GCLOP2023

ABSTRACT BOOK

Global Congress on
Lasers, Optics and Photonics

August 10-12, 2023 | London, UK

CONTACT US:

+91 8712881516

contact@avouchconferences.com

About Conference

Dear colleagues and friends,

On behalf of organizing and program committees, it is my pleasure to invite you all to join Global Congress on Laser, Optics and Photonics (GCLOP2023) which is going to be slated with the support of eminent personalities in the Research field during August 10-12, 2023 in London,UK.

Theme: "Unveiling the Recent Trends and Advancements of Laser, Optics and Photonics"

GCLOP2023 will provide a wonderful opportunity for academicians, researchers, scientists, engineers and pioneering students working in the fields of lasers, optics and photonics to exchange, share and discuss their unique ideas, new knowledge and cutting-edge science, unveiling recent trends and advancement for accelerating scientific discoveries in the area, offering the opportunity to all delegates for networking, also globalizing the research by installing a dialogue between industries and academics for launching new technologies and applications.

The conference will provide the ideal forum to stimulate ideas and establish collaborations as well as to initiate intense discussions to secure projects of the newest generations and to feature a highly interactive, stimulating and multidisciplinary program including workshops, plenary, keynote and invited sessions, and panel discussions.

We are sure that you will find the conference enlightening and inspiring. Come to share stimulating perspectives about the new frontiers in Laser, Optics and Photonics. We hope that, despite the intense scientific program, you will be able to get some glimpses of wonderful London, one of the most fascinating cities in the world.

You are welcome: enjoy the conference and the beauty of London!!!

Prof. Dieter Bimberg
Conference Chair (GCLOP2023)
"Bimberg Chinese-German Center for Green Photonics" at CIOMP of CAS, Changchun. Founding Director "Center of NanoPhotonics", TU Berlin, Germany.

Green Data Communication: Intelligent Physics and Engineering will contribute to a sustainable society

Dieter Bimberg
"Bimberg Chinese-German Center for Green Photonics" CIOMP, Chinese Academy of Sciences, Changchun, China and Center of Nanophotonics and Institute of Solid State Physics, TU Berlin, Germany

Abstract
Since 2014 novel consumer applications like Netflix, Block Chain, LIDAR… not known at that time have led to a huge increase of internet traffic of 60%/year, much more than then originally predicted by companies like Cisco. This increased use of the internet is increasing its electrical power consumption due to increased data traffic mostly inside data centers. New data centers have crossed the 500 MW level. 5G and 6G with their big jumps in data speed will be further enablers for new services, like LIDAR and more, we cannot think about yet, and will increase the energy consumption to an extent not further tolerable.

New research goals are followed presently, focusing on energy-efficiency of data traffic at all hierarchy levels. Inside data centers advanced design of active optical cables, their electronic driver and receiver circuits and the active photonic devices are suddenly in the focus, but now with the goal to minimize their combined power consumption. Vertical-cavity surface-emitting lasers (VCSELs) for 200+ Gbit/s single fiber data transmission across OM5 multimode fiber with a record heat to bit rate ratio (HBR) of only 240 fJ/bit x wavelength @ 50Gbit/s developed in our labs are presented [1]. Photon lifetime management is a new key to adopt the overall energy consumption to the bit rate of the data traffic (e.g. 25 Gb/s, 50 Gb/s,..) [2]

A completely novel design approach for VCSELs will be presented based on etching multiple holes, oxidizing one or several apertures from these holes and refilling them with metal, in order to increase heat conduction and cut-off frequency and reduce parasitic effects. Thermal roll-over is expected to appear at much larger currents compared to the present standard designs, allowing larger single mode output power and possibly dense wavelength multiplexing across distances of several hundred m to 1 km in data centers [3-4].

Finally work on high speed novel drivers based on advanced CMOS design is reported, leading to dramatically reduced energy consumption of VCSEL modules below 500 fJ/bit. A dc-coupled single-ended voltage-mode clock-less driver is demonstrated in 22-nm SOI CMOS eliminating the need for area- and energy-inefficient equalization techniques for data rates up to 60 Gb/s while maintaining error free (BER<1e-12) in our transmission experiments. The highly digitized driver architecture inherently features an impedance (voltage-level) calibration scheme to handle both driver and VCSEL-based process variations. At 60 Gb/s data rate, an energy efficiency of 420 fJ/b is achieved from a single 0.9 V supply which is to the authors knowledge a 3x improvement in terms of energy-efficiency compared to the optical TXs reported to date. The highly digital driver architecture enables the supply scalability down to 0.6 V.

Reference
[1] G. Larisch, R. Rosales, and D. Bimberg, "Energy-efficient VCSELs for 200+ Gb/s optical interconnects", IEEE J. Select. Topics in Quantum Electronics, 25, 1701105 (2019)
[2] G. Larisch, S. Tian, D. Bimberg, "Optimization of VCSEL photon lifetime for minimum energy consumption at varying bit rates", Optics Express 28, 18331 (2020)
[3] D. Bimberg et al., "Advanced Energy-Efficient VCSEL Designs for Large Data Rates", OFC Panel on "Advanced Laser Technologies in Post-100 Gbaud Era", San Francisco June 2021
[4] G. Larisch, Tian Sicong and D. Bimberg: "Multi-Aperture VCSEL and holes with metal as thermal sink", EP 20 192 355.4 + US 17/170,834 and "Multi-Section VCSEL", EP 20 210 737.1 + US 17/170,709

Discover Functional Photonic Structures via Machine Learning

Wenshan Cai*

School of Electrical and Computer Engineering, Georgia Institute of Technology
777 Atlantic Drive NW, Atlanta, GA 30332-0250, USA

ABSTRACT

Advanced neural networks and optimization algorithms have enabled a paradigm shift in the discovery and design of structured photonic materials and devices. In this talk we report a diverse set of inversely designed meta-optical structures, devices, and systems for wave-front control, imaging, computing, and nonlinearity. Flat optics, represented by metamaterials and metasurfaces, foresees a promising route to ultra-compact optical devices. Conventional designs of such meta-structures start with a certain structure as the prototype, followed by extensive parametric sweeps to accommodate the requirements of phase and amplitude of the emerging light. Regardless of how computation-consuming the process is, a predefined structure can hardly realize the independent control over polarization, frequency, and spatial channels, which hinders the potential of metasurfaces to be multifunctional. Besides, achieving complicated and multiple functions calls for designing meta-systems with multiple cascading layers of metasurfaces, which introduces exponential complexity. We have developed a series of deep-learning enabled generative frameworks for the inverse design of plasmonic structures in response to on-demand optical properties, with extended case studies and experimental demonstrations. Moreover, we further present a hybrid deep learning framework for designing multilayer meta-systems with multifunctional capabilities, as well as nonlinear metasurfaces for the generation of new spectral components and active control of light waves. The machine learning methods developed here is applicable to the inverse design of other photonic components and systems, including photonic crystals, chip-scale silicon devices, quantum-optical devices, and nonlinear optical materials. This design methodology is also significant to other disciplines of natural sciences, such as the design of nano materials, searching for new topological insulators, planning of chemical syntheses, prediction of protein structures, and many more.

Keywords

nanophotonics, metasurfaces, inverse design, neural networks, machine learning

Biography

Wenshan Cai is a full professor in the School of Electrical and Computer Engineering, with a joint appointment in Materials Science and Engineering. Prior to joining Georgia Tech in 2012, he was a postdoctoral fellow at Stanford University. Dr. Cai received his B.S. and M.S. from Tsinghua University in 2000 and 2002, respectively, and his Ph.D. from Purdue University in 2008. His research is focused on nanophotonic materials and devices, in which he has made major impacts on the evolving field of plasmonics and metamaterials. Dr. Cai has published ~100 journal articles, which in total have been cited over 20,000 times. He authored the book, Optical Metamaterials: Fundamentals and Applications, which is used as a textbook or a major reference around the world. Dr. Cai is the recipient of several distinctions, including the OSA/SPIE Joseph W. Goodman Book Writing Award and the Office of Naval Research Young Investigator Award. He is a Fellow of SPIE.

Towards Large-Scale and Integrated Functional Metasurfaces

Xingjie Ni*
Pennsylvania State University, USA.

Abstract
Metasurfaces, artificially engineered ultrathin sub wavelength nanostructures with unparalleled light controllability, have shown great potential to revolutionize conventional optics. However, making those devices usually rely on scanning-based techniques, such as electron beam lithography and focused ion beam milling, which have slow speed, high expense, and limited scalability. We developed a mass production-friendly workflow for fabricating large-scale meta-optical devices using deep-ultraviolet photolithography and a multi-exposure process. As a demonstration, we built a single-lens telescope based on a wafer-scale single-aperture metasurface lens. Another limitation of the current metasurfaces is that they require free-space light excitation, making it challenging to integrate them on-chip fully. To address this, we developed a hybrid architecture that synergizes sub wavelength metaphotonic structures with photonic integrated waveguide platforms. Such meta-waveguides achieve various functions in a completely integrated platform, such as steering and focusing guided waves into free space, projecting holograms with controlled phase and amplitude control, and generating laser emission carrying orbital angular momenta. Our study shows a viable route toward complete control of light across integrated photonics and free-space platforms and paves the way for creating multifunctional photonic integrated devices with agile access to free space.

Biography
Dr. Xingjie Ni is an Associate Professor of School of Electrical Engineering and Computer Science as well as Materials Research Institute at the Pennsylvania State University. He joined Penn State in 2015. Prior to that, he was a postdoctoral fellow in Professor Xiang Zhang's group at the University of California, Berkeley. He completed his Ph.D. degree in Electrical and Computer Engineering at Purdue University in 2012 under Professor Vladimir Shalaev's supervision. He received his BS degree in Engineering Physics in 2005 and his MS degree in Automation in 2007 from Tsinghua University.
Dr. Ni's research focus lies in nanophotonics, plasmonics, and metamaterials/metasurfaces. He has made signficate contributions to the development of the metasurface since its emergence. Dr. Ni has published over 40 peer-reviewed journal papers, including 2 Science, 1 Nature, and 3 Nature sister-journal (including Nature Photonics, Nature Nanotechnology, etc.) papers, which have about 8500 citations as of today.
Dr. Ni received the Charles H. Fetter Endowed Faculty Fellowship in 2015. He was selected as an inaugural Moore Inventor Fellow (only five fellows nationwide) in 2016. He also received NASA Early Career Faculty Award in 2017 (eight awards nationwide), Sony Faculty Innovation Award in 2018, and the 3M Non-Tenured Faculty Award in 2019. He received the National Science Foundation CAREER award in 2021.

