optical coherence tomography (OCT) imaging in the mid-infrared (mid-IR) range. The proposed OCT system employs an InF_3 supercontinuum source. A specially designed dispersive scanning spectrometer based on a single InAsSb point detector is employed for detection. The spectrometer enables structural OCT imaging in the spectral range from 3140 nm to 4190 nm with a characteristic sensitivity of over 80 dB and an axial resolution below 8 μm. The capabilities of the system are demonstrated for imaging of porous ceramic samples and transition-stage green parts fabricated using an emerging method of lithography-based ceramic manufacturing. Additionally, we demonstrate the performance and flexibility of the system by OCT imaging using an inexpensive low-power (average power of 16 mW above 3 μm wavelength) mid-IR supercontinuum source.

Related Topics

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Imaging Systems

Optics & Photonics Topics
Optical coherence tomography
Optical design software
Point spread function
Spectral discrimination
Supercontinuum sources
Three dimensional imaging

Ultra-coherent Fano laser based on a bound state in the continuum

Yu, Yi, Aurimas Sakanas, Aref Rasoulzadeh Zali, Elizaveta Semenova, **Kresten Yvind,** Jesper Mørk,

Nature Photonics **15,** 788 (2021)

https://doi.org/10.1038/s41566-021-00883-y

nature photonics

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Article | Published: 12 August 2021

Ultra-coherent Fano laser based on a bound state in the continuum

Yi Yu ✉, Aurimas Sakanas, Aref Rasoulzadeh Zali, Elizaveta Semenova, Kresten Yvind & Jesper Mørk ✉

Nature Photonics **15**, 758–764 (2021) | Cite this article

A Publisher Correction to this article was published on 26 August 2021

This article has been updated

Abstract

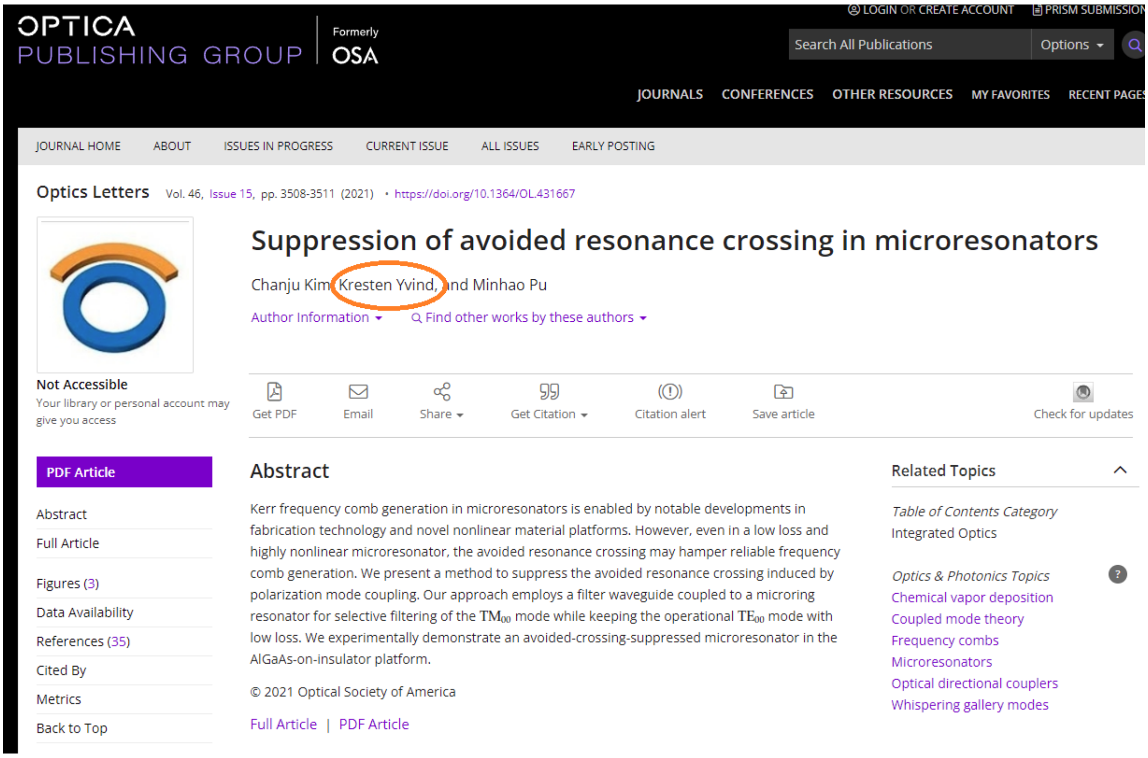
It is an important challenge to reduce the power consumption and size of lasers, but progress has been impeded by quantum noise overwhelming the coherent radiation at reduced power levels. Thus, despite considerable progress in microscale and nanoscale lasers, such as photonic crystal lasers, metallic lasers and plasmonic lasers, the coherence length remains very limited. Here we show that a bound state in the continuum based on Fano interference can effectively quench quantum fluctuations. Although fragile in nature,