Parametric Wavelength Conversion between Infrared and Terahertz wave

Shin'ichiro Hayashi* **and Norihiko Sekine**
National Institute of Information and Communications Technology, Tokyo, Japan

ABSTRACT
Terahertz wave region (frequency: 0.1 – 10 THz (corresponding wavelength: 3000 – 30 μm)) are important not only in basic sciences, such as spectroscopy, electron acceleration, plasma measurement, and radio astronomy, but also in numerous industrial applications, such as in broadband wireless communication, high precision radar, global environmental measurement, and non-destructive inspection, since they have higher directivity than microwaves and higher transmittances in atmosphere and in soft materials than mid-infrared. Therefore, in the terahertz region, high-brightness and tunable sources, high-sensitivity and wideband detectors that could be widely used in these studies and applications are required. In this presentation, we show the generation of high-brightness terahertz wave using parametric wavelength down-conversion from infrared to terahertz wave in a nonlinear $MgO:LiNbO_3$ crystal [1]. We also represent the measurement of terahertz wave using parametric wavelength up-conversion from terahertz wave to infrared in the same process. We speculate that the high-brightness generation and the coherent measurement of terahertz wave could be powerful tools not only for solving real world problems but also fundamental physics, such as real-time spectroscopic imaging, remote sensing, 3D-fabrication, and manipulation or alteration of atoms, molecules, chemical materials, proteins, cells, chemical reactions, and biological processes. We expect that these methods will open new fields.

Keywords
Terahertz wave, Wavelength conversion, Nonlinear Optics.

References:
[1] S. Hayashi, K. Nawata, T. Taira, J. Shikata, K. Kawase, and H. Minamide, Sci. Rep., 4, 5045 (2014).

Biography
Shin'ichiro Hayashi received the Ph.D. degree in physics from Meiji University, Japan, in 2004. From 2004, he was with RIKEN, Japan, as a Research Scientist. In 2016, he joined the National Institute of Information and Communications Technology, as a Senior Research Scientist. His research interests include terahertz wave generation and measurement using nonlinear optics and their applications.

Monolithic Integration of Silicon-on-Insulator & Silica-on-Silicon Waveguides via CMOS Compatible Fabrication

DeGui Sun

School of Physics, Changchun University of Science and Technology, 7089 Weixing Rd., Changchun, China

ABSTRACT

Aimed at the applications of the warming-up silicon-on-insulator (SOI) waveguide photonic integrated circuit (PIC) chips in fibre-optic telecommunications and computer data-communications, numerous research works with plethora achievements have been dedicated to lowering the chip-fibre coupling loss and the guided-mode transfer loss between two different waveguide structures in PIC chip. Thus, an advanced chip-fibre coupling scheme is intrinsically crucial to the research and development of PIC chips. In this work, on the SOI waveguide platform, we present a monolithic integration regime of the silicon core of SOI high-index waveguide and the silicon dioxide core of silica-on-silicon (SOS) waveguide through a CMOS compatible fabrication technique. Such an SOS-SOI integration regime can significantly reduce both the optical loss of mode-conversion between two different waveguide structures and the butt-coupling loss between SOI photonic single-waveguide chip and single-mode fibre. First, starting with the thermodynamic insights to the Deal-Grove model for defining the thermal oxidation, we modelled the Henry's law constant in the silicon oxidation process with the ensemble contributions of thermodynamic and chemical energies. This thermodynamic model clearly presents a significant point as that the oxidation temperature is the dominant approach to handling the oxidation efficiency. Then, we systematically simulated the temperature/time dependences of Henry's constant, and further both the oxidation rate and the oxide thickness. Then, according to the simulation results, on a thick silicon-film SOI platform we realize the low-loss butt-coupling between small-size mode SOI waveguide and large-size mode fibre with a monolithically integrated SOS-SOI-tapered structure fabricated by complementary etching and oxidation of silicon (CEOS). Consequently, the SOS waveguide has a silicon-rich silicon oxide (SiOx) core where the refractive index is efficiently controlled with an alternative etching/oxidation scheme. Consequently, an average chip-fibre butt-coupling (CFBC) loss of 1.3~1.7 dB/facet is experimentally observed. Both the CFBC scheme and the CEOS fabrication feature CMOS-compatible low-cost fabrication and substantial applications in the mass coupling/assembling process of SOI-wire based PIC chips irrespective of the mode-field/dimension discrepancies between PIC wire and fibre. Therefore, in this work, the SOS-SOI regime proved the advancement in reducing the CFBC loss, and the CEOS fabrication leads to monolithic integration, which is compatible with the CMOS technique of micro/nanoscale silicon PIC circuitry. So, such a SOS-SOI-taper regime is envisaged not only to significantly reduces the fibre-chip coupling loss, but also is conducive to both the mass packaging and applications in product industrialization.

Keywords

Silicon-on-Insulator Waveguide, Silica-on-Silicon Waveguide, Monolithic Integration, Etching-Oxidation of Silicon, Chip-Fibre Butt-Coupling.

References

1. K. Chrostowski and M. Hochberg, Silicon Photonics: Fueling the Next Information Revolution, Part-I, 1st ed.; Innis, D., Rubenstein, R., Eds.; Cambridge University Press: Cambridge, UK; 3-27 (2015).
2. R. Marchetti, C. Lacava, L. Carroll, K. Gradkowski, and P. Minzioni, Photon. Res. 18(8), 201-239 (2019).
3. T. Yu, D. G. Sun, Z. Chen, and T.C. Li, Appl. Opt. 59(36), 11253-11260 (2020).
4. D. Andriukaitis and R. Anilionis, Electron. Elec. Eng. 75(3), 23–26 (2007).
5. T. Yu and D. G. Sun, Phys. Chem. Chem. Phys. 23, 17354 (2021).
6. R. Pfeffer and M. Ohring, J. Appl. Phys., 52, 777-784 (1981).
7. S. Kostinski, R. Pandey, S. Gowtham, U. Pernisz and A. Kostinski, IEEE Electron. Dev. Lett., 2012, 33, 863-865 (2012).
8. H. Miyazaki, Phys. Chem. Glasses: Eur. J. Glass Sci. Technol. B 51(2), 136-137 (2010).
9. T. Feuchter and C. Thirstrup, IEEE Photonics Technol. Lett. 6, 1244–1247 (1994).

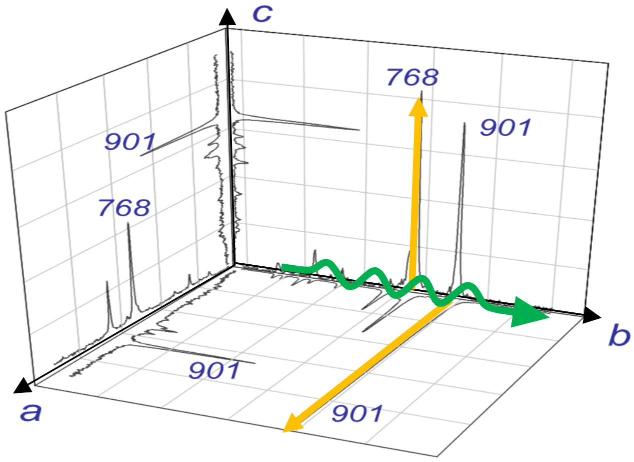
Biography

DeGui Sun is Full Professor in Optical Physics, Photonics, and Information Science at the School of Physics – Changchun University of Science and Technology since 2017. From 2003 to 2016 he was a chief scientist in the small Startup – D&T Photonics, which was spun from University of Ottawa (uOttawa), to carry out the development of silicon waveguide switching components. He received his Ph.D degree from the Chinese Academy of Sciences (CAS) at Changchun Institute of Optics and Fine Mechanics (CIOM) in 1993. Thin in 1994-1998, he was a postdoc fellow in University of Texas at Austin, USA. 1998-2001, he worked in Nu-Wave Photonics for developing the optic communication components; 2002-2003, he was Research Associate and worked in a Joint Project Group at Northwestern University, USA, where he was the team leader. In 2003-2006, he carried out his "100-Talent-Plan" Project of CAS at Changchun Institute of Optics, Fine Mechanics, and Physics (CIOMP), China. In 2007-2018, he was Research Scientist in Centre for Research in Photonics at uOttawa, Canada. In summary, he comprises science researchers and industrial product developer with different backgrounds from working in close collaboration to foster exploratory and seeding research in interdisciplinary areas. Since 2007, he published over 50 papers (excluding some publications using his Chinese name as author), held 5 patents (1 USA patent and 4 China patents). In 2019, he was awarded the outstanding foreign expert of Jilin Provincial Government. He now is member of Optical Society of America (OSA) and member of the IEEE society.

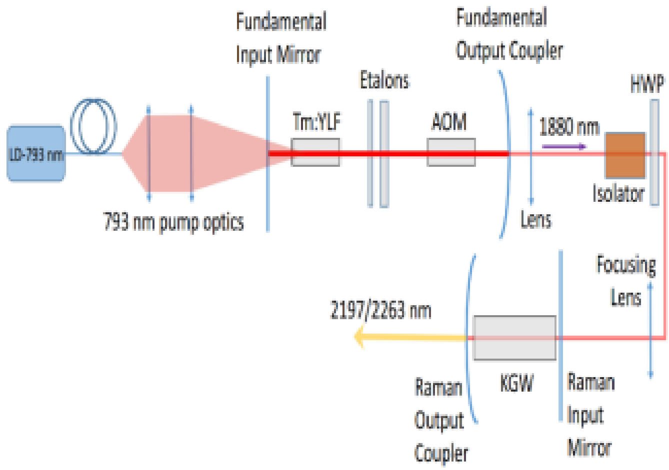
Enlarge KGW Crystal abilities towards the NIR Spectral Range in Raman Lasers.

Salman Noach
1) *Jerusalem College of Technology (JCT), Department of Electro optics, Jerusalem, 9372115 , Israel*

Graphical Abstract



1. KGW gain for tow Stokes shiftsalong crystal axis



2. Schematic design of KGW Raman laser for the NIR

Abstract
Near-infrared (NIR) coherent sources have drawn much attention, as is evident from the recent efforts to develop high power lasers that cover this spectral range, due to several potential applications, including LIDAR, biomedicine, polymer material processing, defense applications, and gas sensing (1). Solid-state Raman lasers are an efficient and useful way to get such high-brightness sources that extend the spectral span of existing lasers (2). Potassium gadolinium tungstate (KGd(WO4)2 or KGW) is one of the most popular Raman gain mediums owing to its good optical and thermal properties. Conveniently, the Raman gain decreases as the wavelength increase, hence KGW mainly use for Raman lasers at the visible spectral range. Moreover, because KGW is biaxial, it has Raman interaction with two different vibrational modes (901 cm-1 and 768 cm-1), yielding the option to obtain two different stokes wavelengths by controlling the polarization direction of the pump source.(3)

At this presentation, results that enlarge the ability of using the KGW up to 2343 nm will present, using different Tm based / KGW external-cavities configurations (4-6). Some of the designs achieved relatively high conversion efficiencies values of up to 40.5 %, and in other design achieved high energy per pulse up to 2mJ. To the best of our knowledge, we are the first to demonstrate Raman conversion in the NIR using KGW crystal and to achieve this level of results, in conversion efficacies and in energy per pulse.

Keywords
NIR Raman laser, Solid state laser, Tm:YLF laser ,Tm:YLF laser, KGW crystal

References

(1) A. Godard, "Infrared (2-12 µm) solid-state laser sources: a review," ComptesRendus Physique 8, 1100-1128 (2007)
(2) H. Pask, "The design and operation of solid-state Raman lasers," Progress in Quantum Electronics 27, 3-56 (2003)
(3) I.V. Mochalov, "Laser and nonlinear properties of the potassium gadolinium tungstate laser crystal KGd(WO4)2:Nd3+-(KGW:Nd)", Opt. Eng. 36, 1660–9 (1997)
(4) UzzielSheintop, Daniel Sebbag, Pavel Komm, Shaul Pearl, Gilad Marcus, and Salman Noach, "Two-wavelength Tm:YLF/KGW external-cavity Raman laser at 2197 nm and 2263 nm," Opt. Express 27(12), pp. 17112-17121 (2019)
(5) E Perez, U Sheintop, R Nahear, G Marcus, S Noach, "Efficient all-solid-state passively Q-switched SWIR Tm: YAP/KGW Raman laserμ", Optics Letters 45 (19), 5409-5412 (2020)

(6) RotemNahear, NeriaSuliman, Yechiel Bach, Salman Noach, "Electro optic actively Q switched Tm:YAP / KGW external-cavity Raman laser at 2273nm and 2344nm", Photonics, High-Power Lasers and Amplifiers (2021)

Biography

Prof. Salman Noach received his Ph.D. in 2002 from the Hebrew University in Jerusalem Israel. Due to 30 years of experience on a wide variety of topics in electro-optics, since he finished his first degree in Electro-optics at JCT,he brings both industrial and academic skills to his researches topics. In 2003, after few years in the industry, hejoin the physics faculty at JCT, since then he has been a faculty member of the Physics Department. In 2009, he founded the Solid State Lasers Laboratory at JCT. The lab is mainly engaged in applied research and development of CW and Pulsed solid-state lasers, Nonlinear optics, Raman wavelength shifting, and Optical amplifiers in the SWIR and the NIR spectral range. Over the years,Prof. Noach has participated and conducted Israel Innovation Authority projects, Israel Ministry of Science, and Ministry of Industrial affairs. The results of his research have been the subject of more than 35 peer review publications, presentation at the leading conferences in laser photonics, two patents, and have led to the establishment of a new start-up company, "Laser Team Medical",https://lasertm.com/.
Prof. Noach is a senior member of OPTICA (formerly the Optical Society of America) and a member of SPIE, the International Society for Optics and Photonics.
Google scholar: https://scholar.google.com/citations?user=DGwr0BEAAAAJ&hl=iw

Polaritonics: New Geometries and New Materials

Ivan A. Shelykh*

Science Institute, University of Iceland, Reykjavik, Iceland and Abrikosov Centerfor Theoretical Physics, Moscow, Russia

Abstract

Polaritons are hybrid light-matter quasiparticles forming in quantum microcavities in the regime of strong light-matter coupling. They possess a set ofremarkable properties, which make them a unique laboratory for study of quantumcollective phenomena at surprisingly high temperatures and perspectiveoptoelectronic applications, including polariton lasers and optical integrated circuits.

In the presentation, we will give an overview of recent developments in polaritonics, namely the physics of polariton lattices and polaritonics of 2D materials, such as transition metal dichalcogenides and ɥhromium halides.

Biography

Education: - 1993–1999 St. Petersburg State Technical University Physico-Mechanical Faculty, student. - 1999- Master degree. Thesis “Interference of the ballistic carriers in semiconductor quantum wires”, thesis supervisor Prof. V.K. Ivanov - 1999-2001 St. Petersburg State Technical University department of General Physics, Ph.D. student; specialisation: physics of condensed matter. - Ph.D. Thesis: "Coherent phenomena in semiconductor quantum wires", thesis supervisor Prof. V.K. Ivanov. Ph. D. obtained 17.10. 2001 in St. Petersburg State Polytechnical University, St. Petersburg, Russia Work experience: September 2001- November 2002 Teaching Assistant in St. Petersburg State Polytechnical University, St. Petersburg, Russia. November 2002- November 2005 Postdoc "Marie Curie" in Blaise Pascal University, Clermont-Ferrand, France November 2005- November 2006 Post. Doc. in the department of the Physics and Astronomy of the University of Southampton, United Kingdom November 2006- August 2008 Visiting professor in International Center for Condensed Matter Physics, Brasilia, Brazil. Head of the group “Quantum wells and 2DEG (Theory)” From June 2008 Professor in Physics Department, Faculty of Science and Engineering, University of Iceland, Reykjavik, Iceland. Head of “Center of excellence in polaritonics” February 2012- January 2017 Nanyang Associate Professor, Division of Physics and Applied Physics, Nanyang Technological University, Singapore From June 2016- Main researcher in ITMO University, St. Petersburg, Russia. Teaching: Science Institute, University of Iceland (2008-present) - Introduction to quantum mechanics - Quantum mechanics I - Quantum mechanics II - Nanophotonics - Electrodynamics II - Classical mechanics II - Nuclear and elementary particle physics

Towards 800G/1.6T Data Center Interconnects Based on Low Chirp Electro-Absorption Modulated Laser

Xin Chen*, Haibo Wang, Richard Cronin, Malcolm Pate, Eva Repiso, Thomas Tilbury, David Rogers, Chaoyi Wang, Pantelis Aivaliotis, Matteo Silva, Stephen Burlinson, Graham Berry, Shabir Mughal, Lu Zhang, Xuefeng Liu, and Bo Zhou

Huawei Technologies Research & Development Ltd., Ipswich Research Centre, Adastral Park, Ipswich, IP5 3RE, UK

ABSTRACT

Due to the increasing traffic on cloud-based services, the data traffic through the data centres continues to grow exponentially. To meet the fast growing demands, Ethernet standards have evolved to 400GbE and discussions are ongoing for 800GbE and 1.6TbE standardization. For the short reach interconnects within datacentres, intensity-modulation direct-detection (IM/DD) systems are highly attractive due to their simpler architecture and lower power consumption. One of the key components, Electro-absorption modulated laser (EML) consisting of distributed feedback laser (DFB) and electro-absorption modulator (EAM), is well suited for short-reach optical interconnect applications at 2-10km range, thanks to its smaller footprint, high bandwidth, high extinction ratio (ER) and low driving voltage which allow oDSP directly driven without driver.

In this study, a packaged low chirp high power EML suitable for 800G/1.6T was developed, it has demonstrated back-to-back (BTB) and 2km transmission of 200Gb/s (100Gbaud) PAM4 signals and clear PAM4 eye opening at semi-cool temperature of 52μC at CWDM wavelength range. We report the first demonstration of a packaged electroabsorption modulated laser is capable of transmission over 2km under 200Gb/s PAM4 operation condition at two CWDM wavelengths of 1271nm and 1331nm. The electroabsorption modulated laser showed over 4.5dB extinction ratio at 1.0Vpp in back-to-back and clear PAM4 eye diagrams after 2km transmission were observed. The TEDCQ is 2.28dB after 2km transmission at 1331nm, less than 1 dB worse than back-to-back. No penalty was observed for 1271nm, TEDCQ remains 1.3dB. BER measurement show less than 0.5 dB penalty after 2km transmission at 1331nm. Electroabsorption modulated laser with greater than 76GHz 3dB bandwidth and higher than 5.0dB extinction ratio at 1.0Vpp have also been developed recently.

Keywords

Electroabsorption modulated laser, Chirp, IMDD, Datacenter, Optical transmitter, Optical Interconnects

References

Xiang Zhou, Cedric F. Lam, Ryohei Urata, and Hong Liu, “State-of-the-Art 800G/1.6T Datacom Interconnects and Outlook for 3.2T”, Proc. OFC, W3D.1 2023.

[2] X. Chen, R. Cronin, H. Wang, M. Pate, P. Liao, K. Bian, J. Zhao, L. He, J. Liu , E. Repiso, D. Rogers, C. Wang, G. Berry, X. Liu, B. Zhou “A Low Chirp Electroabsorption Modulated Laser suitable for 200Gb/s PAM4 CWDM Transmission over 2km”, in Proc. ECOC, Th1E.4. 2022.

[3] S. Yamauchi, K. Adachi, H. Asakura, H. Takita, Y. Nakai, Y. Yamaguchi, M. Mitaki, R. Nakajima, S.Tanaka, and K. Naoe., “224-Gb/s PAM4 Uncooled Operation of Lumped-electrode EA-DFB Lasers with 2-km Transmission for 800GbE Application,” in Proc. OFC, Tu1D.1., 2021.

[4] H. Asakura, K. Nishimura, S. Yamauchi, K. Iwamoto, Y. Nakai, Y. Yamaguchi, K. Tani, R. Nakajima, and K. Naoe., “384-Gb/s/lane PAM8 Operation Using 76-GHz Bandwidth EA-DFB Laser at 50μC with 1.0-Vpp Swing over 2-km Transmission,” in Proc. OFC, Th4C.4. 2022.