Suppression of avoided resonance crossing in microresonators

Chanju Kim, **Kresten Yvind,** and Minhao Pu

Optics Letters, Vol. 46, Issue 15, pp. 3508-3511, (2021)

https://doi.org/10.1364/OL.431667



Optics Letters Vol. 46, Issue 15, pp. 3508-3511 (2021) • https://doi.org/10.1364/OL.431667

Suppression of avoided resonance crossing in microresonators

Chanju Kim, Kresten Yvind, and Minhao Pu
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Abstract

Kerr frequency comb generation in microresonators is enabled by notable developments in fabrication technology and novel nonlinear material platforms. However, even in a low loss and highly nonlinear microresonator, the avoided resonance crossing may hamper reliable frequency comb generation. We present a method to suppress the avoided resonance crossing induced by polarization mode coupling. Our approach employs a filter waveguide coupled to a microring resonator for selective filtering of the TM_{00} mode while keeping the operational TE_{00} mode with low loss. We experimentally demonstrate an avoided-crossing-suppressed microresonator in the AlGaAs-on-insulator platform.

Full Article | PDF Article

Related Topics

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Microresonators
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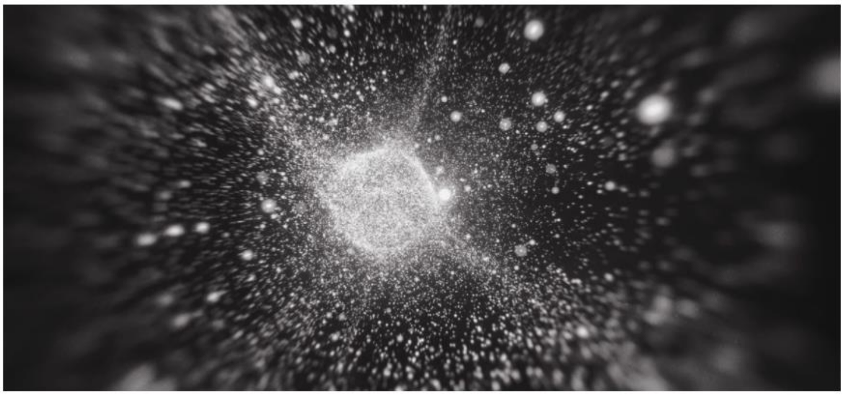


MACHINE LEARNING CAN REDUCE NOISE IN OPTICAL SYSTEMS

DTU Fotonik uses machine learning techniques to reduce optical noise.

Optical applications such as fiber-optic sensing systems, gravitational wave detection, optical space communication, and optical fiber communication need high-power, narrow-linewidth lasers.