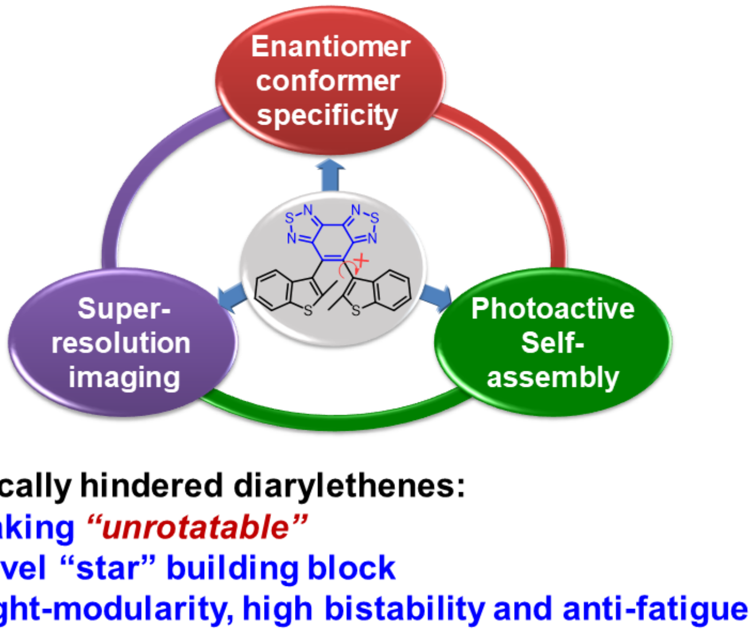
Biography

Dr. Xin Chen is a Principle Engineer at Ipswich Research Center, Huawei Technologies Research & Development Ltd., UK. He received Ph.D from Aalborg University, Denmark, and has worked at academia including York University, Manchester University, Cambridge University, and industry including Corning Research Center, CIP, and Huawei. He has published over 60 peer-reviewed papers and held over 20 patents. His recent work is focusing on high-speed semiconductor transmitters.

Sterically Hindered Diarylethenes with Benzobis(thiadizole) Bridge: Enantiospecific Transformation and Reversible Photo-Superstructures

Mengqi Li, Wei-Hong Zhu *
Laboratory for Advanced Materials and Joint International Research Laboratory of Precision Chemistry and Molecular Engineering, Feringa Nobel Prize Scientist Joint Research Center, Shanghai Key Laboratory of Functional Materials Chemistry, Institute of Fine Chemicals, Frontiers Science Center for Materiobiology and Dynamic Chemistry, School of Chemistry and Molecular Engineering, East China University of Science and Technology Shanghai 200237, China.

Abstract



Our group has recently developed a unique sterically hindered diarylethene system based on benzobis(thiadiazole) ethene bridge, which are allowing us to address the above issues. The use of sterically hindered diarylethenes, as developed in our group, provides the following advantages: (i) introducing a less aromatic benzobis(thiadiazole) unit as the central ethene bridge with high bistability, (ii) successfully separating multiple conformers of diarylethene with high photocyclization quantum yields and enantiospecific photoreaction, (iii) exhibiting conformer dependent and enantiospecific transformations of supramolecular metallacycles, (iv) enabling digital photo-programming of liquid crystal superstructures with intrinsic chirality, and (v) exhibiting dual AIE behavior fluorescent photoswitches.
We believe that our unique sterically hindered diarylethene system acts as a unique photochromic or photoresponsive building block with intrinsic chirality, excellent bistability, high photocyclization quantum yields and enantiospecific transformation. As such, it is expected to act as a key building block for those developing applications in such diverse areas as non-destructive information encoding, self-assembly, and liquid crystal modulation.

References

(1) Xi, H. C.; Zhang, Z. P.; Zhang, W. W.; Li, M. Q.; Lian, C.; Luo, Q. F.; Tian, H.;Zhu, W.-H.* All-visible-light activated dithienylethenes induced by intramolecular proton transfer, J. Am. Chem. Soc., 2019, 141, 18467–18474.
(2) Cai, Y. S.; Guo, Z. Q.; Chen, J. M.; Li, W. L.; Zhong, L. B.; Gao, Y.; Jiang, L.; Chi, L. F.*, Tian, H., Zhu, W.-H.*

Enabling light work in helical self-assembly for dynamic amplification of chirality with photoreversibility, J. Am. Chem. Soc., 2016, 138, 2219−2224.
(3) Chen, S. J.; Chen, L. J.; Yang, H. B.*; Tian, H.; Zhu, W.-H.* Light-triggered reversible supramolecular transformations of multi-bisthienylethene hexagons, J. Am. Chem. Soc., 2012, 134, 13596−13599.
(4) Wu,Y.; Xie, Y. S.; Zhang, Q.; Tian, H.; Zhu, W.-H.*; Li, A. D. Q.*, Quantitative photoswitching in bis(dithiazole)ethene enables light-modulation for encoding optical signals, Angew. Chem. Int. Ed., 2014, 53, 2090−2094.
(5) Zhu, W.-H.*; Yang, Y.; Métivier, R.; Zhang, Q.; Guillot, R.; Xie, Y.; Tian, H.; Nakatani, K*. Unprecedented stability of a photochromic bisthienylethene based on benzobisthiadiazole as an ethene bridge. Angew. Chem. Int. Ed.2011, 50, 10986µ10990.
(6) Li, W.; Jiao, C.; Li, X.; Xie, Y.; Nakatani, K.; Tian, H.; Zhu, W.-H.* Separation of photoactive conformers based on hindered diarylethenes: Efficient modulation in photocyclization quantum yields. Angew. Chem. Int. Ed.2014, 53, 4603µ4607.
(7) Li, W.; Li, X.; Xie, Y.; Wu, Y.; Li, M.; Wu, X. Y.; Zhu, W.-H.*; Tian, H. Enantiospecific photoresponse of sterically hindered diarylethenes for chiroptical switches and photomemories. Sci. Rep.2015, 5, 9186µ9192.
(8) Li, M.; Chen, L.-J.; Cai, Y.; Luo, Q.; Li, W.; Yang, H.-B.*; Tian, H.; Zhu, W.-H.* Light-driven chiral switching of supramolecular metallacycles with photoreversibility. Chem2019, 5, 634µ648.
(9) Li, M.; Chen, L. J.; Zhang, Z.; Luo, Q.; Yang, H.-B.*; Tian, H.; Zhu, W.-H.* Conformer-dependent self-assembled metallacycles with photo-reversible response. Chem. Sci.2019, 10, 4896µ4904.
(10) Zheng, Z.; Hu, H.; Zhang, Z.; Liu, B.; Li, M.; Qu, D.-H.; Tian, H.; Zhu, W.-H.*; Feringa, B. L.* Digital photoprogramming of liquid-crystal superstructures featuring intrinsic chiral photoswitches. Nat. Photon.2022, 16, 226µ234.
(11) Hu, H.; Liu, B.; Li, M.; Zheng, Z.*; Zhu, W.-H. * A quadri-dimensional manipulable laser with an intrinsic chiral photoswitch. Adv. Mater.2022, 34, 2110170.
(12) Liu, S. J.; Liu, X.; Wu, Y. Z.*; Zhang, D. W.; Wu, Y.; Tian, H.; Zheng, Z. G.*, Zhu, W.-H. *, Circularly polarized perovskite luminescence with dissymmetry factor up to 1.9 by soft helix bilayer device.Matter, 2022, accepted.
(13) Yang, H.; Li, M.; Li, C.; Luo, Q.; Zhu, M. Q.; Tian, H.; Zhu, W.-H.* Unraveling dual aggregation-induced emission behavior in steric-hindrance photochromic system for super resolution imaging. Angew. Chem. Int. Ed.2020, 59, 8560µ8570.

Biography

Prof. Wei-Hong Zhu received his Bachelor degree of Chemistry in 1992 from Nanjing Normal University, Master degree of Organic Chemistry in 1995 from Nankai University, PhD degree of Applied Chemistry in 1999 from East China University of Science & Technology (ECUST), China. He worked in AIST Central 5, Tsukuba (Postdoctoral, 2001.10-2003.4) and in Tsukuba University (visiting professor, 2004.7-2005.3), Japan. He became a full professor in 2004, and has published more than 320 SCI papers in international journals with H-index of 76, such as Nature, Nature Photonics, J. Am. Chem. Soc., Angew. Chem. Int. Ed., Chem, Adv. Mater., Nature Commum., Energy Environ. Sci., National Science Review, Sci. China. Chem., CCS Chem., AIChE J., and IECR. He has received several awards, such as NSFC for Distinguished Young Scholars (2013), and Cheung Kong Distinguished Professor by the Education Ministry of China (2015). His current research interests are focused on functional chromophores, including fluorescent sensors, photochromism, and metal free solar cell sensitizers.

Ultra-Broadband Wavelength-Swept Crystalline Fiber Lasers

Sheng-Lung Huang[1,*], Yu-Chan Lin[1], Teng-I Yang[1], and Ping-Hui S. Yeh[2]
1Graduate Institute of Photonics and Optoelectronics, National Taiwan University, Taiwan
2Department of Electronic and Computer Engineering, National Taiwan University of Science and Technology, Taiwan

ABSTRACT
Broadly tunable lasers are useful for basic spectroscopy studies and various applications, from optical communications to biomedical imaging. Transition-metal-ions doped solid-state gain media are eminently suitable for generating ultra-broadband emissions. Glass-clad Ti^{3+}:sapphire and Cr^{4+}:YAG crystal fibers have shown superior performance for broadly tunable lasers in the visible and near-infrared wavelength ranges.[1] The tunable Ti^{3+}:sapphire crystal fiber lasers are efficient and have demonstrated the lowest threshold over a 200-nm tuning range. The Cr^{4+}:YAG crystal fiber laser shows a tuning range of 170 nm, limited by the excited state absorption. Concurrently, wavelength-swept lasers (WSLs) are now widely used for optical coherence tomography (OCT) for fast and non-invasive biomedical imaging. Using Ti^{3+}:sapphire bulk crystal demonstrated an axial resolution of 10 μm.[2] The low axial resolution is because the gain response time of bulk Ti^{3+}:sapphire cannot keep up with the sweeping wavelength for broadband emission. Though higher doping concentrations can raise the gain of bulk Ti^{3+}:sapphire, heat dissipation becomes a challenge with high doping concentrations. Ti^{3+}:sapphire single-crystalline fiber grown by the laser-heated pedestal growth method significantly improves thermal dissipation and pump interaction length.[3] Furthermore, a Ti^{3+}:sapphire crystal fiber waveguide with a propagation loss of 0.045 dB/cm was achieved to allow a low doping concentration.
In this talk, a wavelength-swept Ti^{3+}:sapphire laser with a 250-nm tuning range at a tuning speed of 1200 Hz will be described.[4,5] The sweeping laser dynamics are analyzed in detail. When used in an OCT system, the point spread function of the WSL is estimated to be as low as 1.8 μm, which could offer physicians and clinicians a cellular view of the lesion for facilitating early disease diagnosis.

Keywords
Wavelength-swept lasers, optical coherence tomography, crystalline fiber.

References
1. S. L. Huang, "Crystalline Fibers for Fiber Lasers and Amplifiers," In: G. D. Peng (eds) Handbook of Optical Fibers, Springer, Singapore, 2019. (ISBN 978-981-10-7087-7)
2. M. Wojtkowski, V. J. Srinivasan, T. H. Ko, J. G. Fujimoto, A. Kowalevicz, and J. S. Duker, "Ultrahigh-Resolution, High-Speed, Fourier Domain Optical Coherence Tomography and Methods for Dispersion Compensation," Opt. Express **12**, 11, pp. 2404–2422, 2004.
3. S. C. Wang, C. Y. Hsu, T. T. Yang, D. Y. Jheng, T. I. Yang, T. S. Ho, and S. L. Huang, "Laser-diode Pumped Glass-Clad Ti:sapphire Crystal Fiber Laser," Opt. Lett. **41**, 14, pp. 3217–3220, 2016.
4. Y. C. Lin, T. I Yang, and S. L. Huang, "Ultra-Broadband Wavelength-Swept Ti:sapphire Crystal Fiber Laser," Opt. Lett. **47**, 11, pp. 2778–2781, 2022.
5. T. T. Yang, T. I Yang, R. Soundararajan, P. S. Yeh, C. Y. Kuo, S. L. Huang, and S. Donati, "Widely Tunable, 25-mW Power, Ti:sapphire Crystal-Fiber Laser," IEEE Photon. Technol. Lett. **31**, 24, pp. 1921–1924, 2019.

Biography
Professor Sheng-Lung Huang received the B.S. degree from National Taiwan University, Taipei, Taiwan, in 1986 and the M.S. and Ph.D. degrees from the University of Maryland, College Park, GA, USA, in 1990 and 1993, respectively. He joined the Graduate Institute of Photonics and Optoelectronics (GIPO) and Department of Electrical Engineering, National Taiwan University, in 2006 and became a Distinguished Professor in 2021. He served as the Chairman/Director of GIPO from August 2007 to July 2010. He was also a guest professor at the Abbe School of Photonics, Friedrich-Schiller University of Jena, Germany, in 2014.

Professor Huang is a Fellow of the OPTICA (formerly OSA) and is presently a Distinguished Lecturer of the IEEE Photonics Society (2022/2023). He was a steering board member of the European Master of Science in Photonics (EMSP) and has organized several international conferences and workshops, including OECC 2011 and BioPhotonics 2013. He served as Chairman of IEEE/LEOS (now IEEE/PS) Taipei Chapter (2005/2006), as an Associate Editor of the IEEE Photonics Journal (2016-2021), and was a Topical Editor of the Optics Letters (2005–2011).

Unlocking the Full Potential of Telecom Fiber Networks with Distributed Fiber Optic Sensing

Yangmin Ding[1], Yue Tian[1], Sarper Ozharar[1], Zhuocheng Jiang[1], Ming-Fang Huang[1], Ting Wang[1]

NEC Labs America, Inc., 4 Independence Way, Suite 200, Princeton, New Jersey, 08540, USA

Abstract

This presentation explores the multi-faceted applications of Distributed Fiber Optic Sensing (DFOS) in outdoor-grade telecom fiber networks, transforming standard cables into advanced sensing platforms. Through analysis of backscattered light, DFOS measures variables like temperature, strain, and vibrations, thus leveraging the fiber network for diverse applications.

The talk will cover several use cases including but not limited to traffic monitoring and rain detection. DFOS's ability to detect real-time, nuanced changes in underground and aerial cables empowers both improved traffic management and localized weather surveillance, respectively.

While environmental challenges, long-distance signal transmission, and potential interference pose hurdles to DFOS deployment, the potential for comprehensive, real-time data collection in areas such as infrastructure monitoring, environmental surveillance, and beyond is transformative. This discussion will navigate these challenges and opportunities, highlighting how DFOS can revolutionize outdoor telecom fiber networks, leading to more efficient, interconnected systems.

Keywords

Telecom Fiber Networks, Distributed Fiber Optic Sensing, Traffic Monitoring, Rain Detection, Machine Learning

Draw-Tower Fiber-Optic Grating Array and its Applications

Minghong Yang, Cheng Cheng

National Engineering Research Center for Fiber Optic Sensing Technology and Networks (NERC-FOST), Wuhan University of Technology, Wuhan, China

ABSTRACT

A draw-tower fiber Bragg grating platform is proposed and technically realized at the National Engineering Research Center for Fiber Optic Sensing Technology and Networks (NERC-FOST), Wuhan University of Technology. This system is capable of writing thousands of fiber Bragg gratings during the fiber drawing production. This talk will review the technical congress of this draw-tower fiber-optic grating system with some typical industrial applications.

Keywords

Fiber Bragg grating; draw-tower; industrial applications.

Biography

Minghong Yang received PhD in physical electronics from Huazhong University of Science and Technology in 2003. he was with the Fraunhofer Institute for Applied Optics and Precision Mechanics in Jena, Germany as post-doctoral visiting scholar, after that he worked in the Berlin University of Technology, Germany as research fellow. Since 2009, he has been a research faculty member in the National Engineering Laboratory for Optical Fiber Sensing Technology, Wuhan University of Technology, China. Minghong Yang is a Fellow of IET, a senior member of IEEE, TPC member of the international conferences of optical fiber sensors. He is serving as associate editor for IEEE Sensors Journal. His research interests include optical fiber sensors, thin film sensors.

Thermally Evaporated High Quality Thin Films to Achieve Amplified Spontaneous Emission in All $CsPb(Br_{1-x}Y_x)_3$ (Y = I, Cl) Perovskites

Saif M. H. Qaid[1,2,*] , **Hamid M. Ghaithan**[1,*], **Huda S. Bawazir**[1,2], and **Abdullah S. Aldwayyan**[1,2,3,*]

1 Department of Physics & Astronomy, College of Sciences, King Saud University, P.O. Box 2455, Riyadh 11451, Saudi Arabia
2 K. A. CARE Energy Research and Innovation Center, King Saud University, Riyadh 11451, Saudi Arabia
3 King Abdullah Institute for Nanotechnology, King Saud University, Riyadh 11451, Saudi Arabia

ABSTRACT
As a wavelength-tunable lasing material, perovskites are now generating a lot of scientific attention. Conventional solution-processed $CsPbX_3$ perovskite films sometimes suffer unavoidable pinhole defects and poor surface morphology, severely limiting their performance on amplified spontaneous emission (ASE) and lasing application. Herein, a thermal evaporation approach is explored in our work to achieve a uniform and high-coverage $CsPb(Br_{1-x}Y_x)_3$ (Y = I, Cl) perovskites polycrystalline thin film. The ASE of these films was studied using a picosecond laser system. The ASE profile increases rapidly over the narrow peak in relation to the laser pump intensity, confirming the development of stimulated emission. ASE began when the energy density threshold was reached and ranged between 25 and 170 μJ/cm^2 per pulse for perovskite materials when replacing I with Br and then Cl. This work emphasizes the notable optical properties of high-quality perovskite thin films, leading to possible accessible uses in optoelectronic applications.

Keywords
Perovskite; Inorganic perovskite; thin films; optical properties; ASE profile.

References
[1] Ghaithan, H. M., Qaid, S. M., AlHarbi, K. K., Bin Ajaj, A. F., Al-Asbahi, B. A., & Aldwayyan, A. S. (2022). Langmuir, 2022, 38(28), 8607-8613.µ

Biography
Saif M. H. Qaid: Associate professor at Dept. of Physics and Astronomy, College of Science, King Saud University. I got my BSc degree in Physical Science from Damascus University, Syria, (2004) and a MSc in Laser Physics from King Saud University, KSA, (2010) and a PhD in Laser Physics - Photonics from King Saud University, KSA, (2017).

Research interests:
Synthesis, characterization and analysis of perovskite-type of material for photonics applications like LEDs, OLEDs, Lasers, PV, and Detectors etc.
Investigation of photophysical & optoelectronic properties of thin films and photonics.
Nanostructured Materials and possible applications in Photovoltaics and Optoelectronics.
Synthesis and characterization of Dye Sensitized Solar Cells.
Dynamic Measurements study (EIS, IMPS and IMVS).
Photoinduced Kinetic Studies (Transient Absorption and Time-resolved Emission).
New laser materials.

Low Dimension Bi_2O_2Se based Photodetector

Dr.Chen Chao,

School of Optoelectronic Science and Engineering, China.

Abstract

The unique electronic, optical, and mechanical characteristics of 2D materials make them play significant roles in the field of electronics and optoelectronics. And for the various band gaps corresponding with widely wave length, new 2D materials are being explored in roles in the field of photodetection. The extraordinary electronic, optical, and mechanical characteristics of 2D materials make them promising candidates for optoelectronics, specifically in infrared (IR) detectors owing to their flexible composition and tunable optoelectronic properties. Due to the high carrier mobility, the large current on/off ratio (> 106), moderate energy bandgap(≈0.8eV), and high air-stability of 2D bismuth oxyselenide (Bi2O2Se)μBi2O2Se nanosheets have received increasing attention in Visible-NIR detection.

Here, high-quality 1D nanobelt and 2D nanosheet were synthesized by chemical vapor deposition (CVD) method, as well as the preparing condition and synthetic method were investigated. To study the photoelectric properties of the Bi2O2Se nanobelt and nanosheets, the photodetectors based on 1D Bi2O2Se nanobelt and 2D Bi2O2Se nanosheet were fabricated. The values of the responsivity(R), response time(μ), and specific detectivity (D*) were obtained, which shown great potentiality on the application of Visible-NIR detection and imaging.

Biography

Dr. Chen Chao received his bachelor degree of electronic information engineering and master degree of optical engineering degree in 2004 and 2008 respectively in Electronic Science and Technology of China (UESTC). He completed his doctorate in optical engineering with the Computer Aided Design (CAD) on microbolometer at UESTC in 2015. Druing the past ten years, Dr Chen has been engaged in infrared detector and CAD technology on MEMS device. After his analytical study of uvcooled infrared focal plane arrays, he conducted his research on low dimension and topological insulator materials photodetectors..

Advances of Laser and Fiber Optic Sensors for Industrial Applications

Tongyu Liu*
Shandong Micro-sensor Photonics Ltd, China

Abstract
Fiber optic sensors have been increasing deployed in broad industrial applications due to their advantages such as high accuracy, high reliability, immune to EM interference, distributed sensing and large multiplexing capability. This paper reports recent advances of Quantum Cascaded Laser (QCL)-based CO gas sensors, and non-cooling of laser methane gas senors for large temperature changes. Typical applications in coal mine safety and gas industries are discussed.