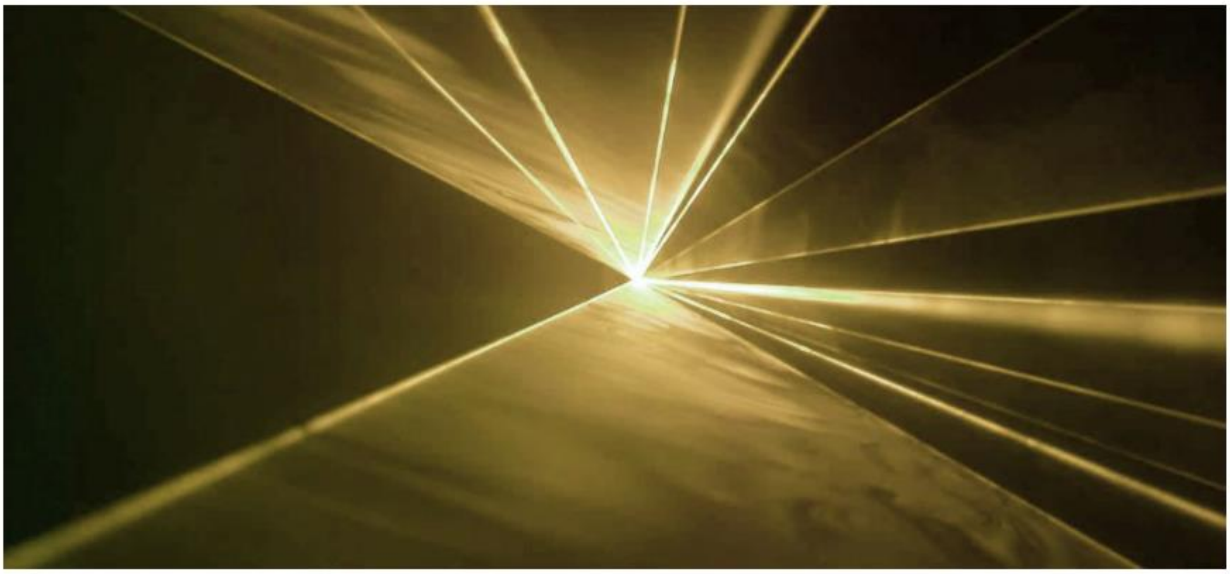
High power is obtained by amplifying the output power of a low-noise laser. However, the amplifiers induce fluctuations in the phase of the incoming optical signal, which causes spectral broadening and leads to poor system performance.

At DTU Fotonik, at the Technical University of Denmark, Darko Zibar and his group use machine learning techniques to significantly reduce noise in optical systems and develop a novel method to measure phase noise close to the quantum limit. They have described their work in "Approaching the optimum phase measurement in the presence of amplifier noise" in Optica.

For the experiment, the researchers chose a Koheras DFB fiber laser with narrow linewidth and ultra-low noise. And their new techniques are relevant in all applications where it is vital to maintain the low phase noise of the seed laser, such as quantum applications.

"At NKT Photonics, we look forward to working closely with Darko Zibar's group and incorporate their work into our lasers to deliver even better products," says CTO, Christian Vestergaard Poulsen.

Contact us now Read the paper on Optica's website.



LASERS FOR SQUEEZED LIGHT

Are you looking for a laser for squeezed light applications such as quantum computers, gravitational wave detection, quantum sensing, or quantum key distribution?

Then you probably know that ultra-low phase noise and high output power are critical factors for squeezed light applications.

May we suggest Koheras BASIK C15 or E15 lasers? You get a stable, narrow-linewidth fiber laser with intrinsically low phase noise.

Koheras BOOSTIK amplifier gives you high power while preserving the low noise.

Get more details

New offer on SUPERLUM's cBLMD-T-850

SUPERLUM’s light source for ultra-high resolution OCT

cBLMD-T-850

is offered for one-week shipment at a very competitive price. This product features 165 nm spectral width at 850 nm with coherence length less than 5 um in air.

cBLMD has USB and UART control interfaces.

As an option, an optical isolator can be integrated. Click here to send a request to our research team for more information. T&C may apply.

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.

November
3
2021

Coming Soon! How to Use Single Mode Fiber: Part 2

In Part 2 of our single mode fiber series, Dave Gardner will demonstrate best practices and techniques when using SM fiber. This includes how to use this fiber as a mode filter, how to maximize coupling efficiency, and how to launch high-power light.

Presented by Dave Gardner, Senior Process Engineer, Thorlabs Advanced Photonics

Click to Register!

Coupling Fiber with Triplet Fiber Optic Collimators

November 24 2021

Coming Soon! How to Capture the Perfect OCT Image

In this webinar, Sebastian Schäfer and Steve Jäger from Thorlabs' OCT Application Team return to demonstrate how to obtain the best image possible with an OCT system. They will also discuss additional hardware and settings to address any artifacts that may appear in your image.

Presented by Sebastian Schäfer and Steve Jäger, Thorlabs OCT Applications

Click to Register!

Capture Images with an OCT Imaging System

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.

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