Keywords
laser methane sensors, QCL CO sensor, coal mine, safety

Biography
Director of Fiber Optic Sensors Key Lab of Shandong Province, founder and CEO of Shandong Micro-sensor Photonics Ltd, China. Obtained BSc degree in 1983 at Dept EE of Shandong University, China, and PhD degree of Material Engineering at Brunel University, UK in 1999. He has been working on R&D of optical fibre sensors since 1990. Current research interests focus on laser gas sensors and fibre optic sensors for industrial and safety applications. Author and co-author of 180 research papers, 3 book chapters and 60 patents. Delivered 20 invited talks on the topic of OFS research and commercialization.

Investigating Optical Properties of Gold Nearly Percolated Thin Films

Elizabeth Hedl[1,3], Vesna Blažek-Bregović[1], Iva Šrut-Rakić[2], Alexander Bergmann[3], Jordi Sancho-Parramon[1,*]
1Ruđer Bošković Institute, Bijenička cesta 54, Zagreb 10000, Croatia
2Institute of Physics, Bijenička cesta 46, Zagreb 10000, Croatia
3Graz University of Technology, Inffeldgasse 33/I, Graz 8010, Austria

ABSTRACT
To investigate the evolution of the optical response in the low frequency side regime of annealed gold (Au) films, a study is performed on gold thin films. Thin films were deposited at room temperature by electron beam evaporation and annealing was conducted on continuous (continuous films just above percolation and continuous films well above percolation) and granular thin films with temperature that induces solid-state dewetting of percolated or continuous films.

Optical characterization is carried out using transmittance and spectroscopic ellipsometry. The measurements showed that optical response of annealed nearly percolated gold films widely varies with the annealing temperature. The properties near or at percolation threshold are influenced by several factors, such as film thickness, particle size distribution and degree of percolation. Furthermore, two different mechanisms of the effect of annealing temperature on the optical and morphological properties of films were studied. Hole formation is easier in thinner films and the holes tend to be closer together. This affects the quality of the film and the homogeneity of annealing at different temperatures.

These results evidence that the optical response of films just above percolation can be broadly tuned in a simple manner, making these samples attractive candidates for temperature detection applications.

Keywords
Au thin films, percolation, electron beam evaporation, spectroscopic ellipsometry

References
[1] H. Sun, M. Yu, X. Sun, G. Wang, J. Lian, Effective temperature sensing by irreversible morphology evolution of ultrathin gold island films, The Journal of Physical Chemistry
C 117 (7) (2013) 3366–3373
[2] C. V. Thompson, Solid-state dewetting of thin films, Annual Review of Materials Re-
search 42 (2012) 399–434

Biography
My name is Elizabeth Hedl and I am an university lecturer and science assistant. I specialize in optics and optical thin films, and field of study from fundamentals of electrical engineering. I graduated from the Bjelovar University of Applied Sciences, Zagreb University of Applied Sciences and are currently enrolled as PhD student at Graz University of Technology in field of Electrical engineering with focus on subject from deposition and characterization of thin films with application in optics technology.

Ring-core Optical Fiber for OAM-based Communications

Yang Yue*, **Xiaoke Wu**
School of Information and Communications Engineering, Xi'an Jiaotong University, Xi'an, China

ABSTRACT
Nowadays, optical communications serves as the information transmission infrastructures through global networks. Emerging applications place huge demands on the data capacity of communication systems. This talk presents high-speed optical communications systems enabled by orbital angular momentum (OAM) mode-division multiplexing.
First, OAM basics and its traditional applications will be introduced. Spatial division multiplexing (SDM) utilizes multiple spatially orthogonal channels to transmit signals simultaneously, dramatically increasing the data capacity. OAM states can be used as an extra dimension, creating an additional set of data carriers in the SDM system. First, we will provide several typical scenarios for free-space optical OAM communications. Next, we will discuss the potential and applications of using OAM modes for spatial multiplexing in a ring-core optical fiber. Several types of ring-core fibers carrying different functions for OAM modes will be presented.

Keywords
Optical Communications, Orbital Angular Momentum, Optical Fiber

References
[1] Nenad Bozinovic, Yang Yue, Yongxiong Ren, Moshe Tur, Poul Kristensen, Hao Huang, Alan E. Willner, and Siddharth Ramachandran, “Terabit-scale orbital angular momentum mode division multiplexing in fibers,” Science, vol. 340, pp. 1545-1548, 2013.
[2] Yingning Wang, Yuanpeng Liu, Wenqian Zhao, Jian Yang, Wenpu Geng, Yuxi Fang, Changjing Bao, Yongxiong Ren, Zhi Wang, Yan-ge Liu, Zhongqi Pan, and Yang Yue, “Multi-Ring-Air-Core Fiber Supporting Numerous Radially Fundamental OAM Modes,” Journal of Lightwave Technology, vol. 40, no. 13, pp. 4420-4428, 2022.
[3] Wenpu Geng, Yiqiao Li, Yuxi Fang, Yingning Wang, Changjing Bao, Yan Yan, Zhi Wang, Weigang Zhang, Hao Huang, Yongxiong Ren, Zhongqi Pan, and Yang Yue, “Highly dispersive coupled ring-core fiber for orbital angular momentum modes,” Applied Physics Letters, vol. 117, no. 19, paper 191101, 2020.
[4] Wenpu Geng, Yuxi Fang, Yingning Wang, Changjing Bao, Zhi Wang, Yan-ge Liu, Hao Huang, Yongxiong Ren, Zhongqi Pan, and Yang Yue, “Highly Dispersive Germanium-Doped Coupled Ring-Core Fiber for Vortex Modes,” Journal of Lightwave Technology, vol. 40, no. 7, pp. 2144-2150, 2022.
[5] Wenpu Geng, Changjing Bao, Lin Zhang, Yuxi Fang, Yingning Wang, Zhi Wang, Weiwei Liu, Yongxiong Ren, Zhongqi Pan, and Yang Yue, “Triple Coupled Ring-Core Fiber with Dual Highly Dispersive Windows for Orbital Angular Momentum Mode,” Advanced Photonics Research, vol. 3, no. 10, paper 2100370, 2022.
[6] Wenqian Zhao, Yingning Wang, Si-Ao Li, Wenpu Geng, Changjing Bao, Yuxi Fang, Zhi Wang, Yan-ge Liu, Yongxiong Ren, Zhongqi Pan, and Yang Yue, “Non-zero dispersion-shifted ring fiber for the orbital angular momentum mode,” Optics Express, vol. 29, no. 16, pp. 25428-25438, 2021.
[7] Wenqian Zhao, Yuanpeng Liu, Yingning Wang, Wenpu Geng, Yuxi Fang, Runzhou Zhang, Zhongqi Pan, and Yang Yue, “Non-Zero Dispersion-Shifted Ring-Core Fiber Supporting 60 OAM Modes,” Journal of Lightwave Technology, vol. 41, no. 7, pp. 2145-2151, 2023.

Biography
Yang Yue received the B.S. and M.S. degrees in electrical engineering and optics from Nankai University, China, in 2004 and 2007, respectively. He received the Ph.D. degree in electrical engineering from the University of Southern California, USA, in 2012. He is a Professor with the School of Information and Communications Engineering, Xi’an Jiaotong University, China. Dr. Yue’s current research interest is intelligent photonics, including optical communications, optical perception, and optical chip. He has published over 240 journal papers (including Science) and conference proceedings with >10,000 citations, six edited books, two book chapters, >60 issued or pending patents, >200 invited presentations (including 1 tutorial, >30 plenary and >50 keynote talks). Dr. Yue is a Fellow of SPIE, a Senior Member of IEEE and Optica. He is an Associate Editor for IEEE Access and Frontiers in Physics, Editor Board Member for four other scientific journals, Guest Editor for >10 journal special issues. He also served as Chair or Committee Member for >100 international conferences, Reviewer for >70 prestigious journals.

Lasers in Live Cell Microscopy

Herbert Schneckenburger
Aalen University, Institute of Applied Research, Beethovenstr. 1, 73430 Aalen, Germany

ABSTRACT
Due to their unique properties −coherent radiation, diffraction limited focusing, low spectral bandwidth and in many cases short light pulses −lasers play an increasing role in microscopy of living cells.1In particular, laser-assisted methods are used for creating images of single planes in 3D specimens, which in a further step are combined in a highly resolved 3-dimensional image. The techniques mostly applied are Confocal Laser Scanning Microscopy (CLSM), where the sampleis imaged point by point− with out-of-focus information being rejected by an appropriate aperture − and Light Sheet Fluorescence Microscopy (LSFM), where individual planes are illuminated selectively. Technical requirements, relevant light exposures (to avoid phototoxic damages) and biomedical applications are summarized for both cases. For selective studies of cell membranes, Total Internal Reflection Microscopy (TIRFM) is used, and cell-membrane topology is studied for various kinds of diseases.Laser-assisted microscopy also includes various methods of super-resolution microscopy below the Abbe criterion. These methods include Structured Illumination Microscopy (SIM), Single Molecule Localization Microscopy (SMLM), Stimulated Emission Depletion Microscopy (STED) and related techniques. As a method of low light exposure we used SIM for identifying sub-cellular structures and location of fluorophores, which are relevant for detection and treatment of diseases (e.g. diabetes).

Fluorescence microscopy also includes methods of SpectralImaging and Fluorescence Lifetime Imaging (FLIM), since fluorescence spectra and lifetimes of various molecular species are relevant for their microenvironment. Techniques include the application of Förster Resonance Energy Transfer (FRET) microscopy, probing changes of intramolecular as well as intermolecular distances in the nanometer range. Prominent examples are reactions to the application of pharmaceutical agents, apoptosis or molecular reactions in the pathogenesis of diseases. Lasers can transfer not only photon energy, but also photon momenta to specimens like living cells. The latter effect is used for micromanipulation, e.g. insertion of certain molecules or genes (laser-assisted optoporation) as well as for holding or moving cells within a focused laser beam (laser tweezers). Application, e.g. single cell sorting or laser assisted transfection, are shown and relevant light doses needed to maintain cell viability are discussed.

Keywords
Laser, living cells, 3D microscopy, super-resolution, FLIM, FRET, micromanipulation

Reference
1.H. Schneckenburger: "Lasers in Live Cell Microscopy", Int. J. Mol. Sci. 23 (9), 5015 (2022), and references therein.

Biography
Herbert Schneckenburgeris a Professor of Physics and Biomedical Optics at Aalen University and a private lecturer of the Medical Faculty of the University Ulm, Germany. He received his PhD in Physics from the University of Stuttgart in 1979 and his habilitation in Biomedical Technology from the University of Ulm in 1992. His research is focused on Optical Microscopy and Time-resolved Laser Spectroscopy, including technical development and various applications in cell and tumor biology. In the period 1979-2022 he published almost 300 scientific articles, received 6 patents, managed and performed 36 projects with third-party funding. He is continuously active as an international expert in his field.

All-Optical Control of the Photonic Hall Lattice in a Pumped Waveguide Array

Shirong Lin[1,2,*], **Luojia Wang**[1], **Luqi Yuan**[1,*] and **Xianfeng Chen**[1,3,4,5]
1 *School of Physical Sciences, Great Bay University, Dongguan 523000, China*
2 *State Key Laboratory of Advanced Optical Communication Systems and Networks, zx, Shanghai Jiao Tong University, Shanghai 200240, China*
3 *Shanghai Research Center for Quantum Sciences, Shanghai 201315, China*
4 *Jinan Institute of Quantum Technology, Jinan 250101, China*
5 *Collaborative Innovation Center of Light Manipulation and Applications, Shandong Normal University, Jinan 250358, China*

ABSTRACT
The quantum Hall system possesses topologically protected edge states, which have enormous theo retical and practical implications in both fermionic and bosonic systems. Harnessing the quantum Hall effect in optical platforms with lower dimensionality is highly desirable with synthetic dimensions and has attracted broad interests in the photonics society. Here, we introduce an alternative way to realize the artificial magnetic field in a frequency dimension, which is achieved in a pump-probe configuration with cross-phase modulations in a one-dimensional four-waveguide array. The dynamics of the topological chiral edge state has been studied and the influence from the crosstalk of the pump fields has been explored. Our work shows an all-optical way to simulate the quantum Hall system in a photonic system and holds potential applications in manipulating light in waveguide systems.

Keywords
light transmission, nonlinear optics, topological optics, waveguide.

References
PHYSICAL REVIEW APPLIED 17, 064029 (2022)

Biography
Dr. Shirong Lin Education & Qualifications Center for Quantum Technology Research, Beijing Institute of Technology (BIT) Beijing, China Theoretical Physics Master's and Doctoral degree Sep. 2012 - Jun. 2019 Centre for Micro-Photonics, Swinburne University of Technology (SUT) Melbourne, Australia Optics Double Doctoral Degree Program Apr. 2017 – Aug. 2019 Academic Appointments: School of Physical Sciences, Great Bay University, Dongguan, China Distinguished Research Fellow Jun. 2022 – present School of Physics and Astronomy, Shanghai Jiao Tong University, Shanghai, China Postdoc & Research Associate Jun. 2020 – May. 2022. Research Interests : Theoretical physics (topological physics, quantum simulation, light-matter interaction) Optics and nanophotonics (structured light & beam shaping, nonlinear optics, opto-magnetics)

Structural Health Monitoring Using Fiber Sensor

P K Sahu

School of Electrical Sciences, IIT Bhubaneswar, Arugul, Jatni, India

ABSTRACT

In this work, a comparative study based on FBG and distributed fiber sensors for structural health monitoring (SHM) applications is reported. The repeatability of measurements andtheir long-term stability and reliability due to the mechanical and environmental impact are analysed and presented. The work presents the use of plastic and glass optical fiber sensorsfor SHM. The main aspects studied in this paper are the application of different types of fiber sensors for structural health monitoring by measuring the strain. A detailed study on the application of signal processing techniques including machine learning techniques for improving the performance of fiber sensors is explained in this paper. The technology developed under this work will enable practical, cost-effective, and reliable systematic maintenance of civil structures like dams, bridges, railway tracks, and other structures. The study will provide a unique opportunity for future growth and adaptation of this technology across the globe.

Keywords

FBG, Distributed fiber sensor, noise reduction, repeatability

References

[1] Rohan Soman, "Multi-objective optimization for joint actuator and sensor placement for guided waves basedstructural health monitoring using fibre Bragg grating sensors," Ultrasonics, Volume 119, (2022),106605,

[2] Tomasz Siwowski, Mateusz Rajchel, Tomasz Howiacki, Rafał Sieńko, Łukasz Bednarski, "Distributed fibreoptic sensors in FRP composite bridge monitoring: Validation through proof load tests," Engineering Structures, Volume 246,(2021), 113057,

[3] K. Bremer, M. Meinhardt-Wollweber, T. Thiel, G. Werner, T. Sun, K.T.V. Grattan, B. Roth "Sewerage tunnel leakage using a fibre optic moisture-detecting sensor system" Sens. Actuators, A, 220 (2014), pp. 62-68

[4] U.M.N. Jayawickrema, H.M.C.M. Herath, N.K. Hettiarachchi, H.P. Sooriyaarachchi, J.A. Epaarachchi, " Fibre-optic sensor and deep learning-based structural health monitoring systems for civil structures: A review," Measurement, Volume 199, (2022),111543

[5] Tiago Paixão, Francisco Araújo, Paulo Antunes, "Highly sensitive fiber optic temperature and strain sensor based on an intrinsic fabry–perot interferometer fabricated by a femtosecond laser," Opt. Lett., 44 (19) (2019), pp. 4833-4836

Optical Phase Change Nanocavity with Dynamic Structural Color

Omar A. M. Abdelraouf [1,2], Xin Cai Wang[3], Weide Wang[2], Jeff Siu Kit Ng[2], Xiao RenshawWang[1,4*], Qi Jie Wang[1,4*], Hong Liu[2,*]

1 School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore637371, Singapore

*2 Institute of Materials Research and Engineering, Agency for Science, Technology and Research(A*STAR), 2 Fusionopolis Way, #08-03, Innovis, Singapore 138634, Singapore*

*3 Singapore Institute of Manufacturing Technology (SIMTech), Agency for Science, Technology andResearch (A*STAR), 2 Fusionopolis Way, #08-04, Innovis, Singapore 138634, Singapore*

4 School of Electrical and Electronic Engineering, 50 Nanyang Avenue, Nanyang TechnologicalUniversity, Singapore 639798, Singapore

Abstract

Thin film structures have been widely utilized in many applications, such as optical coating,[1] semiconductors,[2] optical memories,[3] and photovoltaic cells,[4] which are largely owing to the scalable and cost-effective fabrication processes. Even though thin film technology has been well established, there is still a limitation that the passive structures cannot dynamically adjust the optical response of thin films once fabricated. Dynamically tuning the optical response of thin film structures after fabrication will enable the multi-functional devices to address the demand for the next-generation technology and advanced materials play a critical role in achieving the tunable response of thin film devices. An electrical approach has been demonstrated to alter the order based on the solid-state thin film to alter the order, numberand thickness of layers, which eventually changing the reflectance spectrum.[5] However, the speed, uniformity and cyclability still need improvement.

In this work, we have demonstrated a multi-layered thin-film structure, in which a layer of antimony trisulfide (Sb_2S_3) is sandwiched in the metal-dielectric-metal (MDM) cavity. This cavity acts as a Fabry-Pérot cavity to enhance light confinement inside the Sb_2S_3 layer. Sb_2S_3 is a low loss phase change material in the visible spectrum with a bandgap of around 2.25eV.[6] Upon activation by continuous wave and pulsed laser annealing, the material property of Sb_2S_3, i.e., amorphous, intermediate and crystalline states can be switched quickly and a near unity refractive index contrast between amorphous and crystalline phases can be acquired. After the phase change of Sb_2S_3, the reflection resonance tuned over a broad wavelength range in the visible spectrum. Using a continuous-wave laser with different excitation times, we achieved many intermediate states inside Sb_2S_3 during the phase transition from amorphous to crystalline. We also observed many intermediate states inside Sb_2S_3 using a picosecond laser with different energy densities during the reverse transition from crystalline to amorphous. Our work provides a cost-effective framework for the realization of reconfigurable thin-film-based nanophotonic devices.

In addition, I will present one-step printing of 3D photonic structural colors without requiring post-processing or subwavelength features. Vivid colors with reflectance peaks exhibiting a full width at half maximum of ~25 nm, a maximum reflectance of 50%, a gamut of ~85% of sRGB, and large viewing angles, were achieved. In addition, we also demonstrated voxel-level manipulation and control of colors in arbitrary-shaped 3D objects constituted with WPCs as unit cells, which has great potential for applications in dynamic color displays, colorimetric sensing, anti-counterfeiting, and light-matter interactionplatforms.

Keywords

dynamic structural color, phase change, Fabry-Pérot cavity, thin film,reconfigurable

References

1. Kats, M. A., Blanchard, R., Genevet, P. & Capasso, F. Nanometre optical coatings based on strong interference effects in highly absorbing media. *Nat. Mater.* **12**, 20–24 (2013).
2. Diao, Y. *et al*. Solution coating of large-area organic semiconductor thin films with aligned single-crystalline domains. *Nat. Mater.* **12**, 665–671 (2013).
3. Nonaka, T.; Ohbayashi, G.; Toriumi, Y.; Mori, Y.; Hashimoto, H., Crystal structure of GeTe andGe2Sb2Te5 meta-stable phase. *Thin Solid Films* **2000,** *370* (1-2), 258-261.
4. Lee, T. D.; Ebong, A. U., A review of thin film solar cell technologies and challenges. *Renewable and Sustainable Energy Reviews* **2017**, *70*, 1286-1297
5. Yan, Z., *et al*, Floating solid-state thin films with dynamic structural colour. *NatureNanotechnology* **2021,** *16*

(7), 795-801.

6. Dong, W., et al. Wide bandgap phase change material tuned visible photonics. Advanced Functional Materials 2019, 29 (6), 1806181.

Biography

Dr. LIU Hong obtained his M. Eng and Ph.D. from the Dept of Mechanical Engineering of the National University of Singapore. He joined the Institute of Materials Research and Engineering, Agency for Science, Technology and Research Singapore in 2003. His research interest is focused on the development of advanced nanofabrication technologies for flat optics, tunable metasurfaces, nanophotonic devices, artificially engineered materials and nanoplasmonics, optical nanolithography, etc. Dr. LIU Hong is the Head of the Nanofabrication Department/ Senior Scientist in IMRE, leading the Nanofabrication Department to advance the science and engineering of structured materials at micro- and nanometer scales.

On-Chip Magnetic-Free Quantum Nonreciprocity

Keyu Xia

Nanjing University, China

Abstract

Quantum nonreciprocity, breaking the Lorentz reciprocity in the quantum regime, promises a manner for unconventional quantum information processing. This presentation will show two routines to achieve on-chip quantum nonreciprocity. The first one uses a chiral cavity quantum electrodynamics system. The second achieves quantum nonreciprocity by quantum squeezing a nonlinear resonator with a unidirectional pump laser. These works pave the way towards nonreciprocal quantum information processing.

Biography

Dr. Keyu Xia received his Doctorate of "Optics" in 2007 from Shanghai Institute of Optics and Fine Mechanics, CAS. Since 2017, Dr. Xia has become a full professor and has been working at the College of Engineering and Applied Sciences in Nanjing University. Dr. Xia's research interest includes Cavity quantum electrodynamics, quantum information, chiral and nonreciprocal quantum optics. He has more than 60 peer-reviewed publications in the top-level journals including Science, Nature Photonics, PRL, PRX, etc. His academic achievements have been reported by Science Magazine, Nature Photonics and media Phys.Org etc. His representative achievements include schemes for QND measurement of a flying single photon, building magnetic-free single-photon isolators and circulators, bypassing dynamic reciprocity, and demonstrating the second mechanism for conducting chiral quantum optics—the susceptibility-momentum locking. Dr. Xia was selected as an OSA senior member in 2020.

Optical Imaging and Microvessels *In-Vitro* and *In-Vivo*

Aristotle G. Koutsiaris*
Medical Informatics and Biomedical Imaging (MIBI) Laboratory, Faculty of Medicine, School of Health Sciences, University of Thessaly, Biopolis Campus, Larissa, Greece

ABSTRACT
Optical imaging has contributed significantly to medical and biological science advancement over the last 40 years. Known branches of optical imaging are optical and confocal microscopy, optical coherence tomography (OCT), and optoacoustic tomography. The contribution of these branches to the understanding of microvessels both in-vitro and in-vivo was amazing.

Concerning in-vitro microvessel applications, among the many optical imaging techniques there is micro-particle image velocimetry (μPIV) (Koutsiaris et al 1999). The basic parts of a μPIV system are going to be described and potential difficulties such as field of view loss (Koutsiaris 2022 [a]) are going to be presented.

Concerning in-vivo microvessel applications on humans, there is conjunctival video capillaroscopy (CVC) (Koutsiaris et al 2022 [b]), sublingual video capillaroscopy (SVC) (Rovas et al 2021; Wang et al 2023), nailfold video capillaroscopy (NVC) (Mrowietz et al 2020) and optical coherence tomography angiography (OCTA) (Koutsiaris et al 2022 [c]). Some of the latest state-of-the-art results of these applications are going to be presented.

Keywords
Optical imaging, microvessels, in-vitro, in-vivo, video capillaroscopy

References

Koutsiaris AG, Mathioulakis DS and Tsangaris S. Microscope PIV for velocity field measurement of particle suspensions flowing inside glass capillaries. Meas. Sci. Technol, 1999;10: 1037-1046.
Koutsiaris AG. Loss of field of view due to optical mismatch at the inner diametric plane of cylindrical artificial microvessels. Results in Optics, 2022 [a]; 8:100241.
Koutsiaris AG, Riri K, Boutlas S, Panagiotou TN, Kotoula M, Daniil Z, Tsironi EE. COVID-19 hemodynamic and thrombotic effect on the eye microcirculation after hospitalization: A quantitative case-control study. Clin Hemorheol Microcirc. 2022 [b]; 82(4):379-390. doi: 10.3233/CH-221554.
Koutsiaris AG, Batis V, Liakopoulou G, Tachmitzi SV, Detorakis ET, Tsironi EE. Optical Coherence Tomography Angiography (OCTA) of the eye: A review on basic principles, advantages, disadvantages and device specifications. Clin Hemorheol Microcirc. 2022 [c]; In Print. doi: 10.3233/CH-221634.
Rovas A, Osiaevi I, Buscher K, Sackarnd J, Tepasse PR, Fobker M, Kühn J, Braune S, Göbel U, Thölking G, Gröschel A, Pavenstädt H, Vink H, Kümpers P. Microvascular dysfunction in COVID-19: the MYSTIC study. Angiogenesis. 2021;24(1):145-157. doi: 10.1007/s10456-020-09753-7.
Wang J, Song Q, Yang S, Wang H, Meng S, Huang L, Li Q, Xu J, Xie J, Huang Y. Effects of hydrocortisone combined with vitamin C and vitamin B1 versus hydrocortisone alone on microcirculation in septic shock patients: A pilot study. Clin Hemorheol Microcirc. 2023; In Print. doi: 10.3233/CH-221444
Mrowietz C, Sievers H, Pindur G, Hiebl B, Jung F. Cutaneous microcirculation in patients with peripheral arterial occlusive disease: Comparison of capillary blood circulation in the nail fold of finger and toe. Clin Hemorheol Microcirc. 2020;76(2):279-285. doi: 10.3233/CH-209220.

Biography
Dr. Aristotle G. Koutsiaris studied Electrical and Computer Engineering at the Aristotle University of Thessaloniki (Greece) and Biomedical Engineering at Dundee University (UK). He then joined the research group of Professor Sokrates Tsangaris at the Biofluid Mechanics Laboratory of NTUA (Athens) and received his Ph.D. degree in 2000. His doctoral & postdoctoral work was on the application of optical imaging techniques on microvessels in-vitro and in-vivo, and since then he has worked and taught at several academic institutions, and published on biofluid dynamics, hemodynamics, microcirculation, biomedical imaging, and bio-microscopy, both in-vitro and in-vivo (in animals and humans) with a good international

scientific impact. He is currently an Assistant Professor in the Faculty of Medicine, University of Thessaly.

Regenerative Retinal Laser and Light Therapies for the Treatment of Retinal Diseases - a possible way to save sight?

Jan Tode

Hannover Medical School, University Eye Clinic, Carl-Neuberg-Strasse 1, 30625 Hannover, Germany

Abstract

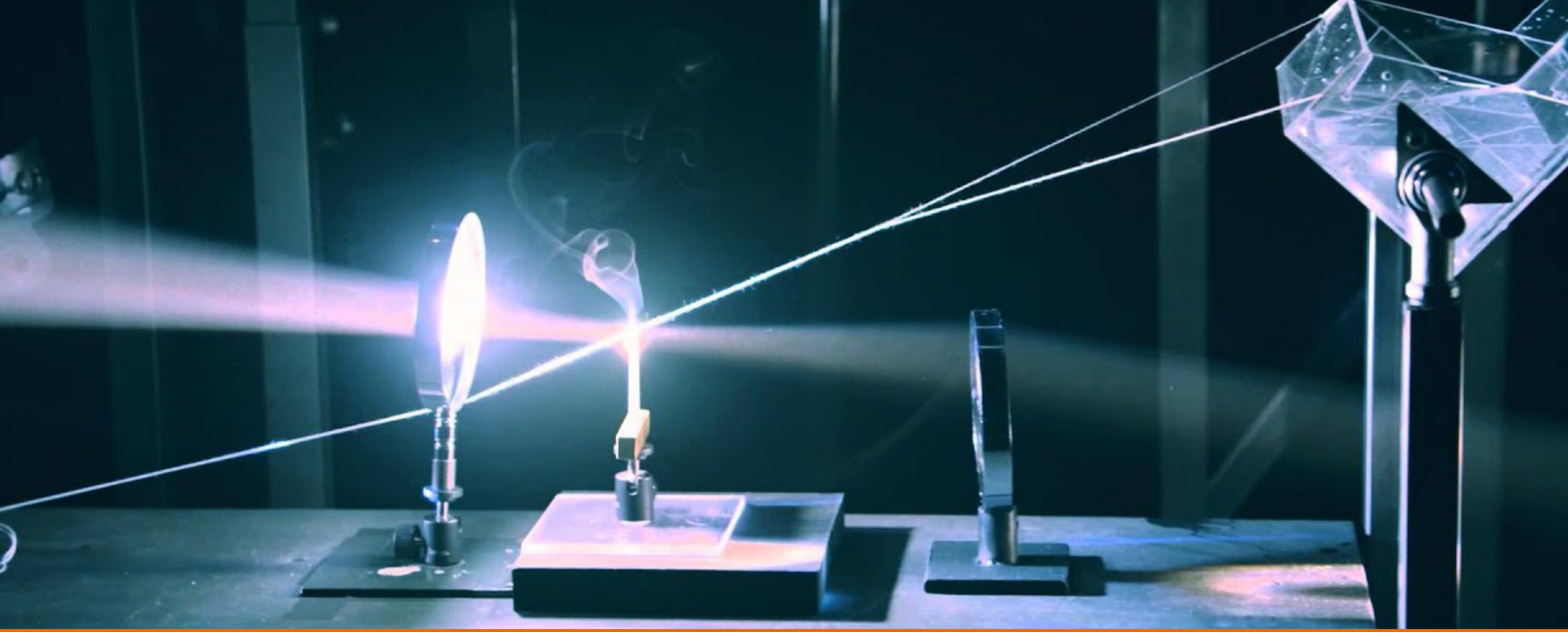
Purpose Vision threatening eye diseases mainly affect the centralpart of the retina, the macula. The most common cause for legal blindness in the western world is age-related macular degeneration (AMD). A cure for this disease in its early stage does not exist. Several laser and light therapies of the eye, aim to act on the choroid/retinal pigment epithelium (RPE)/photoreceptor complex, leaving the neuroretina undamaged. These are a promising approach to treat early AMD and other macular diseases. By categorizing these laser therapies, we aim to make them comparable and more visible as therapeutic option.

Methods A systematic literature review of reported macular laser and light therapies was conducted and data from the author's studies on molecular mechanisms of these laser therapies are included. Application methods were categorized into a standardized system based on their mechanisms of actions.

Results The literature search found 3001 articles. Of those, 194 described laser techniques, 50 addressed dosimetry, 272 were clinical trials and 82 reviews. We analyzed the different laser techniques and propose "regenerative retinal laser and light therapies (RELITE)" as general header. We subdivided RELITE into 4main subcategories that refer to the intended physical and biochemical effects of temperature increase (photothermal laser therapy, PTL), RPE rejuvenation(photodisruptive laser therapy, PDL),photochemical processes (photochemical laser therapy, PCL) and photobiological modulations (photobiological light therapy, PBL). The different irradiation techniques to achieve this were given three-letter-codes, most of them have been reported before.

The known effects of these laser treatments were reviewed, showing the common goal of regenerative mechanisms in the choroid/RPE/photoreceptor complex.

Conclusion RELITE therapies may evolve to an important ophthalmic therapy for macular diseases. We defined categories for a systematic therapeutic goal-based nomenclature. A precise nomenclature system and strict reporting standards are needed to allow for a better understanding, reproduceable and comparable clinical trials and overall acceptance.



GCLOP2024

2nd Global Congress on

Laser, Optics and Photonics

May 28-30, 2024 | Munich, Germany

https://avouchconferences.com/2024/laser-optics-photonics/